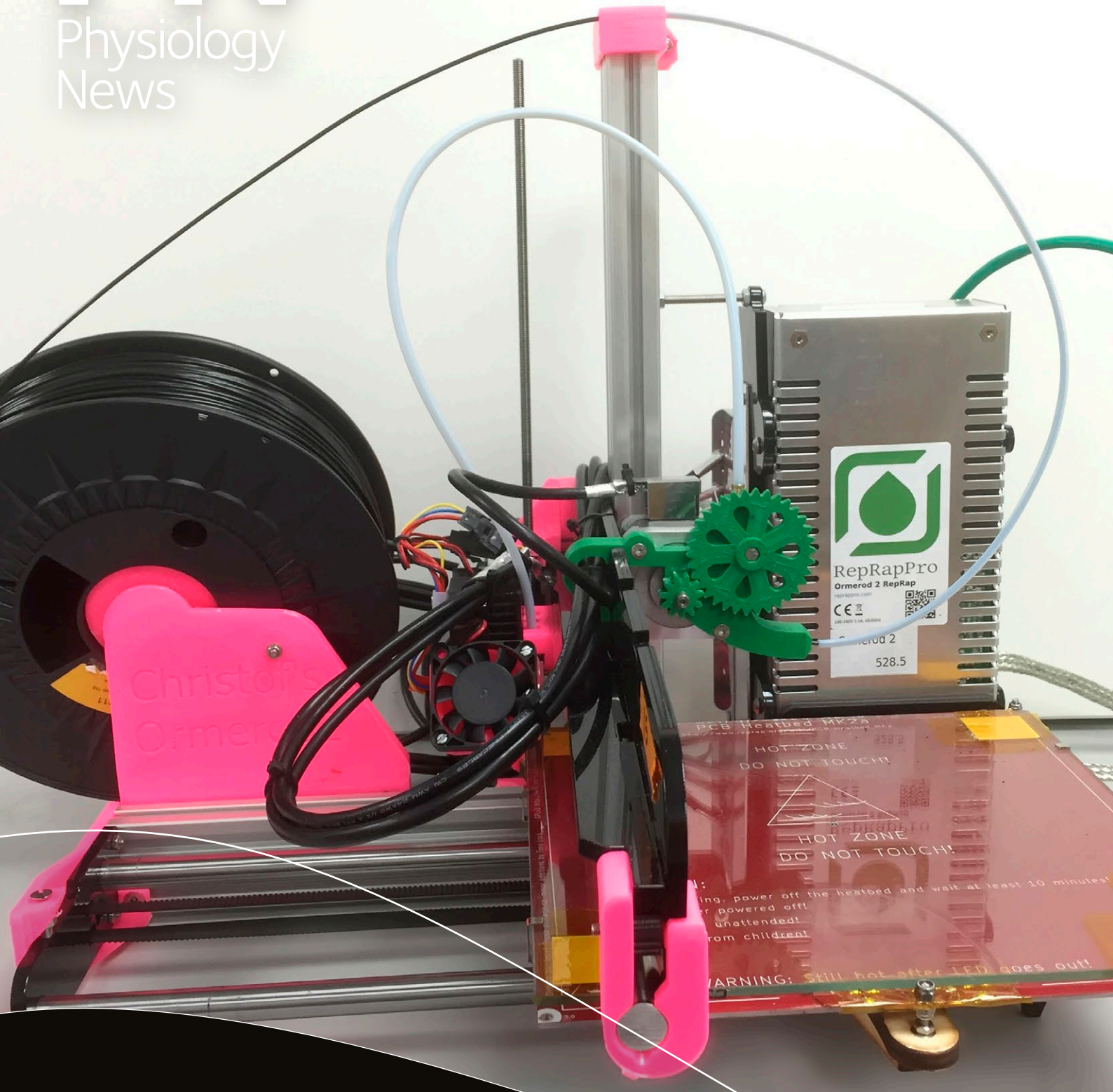
PN
Physiology
News

Issue 101 / Winter 2015



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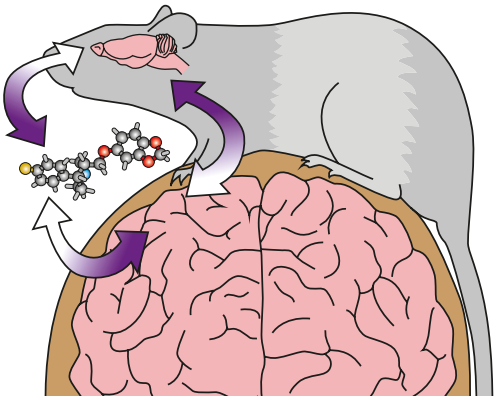
In addition to taught sections, the residential course includes round-table debates, practical sessions and team projects.

For more information and to register interest go to

www.bap.org.uk/nonclinical



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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Welcome to the Winter 2015 edition of *Physiology News*

Introduction

News in brief

News in depth

Meetings & events

Features

Membership

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Cover image: Photo of one of Christof Schwiening's two 3D printers by the Editor






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Roger Thomas

Editor, *Physiology News*

This is the third issue I have edited, and still I wonder if anyone actually reads the editorial. The 101st issue of *Physiology News* is almost bound to be less exciting than the centenary issue, which I think all agree, was brilliantly guest-edited by David Miller. The article by Richard Boyd on the order of author's names evoked perhaps the most interest. I cannot but suspect it was a mistake to have this written by someone with a name beginning with B, though the author does admit a possible conflict of interest. Only those of us with late-alphabet names will have experienced the daily humiliation of being at the end of school roll-calls and many other lists.

I was concerned to read Richard's description of me as treating the old rule with some derision. I deny this. I suppose I could have modified his article at the editing stage. I do remember being persuaded by Erwin Neher that the rule was a mistake as he no longer felt able to publish in *J Physiol*, as (he said) it was by then widely accepted that the senior author should be the last named. I even proposed an AGM resolution on name order, which I remember being rejected only on the Chair's casting vote. The next day the Editorial Board changed the rule, or so I remember. (In those days one was allowed to propose resolutions for the AGM with only one seconder. Now you need a huge number.)

It is of course true that in the old days a decision to attempt publication in *J Physiol* ended any argument on name order. I do not think that promotion problems can be easily dismissed. A lack of concern about name order relies too much on committee members doing more reading than they have time for. First or last author's list of publications on CVs inevitably look more impressive than those lists of people whose names come in the middle. Come to think of it I have seen such lists, which avoid giving the name order by simply stating the title first, then at the end the co-authors names. If you wish to know where the applicant's name came originally you have to search.

A more sensitive topic, and one much less spoken about, is which papers the authors decide to cite when there are many more which are relevant than the journal will allow. In my view you should always cite the key classic work so that people who search for papers that cite it will find yours. Next you should cite all relevant papers published in the journal to which you intend to submit your paper so that the editor will appreciate your effort to raise the citation index. Then you should include the work of anyone who might review your next grant application, and then recent papers that agree with your conclusions. If space permits you might even cite papers that you disagree with, but misspell the title.

An important topic raised in this issue of *PN* has been widely discussed in other publications: the reliability of published conclusions in biological research. This issue has an authoritative article by Martin Michel, the Editor of *Naunyn-Schmiedeberg's Archives of Pharmacology*. There are articles on essentially the same topic in *Nature* 526, 7572, pp182185 by Regina Nuzzo, and a short report in *The Lancet* 385, Vol 9976, p1380 by Richard Horton. The latter reports on a symposium on reproducibility and reliability of biomedical research held at the Wellcome Trust in London. It was held with Chatham House rules, so nothing could be quoted. No names and no pack drill. I might add that the problem was widely discussed at the April meeting of The Society's publication committee, as mentioned in my report in *PN*99, page 9.

This issue also has an important article about human stem cell based models for research in human physiology, particularly of the CNS. The growing cost in money and bureaucracy of research on mammalian preparations certainly drives many to prefer cultured cells rather than for example slices of real brains. I also include a reprint of the first article I wrote for what became *Physiology News*. Now that email is so universally used, even by solicitors and building societies, it is amusing to see how email was recommended in its early days. It was rather cumbersome to use then. Now the problem is that it's too easy for spammers and phishers. This issue also carries a note from the President about Philip Wright. Philip left The Society at the end of October and we wish him well in his future endeavours.

I am considering starting a gossip column, with news from departments still including physiologists. For example, I discovered recently that the successor to the Bristol University department is now a School of Physiology, Pharmacology and Neuroscience. Its head is Chris Fry, once meetings secretary and then chair of the executive committee of TPS (The Physiological Society). Other triple-barrelled departments include those of Oxford and Cambridge. Are there any quadruple-named departments or schools? Would readers welcome such news from the far-flung places where physiology is still important?

I conclude with another plea for feedback, ideally in the form of publishable letters to the editor. If these can raise controversial issues, all the better. Suggestions and proposals for articles are also very welcome – best sent to me at **rct26@cam.ac.uk**

Alphabetical author order

Mark Cain

I enjoyed reading Richard Boyd's interesting piece in the last issue of *Physiology News* about the origins of *The Journal of Physiology*'s alphabetical author policy. As one gets older one often tends to get more interested in history, and I am no exception. In doing so I find myself frequently reminded of the well-known French poet's line that '*Plus ça change, plus c'est la même chose*'

It doesn't come as a total surprise to see AV Hill - a hero to many physiologists, including me – as a major protagonist in the author order debate. Ernest Starling once described the young Hill as '*a chap who likes to be in the thick of things - in the scrum!*' The letters Boyd quotes have the authentic ring of Hill. What they also show us is that issues relating to who did what in bits of research, and who got the credit via author order, was a hot topic in the 1920s, just as it is now.

I am, I should say, old enough to have lived through *J Physiol*'s switch back to NON-alphabetical author order around the turn of the 80s/90s. In fact, I published part of my PhD work in *J Physiol* alphabetically before the changeover, and another bit a few years later non-alphabetically. At the time, I'm pretty sure I thought alphabetical author order was a curious anachronism. Thirty years on, I'm not so sure.

I can't recall anyone ever citing a reason for the old alphabetical policy back when I was a mid-1980s graduate student. It was simply one of those physiology quirks, like voting on communications, or the interminable speeches at the dinners, or the custom that woman authors had their Christian names quoted, whilst men were identified by their initials.

There were, though, a fair number of jokes around in 1980s Physiology Departments about the great good fortune of those born with surnames beginning with letters at the front of the alphabet. One view was that having a surname starting with 'A' or 'B' was worth at least a few extra papers in the hunt for eminence - a kind of corollary to the famous story about David Hubel and Torsten Wiesel that Richard Boyd quotes. Indeed, there is even a letter to *Nature* in 1970 (Vol 228 p 1357) that describes a statistical paucity in *J Physiol* (relative to other journals) of authors with surnames beginning with letters in the latter part of the alphabet. The letter writers interpret this, understandably, as alphabetical author order frightening off those with surnames starting with the later letters. I definitely recall being advised to try and publish at least one paper from my PhD work somewhere other than *J Physiol*, largely to make sure I was first author on something.

Now, scientists are a resourceful folk, and sometimes, creative solutions to the alphabetical author order problem were found. For instance, I collaborated briefly with an eminent physiologist, whose name began with a fairly early letter of the alphabet, and his PhD student, whose name began with one of the later letters. A year or two later, I spotted a new name on a communication of the eminent physiologist's; the new name shared the same initials as the PhD student. It turned out the student had more than one family name, and had decided to switch to using a different one. The new choice, interestingly, began with the letter immediately prior to the letter with which the eminent supervisor's surname began.

Nowadays, of course, we have (sometimes extended) statements on papers about who did what to clarify things. I guess these are an improvement on inferring stuff from author order, which has always been a bit like reading tealeaves. Still, I'm left somewhat envious of those who manage to avoid all the problems inherent in such things by publishing on their own. After all, when did you hear about Albert Einstein having problems trying to explain who was responsible for which bits of the Theory of General Relativity?

Question for the Editor or comment on a recent *PN* article?

Please send your correspondence to **magazine@physoc.org**

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

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The Physiological Society

Biobakes contest 2015

We are delighted to announce the winners of our annual Biology Week 'Bio-Bodies Bake-Off'. The competition, launched at the beginning of September as part of the lead up to the yearly October celebration of bioscience challenged the public to create physiology themed baked goods.

We received 140 entries and our physiologist judge Charlotte Haigh, Associated Professor of Human Physiology at the University of Leeds, and cake judge Richard Burr, Great British Bake-Off Finalist 2014 and author of *Bake it Yourself*, whittled down 140 cakes to a shortlist of 10 for a public vote held in Biology Week. They also each got a change to choose their favourite cake for the Physiologist Choice and Baker's Choice prize.

The Winners

The Physiologist Choice, awarded by Charlotte Haigh, was given to Society Member Carrie Duckworth for her cake 'Gut Feeling' (pictured top). In her cake description she said 'This cake holds the key to preventing bacterial invasion in the small intestine'.

Carrie won brain and heart cookie cutters and a giant plush neuron for her efforts.

The Bakers Choice, awarded by Richard Burr, was given to Claire Lewis from the School of Nursing and Midwifery, Queen's University Belfast for her cake 'Muscle Contraction' (middle).

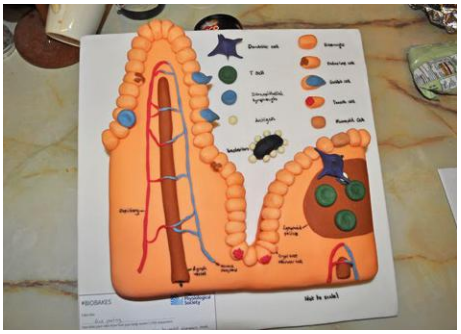
'Love the upstanding axon! There must be a bit of wire work in there. Good icing and realistic muscle fibres [...] Good colour match, excellent use of royal icing to make the cell body and dendrites' commented Richard.

Claire took away a copy of Richard Burr's book as part of her prize.

The public were tasked with choosing the overall winner, with 811 votes, 17 year old Laura Bullimore, and Caitlin McDowell and 18 year old Ella Ifill-Williams took the crowns with their cake 'Bun in the oven' showing the progression of a baby in the womb from 2 months to 7 months (pictured bottom).

The girls won a copy of Richard's book, heart and brain cookie cutters, and a year's subscription to 'Cake Heaven' magazine.

Many congratulations to all the winners, we can't wait to see next year's bakes!



Maureen Young: from chair to commemorative bench

Tilli Tansey

QMUL, The Society's Honorary Archivist

One of the first women to be appointed to a teaching position in a medical school, Maureen became demonstrator in physiology at St Thomas' Hospital Medical School, and Tutor to the newly admitted women students in 1946, and gained a Personal Chair in perinatal physiology in 1975*.

Her two great nephews and her godson decided to commemorate her with an inscribed bench, placed in the garden of St Thomas', just across the river Thames from the Houses of Parliament. On what would have been her 100th birthday, family and friends gathered for a short ceremony of dedication, and to talk about Maureen.

The Physiological Society was represented by members of the History & Archives Committee (HAC) Dafydd Walters and myself. Dafydd recalled visiting St Thomas when he was a young student at UCL, and being astonished at the sight of a sheep in a specially constructed cage in the corner of Maureen's lab in the Obstetrics Department, just yards from the labour wards. I remember first meeting Maureen in the Rayne Institute in 1983. As a young post doc, I was enormously impressed by this retired 'lady professor' (a very rare species anywhere, but especially in St Thomas'), who had a space in the research lab next door and who always, regardless the time of day, or day of the week, wore the cleanest, crispest and whitest lab coat.

Also present was Amanda Engineer, a professional archivist from the Wellcome Library, who has oversight of The Society's archives, and also sits on the HAC. At Maureen's memorial service in 2013, I had approached Maureen's nephew, Michael Young, to ask about his aunt's papers. These have subsequently been collected and deposited in the Wellcome Library, where Amanda is hoping to include them in the anticipated cataloguing exercise of The Physiological Society's own papers, an aim enthusiastically supported by the HAC.

** The enormous contributions of Professor Maureen Young (1915 – 2013) to physiology, especially neonatal and fetal physiology, have been noted already in Physiology News (Fowden, 2013) and in the Society's recent book on Women Physiologists: centenary celebrations and beyond (Wray & Tansey, 2015).*

The dedication

Dr Philip Wright leaves The Society

Richard Vaughan-Jones
President, The Physiological Society

Dr Philip Wright has left The Physiological Society, to pursue fresh challenges. I hardly need to say that, during his 5 years as CEO, Philip has made very significant contributions to The Society. These include facilitating the purchase and renovation of our new premises in London (Hodgkin Huxley House), the establishment with the American Physiological Society of our new open-access journal, *Physiological Reports*, the setting up of new communications, management and membership systems within The Society, and the enhancement of our public meetings and our outreach, education and policy ventures. I, my co-Trustees, Society staff, and Members all thank Philip for his important work, and wish him every success in the future.

Mr Casey Early, The Society's Director of Finance, has been appointed as interim CEO, until a new full-time appointment is made.

Dr Philip Wright

Thomas Hardye School student wins 'Women in Physiology' competition

In the last issue, we announced that 15-year-old Elsie Moore, from The Thomas Hardye School in Dorset, won our 'Women in Physiology' competition earlier this year. This competition was just one of the activities The Society held to mark 100 years of women's membership in 2015. Winning with her poster on Nobel Prize winner Dr Christiane Nüsslein-Volhard, Elsie received a certificate, £50 Amazon gift voucher and a visit from a female physiologist to her school.

With the help of ScienceGrrl, a broad-based grassroots organisation celebrating and supporting women in science, we were able to arrange a visit from Dr Carmen Coxon, Research Assistant at the University of Bristol, to The Thomas Hardye School on 14 October 2015. During her visit, Carmen gave a lecture to their year 12 and 13 students, as well as a talk on the heart involving demonstrations with an electrocardiogram for Elsie's class.

There was also one final – special – prize for Elsie, revealed only on the day itself: a personal message from Christiane Nüsslein-Volhard, written on the poster and presented to Elsie by Headteacher Michael Foley.

(L-R) Michael Foley, Elsie Moore and Carmen Coxon

Judith Wardlaw, Industry Partnership Development Manager at the school, said, 'The day was fabulous – Carmen was truly brilliant with the students and her talks and demos were a real treat. Thank you so much for giving us this link as well as for arranging the special message.'

We would like to thank Carmen for providing this prize visit as well as ScienceGrrl and The Thomas Hardye School for their assistance with arranging it. Further details about the competition are available at **www.understanding-life.org/competitions**

Physiology Feed

Bringing you snippets of the latest intriguing research

Low oxygen before birth and high-salt diet may pose risk for cardiovascular disease

Lack of oxygen during pregnancy combined with high salt intake in later life can damage vascular function in the offspring of mice.

DOI: 10.1113/JP271067

Chewing can lead to high blood pressure in people with Baroreflex Failure

The simple act of chewing can trigger a state of arousal with a sudden increase in blood pressure.

DOI: 10.1113/EP085340

Less is more when it comes to muscle power

Muscle fibres of bodybuilders and power athletes generate a higher isometric force (muscle contraction generates tension without changing its length).

DOI: 10.1113/EP085267

Three hours of uninterrupted sitting damages blood vessels

Three hours of uninterrupted sitting causes substantial disruption to vascular function in the legs in young girls, with a 33% reduction in the ability of the artery to dilate (enlarge) observed. A 10-minute exercise break, however, was able to prevent this adverse impact of uninterrupted sitting.

DOI: 10.1113/EP085355

Resistance exercise can improve Vitamin D metabolism

Resistance but not aerobic exercise may increase the number of Vitamin D receptors (VDRs) in the muscle and improve Vitamin D metabolism.

DOI: 10.1113/EP085207

The dress that broke the internet

Researchers reveal the optical illusion is linked to specific brain activation patterns.

DOI: 10.1016/j.cortex.2015.08.017

continues overleaf

Physiology Feed

Bringing you snippets of the latest intriguing research

Smells like teen spirit

A bioelectronic nose can detect traces of bacteria in water by smelling it. The sensor can detect tiny amounts of contamination in water, making it more sensitive than existing detection methods.

DOI: 10.1016/j.bios.2015.06.053

How the brain controls sleep

A brain circuit originating from the thalamic reticular nucleus (TRN) can trigger small regions of the brain to fall asleep or become less alert, while the rest of the brain remains awake.

DOI: 10.7554/eLife.08760

Remember me?

According to new research, the hippocampus, a brain structure known to play a role in memory and spatial navigation, is essential to one's ability to recognize previously encountered events, objects, or people – a phenomenon known as recognition memory.

DOI: 10.1073/pnas.1513145112

Sixth sense: How do we sense electric fields?

Many animals are able to sense and react to electric fields, and living human cells will move along an electric field, for example in wound healing. Now researchers have found the first actual 'sensor mechanism' that allows a living cell detect an electric field.

DOI: 10.1038/ncomms9532

3-D printing patient-specific medical devices

An innovative 3-D printing technology has been developed that could revolutionise important biomedical equipment, enhancing treatment for everyone from premature babies to patients needing implants.

DOI: 10.1038/ncomms9641

Global warming is taking a toll on cold-blooded animals

New research suggests that cold-blooded animals can tolerate body temperatures only a few degrees above their normal high temperatures before they overheat.

DOI: 10.1098/rspb.2015

Policy Focus

The Physiological Society at the Party Conferences

This autumn, The Physiological Society, together with think-tank Demos, held meetings at the Labour and Conservative Party conference fringes. The meetings, entitled 'Higher Expectations: who cares about teaching in HE?', each involved a panel discussion and Q&A session. Each panel included a member of The Physiological Society Education & Outreach Committee (Judy Harris at the Labour fringe and Blair Grubb at the Conservatives), along with Nick Hillman (Higher Education Policy Institute) and Duncan O'Leary (Demos). Wes Streeting MP took part at the Labour fringe, while John Gill (Times Higher Education) and Megan Dunn (NUS) spoke at the Conservative fringe.

There has been interest in addressing teaching in higher education for a long while. The ex-Science Minister David Willetts called it 'unfinished business', and now his successor Jo Johnson has declared a 'renewed focus on teaching.' The events centred around the forthcoming Teaching Excellence Framework (TEF), and the impact it will have on students and academics. The Society believes that good teaching should be more effectively and consistently recognised, with academics able to be promoted and advance their career through their commitment to and skills in teaching. Currently this is technically possible at many institutions, but a large majority of academics believe it rarely happens. The Physiological Society has recently released a booklet, *Recognising Teachers in the Life Sciences*, giving case studies of academics who have furthered their careers through teaching excellence.

There is widespread agreement that the TEF will have to be carefully considered before its introduction. It runs the risk of driving a wedge between research and teaching, forcing academics to specialise and ending a culture of 'scholarship' involving both research and teaching skills. There will be close scrutiny of the government's Green Paper setting out its plans for the TEF.

Holding our breath for the CSR

By the time you read this, the government will have released the results of the Comprehensive Spending Review. Currently, however, the science sector is keeping its ear to the ground and worrying about possible outcomes. Organisations such as the Campaign for Science and Engineering, and Science is Vital, are working hard to project a unified message from the sector to the government, and The Physiological Society is doing its best to contribute. We will keep members up to date with efforts to ensure the science sector is valued and safeguarded.

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

Project report: the effect of maternal low protein diet on the neuromuscular system of the offspring in mice

Ifigeneia Giakoumaki
University of Liverpool, UK

As part of my MRes course in Musculoskeletal Ageing, based at the University of Liverpool ("Centre for Integrated research into Musculoskeletal Ageing" MRes), I undertook a research project funded by The Physiological Society which was awarded to a new lecturer, Dr Aphrodite Vasilaki. The aim of the project was to determine the effect of maternal low-protein diet on the neuromuscular system of the offspring, using mice as a model organism. The rationale behind this project was to identify whether processes occurring later in life, such as sarcopenia, are influenced by events taking place during prenatal and early stages post pregnancy.

Previous studies have shown that maternal malnutrition can during the early stages of development result in reduced muscle mass and this may lead to sarcopenia later in life. We investigated whether maternal malnutrition could cause a predisposition to sarcopenia and this could be prevented by optimisation of the nutrition at the early stages of development.

Two cohorts of female mice were introduced to and maintained on either a normal (20% protein) or low (5%) protein diet for two weeks and then mated. The two types of protein diet were maintained throughout pregnancy and lactation.

Newborns were cross-fostered to different lactating dams (following either a normal or a low-protein diet), within 24 hours after birth. Mice were collected and euthanised at weaning (21 days old) and muscle tissue and spinal cord samples were collected for analysis.

Results from 21-days old pups demonstrated a significant difference depending on the maternal diet. Specifically, pups fed by mothers on a normal protein diet during lactation had a healthier body and muscle weight than those fed a low-protein diet. On a tissue specific level, the number and size of muscle fibres were significantly different between the 21-days old pups, with those fed by mothers on a low protein diet during lactation showing the most severe effects. In terms of neuronal function, the neuromuscular junction morphology appeared to be distorted in mice following a low-protein diet during pre-natal stages, regardless of their nutrition later in life (early post-natal stages). However, the number and size of α-motoneurons was significantly different in mice born from a normal mother but fed by a mother on a low-protein diet during lactation, compared with the other groups.

Thus, our preliminary data show that maternal low-protein diet can negatively affect the neuromuscular system of the offspring. More analysis is underway to determine whether those defects can be modified with optimisation of the nutrition later in life.

This project has been very successful, since we have tested a novel hypothesis based on the funding provided by The Physiological Society. In addition, the project helped me personally in progressing to my PhD, which is now examining the effects of a low-protein diet on the neuromuscular system at a molecular level.

'Results from 21-day old pups show a significant difference depending on the maternal diet. Specifically, pups fed by mothers on a normal protein diet during lactation had a healthier body and muscle weight as well as size, than those fed a low-protein diet'

101 things (give or take) to do with a physiology qualification

Martin Thomas

Cairn Research Ltd

Seventeen years ago, I related how I managed to help use an unhappy and unsuccessful experience in a large biosciences organisation to establish a rather smaller one. This small company has turned out to be much more rewarding for both myself and a few others.

'How many people work here?' is of course a frequently asked question for people in my current situation. I can admit to there now being 20-odd people in our little outfit now – and some of us are very odd as I rather like to say – but that's because we all like to do interesting things that just also happen to make us a reasonable living! That of course is one of the advantages of being a smaller and fully independent organisation, since we can do things 'our' way. For more about us, both past and present, our website **www.cairn-research.co.uk** can tell you more than you ever wanted to know, especially the 'President's Log' section (yes that's me), linked directly to our homepage.

But this particular article isn't directly about my company. Rather, it's intended to be a more general one about non-academic opportunities for physiologists – or to broaden it out still further, opportunities for people whose interests include physiology - as I think such people are in a much better position to make a useful contribution in other walks in life than they may realise. And on a more personal level, it's also a potential source of advice to people who have the misfortune to be the kind of professional misfit that I am! Here the basic advice is very simple indeed – don't try to hammer yourself into a round hole when you can actually *make* a square one, both for yourself and perhaps a few other similarly-shaped pegs. If enough of us do this, perhaps it will be the round ones that will no longer fit, so please don't be scared to have a go. And in any case, square pegs and holes are a more efficient use of space than their circular counterparts!

Electronics and physiology

Part of my mis-fitting has been that my personal interests happen to include electronics, but as a discipline it does arguably have similarities with at least some aspects of physiology, and I have found that to be generally insightful (although in the past some others have perhaps found it to be inciteful!), as I hope the following flight of fancy will start to make clear. Suppose a group of scientists from different disciplines are confronted with a completely unfamiliar piece of electronic equipment – how would they all investigate it? The physicists might bombard it with subatomic particles to see if they could create any new ones, the chemists might douse it with a series of increasingly noxious reagents to see if they could extract any previously unknown substances from it, and of course the biochemists and molecular biologists would smash it up into very small pieces which they would then try to individually isolate. And what would the physiologists do? They would switch the thing on and try to work out what it actually does!

Of course, for a full understanding of the system under investigation, some sensible combination of approaches is required, so this is in no way to denigrate those other disciplines. In engineering terms, at least in how I have described them here, those other approaches are all 'bottom up', whereas physiology tends to be 'top down', and the goal of course is somehow to get them to meet in the middle. It's just that my feeling is that in the overall scheme of things, the contribution that the 'top down' approach can and should make is often underestimated, so it is here that I see the greatest alternative career opportunities for physiologists, in whatever walk of life these may be, and whether you feel a misfit or not!

At this point, I'm going to see if I can broaden things out a little. As you have no doubt by now guessed, my misfit problem is ultimately because I am one of those people who find it essential to *do* things, but such behaviour in the wrong environment (whether academic or commercial) may not win you any friends.

Of course, in either environment one has to come up with 'results', but my personal experience is that the required processes can be very unpopular, and at worst not even understood – very much a case of 'Stop breaking all those eggs, and get on with making my omelette!' I all-too-well remember once making myself something of a pariah by stinking out a whole building while attempting an 'initiative-driven' chemical synthesis, which I then had to abandon. I was doing it in a fume hood, but it turned out that the people who had designed the then new building had put the air intakes right next to the fume hood extracts. So here's one piece of practical advice right now – whatever your career plans, don't work in a new building if you can possibly avoid it. At least wait until its teeth have come through, so to speak!

Motivation

In general, I think that people who are motivated by 'doing stuff' are going to be much happier – and of course more productive – if they are working in a smaller organisation than in a larger one. In particular, people are much more likely to have more of a team spirit there. If somewhere gets too big, people can be so obsessed with doing 'their' jobs that they can make the organisation less effective as a whole. A good personal example of that was the day I had an idea that would not just secure the future of that research lab, but would also make the world a better place for everyone, and I was so eager to start work on it that I was caught *speeding on the site access road* by no less a person than the *head* of the vast safety and security department! I was so embarrassed by the no-uncertain-terms dressing down I received for this misdemeanour that I forgot what the idea was, so a few years later the whole site had to close. Ok, so I exaggerate a little, but I did have an idea, I did basically forget it, and he was perhaps not quite the sort of person we would have taken on at Cairn! It was a very frustrating place to work, but on the other hand it did instil in me the importance of keeping any traces of that sort of problem out of our little organisation as it grows.

Cairn Research Ltd premises

Resources and research grants

To do things, you need resources too, of course, and in academia, this means getting research grants! However, it seems to me that in order to be successful on that front, you really do benefit from being in one of the more 'prestigious', and hence generally 'bigger' institutions. All very good for the ego maybe, but is that what you really want? Worse, in order to keep a lab together, you'll probably have to spend so much time on grant applications and all the other paperwork that such positions entail, that before long you're having to leave the 'doing' stuff entirely to others – is *that* what you want?

I'm sure there will never be any shortage of people willing to kill their grandmothers (although hopefully not in a literal sense) to take on such positions and work in such environments, and a good thing too! Like it or not, that's the way a lot of science gets done nowadays, and if I could think of a much better one, I would be the first to scream it from the rooftops. But at the risk of being burnt at the stake for saying so, I'm not sure that the most creative people should even seek such positions. With luck, the creativity will come from the people passing through, just as long as the boss has the wit to permit it! If not, then the boss is less likely to get further funding, so at least there's a reasonable chance of the overall process being self-correcting over time.

So yes, by all means go to such places for a while (but choose your boss with care!), but then what? My point is that if you're a bit like me, then to use a physiologist's type of skills and approaches in a less than purely physiological environment might suit you rather better! You might enjoy being at companies like Cairn rather more than you thought, so why not consider this? In reality I think the opportunities are much broader than just looking out for directly physiology-related positions, so if you have any flair for creativity, then I suggest you use that creativity to think up some interesting possibilities for yourself! In my opinion it's the physiological approach to things that may give you the edge. From my own interests and experience I would say that there isn't that much difference between pulling something apart to see how it works, and putting something new together once you understand how the individual pieces work. In fact, a physiological background might give you a better insight into the sort of mistakes you should avoid, such as the vertebrate eye with its photoreceptors all plugged in the wrong way round – our designs can be 'sensible' rather than merely 'intelligent'!

But what about the 'resources' problem? In particular, do you really need massive resources to do interesting things? That was the mistake I made way back then, as I was sufficiently conceited to think that the combination of 'their' money and 'my' ideas would be a winner, whereas it was actually the other way round! So, in order to get Cairn off the ground without any outside investors (a key goal that has fully delivered the expected benefits), I had to learn how to do things in an economical way. By keeping costs down and thinking for the longer term, we've managed to end up with our own premises on our own farm, and we're currently finishing off a nice new building there in order to continue our steady expansion.

Large buildings are often poor value

In fact, perhaps the biggest 'discovery' I've made in Cairn is that you don't need nearly as many resources as you may think to 'get things done'. By the time this heresy is in print, an even greater heresy in the form of a comparison between Cairn's new building and a certain 'other' research building currently nearing completion in Central London should be available as a blog from me on the Cairn website. The difference in scale may be vast, but the difference in cost is bigger still. For example, we don't have a multilevel basement, because our site is big enough for everything to be above ground, we don't need vibration isolation because the nearest roads and railways are a safe distance away, and we don't have a cavernous atrium because we decided not to. In fact, because our building is a wood-clad one (which was a condition of being given the permission) out in the country, it is perhaps more redolent of Bletchley Park, where those people did all their wonderful things from a few hastily-erected garden sheds. Is there a moral here somewhere, I wonder? Never mind how impressive the infrastructure may be, just make sure that the working environment lets you get on with the job!

I think this goes for *experimental* resources too, and here I venture to say that there are possible lessons for everyone, wherever they are working or decide to work, be it academia, industry, or wherever else. In particular, the increasing trend towards 'centralised facilities' looks good on paper, and hence to the growing legions of pen-wielding administrators and accountants who have been steadily securing their bridgeheads into the previously hallowed halls of academia in recent years, but in practice I'm not so sure. Of course, such facilities can make sense sometimes (after all, it's not as if every particle physicist can have their own collider). But if you can only get access to 'the confocal microscope' for a couple of hours on a Thursday, then there's not much more you can do with it other than bunging your (probably by now dead) samples under it for a quick look. Cairn's customers tend to be a pretty ingenious lot, and we see those of them who can get away with it modifying equipment in a variety of ways in order to do rather more 'interesting' things with it, but then it has to be 'theirs'. If you start drilling holes in shared equipment, you're very quickly going to upset other users, not to mention the priest-like figures who may be charged with guarding these sacred relics. You're much more likely to do genuinely innovative work with humbler equipment that's under your own control, so do check the skips regularly. You may find last year's model lurking there for the taking, it having been thrown out to make space for the latest communal behemoth!

At this point I see an approaching army of incensed administrators, clearly intending to consign *me* to a skip if only they could, so to avoid unnecessary bloodshed I think it best to bring proceedings to an abrupt conclusion!

Lab_13 Ghana

Anisha and students mark the opening of Lab_13

Anisha Tailor

Outreach officer,
The Physiological Society

In March 2016, Anisha Tailor, Outreach Officer at The Physiological Society took a six month sabbatical to work on an education project in Ghana. The project aimed to raise student engagement in science by putting professional scientists in classrooms to support young people in becoming scientists through practical discovery and student led-investigation.

After a class on 'How do our eyes work?' I tore off the corner of the plastic water sachet I had been using in my lesson and drank. The pliable bags are the most common containers for drinking water in Ghana. You can buy bottles, but the sealed 500ml sachets are much cheaper and the cool packets could be bought from the heads of hawkers through the window of the bus. I always had a bag on me. I would squash and flatten it in my hand and watch the air bubble move around the packet. I would place it on my head when I was too hot to cool me down. I would pour the water over vegetables to clean them before cooking. There was always a use.

On this particular day, I had been using the sachets to explain sight, and the ability of the lens to adjust its focus by changing shape. My students had peered through the transparent packets, sloshing around the contents as they pulled the bags taught or lay them loosely over snippets of texts making their observations. I took my final sip from the bag in my hand and slipped the plastic into my pocket, tomorrow I could use the empty packet to make a diaphragm for some balloon bottle lungs. This was my life as Scientists in Residence for Lab_13 Ghana.

Last spring I volunteered 6 months of my life to work on a pilot project aiming to establish a 'proof of concept' for a new model of science education in resource-constrained environments. I was to set up a lab space based on a network of UK labs called Lab_13, in Ghana. The space would be an area in a school dedicated to the exploration of science through student led enquiry and experimentation. The ethos of the lab was to ignite curiosity in young people by putting them in charge of their own learning through a student led approach to teaching.

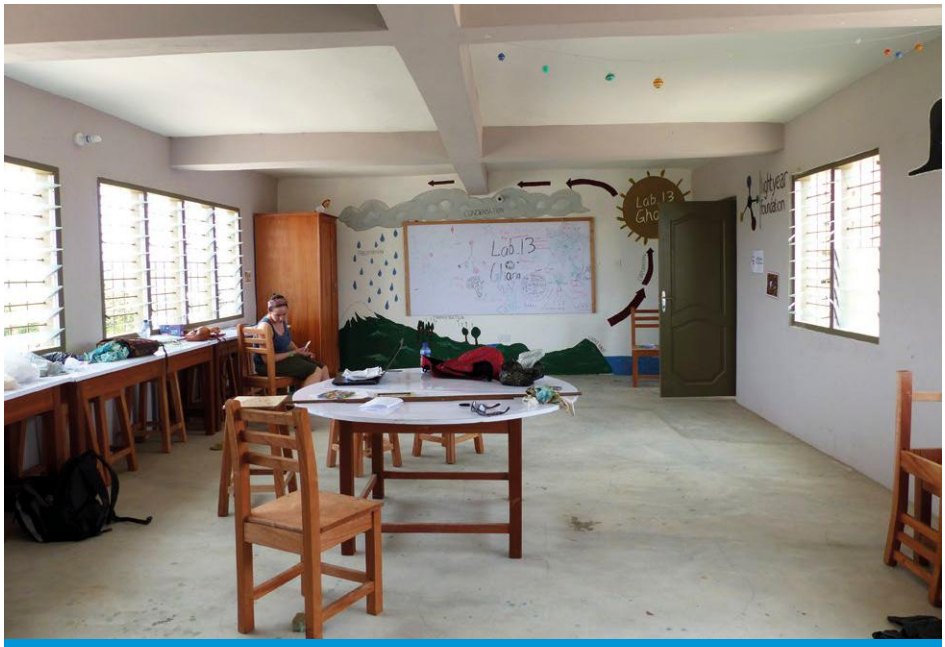
Across the world, education is usually teacher led; time and curriculum restraints can often mean that students are taught to pass exams, they learn A and B, but do not take part in the journey of discovering answers themselves. Scientific methodology of hypothesising, observing, experimenting and making conclusions are either put on the backburner or crammed in briefly.

This is especially true for Ghana. While discussing the education system with my Ghanaian colleague, he told me of his own experience going through the country's education system, stating '*science teaching is theoretical, notes are written on the board for students to copy, tests are taken periodically, and a final examination is given at the end of the year*'. He was a scientist himself, he had attended Kwame Nkrumah University of Science and Technology (KNUST) and had been working as a research assistant looking at agricultural biotech and plant disease diagnostics. It was through extracurricular hands-on activities, field trips, and his own reading about great scientists and discoveries he became inspired to pursue his field of agricultural science.

The Lab_13 model, which in the UK, is used as an Ofsted example of good practice in schools, not only allows students to learn about great discoveries and scientists through books, it puts them in direct contact with scientists themselves. Each lab has its own professional Scientist-in-Residence (SiR), an inventor, maker, a scientific discoverer, whose sole job is to be their normal inquisitive self, and to support students in their own practical endeavours and investigations. The model allows a sort of observational learning, resulting in a diffusion chain of passionate student scientists spreading across a school. Along with three others volunteers I become part of Lab_13 Ghana's first SiR Team. The students took the lead, and we became their lab assistants, helping them carry out experiments to answer questions such as, why is the sky blue? If it rains from such a great height, why does rain not hurt me? Why don't I have hair on my hands? Why do foods have expiry dates?

In the 6 months I was in Ghana I worked with local schools and authorities to engage with 30 schools, 700 students and 65 teachers fortnightly. I made brain hats to discuss neuroscience, gathered hibiscus flowers for pH indicator and used glitter to talk epidemics. I saved every bit of my recycling to make lungs, boats, and water filters, and covered my kitchen in flour and food dye for lessons on sea currents and electricity. I watched a passion develop through introducing practical experiments with the use of locally sourced equipment and materials, and saw aspirations soar by the introduction of real scientists into classrooms all over the district.

The Lab_13 model, which had proved successful in the UK, saw an equally incredible student response in Ghana. Translation, however, was not always easy; there are of course always challenges in setting up a pilot project. I had expected



The lab ready to hold class following redecoration

Students repurposing electronics

tackling misconception present in the country that 'doing' science required specialist labs and equipment, or dealing with the culture of students being quiet recipients of knowledge from 'all-knowing' teachers to be the biggest, but in fact they weren't. For me, the biggest challenge didn't even relate to translating the model, it was my own personal experience of becoming a teacher.

Every two weeks I led sessions for seven schools. I took my students' questions, created bespoke classes surrounding their interests, researched areas of science in which I was not an expert and sourced inexpensive equipment and resources for my lessons. I assisted my team in their classes and tried to ensure that I was an ever present figure in the Lab, so students could always drop in. My timetable wasn't full, yet I found myself constantly working, weekdays, weekends, evenings, as did the rest of my team. I had known that this was certainly not an uncommon phenomenon in the teaching profession, but I only had seven sessions every two weeks and I was constantly busy. In the UK, a typical school timetable would see a teacher working a minimum of 20 sessions over just one week and I found it difficult to even comprehend how the teaching of science with such time constraints on staff time could possibly be kept engaging and practical. For me, I found relief in partnership.

Students and lecturers from KNUST supported the activities of Lab_13 Ghana by taking part in guest lectures, Saturday Clubs, and even becoming mentors to some of our students. While my team and I acted as the daily Scientists-in-Residence, we couldn't always offer an expert opinion on every topic, nor had the time to become versed in depth. We could encourage inquisitiveness and support a scientific approach to investigation (in fact I actually learnt quite a lot of new and long forgotten science through working with the students in their experiment designs). But sometimes we lacked a deep subject knowledge invaluable in thinking of a perfect analogy, or finding a resourceful way to explain and investigate a problem. This, in addition to a shortage of time, is a common problem for both teachers in Ghana, the UK, and undoubtably much of the world.

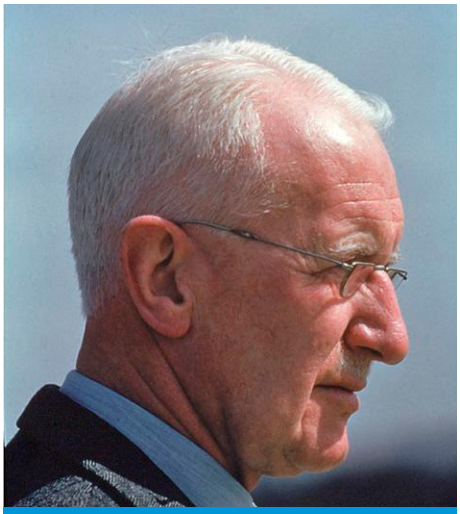
In the UK, secondary school science teachers will have a degree in a particular area of science; however, they are expected to engage students across a wide breath of topics not necessarily in their specialist field. Primary school teachers often don't have a science background at all. Our lab hosted visits from pharmaceutical lectures, electrical engineering students, immunologists, and material scientists, and I experienced first-hand the impact of having the support of a community of professional scientists in enhancing teacher confidence in teaching areas in which they had limited knowledge.

The teachers at my schools told me the work we carried out and the partnerships formed made their students more curious and confident, better able to observe and evaluate, with greater abilities to think rationally and draw conclusions. It was so gratifying to see the effect of only the first 5 and half months of the project, and emphasised to me the importance of forging links between the scientific community and schoolchildren.

As a Society, we share a wealth of knowledge on human and animal physiology and should be supporting the development of future undergraduates, PhD students, postdocs and academics by ensuring we are present at the start, in the formative years of education. A knowledge for, and passion for ones subject, is vital in promoting that passion in others and ensuring the future of a disciple. As a community of scientists who found their path to physiology, I'm sure you can pinpoint the moments where your fascination about the world around you veered you in the direction of this particular scientific study. For me, my joy of science can be tracked back to a vivid memory of the WISE (Women in Science and Engineering) bus parking up in my school's playground and being invited on to tinker and investigate, coming to the realisation that 'this is cool'.

I can only hope that this is the effect I brought about in Ghana, and can also catalyse for The Society. This is why I call on the Membership to take arms, become a Physiologist-in-Residence. I'm not asking you to move to a different continent, or become a permanent member of staff at a school; I'm asking you to take your passion to surrounding schools and share it. Support local schools, which may lack the resources, budget or staff time to be able advocate for our field. It is only by investing our time in the future will we be able to create the next generation of high quality physiologists and ensure the continuation of cutting edge research. Become part of the moment, a memory someone can track back to the start of their love affair with science.

Blue Plaque at AV Hill's former home



AV Hill in 1955 (Photograph by Harold Lewis)

David Miller

Chair, History & Archives Committees & Hon. Res. Fellow, University of Glasgow, UK

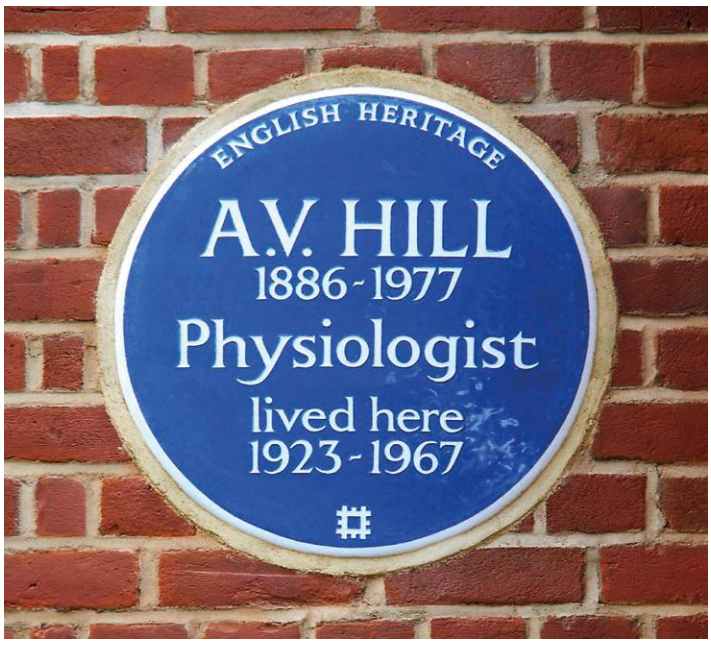
The pre-eminent physiologist and humanitarian AV Hill's former London home was at 16 Bishopswood Road, Highgate, North London. It has been owned by Highgate School since his death, and has recently been extensively refurbished by the architects, Atelier. English Heritage commemorated AV's residence by unveiling a Blue Plaque at the house on 9 September 2015. The plaque describes AV simply as 'Physiologist'. The only other plaque bearing that simple epithet is at Henry Dale's former home (Mount Vernon House, Hampstead).

The event, sponsored by Atelier and the estate agents Savills, was attended by a number of AV's extended family, together with dozens of other guests and dignitaries. Jonathan Ashmore, Fran Ashcroft and I represented The Society. Brief speeches were made by Greg Dyke (Chairman of The Football Association and former Director General of the BBC), Dr Julie Maxton (Executive Director, Royal Society), Prof Nicholas Humphrey (psychologist and philosopher), Stephen Wordsworth (CARA – Council for Assisting Refugee Academics) and Sir Ralph Kohn FRS (founder of the Kohn Foundation) who had proposed the Blue Plaque to honour AV's memory. Amongst the speeches, Nicholas Humphrey (a grandson of AV) described that regular guests at the house included many Nobel laureates, AV's brother-in-law, the economist John Maynard Keynes, and friends as varied as Stephen Hawking and Sigmund Freud. The afterdinner conversations involved passionate debates about science and politics. '*Every Sunday [as a child] we would have to attend a tea party at grandpa's house and apart from entertaining some extraordinary guests, he would devise some great games for us, such as frog racing in the garden or looking through the lens of a [dissected] sheep's eye.*'

Archibald Vivian Hill (1886-1977)–known to all as 'AV'–was the first British winner of the Nobel Prize for Physiology or Medicine (in 1922/3), honoured for his early work on heat production in muscle. He is widely regarded as a founder of the discipline of biophysics, bringing his command of mathematics and physical principles to his work in physiology. His research work was fundamental in areas as varied as hormone-, neurotransmitter- and drug-receptor physiology, enzyme kinetics, muscle metabolism, nerve function, the mechanism of muscle mechanical function and more. One reason for the speech from Greg Dyke, representing the FA at the unveiling, is that aspects of AV's work are also recognised as foundations of Sports Science: AV was himself a gifted athlete. He was mentor to several generations of leading physiologists. He led the physiology department at Manchester University (1920-23) and then at University College London (1923-1951). He joined The Society in 1912 and filled many major roles (Secretary 1927-33, Foreign Secretary 1934-45, served many years on the Editorial Board of *JPhysiol*). He was elected a Fellow of The Royal Society in 1918, going on to fill several senior roles (Council from 1932-4, Biological Secretary 1935-45, Foreign Secretary 1946) and held a Royal Society Foulerton Professorship. In World War II, he served as the (independent) MP for Cambridge University, his *alma mater*, and on government wartime science and technical committees.

Beyond his research, mentoring, government work, science administration and teaching, AV's humanitarian work was exemplary. He played a leading role in setting up CARA (in 1933, with Ernest Rutherford, William Beveridge and others) and thus in the work to assist and support scientists escaping persecution in Nazi Germany. At the Blue Plaque ceremony, Sir Ralph Kohn referred to this endeavour: whilst still a child, Sir Ralph himself had escaped (together with his parents) from Leipzig in 1935. Sir Ralph reminded me that Bernard Katz had also escaped Leipzig the same year. He became a PhD student of AV and lived for some years as a lodger at AV's home: thus there is a case for a further physiologist's Blue Plaque at 16 Bishopswood Road.

Hill said and wrote much that is worthy of being quoted. As a champion of the value of unfettered original research, he observed in his Inaugural Lecture for the Jodrell Chair of Physiology at UCL in 1923 (when he succeeded Ernest Starling), '*Medicine is continually demanding more information and help in the grievous and urgent problems which it has to solve – useful information, practical information, information which is likely to help heal ... minds and bodies. It is impossible not to be moved by this appeal, and in their hearts there are few physiologists who do not hope that their work may prove, in some sense and at some good time, of service to mankind in the maintenance of health, in the prevention of disease, and in the art of science and healing. One's heart, however, is not always one's best guide; more useful in the end is the intellectual faith ... which urges Tom, Dick and Harry in their humble way to explore each his own little strange and miraculous phenomenon, whether in the organic or inorganic world.*' [as quoted by Brian Jewell in *Physiology News*, Summer 2008, p12].



(Clockwise from top)

Guests assemble at AV's former home, 16 Bishopswood Road, Highgate, London

(L to R) Sir Ralph Kohn, Stephen Wordsworth, Julia Maxton, Nicholas Humphrey, Greg Dyke

The Blue Plaque

Photo credits: David Miller

From the archives: the cost-free joys of email

From The Physiological Society Newsletter February, 1991. Edited by Alison Brading, Oxford. (This would be numbered zero in the current system)

The cost-free joys of email

As a recent convert to email I have the convert's usual desire to persuade others of the benefits of joining the system. Before this fades I thought it worth the effort of an article for Alison's newsletter, which I will probably have to post to her. Perhaps after reading this she will join herself!

As many will know email is a computer-to-computer system to enable people to communicate with each other internationally, nationally and locally. You need access to a suitable terminal (often a lab PC connected by a network to an institute's central computers); you will need to register with your computer centre. I had to fill in 3 different forms and get one signed by my department head) and a mail name. Your mail name plus institute's address is your personal email address. Mine, for example, is **roger.thomas@bristol** in the UK, or **@uk.ac.bristol** outside.

The mail name in effect is that of a virtual pigeon hole or 'mailbox' in the memory of a local computer. You look in Your mailbox from time to time using any suitable terminal, not necessarily yours, and your personal password. You can use the same terminal to reply, print out the message, or even forward it.

Email has two great advantages: high speed and zero cost. Its speed can approach that of a fax, while its cost is that of internal mail. It is easier to send than a fax, often faster, for example if the two fax machines are inaccessible, and free! (Have you heard about Bristol University's lost £4.6 millions? I digress.) It's easiest to send, but very hard to edit, something you type in directly. Email does have some problems, I admit.

Too few people have email addresses. Speed depends on the recipient looking in his mailbox reasonably often. The sender has to type the message in, or at least be able to load a file typed by someone else and send that. Both sender and receiver need some computer skills. The details depend on your local computer network's email program, and in Bristol are due to be simplified soon. But it really takes very little time once you are used to it.

How easy is it to look in your mailbox? With my PC in DOS mode I first type kermit. Then c to connect to the network, Then I enter call mail. When prompted I type pyrct to log on, and then my six-letter password. That's all.

Once connected to the email computer the procedure is Quite simple and mostly explained on screen. On connection mine displays the titles of the last 10 messages received, and brief notes on the various choices. To read a message you select its title with cursor keys and press return. To reply you type r, then return, then a title, then press return two or three times until the instruction 'please enter message' appears, then do so. Finally type a full stop at the start of a line, then return twice, and the message is sent! It needs more steps to send a file, but they are quite easy to learn. An unformatted text-file is harder to send than a message typed into email directly, but easier to edit.

Hardest to handle are binary files, such as a TIFF file from scanned artwork, or a program, or a formatted word- processor file, which can be sent after conversion to ascii coding. (If you have an IBM PC or clone I can send you, courtesy of Mike Rickard, without whose help I'd never have leamt to use email, a BASIC program to decode coded file conversion programs, with all you need to code and decode binary files. If you'd like me to send you these please ask, but only via email!)

Is electronic mail really free to people in the academic system, and if so who pays? Laurie Burbridge, Deputy Director of our Computer Centre, confirms that it is free. Via email (!) he tells me that all email to other U.K. Universities goes over a national network called JANET.

This is centrally funded by the D.E.S. via the Computer Board and there is no cost to the user at all. It is one of those services which is genuinely free, and the best analogy would be with making an internal telephone call. The same is true of email sent to other Universities in North America, Europe and many other countries world-wide – all available at no cost whatsoever. The disadvantage with international email is that the addressing conventions are rather bizarre, but this is only a problem the first time you want to contact a colleague in, say, University of Utah.

Costs are, however, incurred if you wish to send email to any user who is not connected to JANET or one of the international academic networks.

RC Thomas, 14 January 1991

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www.physoc.org/bbep2016

2–6 April

Experimental Biology 2016
San Diego Convention Center, San Diego, United States

experimentalbiology.org/2016

7–9 April

Advances & Breakthroughs in Calcium Signalling
The Hilton Hawaiian Village Resort, Hawaii, United States Minor Outlying Islands

calcium-signalling.weebly.com

29–31 July

Physiology 2016
Joint Meeting of the American Physiological Society and The Physiological Society
Convention Centre Dublin, Ireland

www.physiology2016.org

Meeting Notes

A Pharmacist's take on Physiology 2015

6–8 July 2015,
Motorpoint Arena,
Cardiff, UK

Hafeeza Ayuoob & Vytautas Kontrimas

University of Reading, UK

This year Cardiff was the central hub for physiologists from all over the world hosting an internationally acclaimed Physiology 2015 symposium. The conference held at Motorpoint arena enabled us to learn and understand various research areas as well as gave the opportunity to present our work. Additionally, it was an excellent chance to get updated about recent findings and advancements in cardiovascular, metabolism, neuroscience and many other fields.

The public lecture presented by Sophie Scott was titled 'The science of laughter'. It gave us an insight into the evolution of laughter and how certain emotions appear to be interpreted universally. The talk was also a great example of how complex information can be transformed into a charming and easy to follow lecture. After this lecture we felt motivated to become better communicators, which is an important aspect for pharmacists.

We were also given the opportunity to communicate our own summer research project during the poster session on the last day. Our research was based on carbon monoxide and hydrogen sulphide gases and their role in neurodegenerative diseases, particularly Alzheimer's disease. We found this to be a very key moment of the conference enabling us to develop interpersonal skills such as communication, which also increased our confidence. Unexpected questions and observations from physiologists propelled a range of new ideas and perspectives regarding our research. Overall it was a challenging but without a doubt an invaluable experience.

In addition, we were lucky enough to explore and see other posters that were displayed. The range of posters and depth of knowledge everyone had was outstanding. One poster in particular we found to be quite interesting. It revealed that simvastatin could be useful for hypertensive patients by improving endothelial cell function of blood vessels within the brain and reversing the loss of capillary density. We kept coming back to this poster as this was very new and certainly useful in our future career as pharmacists. Yet another poster highlighted an importance of glycolysis metabolite methylglyoxal in Type 1 diabetes and especially its complications such as neuropathy and nephropathy.

As an undergraduate, Physiology 2015 provided a great platform for networking due to the diverse audience, ranging from professional researchers to PhD students from all over the world. It allowed us to appreciate the scope of knowledge gained throughout our pharmacy studies and summer research project.

Meeting both PhD students and research scientists was an outstanding opportunity to explore possible pharmacy career paths in particular medical writing or industrial pharmacy.

It is beyond a doubt that this was an amazing, memorable and insightful experience, which will be applicable in our future as pharmacists.

Lastly, we would like to thank University of Reading, The Physiology Society and The Alzheimer's Society for giving us the opportunity to complete the summer projects and present our findings. Also, we would like to thank our project supervisor Dr Mark Dallas for all the support and encouragement he has given us throughout.

Meeting Notes

The Journal of Physiology supports a symposium at the World Congress of Microcirculation in Kyoto, Japan

25–27 September 2015,
International Conference Centre,
Kyoto, Japan

Geraldine Clough

Professor of Vascular Physiology
Institute of Developmental Sciences
University of Southampton, UK

L–R: Mark Hanson, Yuichiro Arima, Phoebe Stapleton, Geraldine Clough , Giovanni Mann, Tien Wong

Our speakers from the UK, USA, Singapore and Japan got together through the sponsorship of *The Journal of Physiology* in the beautiful settings of the Kyoto International Conference Centre, to discuss 'Microvascular plasticity and developmental priming: impact on human health'. The symposium was organised by Geraldine Clough and Giovanni Mann and formed part of the highly successful 10th World Congress of Microcirculation.

Mark Hanson from the University of Southampton UK opened proceedings with an examination of the mechanistic basis and wider implications of adopting a developmental perspective on human ageing. Professor Hanson used a life course model to place ageing in the context of the attainment of peak capacity for a body system, such as the cardiovascular or musculo-skeletal system, starting in early development when plasticity permits changes in structure and function induced by a range of environmental stimuli, and ending in decline.

Phoebe Stapleton from the Department of Physiology and Pharmacology, West Virginia University USA went on to talk about the impact of nanoparticle exposure during pregnancy and its detrimental effects on maternal and foetal health at each stage of gestation. There are currently no safety guidelines associated with engineered nanoparticle exposure during pregnancy and Dr Stapleton described how exposures prior to conception, as well as during gestation, may have long term consequences associated with nanoparticle translocation, pulmonary inflammation, and microvascular dysfunction.

The Kyoto International Conference Centre, venue for the symposium

The next contribution came from an early career investigator, Dr Yuichiro Arima from the Department of Cardiovascular Medicine, Kumamoto-University, Japan. Dr Arima presented his work using the multi-photon microscopy to explore the heterogeneity of the coronary vasculature and how under-nutrition during gestation can influence the proper development of heart and coronary circulation in low birth weight mouse offspring.

The symposium was concluded by Professor Tien Wong who described his recent work using retinal vascular imaging in children and adolescents directed at understanding cardiovascular disease (CVD) risk in early life. These studies show that the same retinal vascular changes linked with stroke, hypertension and CVD were associated in children with lower birth weight, shorter gestational age, hypertension, overweight/obesity, and type-1 diabetes.

Together our speakers eloquently supported the paradigm of the symposium (and the meeting as a whole) that the microcirculation is a site for pre-clinical processes underlying the development of CVD in adulthood and that it may offer an accessible and relevant marker for the assessment and mechanistic understanding of later risk.

Review articles from the symposium talks will be published in a Special Issue of *The Journal of Physiology* focused on Cardiovascular and Skeletal Muscle Ageing to tie in with The Physiological Society's 'Understanding Ageing' year in 2015. This Special Issue aims to cover all areas of physiology, with an emphasis on the effects of ageing on cardiovascular and skeletal muscle function, including cardiac and muscle performance in exercise.

From the Archives: reports of the Sheffield, Mill Hill and Nuffield Institute meetings of 1965

Transcribed by Roger Thomas

The Physiological Society Sheffield Meeting, 24–25 September 1965

With RB Fisher in the Chair a Semi-Annual Meeting of the Society was held in the Department of Physiology of the University of Sheffield on Saturday, 25 September, 1965 starting at 9.15 am. Ten minutes later 15 Ordinary Members and 3 Associate Members had been elected, Elizabeth A. Ullmann and PR Lewis acting as Scrutineers to the ballot, and places and dates of scientific meetings for 1966 were approved.

The Semi-Annual Meeting only briefly interrupted a scientific meeting under the Chairmanship of DH Smyth. This had begun at 2 pm on the previous clay with 8 of the 26 Communications of the Meeting and it was continued after tea with no less than 40 Demonstrations. These were mainly drawn from DH Smyth's own department and R Barer's department of Anatomy and Human Biology which not even the most prejudiced of physiologists could describe as corpse-centred.

At 6.30 pm Members and their Guests were entertained most generously to sherry by the Vice-Chancellor and, at 7.15 they dined in Stephenson Hall. After dinner R Passmore spoke of the great pleasure Members had had in this meeting at the very centre of England and he warmly thanked the Chairman and his colleagues. DH Smyth in his reply welcomed the Vice-Chancellor and two Guests of the Society, Dr. Heinz and Dr. Ring from Frankfurt, and said how delighted he and his colleagues were to have Lady Mellanby in Sheffield once again. He explained that his own special genius was not in arranging of meetings but in finding the right man to do this for him. His particular genie on this occasion was G Wiseman who, through these two days , never failed to materialise with a bus or a beer or whatever Members were wishing for.

Finally at the end of a very substantial dinner with excellent wines, DPC Lloyd was moved to speak well of George III, but apparently a few more meetings of The Society must still pass before his lingering reservations about the true merits of Lord North can be removed.

Signed: W Feldberg

The Physiological Society Mill Hill meeting, 5–6 November 1965

The Meeting at the National Institute for Medical Research on the 5/6 November, 1965 was perhaps the last Mill Hill Meeting of The Society to be held at W Feldberg's invitation. It should perhaps have been a solemn affair but he took very good care that it was not.

Under his Chairmanship and those of OG Edholm and. DH Sproull, 26 Communications were given. In some of these the tide of undiscovery or rediscovery had ebbed rather far in the previous 6 weeks and sometimes what promised to be a full spring tide appeared as a modest neap - yet, with charitable guidance from the Chair, The Society amended all.

At Dinner which was held in the Institute on the Friday evening, the wines were very generously given by the Divisions of Experimental Biology, Human Physiology, Organic Chemistry and Physiology and Pharmacology. The Society's thanks to the Chairman and his colleagues were splendidly given by H Davson in fine Shakespearean lines. He modestly compared his own oratorical powers with those of GL Brown whom he thought night have been better able to 'serve forth the funeral baked meats'. In this he was perhaps a little unjust to himself - and to Shakespeare.

W Feldberg spoke three times. He welcomed the many foreign guests. He gave the speech he would have given if he had been sure that this was positively his last appearance. He passed on to the young advice on the art of physiological experimentation given to him. The approach of his teachers ranged from the statistical with Langley through the inspirational with J Barcroft to the astronomical with Dale and confirmed our long lasting suspicion that all that is really essential is simply to be gifted at doing good experiments.

The meeting ended on Saturday afternoon in the usual agreeable Mill Hill all way with the Demonstrations, of which there were 14, and with tea at half past four.

Signed: LG Goodwin, The Physiological Society

The Nuffield Institute of Comparative Medicine Meeting, 10–11 December 1965

At the invitation of LG Goodwin a meeting of The Society was held on the 10/11 December, 1965, at the Nuffield Institute of Comparative Medicine of the (Regent's Park) Zoo.

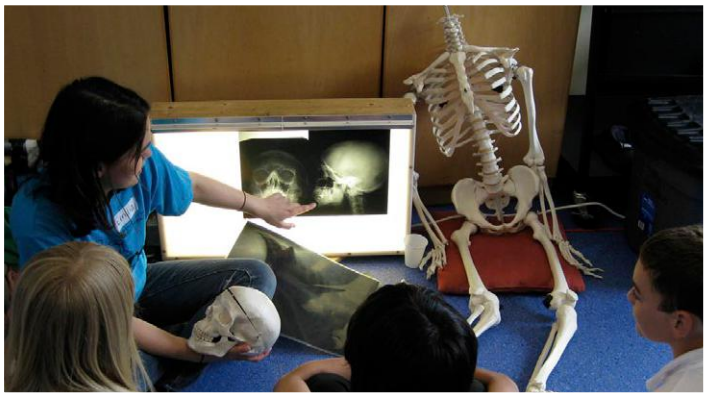
The Meeting was opened by S Zuckerman, who had played a major role in the founding of the Institute and who confessed that this was the first meeting of the Society which he had attended for over 20 years. After taking the Chair for the first session he left before tea but it was not known for certain that he was really about to meet JZ Young at the back door of the Treasury. He was followed in the Chair by LG Goodwin, GW Vevers and PA Jewel and in all 20 Communications were heard, the first on the Programme being withdrawn because of ill health.

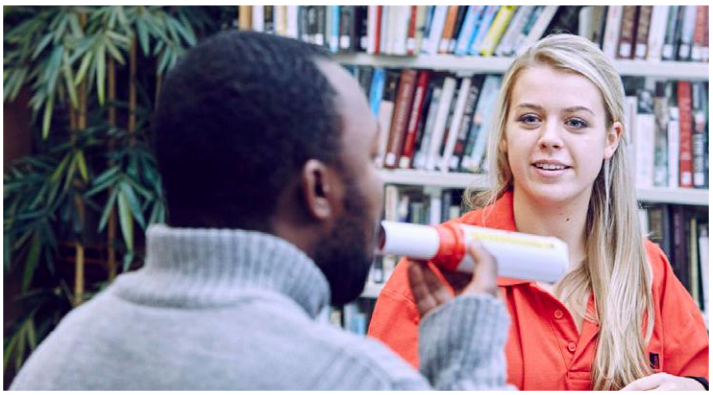
After the dinner, which was held at the Royal Society of Medicine, A St G Huggett, whom Members were delighted to see looking so marvellously well, thanked the Chairman and his colleagues and especially Miss Pat Wright for a very happy first Meeting at the Zoo. He looked forward to a Demonstration in which a single injection would change sex. He remarked that after all the difference between the sexes was slight and that they were only separated by an OH group. From a cry of '*Vive la difference*' it appeared however that there were still unfortunately those for whom 'Oh No's were more important than the OH's.

The Chairman welcomed Members and their Guests and noted that, as was appropriate for his Institute, work on no less than 12 species of animals had been described; the Meeting was, in fact, only saved from an unlucky 13 by W Feldberg's reticence about rabbits.

Throughout the Meeting and especially at the time devoted to the 12 Demonstrations, Members enjoyed the freedom not only of the Nuffield and Wellcome Institutes but also of the Zoo and, on the Saturday after lunch, L.G.Goodwin announced that the magic Passwords 'Physiological Society' would unlock the doors of the houses of the Zoo including those of almost the best Aquarium in England.

Signed: Eric Neill

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The Physiological Society

3D Printing Primer for Physiologists

3D printing is about to revolutionise the medical world – from printing realistic surgical models, stents, prostethics, to heart valves, bones or ear cartilage. Physiologist Christof Schwiening recounts his own experiences with 3D printing.

Christof Schwiening,
University of Cambridge, UK

Printing objects out of plastic has become relatively easy in the past couple of years with the development of consumer-level filament deposition technologies – essentially using a computer controlled print head to squirt hot plastic onto a level bed. The 'Boot' (Fig. 1) was my first 3D print – and had no function other than to allow me to discuss some unusual ideas with colleagues in the coffee room. But 3D printers have myriad usages for physiologists, below I have discussed the why, how and the wow of current 3D printing technologies.

Once I had only a tendency to accumulate bits of old kit, but the closure of our mechanical workshops about 10 years ago turned me into an obsessive hoarder. Modifying a superfusion system, changing the mounting of electrodes, attaching a keyboard in an accessible location or protecting bits of electronics from Ringer's solution requires a good supply of bars, bolts, tubes, washers, clamps, nuts, Perspex and a mass of Silicone rubber, plasticine or Blu-Tack. Often no suitable commercial solution is available and without access to a friendly skilled workshop the Blu Tack ends up becoming a permanent feature which all too often sags and then eventually fails. With the workshop gone I was increasingly forced to use my own workshop at home. Of course there were other workshops around the University but the turn-around times were long, and iterative redesigns were simply impossible since each version required remaking from scratch.

I had heard about 3D printers in the news but had always assumed they were expensive toys of limited real world use. I began to pay a bit more attention in 2012 when Hugh Matthews decided to produce a new first year practical and needed to make 40 strain-gauge mounts to fit between the students' fingers.

To make the mounts he first bought a box of rods, motors, clamps and some control electronics from RepRapPro. When assembled, the box of bits formed a 3D printer called a Mendel. The concept behind this form of 3D printing - fused deposition modelling (FDM) – is not radically different from forming a coil pot with clay. A heated (200-250°C) print-head has plastic filament (~1.75 mm diameter) fed through it out of a fine nozzle (0.3-0.5 mm), as it is made to scan across a bed with the print-head lifting a little (~0.3 mm) as each layer is completed. Thus an object can be, literally, drawn into existence.

My enthusiasm for this technology was ignited whilst making an automated fly-tapper for a colleague from some 1950s Swedish Mechano (FAC X2). I had all the necessary gearing, posts, plates and a motor, but I could not find a way of mounting the tube of flies on the end of a lever arm. I was, frankly, beginning to look a bit stupid when another colleague appeared (Kevin O'Holleran, Cambridge Advance Imaging Centre, CAIC), and hearing of my problem suggested '*let me just print you something*'. Within 30 minutes, he had a design and his MakerBot (a commercial 3D printer) began buzzing into life.

Figure 1. Injection-moulded Morph and Chas discussing a scale 3D printed model of a 'boot' (Schwiening & Davies (2014). The use of water displacement to produce high-resolution leg cross-sectional profiles. *Proc Physiol Soc* **31**, D1). Sometimes a scaled version of an object makes it easier to explain and discuss design elements.

The actual print took about 1 hour but what he delivered was almost exactly what I wanted. It seem churlish to criticise the design, after all it worked reasonably well – but, I did – which resulted in him returning a short time later with the perfect 3D printed piece of plastic. I was amazed, this really was a rapid prototyping process.

It was only a brief time before I managed to persuade my son that he wanted a 3D printer kit for his 17th birthday; at that point I could not see quite how I could justify one for the lab. Had my wife known the true cost of the printer, Max may well have ended up with a replacement phone instead.

Building a 3D printer is not entirely a trivial task. Max and I slaved over the construction for many evenings before we had it functioning. But, it is not impossibly difficult as Jessica Chadwick (a second year physiology student from Leeds) showed this summer, when she assembled one in my lab. I hope she won't mind me saying this, but it can be done by someone with no engineering or DIY background, requiring nothing but a bright mind and an ability to follow online instructions. Assembled 'ready-to-go' 3D printers are relatively cheap and an easy option. But, the process of FDM is a bit of an art and the purists claim that true empathy for the dynamics of molten plastic can only be attained by building the machine from scratch!

Often the easiest way to exploit 3D printing is to make friends with someone who already has one – or find the nearest workshop using them. The big advantage to FDM is that manufacture occurs from a design produced on a computer and involves just a machine with no complex drilling, milling or machining. Once a design has been made, tweaks to angles and dimensions are easy and a new

3D printing technologies

FDM printers

These extrude melted plastic in layers, are by far the most common consumer-level 3D printer. A very basic model capable of small prints in PLA costs about £250 for a self-assembly kit (e.g. Fisher Delta, RepRapPro) or £1,000 for an assembled model (Makerbot Replicator Mini, RS). Spending a bit more money is worthwhile since it buys larger print areas, heated beds (necessary for some plastics like ABS that have high thermal expansion coefficients), multiple print heads and designs that are either more compact or robust. For those interested in DIY options, printers produced by RepRapPro are a good option with a strong emphasis on Open Source designs and a lively community of enthusiasts. For off-the-shelf solutions RS stocks a wide range of models.

Stereolithography

(SLA) printers use a UV laser to selectively cure resin within a bath - it was one of the first 3D printing techniques. SLA printers tend to be more expensive to buy and run (the liquid resin being troublesome); however, they can produce high-resolution designs with speed. In particular the newer generation digital light projection (DLP) printers which cure plastic by projecting a UV image of each layer on the resin can produce objects very quickly and at very high resolution.

Material jetting printers

These printers use a moving print head to squirt the substrate into place. They come in many different forms with a range of substrates ranging from chocolate to metal. Indeed bio-printing is possible with living cells being deposited to form 3D organs.

Selective laser sintering

This is a process where a laser is used to fuse particles within a powder together, the advantage here is that objects can be made from glass, ceramic or metal. The high-power laser required tends to make such machines rather expensive.

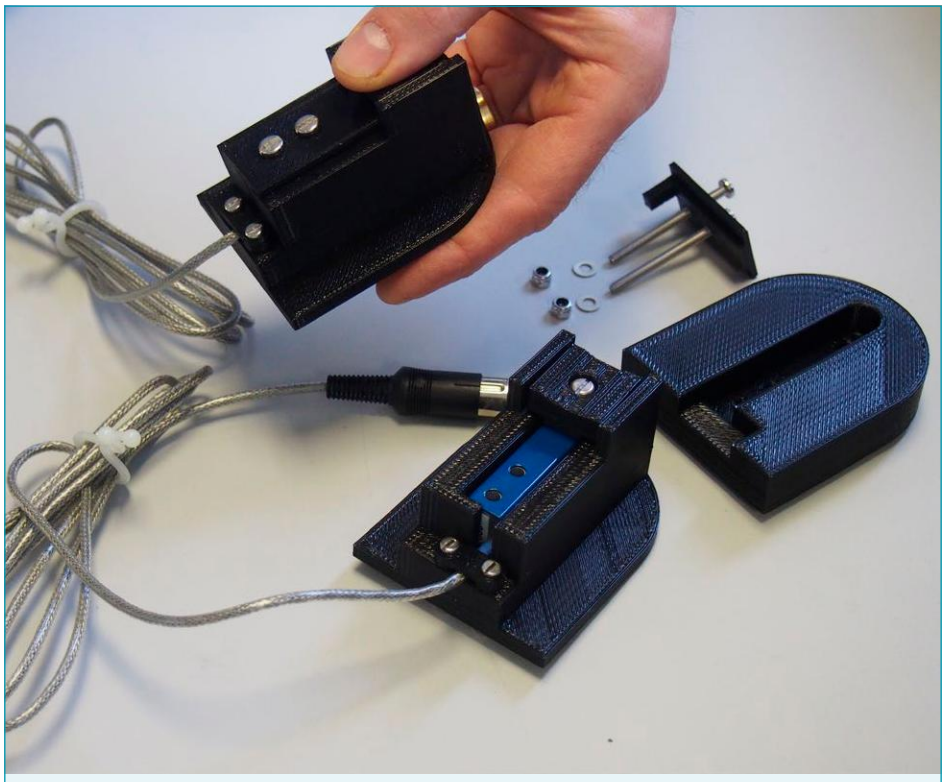


Figure 2. Robust force transducer mounts for an undergraduate human nerve-muscle practical shown in use and disassembled. A set of 40 were produced by the classroom technicians to replace our frog nerve muscle practical. (Hugh Matthews, PDN).

'There are many ways of creating the designs. Purists with a mathematical or computing background often favour open source 3D programming languages (like OpenSCAD) which allow specified simple objects to be fused together, scaled, rotated and to be cut by other objects'

object can be printed. Thus, once one has mastered the art of computer aided design (CAD) almost anything is possible. Access to a cheap printer allows for rapid prototyping before, if necessary, emailing the final design to a high quality industrial machine. The cost of printing is, almost, negligible: in terms of raw material, perhaps £30 per kilogram of printed object – and most of the objects here weigh less than a tenth of that. The cost is most accurately reflected by the investment of time in learning how to design functional objects. It is a skill, once acquired, that is easily refined through practice.

The design process does require some knowledge of what FDM printers can and can't do. Typically overhangs (unsupported areas), tall thin structures or bridging elements are problematic. But, there are also designs that could not be manufactured in any other fashion than 3D printing (see the incredible 3D printed microscope in Fig 3). Creating complex internal structures within an object is no problem and something that cannot be achieved by machining techniques or even competing plastic technologies such as injection moulding. This allows objects that might otherwise have to be screwed together of constructed from multiple pieces to be made in one go. The cost and time savings of such a technology are obvious.

There are many ways of creating the designs. Purists with a mathematical or computing background often favour open source 3D programming languages (like OpenSCAD) which allow specified simple objects to be fused together, scaled, rotated and to be cut by other objects. For people used to a 'what you see is what you get' approach programs like FreeCAD, Autodesk Inventor (my current program of choice free within the educational sector) or even SketchUp are more easily accessed. They allow 2D drawings to be extruded into 3D objects. It is a simple process which can build to produce a complex object with the 2D designs being drawn on any face of a 3D object before being extruded to give that drawing depth. Dimensions (linear or angular) can be specified and modified at a later stage.

Once an object has been designed a couple of file conversion steps are required to turn it into the code (typically G-code) that instructs the printer. Often the process involves saving the object as an STL file - an industry standard file type that specifies 3D objects - before being sliced (using freeware such as Slic3r) into layers with appropriate controls for the specific printer.

Once mastered – and I have several 3rd year degree students designing objects to be printed on my printers – the opportunities are almost endless. A variety of plastic filament types exist with varying properties. PLA (polylactic acid) is often used by beginners because of its low melting point and ease of use (and when printed it smells like chips cooking). But, ABS (acrylonitrile

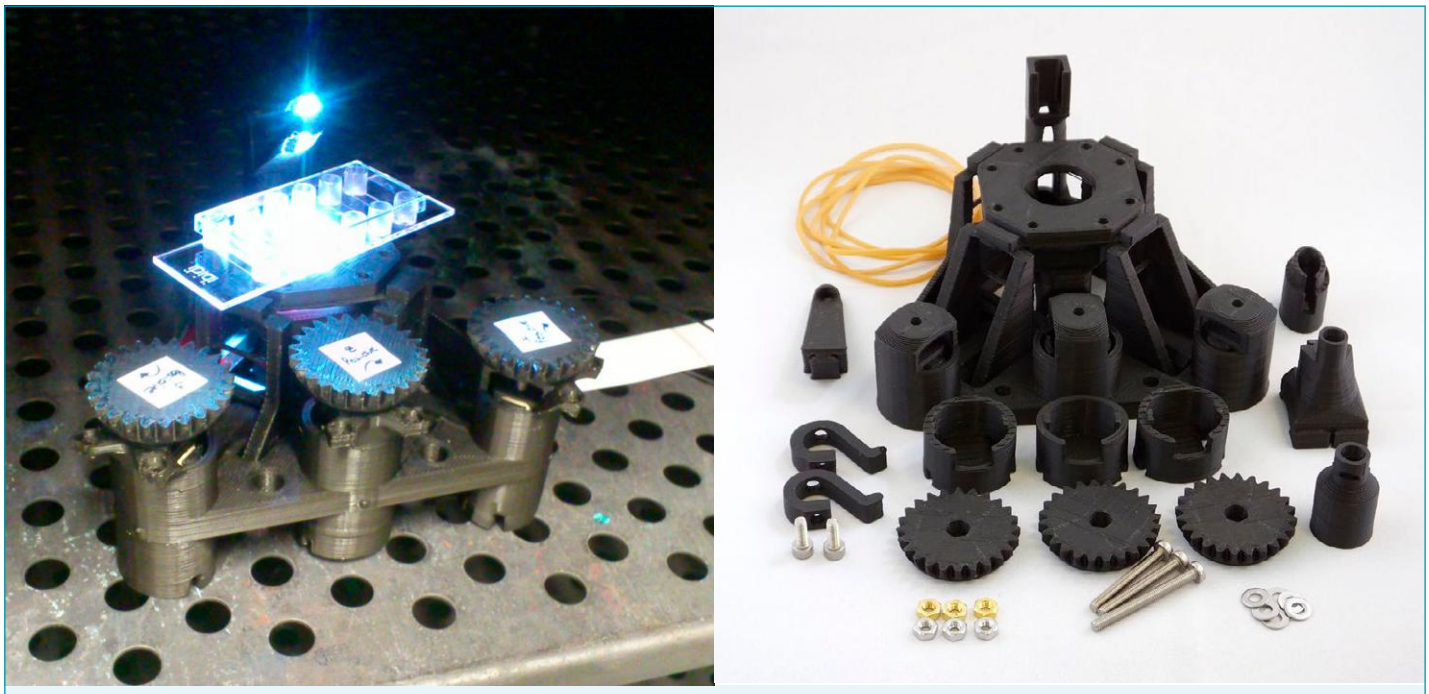


Figure 3. A fully functional remote controlled microscope suitable for housing in an incubator. This 3D printed microscope has built-in sub-micron resolution 3-axis stage (manual or stepper motor controlled with 8 mm range) based on the inherent flexibility of the plastic, objective lens, light source, video imaging and optional dark field or fluorescence illumination. The bulk of the microscope is a single print capable of being produced by a RepRapPro Ormerod. The full microscope requires only a small number of additional parts (bolts and screws and a mobile phone camera lens). Such projects represent the extreme end of what is possible with a 3D printer and impeccable design work (Richard Bowman, Physics, Cambridge). See **http://arxiv.org/abs/1509.05394** for the design principles and more information..

butadiene styrene) has superior heat resistance and can be fused and smoothed by acetone resulting in vastly stronger objects as the layers of deposited plastic are melted more completely together. Nylon and a range of elastic filaments now exist, although I have yet to use them in anger. The colours available are endless from the light absorbing blacks to transparent filaments - pink, red, blue, fluorescent, sparkling are all available. Indeed, many printers now work with multiple colours or different types of filaments (such as dissolvable ones) to produce overhangs that would otherwise be impossible.

For me, the ability to execute a rapid prototyping loop (design, print, test, redesign, reprint, retest etc – sometimes with the whole assembly modelled, see Fig. 4) where the quality of the final object is not limited by traditional workshop skills is revolutionary (e.g. Fig. 5, a lightweight case that holds a complex piece of electronics perfectly in place). Of course my drawers are still full of bits of old kit, but now their value has been multiplied ten times. If I can find an appropriate motor, producing a functional mount for it is trivial. If I need a seal, I can make the right sized lid for an O-ring that I already have. Thus, almost all of my 'junk' is suddenly dimensionally correct because I can design and specify what it connects to.

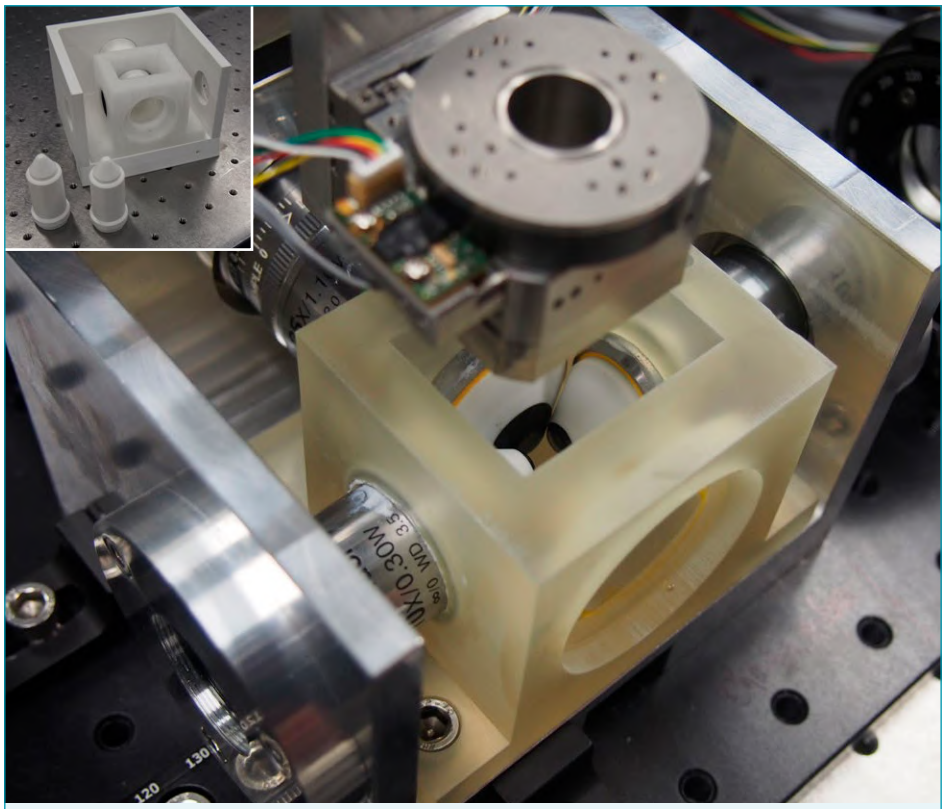


Figure 4. Prototyping using a 3D printer (inset), a waterproof chamber for a light-sheet microscope involves making 3D models of all the elements including the objectives. It is a cheap way of optimizing the positioning of all the elements before the final bath design could be sent out for high tolerance printing. (Ruth Sims, CAIC).

‘If I can find an appropriate motor, producing a functional mount for it is trivial. If I need a seal, I can make the right sized lid for an O-ring that I already have’

Figure 5. Making cheap electronics robust without adding weight. (Inset) An OPI TrueSense Exploration Kit (512 Hz 13-bit A/D, 3 axis accelerometer, temperature sensor, Wifi broadcast and 11+ hours on board recording - £30) mounted in a 3D printed water-resistance case (shown assembled in main picture) designed to clip to a Garmin heart rate strap for ECG recording in a 3rd year BSc project on stair climbing (Christof Schwiening).

How to get started in 3D printing

My advice is not to jump straight in and buy a 3D printer – unless you are a technically-minded geek. The time investment is considerable. Whilst a DIY machine can be assembled in 10-20 hours you should expect things to go wrong and be willing to troubleshoot. Even an off-the-shelf machine will require some maintenance and tweaking. Instead, my advice is to find someone with a 3D printer and ruthlessly exploit them! With any luck they will be more than happy to design something for you and print it out. But more importantly, they might also sit with you during the design process so you can see the software in action. It is then only a matter of downloading the software for yourself and attempting a few tutorials. One of my third year physiology students was designing and printing objects on my RepRapPro Ormerod 2 whilst I was away teaching, having had just a single hour of demonstration. Most Universities will now have central facilities for some form of 3D printing using a range of machines. Often these will be capable of producing objects at higher resolution and tolerance than consumer devices and from more durable materials. Prototyping using cheap FDM printers is often just a first step towards the printing of a commercial-grade object.

What use is a 3D printer to me?

Typically the world of 3D printing designs (e.g. **www.thingiverse.com**) is full of designs for parts to ‘improve’ existing 3D printers - indeed, the simpler structural elements of many DIY printers are printed by other 3D printers (they are to some extent self-replicating). But, the range of possibilities is almost endless whether you are a scientist looking to solve relatively trivial problems such as housing filters or electronics an educator rolling out a new practical, engaged in cutting edge manufacturing or attempting to engage prospective students (Fig. 7).

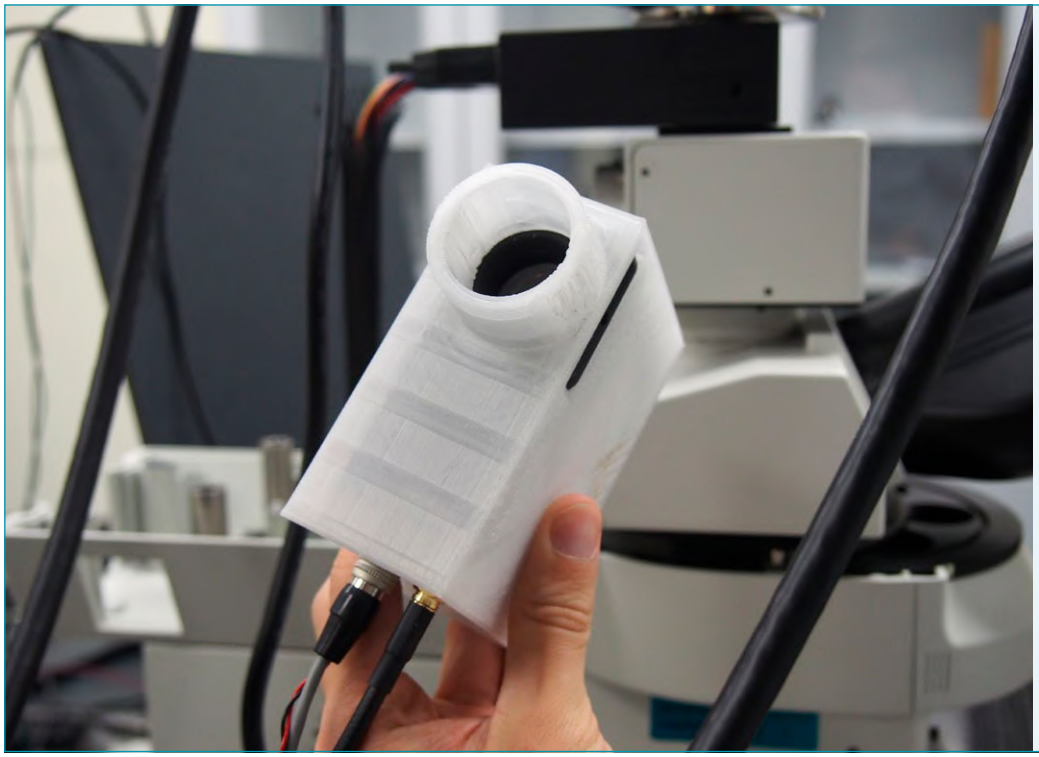


Figure 6. Photomultiplier (PMT) alignment mount for a microscope – the locating slot holds the PMT securely in place, no screws needed (Kevin O'Holleran CAIC).

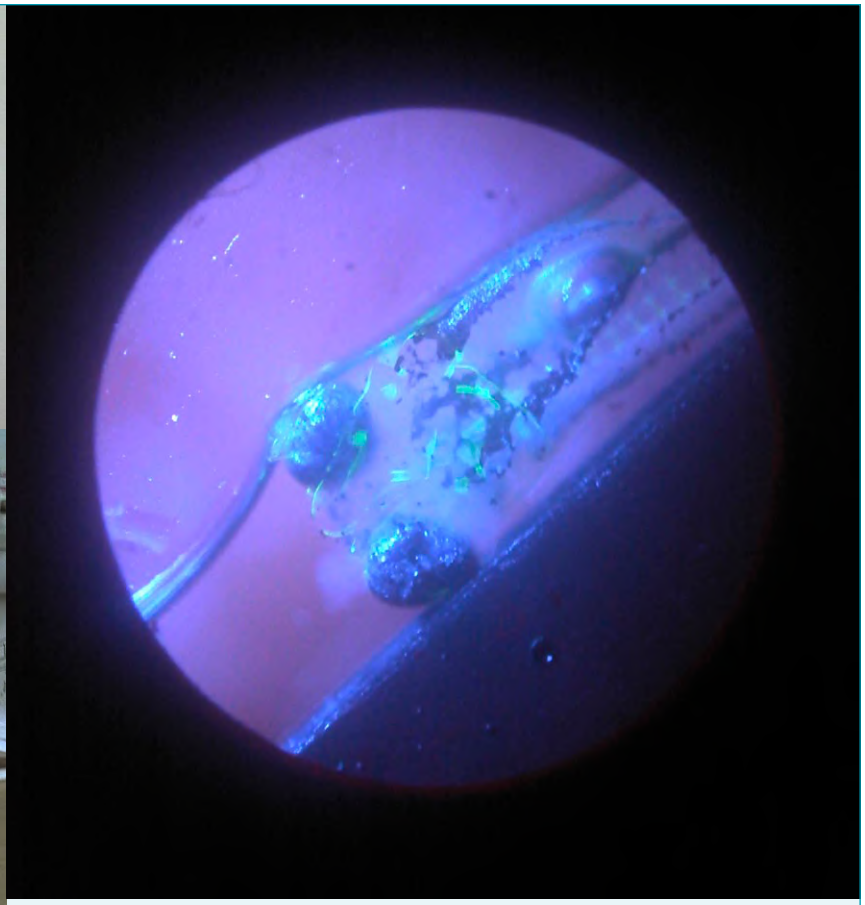


Figure 7. With a spare objective, an eyepiece, a cheap LED and some 3D printed parts (left) it is possible to make a fluorescence microscope (middle) capable of showing live Zebrafish encoding GFP (right). Once assembled and with the Zebrafish in position, the microscope is pushed down clamping the stage in place allowing the microscope to be passed between a group of A level students. (Christof Schwiening, PDN).

Why are we still using animals to study human neurophysiology?

Could stem cells completely replace animal models in research one day?

Eric Hill

Life and Health Sciences,
Aston University, UK

Animal models have been central to our understanding of human physiology, but human stem cell based models may help us to further our knowledge and tackle devastating diseases such as Alzheimer's disease. Stem cell-derived brain cells have emerged as a powerful tool to model neuronal behaviour and disease pathology; their increasing use in drug discovery promises to help speed up drug screening and reduce the number of animals used at the earliest stages of testing. Here I discuss the utility of these cells, potential pitfalls and recent developments in the field.

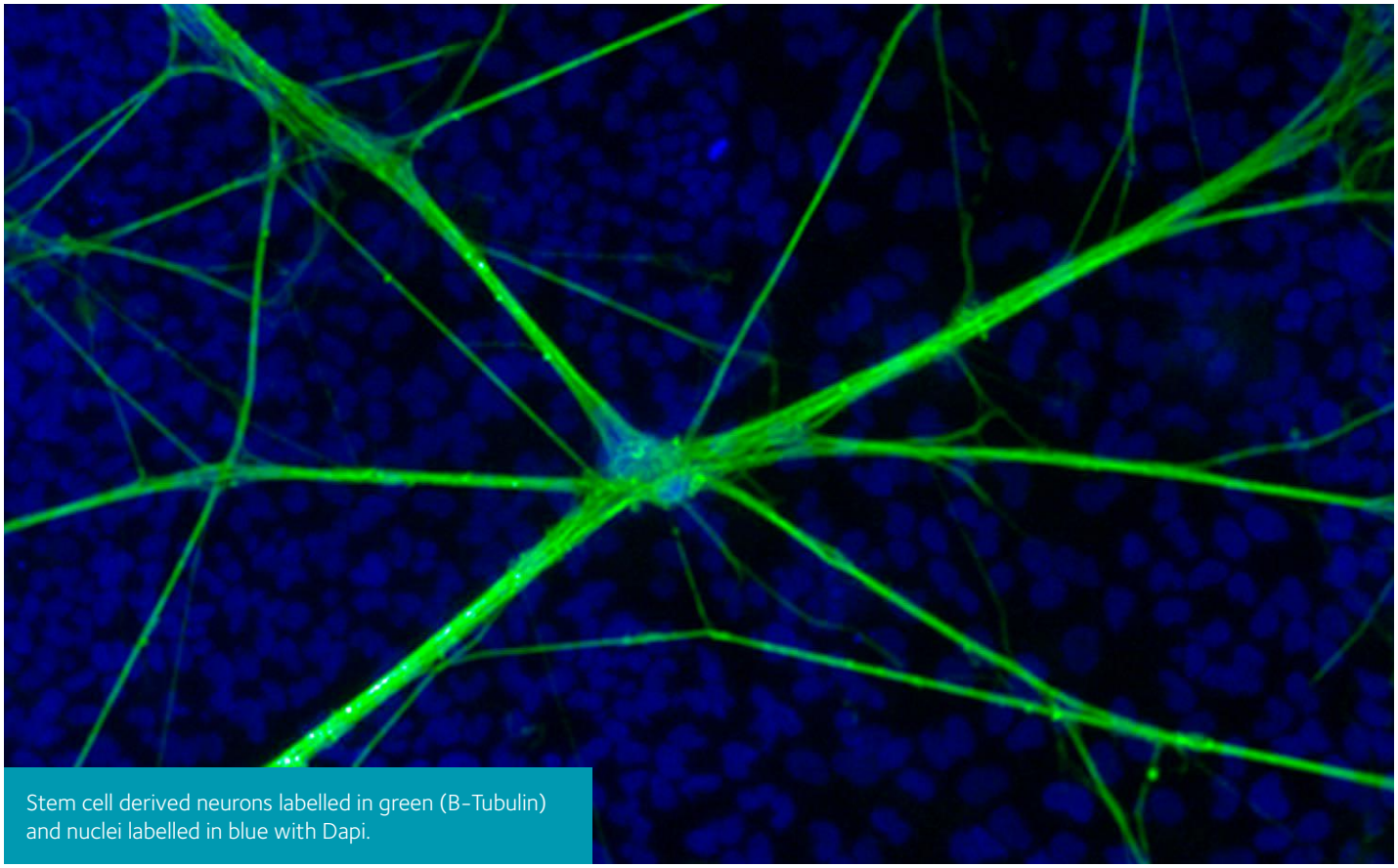
A scarce resource

Logically, human tissue would be the best platform for the study of human diseases, although for obvious reasons, such tissue is not always readily accessible. This is particularly apparent for the study of the human central nervous system (CNS). Consequently, animals as diverse as worms, flies and various mammals are currently used to model human physiology and neurophysiology. These systems have given us a great deal of information regarding our normal biological processes, but some aspects of our physiology and neurophysiology are uniquely 'human'. This is borne out by difficulties in reproducing many diseases in animals that affect significant numbers of the elderly, such as Alzheimer's disease. Indeed, not even the latest and most sophisticated transgenic models recapitulate all of the features of this complex neurodegenerative condition. Clearly, such conditions require highly specialised and relevant experimental platforms for us to even begin to understand their complex aetiology. Compellingly, in the public as well as the medical and scientific minds, stem cell technology now has a powerful appeal in the search for such platforms.

The potential of stem cells

Stem cells are unspecialised cells that are capable of self-renewal and are able, under the correct conditions, to differentiate into all of the different cells within the body. Since the derivation of the first human embryonic stem cell line (hESCs) in 1998, the field of stem cell biology has rapidly expanded. Furthermore, the development of induced pluripotent stem cells (iPSCs) has further increased the potential use of stem cells whilst avoiding ethical issues associated with the use of embryos. This revolutionary technique allows scientists to produce stem cells from the skin cells of patients thus providing highly relevant patient/genotype specific models in which scientists can study disease processes.

Stem cells have now been used to produce a variety of different cell types and tissues such as brain, heart and gut. For many scientists, the production of neurons has been of great interest as it allows researchers access to human brain cells. More importantly, the production of specific populations such as cortical or dopaminergic neurons has allowed researchers to investigate the activity of



Stem cell derived neurons labelled in green (B-Tubulin) and nuclei labelled in blue with Dapi.

neural networks from particular regions of the brain. As such, the potential to produce human brain cells from sources such as stem cells has huge potential for studying human disease, as well as providing tools for drug screening.

Are these cells physiologically comparable to animal or even actual human brain cells?

Understandably, there is great excitement surrounding the development of iPSC technology particularly in the area of disease modelling. It is also undeniable that public expectation is also significant, especially in the areas of much-feared and currently intractable neurodegenerative conditions such as Alzheimer's' and Parkinson's diseases. However, it remains to be seen whether these cultures can actually recapitulate many of the processes observed in animals or human derived cells. Whilst some studies have only described the presence of neuronal markers and cell morphology, the description of the hallmark features of genuine neurons such as the ability to fire action potentials is now commonplace. Using both human embryonic stem cells and induced pluripotent stem cells researchers have described the development of neuronal features including synaptic activity, neurotransmitter release, network formation, highlighting the maturation of these cells. However, currently no studies have reported synaptic plasticity, a key feature of CNS learning and information processing, in stem cell derived neurons.

Stem cell modelling like much of neurophysiology has focused on neurons

Unfortunately, many of the studies that have developed protocols for the derivation of neural cells have not considered the importance of glial cells such as astrocytes. Astrocytes are no longer viewed as providing a structural role within the brain and are now known to be intimately involved with neuronal signalling, with astrocytes and neurons forming what is now termed the 'tripartite synapse' (Volterra and Meldolesi, 2005). Furthermore, astrocytes represent a complex and diverse network of cells that plays a role in information processing and behaviour. The study of human neuron and astrocyte cultures is potentially more complex than other cell types, since we do not really know or understand how human neuron and astrocytes function to the same extent, as we understand rat model neurons. Human astrocytes are much larger and more functionally diverse than their rodent counterparts (Oberheim *et al.*, 2009) and it has even been suggested that human intelligence may in part be due to the actions of glial cells. Human astrocytes (glia) have evolved to be more complex than rodent astrocytes and thus, must contribute to specific human brain functions. Such findings indicate significant and important roles for human astrocytes, which support the notion that these cells should be given equal importance to that of neurons in the development of stem cell derived neuronal networks.

The 'star' of the show

We have previously shown that stem cell-derived astrocytes form an interconnected network that allows the propagation of calcium waves between cells via gap junctions. These astrocytes respond to neuronal activity and also communicate with each other via the release of gliotransmitters (Hill *et al.*, 2012). More recently we have demonstrated that these cells alter their metabolism in response to neuronal activity, a process which has previously only been observed in rodent models (Tarczyluk *et al.*, 2013). A number of labs have now developed efficient protocols to produce highly enriched cultures of astrocytes from hESCs and iPSCs that display the features of mature astrocytes (Shaltouki *et al.*, 2013). It is now clear that if new cellular platforms are intended to generate functional neuronal networks that behave as networks do in the brain, then all the cellular components that comprise those networks, such as astrocytes, must be included in a viable model. Indeed, studies have shown that human neural precursor cells (hNPCs) grown in the presence of astrocytes mature at a faster rate than neurons alone. The presence of astrocytes also enhances the survival of cells; in our laboratory co-cultures containing astrocytes extend neuronal survival four-fold, to beyond twelve months.

‘Satisfying the powerful public, scientific and medical expectations of stem cell technology, with regard to human CNS study and therapy is a daunting challenge’

What’s my age again?

A limiting factor in the use of iPSC-derived neurons to model age related disease is the biological age of cells. iPSC-derived neurons mature over a period of months. However, even at this stage, cells may resemble tissues derived from 8–10 week old foetuses (Mariani *et al.*, 2012). This foetal-like nature is clearly an issue for investigators hoping to study late onset diseases such as Alzheimer’s. However, a number of strategies to expedite the ageing of cells in culture have been employed (Miller *et al.*, 2013) with the aim of recreating cell types of specific ages.

The third dimension

Traditional 2D *in vitro* models lack the structural organisation required to recapitulate the complex networks observed in the brain. A key developmental event such as the formation of cortical layers is not observed in 2D culture. However, the rapid expansion of organoid culture protocols have led to the conditions that, to a high degree, reproduce the *in vivo* environment and allow the production of defined cortical layers (Lancaster *et al.*, 2013). This intriguing technique has huge potential for studying human development as well as a range of neurological disorders.

The future

Satisfying the powerful public, scientific and medical expectations of stem cell technology, with regard to human CNS study and therapy is a daunting challenge. The models must be relevant, reproducible, practical, yet sufficiently flexible to undergo cross-adaptation to a variety of different purposes, ranging from basic research in CNS development and function, through to drug efficacy and toxicity studies. Perhaps the key to the success of iPSC derived models is their ability to produce neuronal networks that acquire mature circuitry capable of complex tasks such as memory formation. Such a feature is the cornerstone of relevance to man. Indeed, the ability to generate specific cell types as well as 3D structures will offer alternative culture techniques that will enhance these functions. The combined use of gene editing techniques will enable researchers to manipulate stem cell platforms to study CNS diseases in ever greater detail. Judging by the pace of recent progress, it is perhaps only a matter of time before human stem cell-derived models will reproduce the actual network connectivity and functions that are observed in our own brains so that they will offer an attractive and compelling alternative to the use of animals in studying human physiology.

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Trust me – I'm a scientist

Trust is fundamental in science. More often than not, we design our experiments at least in part based on data published by others. We trust them to be true, unless proven otherwise.

Martin Michel

Dept. of Pharmacology,
Johannes Gutenberg University,
Mainz, Germany

The public tends to trust scientists, at least more than many other professions. That's why an advertisement more often states, *'as shown by scientists' than 'as shown by used car dealers/politicians/lawyers'* (pick whoever you dislike most). However, this basic trust received a major blow when scientists from Bayer reported that they were unable to reproduce two thirds of published major findings (Prinz *et al.*, 2011). Thereafter, others reported similar proportions of irreproducible studies in various fields of biomedical science. This is not only a problem of obscure journals with weak referee systems; it affects 'big' journals such as *Nature, Science* or *Cell* at least as much. This has not only shocked the academic community and pharmaceutical industry. Funders such as the Wellcome Trust or the NIH (National Institute of Health) became concerned, the latter particularly because the US Congress may reduce their funding. Even the general public has noticed, as evidenced by a cover story in *The Economist* in October 2013.

In God we trust – all others must bring data

Those who have looked into root causes of lack of reproducibility, agree that fraud is only a very minor part of the problem. Rather, poor standards in experimental design, data analysis and transparent reporting what actually has been done appear to be at the core of the problem. In my own experience, I find that the vast majority of published studies lack too many important details to permit the repeat of a key experiment. Examples include the strain of animals, the identity of antibodies or the incubation volume in a biochemical assay; this list goes on and could fill a book. Some high-profile journals may in part be to blame, as they have asked authors to produce only short methods sections, printed them in smaller font, or relegated them to online supplements. All of this has sent a message to young scientists that details of methods might not be so important. Boy, were they wrong! However, this probably is easy to address by more comprehensive and transparent reporting of experimental methods and data analysis approaches, and several journals have meanwhile adapted their Instructions to Authors to account for this.

The smell of a t-shirt can affect outcome of an experiment

We expect that key findings can be confirmed not only when each detail of a reported experiment has been adhered to (reproducibility in the specific sense of the word) but also if apparently minor details have been altered (often referred to as

‘We do have a major trust crisis at hand, and issues with study design, comprehensive and transparent reporting, and proper data analysis are likely to be major root causes.’

robustness, although this is a vaguely defined term). This has two reasons. First, a finding that can only be obtained under extremely standardized conditions is less likely to be relevant to the overall progress of science. Second, on purely pragmatic grounds, we simply cannot monitor every detail of an experiment. Thus, did you ever consider that the smell of your t-shirt might affect the outcome of your experiment? It apparently can (Sorge *et al.*, 2014). There are probably many such unknown factors. Moreover, it was shown that investigators expecting groups to be different are likely to find such differences – even when they do not exist. That is the reason why it is important that interventions are randomised and, as far as possible, investigators be blinded to group allocation in experimental studies. Clinical medicine has realised this decades ago and made the double-blind, randomised study the gold standard of investigation. Shouldn’t we be embarrassed that clinicians have developed more sophisticated approaches to research than scientists? (Yes!!)

Don’t be a P-hacker

Other than lack of robustness, there may be an even bigger problem leading to lack of reproducibility and that relates to inappropriate use and interpretation of statistical tests. Many have the misconception that the asterisk on top of a data point, by indicating statistical significance, also implies that a finding is true and even relevant. Rather, a P-value tells us the probability that a certain group difference would have been observed by chance if the samples had been selected randomly from the same group. Thus, a P-value is only meaningful if all factors other than the primary variable we are investigating are the same in all groups or at least randomly distributed, be it animal strain, presence of disease or treatment with a drug. Several investigator-induced violations of this randomness principle have been summarized under the term P-hacking (Motulsky, 2014). Thus, if you change number of experiments, parameters to be analysed or method of analysis after having seen initial results, you deviate from the path of randomness. For example, you may have done an experiment six times, analysed the data and obtained a P-value of 0.06. You feel uncomfortable with this, as you can hardly submit your manuscript this way. Thus, you add two more experiments in the hope that with a total of eight you will reach the magic significance threshold. Other examples include a post-hoc decision for normalization of the data or the choice of a different statistical test. All of this introduces a major bias for finding a difference, even if it is not there, and for exaggerated effect sizes. The asterisk you have gained may look like a trophy, but it actually increases the risk that the observed difference is not robust. Thus, any type of modification of sample size or analysis techniques that was decided upon after the experiments had started precludes meaningful statistical analysis, unless specific precautions have been taken. A key conclusion from the above is that P-hacking may make results look nice but actually makes them less meaningful up to being invalid. Generally, one should focus less on P-values and more on effect sizes.

Most reported results must be wrong

But even if everything has been done ‘by the book’, findings may have a poor robustness, as already predicted (Ioannidis, 2005) years before the Bayer paper (Prinz *et al.*, 2011) had been published. John Ioannidis emphasized that finding a group difference to be statistically significant may not necessarily have a large positive predictive value - even if no P-hacking occurred. David Colquhoun expanded this idea and highlighted the problem of the ‘false discovery rate’ (Colquhoun, 2014). Thus, a P-value is the probability of seeing a difference as large as you observed, or larger, even if the two samples came from populations with the same mean. However and in contrast to a common perception, it does not tell us the probability that an observed finding is true. Thus, simulations show that a P-value < 0.05 in correctly designed and executed experiments may nonetheless be associated with a false discovery rate of up to a quarter (Colquhoun, 2014). The actual false discovery rate with a P-value < 0.05 depends on several factors, but a poor positive predictive value/high false discovery rate may particularly occur when sample sizes (number of experiments) or effect sizes (magnitude of difference between groups) are small (Ioannidis, 2005). In reaction to this, journals have started to require that minimum sample sizes are required to allow for statistical analysis (Curtis *et al.*, 2015).

50 million Elvis fans can’t be wrong

Confronted with the above, I heard more than once ‘we have always done it this way’ or ‘everyone else is doing this’. I have confessed that in 10 out of my last 10 original papers my own work in one or more ways did not live up to the standards I meanwhile have recognized to be appropriate (Michel, 2014). Therefore, I can understand the emotional reaction to a very fundamental critique of the way research has largely be done in the past, but after having cooled down a bit I trust that you acknowledge that this argument is entirely non-scientific. *Fifty million can’t be wrong* was a title of a greatest hits album from Elvis released in November 1959, when Elvis was still considered ‘controversial’. While it made for a well-selling album, it is as much of an argument as ‘eat shit – 50 trillion flies can’t be wrong’. We do have a major trust

crisis at hand, and issues with study design, comprehensive and transparent reporting, and proper data analysis are likely to be major root causes. Those who have carefully looked into the matter all agree on this. As scientists, we should look at this evidence and act accordingly to modify our own behaviour.

The pharmacology journal Editors' initiative

Realising that improving our practise of study design, data analysis and transparent reporting will take nothing less than a culture revolution, editors of several major journals in pharmacology have come together to develop shared editorial policies. This includes Biochemical Pharmacology, British Journal of Pharmacology, the Journal of Pharmacology and Experimental Therapeutics, Naunyn-Schmiedeberg's Archives of Pharmacology and Pharmacology Research and Perspectives. As an initial step, they have developed shared criteria for transparent reporting which will become part of their Instructions to Authors. Major journal publishers including Elsevier, Springer-MacMillan and Wiley have endorsed the initiative. We are currently in the process of inviting all major pharmacology journals to also join this initiative and will be happy to cooperate with the Physiology community to do implement the same within their discipline.

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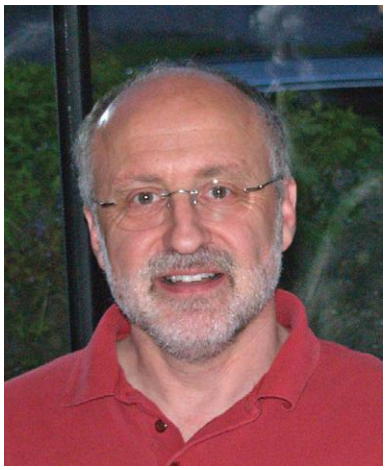
Acknowledgment

Thanks to Dr Harvey Motulsky for helpful comments on this manuscript.

New Council Members

Meet our latest Trustee and Affiliate members



Guy Bewick

New Trustee

I started my research career in a Department of Physiology (1982, Kings College London), becoming an affiliate member almost immediately. The Society has been my natural home ever since, with its unique blend of intellectual and scientific rigour coupled with accessibility and collegiality. I have been a regular participant in Society meetings throughout, and have benefitted greatly from society membership; from valuable networking opportunities, travel grants to visit other laboratories and support to fund and organise Symposia. This has made me very much aware that The Society's success depends upon full and active participation of the membership. I am therefore delighted to have the opportunity to join the Council to help guide the governance of The Society.

The Society's membership numbers have waxed and waned in the intervening years, but its current resurgence shows the success of the course now being plotted. I feel it also reflects the growing appreciation in the wider scientific community how essential physiological research is for uncovering the function of all the genes and proteins that have dominated biological research in recent decades. I will support any evolutionary change that helps maintain this vibrancy and relevance, and not just change for change's sake. I will also support plans to perpetuate and enhance the historical rigour and quality of those journals.

I regularly see at first-hand the enthusiasm for hands on Physiology at all levels, whether by hosting school pupil work placements, supervising undergraduate lab projects or during public engagement events. I will encourage the development of more engagement opportunities at all levels. Finally, the current economic climate means it is more important than ever for The Society to lobby vigorously for research funding, highlighting the fundamental importance of Physiology. The Council of Trustees has a substantial role to play in all of these matters and I will contribute energetically to this future work.

Frank Sengpiel

New Trustee

I became an affiliate member of The Physiological Society while doing my DPhil at the University of Oxford and have been a full member since 2001. I have been very much an active member throughout, first as co-convenor of the Development & Plasticity Special Interest Group and then as theme lead for the Cellular & Integrative Neuroscience theme from 2010 to 2014. I have co-organised a themed meeting (Cardiff 2009) and have been involved in the selection of symposia for both themed and main meetings. I was a member of the programme committee for IUPS 2013. In addition, I have reviewed numerous neuroscience related grant applications for The Society during my tenure as theme lead.

At Cardiff University, I am Head of the Neuroscience Division within the School of Biosciences. I have led a research group for the past 15 years, which has been funded throughout by grants from MRC, BBSRC, Wellcome Trust and EU. At the same time, I am very much involved in teaching our BSc Biomedical Sciences and Neuroscience students. At the University's Neuroscience & Mental Health Research Institute I am responsible for public engagement and have been involved in organising public lectures and open afternoons for stakeholders and policy makers, Brain Bee competitions for A-level students and Brain Games for primary school children and their families. Finally, I am on the editorial board of Current Biology and Journal of Neuroscience Methods.

I hope to be able to continue to contribute to The Society as a Trustee. Through my previous roles, I am familiar with how The Society works and have shown my commitment to it. I believe that because of my experience in these areas I am well equipped to shape the future direction of The Society in terms of outreach and engagement with the public, promoting physiology to the outside world, and with respect to policy (esp. education and animals in research). Above all, I want to ensure that The Society keeps offering great value to its members through cutting-edge scientific meetings, high quality publications and grant support.

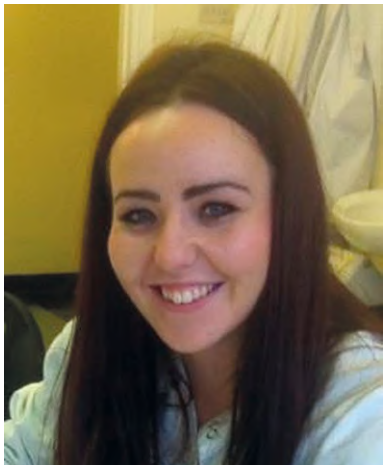
Holly Shiels

New Trustee

I have been a member of The Physiological Society since 2001 and have been actively involved in the meetings and various aspects of The Society since then. My first official role was in 2001 as the last Special Interest Group convenor for Comparative Physiology. Through this role, I attended council meetings and became familiar with the workings of The Society. Much of the early work in physiology, including that of some of the founders of The Physiological Society, used non-mammalian models to understand fundamental processes. My current research is still very much focused on comparative physiology and spans the cardiovascular and environmental physiology fields. So, I have wide-ranging interests in research areas across themes.

During the 14 years, I have been a member of The Society, I have contributed to meetings with posters and oral presentations of my research. I have been involved in organising sessions and symposia both at The Physiological Society's Annual Main Meeting and in representing The Physiological Society at meetings with sister societies internationally. My postgraduate students have competed for various awards and we have hosted a number of undergraduate summer studentships sponsored by The Physiological Society.

I take this responsibility very serious, and strive to maintain the excellent work of The Physiological Society. I am interested in promoting equal representation of all Physiological Society themes in any new ventures or decisions.



Rachel McCormack

New Affiliate member

My career as a physiologist started 7 years ago when I undertook an undergraduate degree in the University of Liverpool in physiology. Following this, I went on to gain an MRes in clinical sciences. I have recently a PostDoc, which aims to identify the effect of MicroRNA's on skeletal muscle ageing. The project builds on my PhD, during which I studied the effect of inflammation and the polyphenol resveratrol on skeletal muscle ageing.

I have been a part of The Physiology Society for over two years and I am looking forward to my role as the affiliate representative for The Society. In my role, I hope I can make valuable contributions and complement existing strengths in diverse areas within The Physiological Society. My interests particularly lie in the outreach department, as I think it is extremely important that we communicate our science to the public and allow them to get excited about new projects that are being undertaken. I have previously been involved with numerous outreach activities within The Society and now sit on the committee for the outreach department.

I have previous experience in similar roles, as I was the final year representative for my undergraduate physiology course at the University of Liverpool. I am also an active member of the Athena Swan Team in the Institute of Ageing and Chronic Disease at the University of Liverpool for which we are proud to have successfully achieved a silver award, and I would like to bring my experiences on promoting gender equality, particularly in career development, to The Physiological Society.

I am relishing the opportunity to represent the affiliate members of The Society, as well as getting further involved within The Society and taking part in discussions to ensure that my peers' views are heard and also make an impact on the way The Society runs and welcome any thoughts or comments from the physiology members.

Mathew Piasecki

New Affiliate member

I first became a member of The Physiological Society as an undergraduate studying biomedical science at Manchester Metropolitan University. A PhD at the same university closely followed and I am now several weeks into my post as a Research Associate. My area of research is neuromuscular physiology. More specifically, it involves researching the neuromuscular changes that occur with ageing such as motor unit remodelling, and how lifelong exercise may affect this. My average workday may include data collection using electromyography, whereby we insert small needles into contracting muscles, or carrying out the seemingly never ending data analysis, which I'm told is a rite of passage for all PhD students.

These are exciting times for affiliates in The Physiological society. The Society as a whole is expanding, and the number of affiliate members has increased by around 20% since the end of 2013. There are also some interesting meetings planned for the future, with the possibility of a meeting focusing on PhD students and early career researchers. This will present an opportunity for affiliates to attend a specialist conference and present their work, and shows that the benefits of being a member of The Societygo above and beyond the availability of travel grants.

With this in mind, I would encourage all affiliate members to engage in future events as much as possible. Please feel free to contact me if you think there are any issues that should be included in council meetings.

Physiology Friday festivities at University College Cork

John Mackrill

Department of Physiology, UCCork

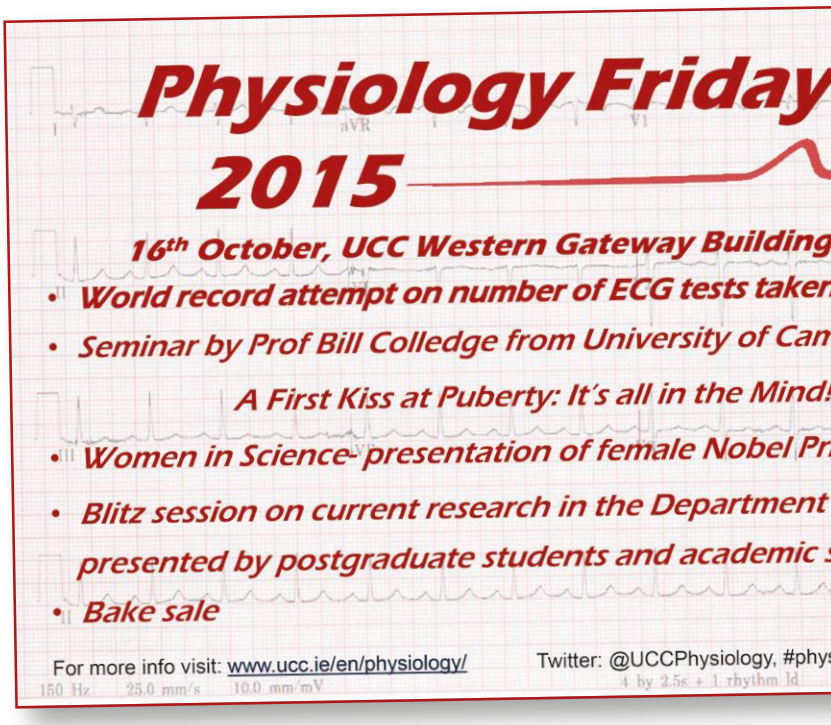
Photographs by Marcella Burke and Kieran McDonnell

After an action-packed week of festivities, made possible by the tireless efforts of undergraduate and postgraduate students, postdoctoral researchers, academic, administrative and technical staff, we held our main event 'Physiology Friday', on Friday 16 October 2015. This took place in the Western Gateway Building, one of the largest buildings dedicated to third level education in Ireland and home to the Department of Physiology.

The party kicked off with a trial of the 'Mobile Physiology Laboratory (MPL)', a portable bicycle ergometer and metabolic system, which we hope to use as a valuable outreach resource in the future. The MPL arrived at Bishopstown Community School, Cork City and was used to demonstrate cardiovascular, respiratory and metabolic responses to exercise to year 4 pupils (equivalent to year 11/GCSE stage in the UK). This demonstration was met with enthusiastic responses from the class involved and will be developed further as an educational tool.

The foyer of the Gateway Building provided a space for interaction with members of the public and the University. These events included:

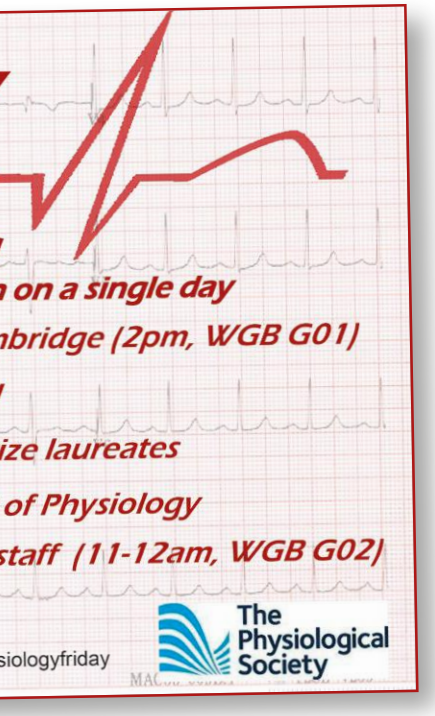
- A celebration of 'Women in Physiology', marked by a 'newspaper', a poster and 'walking exhibitions' (through the medium of tee-shirts), highlighting the achievements of the twelve female Nobel Laureates in Physiology or Medicine
- Double-sided posters presenting research carried out by postgraduates in the Department, with technical and lay versions aimed at different groups of visitors
- A world-record attempt to register the greatest number of ECG traces in five hours (over 280 were taken, including that of a government minister)
- A passport competition to record visits to various exhibits and a 'Biobake' cake sale, which raised €625 for the Irish Heart Foundation.



The flyer advertising Physiology Friday at University College Cork

Two research seminars were held during UCC's Physiology Friday. One was a blitz session by academics and trainees in the Department, in which research activities were summarised in presentations delivered at a blistering pace (less than four minutes per 'speaker') in styles as diverse as poetry, Irish language, animation and rap. The second seminar was a highly entertaining and informative public lecture entitled 'A First Kiss at Puberty: It's all in the Mind', presented by Prof Bill Colledge, from the University of Cambridge.

Our Physiology Friday celebrations were recorded for posterity in multiple formats, which we aim to employ in the future for outreach to the public. These include a dedicated Physiology Friday page on our departmental website: **http://www.ucc.ie/en/physiology/phyfriday/** and release of video clips via social media. We would like to express our gratitude to The Society for funding these fun and exciting events, which will no doubt seed the growth of future successes in promoting Physiology as a discipline.



An overview of the activities taking place in the foyer of the Western Gateway Building, which attracted considerable interest from staff and students from UCC and from members of the public.

'Women in Physiology', an event celebrating female Nobel Laureates in Physiology or Medicine

Dr Therese Ruane-O'Hora discusses exercise physiology with the class, while Ms Emma O'Riordan (of the school) acts as a test subject for the Mobile Physiology Laboratory, assisted by Dr Grzegorz Jasionek and Mr. Kieran McDonnell.

Obituary:

Joseph Fairweather Lamb FRSE 1928 – 2015

Joseph Fairweather Lamb

Jim Aiton, Eric Flitney, Bob Pitman & Nick Simmons

Images in this article provided courtesy of the Lamb family

Joe Lamb is fondly remembered within the community of The Physiological Society as one of its most prominent members, being awarded Honorary status in 2005. He held the Chandos Chair of Physiology and was Head of the Department of Physiology & Pharmacology at St Andrews University from 1969 until his retirement in 1993. He served on the Editorial Board of *The Journal of Physiology* (1968-1974) and became Senior Secretary of the Executive Committee from 1982 to 1985, missing out the 'apprentice' position of Meetings Secretary. Joe was elected Fellow of the Royal Society of Edinburgh in 1985.

Joe was born into farming stock in Angus. His early education was at Auldbar Junior School and then Brechin High School. He was conscripted into the RAF in 1947, under wartime regulations, and for two years worked on aerial design and maintenance at Bletchley Park, before commencing his medical training at the University of Edinburgh. He held house jobs at the Dumfries & Galloway Hospital and at the Eastern General Hospital in Edinburgh. Joe's career as a physiologist began in earnest via the final year intercalated Honours course at Edinburgh, followed by a junior Research Fellowship. He was appointed Lecturer in Physiology at the Royal Dick Veterinary College (1958-1961) where he completed his PhD. He then moved to Glasgow University and was promoted to Senior Lecturer in Physiology (1961-1969) before leaving to take up the Chair of Physiology in St Andrews.

Joe had an infectious enthusiasm for research and was always excited about the next experiment. His research was in cardiac physiology with a particular interest in the mechanism of action of cardiac glycosides at the cellular level. His PhD dealt with the relationship between electrical activity and ionic gradients in isolated tissue, most notably with intracellular Cl. Later, in Glasgow, he and John McGuigan worked with superfused ventricular tissue and showed that mechanical effects on the extracellular space during the cardiac cycle greatly exacerbated the difficulty of making accurate measurements of intracellular ions and membrane fluxes. It soon became apparent that a reductionist approach using a simple cell system would be needed to overcome these problems. Joe was the first physiologist to introduce cultured chick heart cells grown on glass coverslips for this purpose. The important advantages of rapid exchange and ease of ion flux measurements achieved by this means came at the expense of some cell de-differentiation. The latter was circumvented later by the use of isolated myocytes and stem-cell derived cultures. In St Andrews, Joe became increasingly interested in cardiac glycosides and their well-known, but poorly understood, narrow therapeutic profile. In seminal studies using established human (Giradi and HeLa) cell lines he investigated the short- and long-term effects of cardiac glycosides, such as ouabain and digitalis. Treating cells with ouabain at therapeutic levels raised intracellular [Na] and during prolonged exposures led to up-regulation of cellular Na-pump density. Similar long-term effects were seen with ethacrynic acid or lowered external K. The increased pump density was prevented by blocking mRNA and protein synthesis, providing the first direct evidence for genetic regulation of Na-pump density by intracellular cations. The response to ouabain turned out to be complex, involving the internalisation of existing Na pumps to vesicular endomembranes, release of cardiac glycoside on vesicular acidification and recycling of Na-pumps to the plasma membrane, together with newly synthesised Na pumps.

Joe's career took him from the highly respected Institute of Physiology in Glasgow to St Andrews where physiology was still taught to medical students despite the separation from Dundee but where research activity was limited. Joe was steadfast in his desire to do what was best for his staff and his department. He was loyal to his colleagues and their students, backing their research activities through the 'class grant' that always seemed to be overspent. The atmosphere in the department was congenial and a vibrant research culture was fostered in which morning coffee and afternoon tea became

opportunities for wide-ranging discussions of new ideas and experiments. The number of research staff (post-docs and students) increased progressively, backed by an active seminar programme, amply fortified by post-seminar buffets from a local delicatessen. Bob Goldman, Alan Cuthbert and Mike Berridge were recipients of the 'University of St. Andrews Visiting Lectureship' and each delivered an intensive series of lectures to staff, research students and undergraduates. Joe's ability to procure new lectureships was key to the expansion of the research base, so that the mean age of staff in the 1970 and 80s was comparatively young. Several (Jim Aiton and Nick Simmons) benefitted greatly from the superb tissue culture facilities, where media were made to order and vast quantities of glassware were sterilised and recirculated each week by a dedicated technical team.

Joe was equally committed to delivering high quality teaching and education. The department had high student-staff ratios in the early years, which meant that each staff member had to plan and deliver lectures on several topics, not necessarily related to his or her own research area. This required Joe to distribute the teaching sensitively, to ensure equitable work loads and provide sufficient time for research. He generally managed to achieve this, so his decisions were accepted without dissent. However, on one memorable occasion a replacement had to be found at short notice to teach the 2nd year level course in gastrointestinal physiology. The matter arose at a staff meeting during which Joe asked if anyone would like to volunteer. There were no immediate takers, so Joe decided that he would have to nominate somebody:

JFL: *Dr X, since you are not engaged in any research, I think you should take on this responsibility.*
Dr X (looking flustered): I*'m sorry sir, but I can't because I don't know anything about gastrointestinal physiology.*
JFL: *I expect every member of staff to be able to teach any topic at 2nd year level. I teach four courses, none of which has any relevance to my research. I must insist that you go away and plan how you are going to do it.*
Dr X: *Well, since you insist, I will. But as you are such an outstanding teacher, perhaps you could advise me on how to proceed.*
JFL: *Of course. The human GI tract is approximately 32 feet long and you have 8 lectures, so my advice is that you cover 4 feet per lecture.*

Joe often relied on his mischievous sense of humour to defuse a potentially difficult situation. The principles that directed our research - innovation together with rational assessment of results - also guided the way physiology was taught. For the large junior classes, Joe initiated debate of the rationale for traditional practical teaching. This resulted in the introduction of a (then) radical audio-tutorial system of teaching, where key concepts were encapsulated in simple lab-based exercises within audio/tape programmes. Comprehension was then tested by a small group of staff and tutors in one-to-one question and answer sessions. A precursor of CAL and FAQ! Joe's fascination with the use and abuse of statistics resulted in a fruitful collaboration with Richard Cormack, then Professor of Statistics at St Andrews, which led to exercises for the junior classes. A successful textbook, *Essentials of Physiology*, co-authored with Charles Ingram, Ian Johnston and Bob Pitman, epitomised his approach to teaching, with direct and straightforward narratives illustrated by clear, uncluttered graphs and diagrams.

Joe's belief in rational decision-making in public-spending policy led him to champion several high-profile campaigns. He was co-founder with Denis Noble, John Mulvey and others of 'Save British Science' (SBS), a group that started with 'crowdfunding' of a full page letter to *The Times*, emphasising the considerable successes of British science and protesting the cutting of the Science budget by the then Thatcher government. This was the start of a long campaign (1985-2005), which led to some mitigation of the cuts and, crucially, resulted in the acceptance by successive governments that the benefits of a strong science base greatly outweighed the relatively modest costs. SBS lives on still, in the form of the Campaign for Science and Engineering (CASE), since some of the funding issues that led to its foundation are as relevant today as they were in 1985. Joe also campaigned for improved career prospects and better pay structures for postgraduates and post-docs. His campaigning zeal continued as Chair of the 'Gas Greed' campaign that targeted excessive executive pay and poor performance. *The Herald* noted, '*As the man to kick-start the campaign, his own research interest on the effects of the stimulant digitalis on the heart, is most appropriate*'. Joe deployed half a million shareholder's votes he had garnered to vote against the Chair of British Gas at the AGM in 2011.

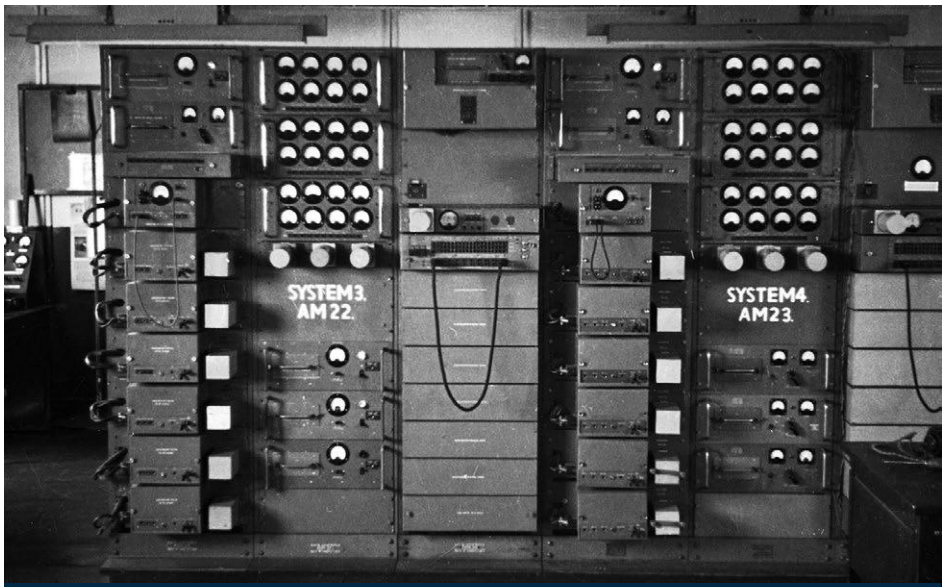
Joe's well-known love of electronic gadgetry was most likely born at Bletchley Park. First the Sinclair watch, calculator and computer, followed by an Acorn Atom, an Olivetti, a BBC micro, the IBM-PC and then the whole department wired for the Cromemco micro running Cromix. His enthusiasm for the next new computer was unbounded.

Joe was an enthusiastic sailor. He was an accomplished 'jack of all trades' in sailing boat building and maintenance at St Andrews. A considerable quantity of teak benching from the refurbishment of the teaching labs in the Bute Medical buildings was 'upcycled' for decking and fitting out. He occasionally persuaded ('press-ganged', might be a more appropriate term) junior members of staff to serve as crew. On one such trip from St Andrews to the West Coast, two reluctant tars mutinied and jumped ship in Peterhead. On his retirement Joe purchased a 38ft Rival in which he and his family sailed extensively around the UK, Holland and the Bay of Biscay.

Joe Lamb will perhaps best be remembered for raising the national and international profile of research in 'his' department. His leadership enabled 'physiology' and 'St Andrews' to be mentioned together in the same sentence with pride.

Joe is survived by his wife, Bridget, his first wife, Olivia, seven children and eleven grandchildren.

Bis vivit qui bene vivit



Joe's 'workstation' at Bletchley Park

Experimental Physiology

New Editors

Ken MacLeod is currently Reader in Cardiac Physiology at Imperial College. He obtained his degrees at Aberdeen and Edinburgh Universities and did post-doctoral work at University of California.

His laboratory examines the processes that control cardiac cell contraction in health and disease. Investigation of these processes are fundamental to our understanding of the workings of the heart, will allow a more logical approach to therapy and, in the longer term, may provide impetus for the generation of novel treatments. The processes are studied at a variety of biological levels, from the single cell to the whole heart using a variety of physiological and biophysical techniques.

Paula Brunton is a Senior Research Fellow and Group Leader at the Roslin Institute, University of Edinburgh. She received her PhD from the University of Edinburgh in 2002 and then completed post-doctoral training at the Universities of Newcastle and Edinburgh before joining the Roslin Institute in 2010. An expert in the areas of stress neurobiology, neuroendocrinology and behaviour her key research themes are focused on understanding the impact of maternal stress exposure during pregnancy on the mother, the pregnancy and her offspring and on subsequent generations, with a particular emphasis on unearthing the underlying central mechanisms involved and how the effects can be prevented or reversed.

Dr Philip James Atherton is Associate Professor and Deputy Head of Medical Sciences and Graduate Entry Medicine in an MRC-ARUK Centre of Excellence for Musculoskeletal Research at the University of Nottingham. Hs past work has focused on the identification of central mechanisms regulating metabolism in human musculoskeletal tissues, and where appropriate, using more tractable *in vitro* cell models. Combining molecular biology, stable isotope methodologies and detailed *in vivo* human physiology approaches, he has been a key part of a research team that has discovered a number of fundamental parameters that govern alterations in musculoskeletal metabolism with ageing and disease. The current direction of his work involves combining pre-clinical and clinical molecular physiology with the innovation and application of novel stable isotopes and the integration of OMIC'S (genomics/metabolomics). The overarching aim of these efforts is to discover predictors, biomarkers and the mechanistic underpinnings of musculoskeletal declines in ageing and disease(s), and approaches to mitigate this.

New Editor-in-Chief – applications and nominations invited

After a successful 5-year term as Editor-in-Chief of *Experimental Physiology*, Paul McLoughlin will be standing down at the end of September 2016. Paul has set an extremely high standard of Editorship, which will be hard to match. A panel chaired by Prem Kumar, the Head of The Society's Publications Committee, has been set up to find his successor.

For further information about the role and how to apply, or if you would like to suggest a candidate, please contact Simon Rallison **srallison@physoc.org** or Emma Ward **eward@physoc.org.**

Women in physiology – December issue

100 years ago, the Physiological Society formally admitted women as members. In celebration, Experimental Physiology and guest editor Janice Marshall have compiled a Special issue containing review articles from Women recipients of Society Awards updating us on their findings since they received their Awards.

Primarily Joan Mott Lecturers, including this year's Hannelore Daniel, but also recipients of the Wellcome, GlaxoSmithKline and Annual Review awards, we are pleased to publish articles from Kay Davies, Maria Fitzgerald, Abby Fowden, Diane Lipscombe, Janice Marshall, Lucilla Poston, Daniela Riccardi, Nancy Rothwell, Holly Shiels and Sue Wray.

The Journal of Physiology

The Journal at Neuroscience 2015

This year's host of the Society for Neuroscience's annual meeting was the wonderful Windy City (Chicago).

The conference was held in McCormick Place, just outside the city centre. We were shuttled there each morning from our downtown hotel via the rather drab and uninspiring McCormick Place 'Busway' – not the best first impression of the city! Anyone who has had the 'pleasure' of going through this express way to the convention centre will agree that this is not somewhere you'd want to get lost at night! That said, the convention centre itself was clean and spacious and was a great venue for the 28,000 people who were attending this year's meeting.

Our booth was well positioned in the exhibit hall and we had a steady stream of researchers coming to talk to us about *The Journal of Physiology*. Everyone we spoke to had heard of *The Journal* (a good start!) but not everyone new about the current interest we have in attracting top-quality papers from the neuroscience community. It was great to be able to give out some free sample copies of our most recent neuroscience issues to showcase our content. Several people asked how we were coping with the recent deluge of open access journals hitting the market so we were pleased to say that after a period of a couple of years when submissions had been flat or declining, the 2015 statistics show a growth in submissions compared to last year. Neuroscience papers represent about 40% of our overall submissions so it is essential that we have the *JP* brand visible at international meetings to ensure that this community stays loyal to us.

This is still an important conference for many current and former editors of *JP* and we were pleased that most stopped by the stand to say hello and offer their support.

The virtual issue we put together for this conference highlighted some of our best neuroscience papers and was well received, as was our list of 'reasons to publish' which should help persuade many people who are considering where to publish that the thorough peer review and prompt turnaround times we offer mean we are an ideal outlet for their research.

We were expecting to be fully layered-up with coats, hats and gloves in October in Illinois, but the winds off Lake Michigan were light and the weather was bright, warm and sunny. We have booked another prime location for next year's conference in San Diego. Hopefully we'll see people there who have submitted to *JP* in the intervening 12 months!

New Editor-in-Chief

We are delighted to announce that Kim E Barrett has been appointed as the new Editor-in-Chief of *The Journal of Physiology*.

Kim completed her PhD at University College London and has since held various roles at University of California, San Diego since leaving the UK in 1982 for a post-doctoral fellowship at the NIH. She is currently a Distinguished Professor of Medicine and Dean of the Graduate Division at UCSD. Her research interests include the mechanisms of epithelial ion transport, the pathophysiological consequences of enteric infections, abnormalities in epithelial transport and barrier function in specific GI disease states, and the mechanisms of action of probiotics.

Kim has a long-standing relationship with The Physiological Society as well as the American Physiological Society, where she has held positions including Chair of the Publications Committee (2005-2010) and President (2013-2014). She has served of *The Journal of Physiology*'s Editorial Board for a number of years and is currently Deputy Editor-in-Chief for *The Americas*.

Kim's wealth of knowledge, enthusiasm and commitment to continuing to grow the reputation and success of *The Journal* means that we can expect to have an engaged and valued leader to steer *The Journal* over the coming years.

Kim will start this exciting and influential role in April 2016, after shadowing outgoing Editor-in-Chief David Paterson for several months to ensure a smooth transition. Please join us in congratulating Kim on her appointment.

Physiological Reports

Welcome to a new Associate Editor

Reflecting the increase in submitted papers, especially now *Acta Physiologica* has joined *JP*, *EP* and the *APS* journals in cascading papers to *Physiological Reports*, Morten Thomsen at University of Copenhagen has been appointed to the team of Associate Editors. Morten's recruitment particularly strengthens our coverage of cardiac physiology.

Case Reports

As announced in the last issue of *PN*, *PR* has added a further category of peer-reviewed article to its repertoire. The first Case Report has now been published. We hope that the new feature will prove valuable to authors and readers. To help get it off the ground, the Article Processing Charge for Case Reports, usually $1000, is being waived for articles accepted before the end of February 2016.

Physiology 2016

A joint meeting of The Physiological Society and the American Physiological Society

Friday 29 July – Sunday 31 July 2016

Convention Centre Dublin, Ireland

Confirmed keynote lecturers

Laura Bennet
University of Auckland, New Zealand

John Cryan
University College Cork, Ireland

Jeffrey Friedman
Rockefeller University, USA

Emma Hart
University of Bristol, UK

Lisa Heather
University of Oxford, UK

W Jon Lederer
University of Maryland, USA

Chris Miller
Brandeis University, USA

John O'Keefe
University College London, UK

Nandhuri Prabhakar
University of Chicago, USA

Indira Raman
Northwestern University, USA

Susan Wray
University of Liverpool, UK

www.physiology2016.org

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