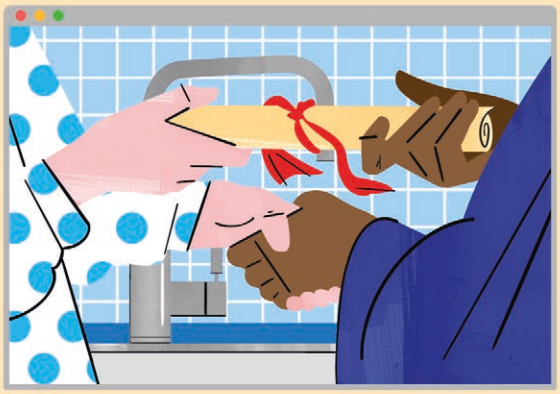
# PN Physiology News

Issue 119 / Summer 2020





## Education Special Issue

The Physiological Society



# Physiology News

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

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

Join now to support your career in physiology:
Visit **www.physoc.org/membership** or call **0207 269 5721**.



| Membership Fees for 2020 | FEES |
|---|---|
| Fellow | £120 |
| Member | £90 |
| Retired Member | – |
| Affiliate | £40 |
| Associate | £30 |
| Undergraduate | – |





magazine@physoc.org

www.physoc.org

@ThePhySoc
/physoc
/company/The-Physiological-Society
/physoctv
@thephysoc

Designed and printed in the UK by The Lavenham Press Ltd.



Welcome to the Summer 2020 edition of *Physiology News*

## Introduction



## News and Views



## Events



## Features



## Membership



**Cover image:** Cover design by Jamie Wignall. Twitter: @jamie_wignall, Website: jamiewignall.com

# Lessons for The Society from COVID-19

*Nicholas Freestone*
Kingston University, London, UK

*Sarah K Hall*
Cardiff University and Chair of Education, Public Engagement and Policy Committee of The Physiological Society

The COVID-19 pandemic has highlighted the central role of education in society. Whether you are an academic, a teacher, a student or a parent facing home-schooling, the abrupt switch from on-campus education to the online realm has had a profound impact on our working and home lives. While the crisis may have revealed vulnerabilities in an education system that is often under-resourced and under-appreciated, it has also underlined the imagination, resourcefulness, dynamism and perseverance of educators and students alike as we have successfully adapted to the new "normal."

Much of this issue of *Physiology News* focuses on the theme of adaptation. In a discipline that emphasises hands-on practical laboratory-based skills, Dave Lewis (p. 10) addresses the ways that physiology educators can provide relevant and authentic learning opportunities for their students within the current constraints of these strange times. He has provided colleagues with a suite of alternatives to traditional laboratory-based final-year research projects that are achievable and imaginative. He also makes suggestions for remote alternatives to laboratory-based practicals (p. 13). Marc Demolder shares his view from Belgium (p. 32), recounting how practicals were shifted online to such an extent that his students did more "labs" this year than previously, although he cautions that the sudden shift to a different style of teaching may have adversely affected the quality of student work.

In the UK, the transition to online learning was achieved within 2 weeks of the imposition of Government lockdown, earlier this year. Laura Ginesi's diary of events around lockdown ("Go home, stay there, and put your teaching online from Monday" was her management's injunction) reveals how difficult, time-consuming but ultimately fulfilling she found that transition. Her experiences will strike a chord with many readers (p. 44).

Underpinning the ongoing efforts to adapt to the online context, while maintaining the student experience and managing academic workload, Maria Toledo-Rodriguez and Alison Mostyn provide us with a valuable overview (p. 22) of available online technologies to support teaching and learning. All aspects are covered here, from teaching to assessment, OSCEs (objective structured clinical examinations) and interactive (anonymous) in-lecture polling. Importantly, they also consider student wellbeing and how to sustain a learning community in the electronic realm.

Equally useful are two thoughtful contributions from recipients of The Society's Otto Hutter Teaching Prize. James Clark (p. 47) highlights four very recent research papers addressing alternative forms of delivery and engagement, including use of flipped modules and musical jingles, that are relevant to successful online activities. Julia Choate meanwhile (p. 48) takes a wider look at the literature and highlights three pedagogical studies that continue to inspire her approach to teaching, as well as her ongoing research activities. Writing from the student perspective, Róisín Ní Dhonnabháin (p. 46) reminds us, however, of differences in students' technological literacy and how the move online may have exacerbated existing inequalities.

A study from The Physiological Society (p. 14) reminds us of the necessity of providing practical laboratory-based skills training for our students. Although physiology graduates find employment across the wide spectrum of careers, the largest single occupation is as biological scientists and biochemists. It is incumbent upon us as educators to give our students the essential scientific and transferable skills required for them to move into this world of work. How we facilitate this in the context of the pandemic understandably takes up a lot of this edition.

Harry Witchel and colleagues (p. 16) consider the efficacy of online versus classroom learning. While there are arguments for and against both, they issue a plea for more considered research to clarify matters and to inform future practice. A good place for readers to start would be participating in Harry's education symposium at Physiology 2021 in Birmingham!

Such educational research clearly underpins successful teaching and learning activities. You might be surprised to learn that7 of the 10 most accessed articles across the entire suite of APS titles last year were pedagogical studies published in *Advances in Physiology Education* (Barbara Goodman, p. 12). For instance, Khalil and Elkhider's 2016 paper on learning theories and instructional design models was downloaded 81,467 times by June 2020! This is the kind of exposure that many of us can only dream of and shows the appetite for research that underpins best practice in our teaching and provision of learning.

Paradoxically, whilst pedagogical research is highly valued by our colleagues, Judy Harris' latest survey (p. 26) found that promotion and progression for teaching-focused staff is less apparent now than in 2013, in comparison with research-focused colleagues. 60% of the respondents to Judy's survey were unaware of *any* professorial appointments on teaching pathways in their institutions within the last 3 years. Even with the advent of the UK's Teaching Excellence Framework, there is still work to be done in the sector to recognise consistent and achievable promotion criteria for teaching-focused staff and establish parity of esteem across academic career pathways.

It is clear that this global pandemic has highlighted the many roles of scientists in tackling the virus, and communicating and disseminating this knowledge effectively is more important now than ever. Commenting on the wider public engagement aspects of our academic lives, Paul Zehr recounts (p. 40) his use of the physiology of superheroes to explain our science to non-experts. He concludes that if knowledge is power then we, as physiologists, are superheroes! Now that's a good point to whet your appetite on for this fascinating issue of *Physiology News*.

We welcome your submissions and suggestions for our upcoming Medical Technology Special Issue. We are in the process of determining the exact scope of this issue, but as usual we will generally look to cover the latest developments in physiology research, policy and education of physiology and its allied disciplines.

https://doi.org/10.36866/pn.119.5

# Lessons for The Society from COVID-19

*Bridget Lumb*
President, The Physiological Society

Membership is at the heart of The Society. Through publications and scientific conferences, we offer access to the latest science, and through workshops and grants we offer professional development to support your career.

Although in-person conferences and events will always be a key part of what we offer, the current pandemic has demonstrated that The Society can support many more people by increasing online provision.

We moved very quickly following lockdown to establish a series of online resources in our COVID-19 Hub. This included a programme of professional development webinars for our Members, focused on the topics you told us were important - such as dealing with mental health issues during this difficult time. Over the course of 10 weeks hundreds of Members took part on topics such as publishing for beginners and online networking.

We also took advantage of the flexibility software like Zoom offers to respond quickly to changing events. For example, we worked with Mike Tipton (University of Portsmouth, UK) to arrange a webinar on guidance to returning to the lab, setting it up within days of the government guidance being issued. This was tremendously successful, with over 650 people taking part from 33 countries – a truly international endeavour!

This has shown The Society has the ideas and agility to respond quickly to changing events.

At the time of writing, our first complete virtual early career conference Future Physiology 2020 has drawn to a close. It has been a fantastic week of keynote talks, oral communications, panel discussions and poster presentations – all conducted in a virtual environment. We have had people join us, both as presenters and attendees, from across the world. The feedback on the science has been overwhelmingly positive, as has the response to the technology we used to host the conference. People could attend while sitting in their garden (even if the weather has not always been sunny!). And by programming it over the course of a week we enabled people to attend while also keeping on top of their day jobs.

The success of Future Physiology 2020 showed that online provision can increase the number and diversity of people that engage with and contribute to The Society. This can only be a good thing. Even when "normality" resumes, The Society cannot go back to offering solely face-to-face events.

As we plan for the future, we must be able to evolve and adapt to the needs of our Members to ensure that we remain relevant, including the development of new products and services that meet our Members' changing needs. This will include access to Member-only resources, such as professional development opportunities, and Member-only discussion groups.

In response to these changing times, Trustees took the decision at our June Council meeting to invest in developing a new online Member area of our website. This will be a secure section of the site where Members will be able to log in and will sit alongside the Member Portal, which will still be used for booking events and updating your membership. This new Member area will enable us to expand our array of Member-only materials such as webinars, practical guides and teaching resources. These will be exclusively for our growing community of Members. We are starting this work now and the new section will go live next year.

We also know that our Members want more networking opportunities – 88% of respondents to a Member survey we held in March told us this was a priority for them, with over half saying that networking with Members is currently difficult. Our new online Member area will seek to change that. We are working on an online community for Members, which we hope will become the home of physiologists on the web.

Members will be able to discuss the latest research, share teaching resources and engage with Society Representatives. Each Theme will be represented too, enabling our cross-cutting communities to thrive.

This has been a challenging few months for us all and I know that many of us have concerns about research and teaching moving forward. The uncertainty is likely to be with us for some time yet – and The Society will continue to support our community through this.

The lockdown has also forced us to innovate and respond rapidly to new situations. As we move forward, The Society will take the positive lessons from this so that we become a more responsive, online Society catering for the needs of our Members.

All the best wishes for the future.

"Although in-person conferences and events will always be a key part of what we offer, the current pandemic has demonstrated that The Society can support many more people by increasing online provision"



https://doi.org/10.36866/pn.119.6



# Supporting clinicians on the front line to save lives

Mike Tipton
Editor-in-Chief of *Experimental Physiology*
David Paterson
President-Elect of The Physiological Society
Andrew Mackenzie
Head of Policy and Communications,
The Physiological Society

In the space of less than 6 months, the COVID-19 pandemic has caused an unprecedented global health and economic crisis. At the time of writing (July 2020) there have been over 12 million cases worldwide and over half a million deaths. The Director-General of the World Health Organization, Dr Tedros Adhanom Ghebreyesus, has said that "The worst is yet to come."

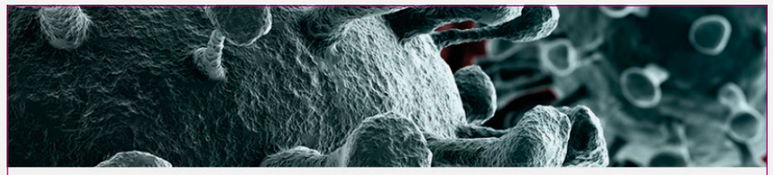
It is clear that the only route out of this crisis is through scientific research. Whether finding better pharmacological treatments or pursuing a race for a vaccine, the eyes of the world are on researchers to provide answers.

Physiology has been at the forefront of this search for answers. When COVID-19 patients started appearing in emergency departments, they didn't respond to standard treatment regimes. Medicine had to go back to first principles and understand systems physiology at work.

The result of greater physiological insight has changed how COVID-19 patients are treated. From how ventilators are deployed through to what medications are used, improved physiological knowledge is saving lives.

While initially COVID-19 was viewed as primarily a respiratory illness, we now know that this is only one facet of the disease, in addition to thrombosis and the cytokine storm.

Our improved understanding of the impact of COVID-19 on our bodies has enabled clinicians to change their approach to treatment, such as no longer rushing to put patients on ventilators and instead placing patients in the prone position to improve gas exchange. Greater insight into the immune response helps explain why dexamethasone has been hailed as a "ground-breaking treatment" for hospital patients seriously ill with COVID-19.



Home › COVID-19 Hub › Questions from the front line

## Questions from the front line

Our COVID-19 Advisory Panel seeks to provide an evolving understanding of the physiological and pathophysiological mechanisms underpinning this disease. Read questions our COVID-19 Advisory Panel received from front line clinicians dealing with patients.

In this time of crisis it is more important than ever for the scientific community to come together.

Back at the end of March we began discussing how academic physiologists like us could best help clinicians on the front line. Clinicians were working tirelessly night and day to keep people alive and simply did not have the time to analyse the mountains of data coming through from patients.

Following discussions with our friend and colleague Professor Hugh Montgomery, Consultant Physician, The Physiological Society partnered with the Intensive Care Society to establish a COVID-19 Advisory Panel. The driving force for this initiative was to enable researchers to provide the "operational support" to the medics dealing with patients, and to ensure they benefited from the latest thinking and analysis. Within hours the staff of The Physiological Society had got things up and running and within 48 hours, 26 expert physiologists from around the world had answered our call.

The aim of this group was to support frontline clinicians in the fight against COVID-19 by providing insight into the fast-evolving understanding of the physiological and pathophysiological processes underpinning the disease. Our physiology colleagues were determined to help, and we would like to thank them for their time and support during what was a difficult and uncertain period.

By establishing a "question and answer" system on The Physiological Society website, we enabled clinicians to send questions into the group for consideration. Within 24 hours we aimed to have an evidence-based response prepared for online posting. This helped improve the clinical understanding of the disease and inform best practice.

The question areas covered the whole array of physiological systems, including queries on abnormal coagulation, renal failure, hypertension, cardiac troponins and PPE. **https://www.physoc.org/covid19/questions/**

While in recent years the discipline of physiology has suffered from something of a crisis of identity, when confronted with an unknown, new disease, the value of physiological research is clear. The expert insight physiologists rapidly provided in this crisis saved lives.

The Physiological Society, and all of us in the physiology community, first and foremost must now act to ensure the physiological lessons from this disease are learned so we are more prepared for the next challenge. There is still much we don't know.

We must also learn the broader structural lessons about the deep, inextricable connection between physiology and medicine, and the importance of a rapid response in a dynamically evolving crisis. Physiology gives clinicians the toolkit to deal with the unknown. By working with clinical partners we should cement the closer links between our communities we have established during last few months so we are collaborating and ready to respond, because in this new normal of uncertainty, one truth is certain: this will not be the last pandemic.

https://doi.org/10.36866/pn.119.7

## The joy of sex

Vivien Rolfe
Head of Herbal Research, Pukka Herbs Ltd.

.

I enjoyed the "Sex in Studies" article in the Spring 2020 Physiology News written by Natasha Karp and her colleagues at AstraZeneca. The article discussed sex bias in human research, and that despite an NIH Revitalization Act of 1993 mandating the inclusion of women and ethnic groups in clinical studies, both are still woefully under-represented – and rarely included at all – in all phases of clinical development. Natasha cited the work of Beery & Zucker, 2011 who looked at the distribution of participants by sex across a number of academic subjects, and physiology as a discipline was poor at representing female subjects in research – in fact, no female participants were found at all in their analysis of human studies. Others acknowledge that studying both sexes is essential for the future of science, and we need to begin in our education systems to start to redress the data gap when it comes to the female body, as explained in the much acclaimed books by Caroline Criado-Perez (Invisible Women, Do It Like A Woman).

I attended a webinar recently by The Society that featured research talks from male early career researchers. I was surprised that they had exclusively conducted research on male subjects (for what was not specifically a male health issue). All of the work they cited involved only male participants. When questioned, one of the speakers suggested that they wished to "exclude the effect of menstrual cycles" from their results.

This last part shocked me the most. It was exactly what I recall being told in my physiology degree a number of years ago. I then carried this misconception with me into my early career. This experience has made me reflect that we are all strongly influenced by our education and laboratory cultures. Perhaps the webinar was a one-off, but it makes me suspect that we aren't getting our physiology education right.

Here are some ideas:

1. Those leading physiology courses, departments and laboratories need to map where sex and ethnicity bias in science is taught as part of their programmes or professional training as a starting point.
2. We should develop a traffic light system on every communication and publication to illustrate whether data bias has been considered – maybe red for white male only, amber for both sexes or ethnic diversity, and green for full diversity being researched and considered?
3. Educators should consider where bias permeates into their textbooks and lecture notes – do we still persist in using the "normal adult male" to teach physiology?

By not considering data biases within our science, we are not appreciating the intricacies of physiology, which I suspect is what fascinated us about the subject in the first place. We need to reach out to students and early career researchers now, otherwise we'll not see change for another generation. We will all be perpetuating the myth that we need to exclude the menstrual cycle and diversity more widely from our science, and as Caroline Criado-Perez suggests "women are dying, and the medical world is complicit. It needs to wake up".

## Explore alternative career paths on our website!

The discipline of physiology is broad and complex, which is reflected in the wide range of exciting careers in the field. You will find physiologists working in roles in hospitals, universities, space agencies, sporting arenas, mountain tops – you name it!

Our careers pages host a variety of content highlighting the breadth of careers relating to physiology. Watch case study videos from researchers working in a range of areas, from conservation to space physiology. But there is more to physiology than research alone - we also have inspiring videos from those working in teaching, industry, healthcare and science communication.

If you are still in the early stages of your career, our "Supporting your next career move" pages could help. These contain tailored information for 16-19 year olds, undergraduates and postgraduates on how The Physiological Society can support you in taking the next steps in your career.




https://doi.org/10.36866/pn.119.8

# Final year or honours research projects: Time for a total re-think?

*Dave Lewis*

University of Leeds, UK

Less than ten percent of bioscience graduates go on to careers in scientific research, and the overwhelming majority leave science altogether[1]. Traditional laboratory-based, fieldwork or literature review projects do not provide the requisite work experience or skills development for the diverse range of career paths followed by the majority of our graduates. There is, therefore, an urgent need to broaden the expectations that both students and educators have for final year or honours projects, to move beyond seeing them merely as opportunities for students to gain research experience or an understanding of the research process, to a broader US-style Capstone (or culminating) Experience. Students apply the knowledge and skills gained in earlier years to an enquiry-based problem, which may or may not be research, and creating an output as a solution to this problem. In doing so, students showcase their knowledge, skills and understanding to us and future employers.

Recognising the above, many Bioscience Departments or Faculties have started to broaden their portfolio of final year or capstone projects. The Royal Society of Biology has made substantial changes to its capstone accreditation criteria for BSc degrees. Now any format of capstone, including those that are team-based, is acceptable provided they include opportunities for analysis, synthesis and critical evaluation of information, and result in a defined output. The COVID-19 pandemic has accelerated this rate of adoption of alternative capstones across the sector. With the expectation that laboratories may still be closed at the start of the upcoming academic year or, if open, with substantial social distancing requirements in place, many colleagues are looking for alternatives to traditional laboratory or fieldwork projects. The QAA Biosciences Benchmark Statement requires students to undertake a research project. *En masse* replacement with critical literature reviews is not acceptable; less than 10% of students would select this option given the choice[1,2]. Non-traditional capstones, all of which are deliverable solely or predominantly remotely, are thus an ideal solution. These include:

- **Virtual laboratory:** Currently critical review project students at Leeds write a grant proposal as an extension exercise to their scientific paper. Why not flip the concept? Students formulate a research question, design a study, test their hypothesis using simulations or re-analysis of existing data, and when laboratories re-open, undertake a short proof of concept/pilot study;

- **Virtual fieldwork:** Use publicly available webcams or video recordings of humans, animals or the environment to explore discipline-relevant research questions, e.g. nesting behaviour of birds;

- **Bioinformatics/Big data:** Using bioinformatics tools to interrogate (e.g. genomic) datasets or analysis and interpretation of the many publically available (e.g. health, environment) or School/Faculty research (e.g. neuronal recordings) datasets, e.g. **https://bit.ly/OADataRep**;

- **Computational modelling/ Simulations:** Investigate the physiological or pharmacological modulation of existing models or simulations of systems, organs or tissues (e.g. intact animals, heart, neurones). This could include the evaluation of the scientific accuracy and educational benefits of simulations currently used in education, e.g. **https://bit.ly/e-BioPracticals** or accuracy of automated data tracking/scoring systems (e.g. OptiMouse);

- **Grant proposal:** Rather than grant proposal as extension exercise, it becomes the principal output. Sections within it are those in real grant applications to funding bodies, e.g. BBSRC or MRC. "Pilot" data comes from previous studies in the supervisor's lab;

- **Systematic reviews with or without meta-analysis:** A defined, systematic way of undertaking a comprehensive review of the literature, used a lot in clinical trials/health science but increasingly in animal experiments and education. Previous reviews undertaken by Leeds students include: Pharmacotherapies for gestational diabetes; Animal welfare factors influencing reproducibility and reliability of studies involving lab animals; E-learning and other resources as replacements for face 2 face undergraduate practicals in the Biosciences;

- **Surveys/Focus Groups:** Any topic or area, and of students, staff or the public e.g public attitudes/knowledge of antimicrobial resistance; attitudes to the use of animals in education; interaction between developers, clinicians and patients in the development of Digital Health Apps (the latter was innovative in its use of Twitter to engage participants in the first instance;

- **Scientific writing:** Creation of web-content for Small to Medium Enterprises (SMEs, e.g. scientific information on their products **https://badrilla.com/project-landing**). The content behind each tab was written by a team of students;

- **Commercial/Technical reports:** Using publicly available information to write technical or commercial reports (e.g. impact of legislation, analysis of markets etc.) for SMEs or other clients;

- **Professional Education:** Development of education and training resources for researchers (e.g. The Reproducibility Crisis **https://www.youtube.com/watch?v=OwmDzLfg9es**; vodcasts on good practice in specific research methodologies/tools);

- **Educational development:** Creation and evaluation of resources for use in undergraduate education (e.g. practicals, problem solving exercises). An ideal opportunity for students to repurpose existing face 2 face practicals into online versions or create online problem solving exercises;

- **Science in schools/Public engagement:** Create an interactive science workshop for use in schools or as a public engagement activity (for the Faculty, Charity or other educational organisation). Delivered virtually, or if social distancing conditions are relaxed later in the year, face 2 face.

> "By broadening the portfolio of capstones available to students whilst also retaining more traditional formats, it enables students to decide exactly what they want to get out of their Capstone and choose accordingly"

For more details on any of the above and additional opportunities, see: **https://mymedia.leeds.ac.uk/Mediasite/Play/a3add1c5d3b34120ae9899c30bb67b6b1d** or contact me (d.i.lewis@leeds.ac.uk).

The critical question is what do students think about these alternative capstones? In short, they love them. Given the chance, one in three students would opt for a non-traditional capstone [Lewis DI, 2020].

*"So rewarding, the highlight of my whole education. I gained so much from it personally and professionally" (BSc Neuroscience in relation to Medicine)*

It enables them to try out different career options in a safe space, and opens their eyes to new career opportunities:

*"Always loved working with children, but interestingly this project has allowed me to realise it may perhaps be my "calling" (BSc Neuroscience in relation to Medicine)*

And enhances their employability:

*"Main thing I've gained from the project is being able to look at complex situations from other perspectives than a purely scientific one. For example, I've had to look at social policy and the law in depth, and as a result appreciate how science helps to inform these areas" (BSc Human Physiology)*

*"Invaluable to me, in terms of enjoyment within my degree but also skills that I have been able to develop to help me with my future endeavours. It's challenged me personally to motivate myself, set realistic goals, and be creative in my problem solving." (BSc Neuroscience)*

*"Our business-minded approach to meeting the objectives gave me the opportunity to utilise my problem solving and communication skills on a daily basis. Our use of social media allowed us to present the findings and communicate with specialists displaying interest in our research. It's an excellent opportunity to demonstrate your aptitude in a scientific, non-laboratory working environment." (BSc Medical Sciences)*

Non-traditional capstones are not without their challenges, for both students and staff. However, with appropriate scaffolding and support, these can be overcome. By broadening the portfolio of capstones available to students whilst also retaining more traditional formats, it enables students to decide exactly what they want to get out of their capstone and choose accordingly.

Capstones are a high impact educational practice. They can be both transformational and translational (prepare students for the world of work). An opportunity for students to showcase their knowledge, understanding and skills, including 4th Industrial Revolution skills, to us and potential employers. We should not see online or non-traditional capstones as a short-term fix in response to the current COVID-19 situation. Rather, an opportunity to develop and enhance our programmes, to better meet the aspirations and needs of students, and to better prepare them for the 21st Century workplace.

*Dave Lewis is Senior Lecturer in Pharmacology & Scientific Ethics at the University of Leeds. His interests include developing and evaluating non-traditional formats for undergraduate final year Capstone projects, and the development and delivery of professional education in research animal sciences in the Emerging World. Dave has previously been awarded The Society's Otto Hutter Teaching Prize and is an AdvanceHE National Teaching Fellow.*

### References

1. Lewis DI (2020). Final year undergraduate research project or a "Capstone Experience"? Time for a re-think. *British Journal of Clinical Pharmacology* **86**(6), 1227-1228. https://bpspubs.onlinelibrary.wiley.com/doi/abs/10.1111/bcp.14266
2. Lewis DI *et al.* (2017). Final year undergraduate research projects in the Biosciences: Student and staff expectations, outcomes and impact on career choices and employability. *Proceedings of the British Pharmacological Society*, Pharmacology 2017, London. Available at: http://www.pA2online.org/abstracts/Vol18Issue1abst135P.pdf



https://doi.org/10.36866/pn.119.10

https://doi.org/10.36866/pn.119.10



Read the latest press releases from our journals at **physoc.org/news**

**First telomere-to-telomere complete sequencing of a whole human chromosome**

https://doi.org/10.1038/s41586-020-2547-7

**Scientist Calculates The Maximum Amount of Hot Dogs a Human Can Eat in 10 Minutes**

https://doi.org/10.1098/rsbl.2020.0096

**For The First Time, Human Cartilage Has Been Engineered in Space**

https://doi.org/110.1126/sciadv.aba4174

**Study of Over 1 Million People Finds Intriguing Link Between Iron Levels And Lifespan**

https://doi.org/10.1038/s41467-020-17312-3

**Mind-Boggling New Study Shows Dogs Can Use Earth's Magnetic Field to Navigate**

https://doi.org/10.7554/eLife.55080

**A Mutated Neanderthal Gene Could Make Some People More Sensitive to Pain**

https://doi.org/10.1016/j.cub.2020.06.045

**Male Seahorse Pregnancy Has Some Eerie Similarities to Human Childbearing**

https://doi.org/10.1007/s00360-020-01289-y

**First Meta-Analysis Confirms Link Between Lithium in Drinking Water And Suicide Rates**

https://doi.org/10.1192/bjp.2020.128

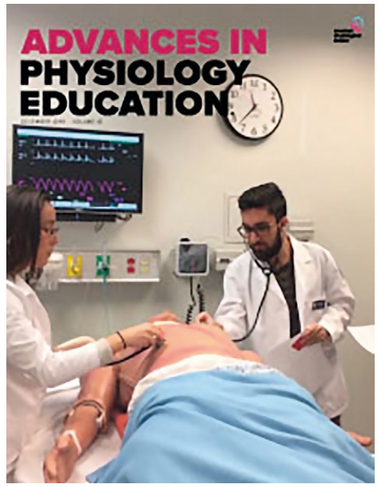
**Anglerfish Physically Fuse to Their Mates, And We Finally Know How That's Possible**

https://doi.org/10.1126/science.aaz9445

# Physiology education manuscripts in demand: Top accessed articles in *Advances in Physiology Education*

*Barbara E Goodman*

Editor-in-Chief, *Advances in Physiology Education*




*Advances in Physiology Education* is one of the family of journals published by the American Physiological Society (APS). Submissions of manuscripts to *Advances* cost nothing and accepted papers are available with free access from their initial posting online. Annually a printed copy of the journal with all 4 issues is available to those who request it. Publications in *Advances* are contributed from the global community of physiology educators and carefully peer-reviewed by expert colleagues. Of all the APS family of journals, 7 out of the 10 most accessed articles (full-text accesses) during 2019 were published in *Advances*. The top three accessed *Advances* articles are briefly described below.

**Number 1 Most Accessed 2019**

"Applying learning theories and instructional design models for effective instruction" by Mohammed K. Khalil and Ihsan A. Elkhider from the University of South Carolina School of Medicine in Greenville, South Carolina, USA published on 11 April, 2016 (*Advances in Physiology Education* **40**, 147 – 156). In this article from the Best Practices series, the major learning theories are discussed and selected examples of instructional design models are explained. The objective of the article is to present the science of learning and instruction as the theoretical evidence for the design and delivery of instructional materials in the classroom and laboratory. As of June 2020, this article has been downloaded 81,467 times!

**Number 2 Most Accessed 2019**

"Measuring osmosis and hemolysis of red blood cells" by Lauren K. Goodhead and Frances M. MacMillan from the School of Physiology, Pharmacology, and Neuroscience of the University of Bristol, Bristol, UK published on 19 May, 2017 (*Advances in Physiology Education* **41**, 298 – 305). This article from the Sourcebook of Laboratory Activities in Physiology series, describes classroom laboratory experiments to help students visualise and appreciate osmosis (the movement of water and small molecules across selectively permeable membranes of mammalian cells). Animal blood is bathed in solutions with differing osmolarities and tonicities to explore the concept of water movement by osmosis and the resultant haemolysis. As of June 2020, this article has been downloaded 71,180 times.

"Of all the APS family of journals, 7 out of the 10 most accessed articles (full-text accesses) during 2019 were published in *Advances*"

**Number 3 Most Accessed 2019**

"Attention span during lectures: 8 seconds, 10 minutes, or more?" by Neil A. Bradbury of the Department of Physiology and Biophysics of Chicago Medical School, Rosalind Franklin University of Medicine and Science, North Chicago, Illinois, USA published on 8 November, 2016 (*Advances in Physiology Education* **40**, 509 – 513). This article presents a Personal View by reviewing the literature on the "common knowledge" and "consensus" that there is a decline in students' attention 10 – 15 min into lectures. The author believes that the most consistent finding from his literature review is that the greatest variability in student attention arises from differences between teachers and not from the teaching format itself. Thus, it is the job of the instructor to enhance their teaching skills to provide not only rich content but also a satisfying lecture experience for the students. As of June 2020, this article has been downloaded 39,910 times.

The other four *Advances* articles in the top 10 most accessed in 2019 included an APS Refresher Course Report on "Smooth muscle contraction and relaxation" by R. Clinton Webb, a Best Practices series article on "Learning theories 101: application to everyday teaching and scholarship" by Denise Kay and Jonathan Kibble, an editorial on "The "African gene" theory: it is time to stop teaching and promoting slavery hypertension hypothesis" by Heidi L. Lujan and Stephen E. DiCarlo, and a Staying Current review on "Recent advances in thermoregulation" by Etain A. Tansey and Christopher D. Johnson. These articles ranged from >20,000 to almost 30,000 downloads.

This short article shows the variety of offerings in *Advances in Physiology Education* and documents the global demand for these contributions to the literature.

*Barbara E. Goodman, PhD., is Professor of Physiology at Sanford School of Medicine of the University of South Dakota. As a long-time member of the Editorial Board, Associate Editor, and now Editor-in-Chief of Advances, she is also a past chair of the American Physiological Society's Education and Communications Committees, and the Teaching Section and organiser of the APS Institutes on Teaching and Learning and the Physiology Educators Community Of Practice blog site. https://blog.lifescitrc.org/pecop/*



https://doi.org/10.36866/pn.119.12



# Delivering a high-quality practical education remotely

*Dave Lewis*

University of Leeds, UK

Given the current COVID-19 situation, it is highly likely that teaching laboratories will not be open at the start of the upcoming academic year. When they do open, there will be social distancing and health protection measures in place which will limit both the numbers of students in the laboratory at any one time (up to 75% reduction in capacity), and also the types of practical (e.g. human cardio-respiratory physiology studies) we can offer. We also need to cater for students who can't physically be present for health or other reasons.

The QAA Biosciences Benchmark Statement requires students "*to undertake appropriate practical education throughout their course.*" Similarly, the Royal Society of Biology Degree Accreditation criteria for BSc programmes requires "*the acquisition of technical skills and familiarity with the practical environment.*" We cannot opt out of providing practicals just because of the COVID-19 pandemic and therefore what are the alternatives? Options include the replacement of existing practicals with others that are "do-able" in the current environment, video demonstrations, virtual field trips, provision of data sets, simulations, virtual reality and 2nd Life (virtual worlds). Which, if any, of these is a valid alternative? Do any provide a high quality, engaging and enjoyable educational experience? To address that question, we first have to consider why we provide practicals. Reasons could include:

- Giving students hands-on experience of experimental techniques and the development of laboratory skills;
- Reinforce knowledge and understanding gained from other educational activities;
- Education in, and experience of, experimental design;
- Education in, and experience of, data analysis and interpretation;
- Development of critical thinking, creativity, problem solving, communication and team working skills;
- Fostering the development of collaborative learning networks.

Modification of existing practicals so they can be undertaken in alternative environments (e.g. human exercise physiology studies outside) would enable all of these learning outcomes to be achieved. Use of publically available webcams to address research questions involving humans, animals or the environment is another robust alternative. However, video demonstrations of practicals, virtual reality and 3rd Life are unlikely to provide an engaging and high quality educational experience alone. They could be used to reinforce knowledge and understanding gained from other educational activities, but to achieve the other learning outcomes, would have to be packaged with other activities, for example the analysis and interpretation of existing datasets (including those available at **https://bit.ly/OADataRep**).

"Which, if any, of these is a valid alternative? Do any provide a high quality, engaging and enjoyable educational experience? To address that question, we first have to consider why we provide practicals"

This leaves simulations. Those currently available to educators range from the complex (and costly) human patient simulators (used extensively in medical and health sciences education) to computer or web-based simulations of organs, tissues, cells or even biological processes. Long gone are the days of slow simulations of dubious validity. There are many high quality, scientifically robust simulations and models available, increasingly being used both in research and drug development. In a project part-funded by a British Pharmacological Society Teaching Grant, I am collating simulations from across the world that can be used in Bioscience education. This is a living list, available at: **https://bit.ly/e-BioPracticals** which will be updated regularly. If you know of any additional simulations, either free or commercially available, please send me details (d.i.lewis@leeds.ac.uk) and I will add them. Given our need for alternatives to practicals is immediate, this list does not contain any evaluations. These will be added at a later date.

Used appropriately, simulations can address all the learning outcomes for practicals except hands-on practical experience. They have much greater potential than just a short-term replacement. At Leeds, we are replacing our Level 4 and 5 (undergraduate year 1 and 2) recipe-driven practicals with semester-long team-based mini-projects using simulations (e.g. of neurones or isolated tissues), giving students experience of experimental design, hypothesis testing, data collection, analysis and interpretation of large datasets. Simulations enable students to address research questions that could not be addressed in real-life for legal, ethical or health and safety grounds. Going forward post-COVID, we can use them as pre-practical learning activities for students to design studies and test hypotheses so that when they go into the laboratories they are fully aware of experimental set-ups and protocols and know what they are looking for, for example modification of ion channels in simulations of single neurones followed by real-life electrophysiological recordings in snail brain or other invertebrate preparations.

In short, it is time to ditch those dated, dusty practicals, broaden our expectations and learning outcomes, embrace technology and adopt a more blended approach to practical education. In so doing, better prepare our students for the remainder of their programmes and for their future careers, whatever these may be.

*Dave Lewis is Senior Lecturer in Pharmacology & Scientific Ethics at the University of Leeds. His interests include developing and evaluating non-traditional formats for undergraduate final year Capstone projects, and the development and delivery of professional education in research animal sciences in the Emerging World. Dave has previously been awarded The Society's Otto Hutter Teaching Prize and is an AdvanceHE National Teaching Fellow.*

https://doi.org/10.36866/pn.119.13

# Mapping the landscape for physiology students and graduates

*Chrissy Stokes*

Head of Professional Development and Engagement, The Physiological Society

*Sarah K Hall*

Chair of Education, Public Engagement and Policy Committee, The Physiological Society

The Society has a key role to play in feeding the pipeline of career physiologists. This role has gained in significance as the number of named physiology degrees and physiology departments has waned. However, while the number of students enrolled in named physiology degrees may be declining, undergraduate students do not display a lack of interest in physiology content. In fact, as students develop an understanding and appreciation of the subject, it appears they are more likely to actively seek to continue studying physiology. This is illustrated by the popularity of intercalated degrees in physiology (reported by King's College London, KCL) and the high proportion of students choosing advanced physiology modules following a common-core first year (reported by Cardiff University).

In line with the development of the new Society strategy, in 2019 we held a focus group meeting with 16 – 21 year-old school pupils and undergraduate students to discuss how The Society might develop useful resources for this target audience. As well as highlighting the desire for more specific information on routes into studying physiology at university, these students were keen to have more information about employment opportunities after graduation with a physiology degree.

Advised by the then Education and Outreach Committee, a Task and Finish Group (TAFG) was assembled in early 2019 to advise on the design and implementation of a project to map the current landscape into and out of studying physiology at universities in the UK and the Republic of Ireland (RoI). Members of the TAFG came from a range of backgrounds in education and industry, with interests in supporting graduates: Sarah Hall, Cardiff University (Chair); Richard Bowater, University of East Anglia; Peter Jones, King's College London; Frankie MacMillan, University of Bristol; Jacqueline Naylor, AstraZeneca; and Vicky Walker, school teacher. The key aims of the project were to capture the entry requirements for physiology and related courses, and to identify the employment destinations of graduates in physiology and related subjects. This information would then be made available to Members, as well as to undergraduates considering employment opportunities and those promoting physiology as a study option at their institution. The intended impact would be to support undergraduate study of physiology and highlight career pathways for physiology graduates.

In consultation with Society Representatives from institutions across the UK and RoI, the TAFG identified 30 entry degree courses* that had at least one-third physiology content; these included Sport and Exercise Science (SES) and Biology, as well as Physiology and Neuroscience. Almost half of the Society Reps reported that their degrees contained at least 50% physiology content; however, it was noted that the total amount of physiology in a degree often depends on the modules selected. 29% of Society Reps also reported that their institution offers a physiology-named course that students can switch to mid-degree or as an exit degree. The timing and requirements for such a switch also vary widely between institutions, with some restricting movement to the 1st year while others permit movement up until the end of the 3rd year.

The information from Society Reps was used to identify appropriate UCAS and CAO codes for further investigation across all institutions in the UK and RoI, respectively. Physiology is also taught as part of a number of clinical and healthcare degrees but these were not included in the study.

The group then commissioned work from the labour market analytics firm Emsi to gain a deeper insight into UK and RoI routes in physiology: both entry requirements for degree programmes and employment destinations after graduation. There is notable variation in entry requirements for physiology-related degrees across the UK, from 72 UCAS points or BC at A-level for a Sports and Exercise Science degree to 144 UCAS points or AAA at A-level for Neuroscience. The median entry tariff for named Physiology degrees was 128 UCAS points (ABB at A-level). In the RoI there is also a huge variation in requirements, from 230 to 566 CAO points across SES and physiology/biomedical science courses (SES courses tend to have lower requirements than for physiology/biomedical courses.

For the purposes of gaining focused, meaningful information on graduate destinations, the study was narrowed to five degree codes, and students graduating in 2009 and 2010. Reviewing data from CVs posted by almost 2,500 graduates in this cohort revealed their job profile over the first decade of their careers. These data show that the largest single occupation for all physiology graduates (including SES) is as biological scientists and biochemists, confirming that graduates commonly remain in physiology-related work. Non-research career destinations include teaching, management (sales, accounts and business) and clinical/allied healthcare practice. Reviewing first, second and third career destinations of this cohort demonstrated opportunities for movement between employment categories.

The TAFG has now reported to the Education, Public Engagement and Policy Committee and more detailed outcomes from this study will be made available online in 2020. We also aim to build on this initial work, to inform future development of the Society's careers resources.

*Chrissy Stokes is Head of Professional Development and Engagement at The Physiological Society.*

*Sarah Hall is a Reader in Physiology at Cardiff University, with a focus on Teaching and Scholarship. She is Deputy Director of Undergraduate Education in the School of Biosciences and Programme Leader for the Physiology degree. At The Society, she is currently a Trustee and Chair of our Education, Public Engagement and Policy committee.*

*Degree courses included undergraduate courses that lead to a postgraduate qualification as well as BSc courses e.g. a 4-year course resulting in an MSci.



https://doi.org/10.36866/pn.119.14



# Reports of The Society's recent committee meetings

*The purpose of these short updates is to keep you informed about the work of our committees. The following summaries detail the meetings of the past few months.*

## Finance Committee

**February 2020**
Jeremy Barker of Cazenove Capital Management attended the meeting and gave a presentation on the 2019 portfolio performance and 2020 outlook. The Committee received and discussed the Q419 Management Accounts narrative and figures. It was confirmed the 2019 audit would be the last one done by haysmacintyre with Buzzacott as The Society's new audit partner for 2020. The Committee received the risk register and a summary of key risks from the Senior Management Team. The CEO reported on the one remaining key risk of reliance on a sole income stream and next steps on income diversification. The two largest reductions in risk score were the successful implementation of a portfolio of updated and legally compliant HR policies and the launch of new robust and compliant Articles of Association and Regulations.

## Council

**March 2020**
The President, Bridget Lumb, reported that following a successful presentation of the outcomes of the Grants Review Task and Finish Group, Prem Kumar had agreed to Chair the Grants Implementation Task and Finish Group. The first meeting was scheduled for March 2020. It was noted that concerns had been raised by the Board Affiliate Representative regarding the lack of opportunities for Early Career Physiologists in the initial offering and the Board agreed that an Early Career Representative should be on this group.

The outcomes of the income diversification and strategic fund initiative workshop, held the day before Council, which had considered the current landscape for income diversification and the potential revenue streams using a process of traffic lighting to narrow down suggestions to viable commercial initiatives for investment, were summarised by the Director of Scientific Programmes. It was agreed that once a clearer route forward was agreed, a Task and Finish Group, led by External Trustee John Cripps, would be set up. The discussion had also considered current cost-saving options across existing activities.

To note: The Coronavirus pandemic has affected some of the activities The Society had planned to deliver in 2020, for example all face-to-face events have either been cancelled or postponed until 2021. The Society has responded by successfully moving Future Physiology to an online conference using new technology that provides the necessary functionality as well as hosting a series of webinars for each Theme and webinars focused on professional development. However, the Trustees are regularly reviewing the situation and working with the Senior Management Team to assess the impact of this ongoing crisis and will keep members updated as decisions are made.

**April 2020**
The Conferences Committee met on 22 April using an online format for the first time. The agenda and discussions were dominated by the impact of COVID-19 on conferences and meetings. At the meeting, some of the planned conferences for 2020 had already been postponed while Future Physiology 2020 was discussed since it had been pivoted from an in-person to a virtual conference. A new programme of webinars and the future format of conferences were also discussed. Since the committee met, The Society took the decision to postpone the remaining in-person conferences and meetings in 2020. The Chair reported that the Theme Leads were keen to recruit an Early Career Theme Lead for each Theme, and that this call would be open in August. Once they are in place, networking meetings would be arranged in the first instance online, and then in person at the earliest opportunity in 2021.

## Publications Committee

**April 2020**
The Publications Committee met virtually in April 2020, chaired by Debbie Baines. The impact of COVID-19 was a recurring theme. In light of potential difficulties in recruiting new Editors-in-Chief mid-pandemic, the Committee agreed to extend the terms of Kim Barrett and Mike Tipton by one year. There was also discussion on how the synergy between The Society's journals and meetings could continue to be improved. *Experimental Physiology*'s call for papers from the 2019 Extreme Environmental Physiology meeting had proven a notable success, and the Committee discussed ways to achieve similar success should upcoming meetings be cancelled or "made virtual". While research submissions remained stable, the Committee were informed of the likelihood of a decline at some point in the future due to global laboratory closures caused by the pandemic.

The Editors-in-Chief of *The Journal of Physiology, Experimental Physiology* and *Physiological Reports* presented their respective Editorial Reports. *The Journal of Physiology* and *Experimental Physiology* remain on a transformative pathway to Open Access with Wiley. There was conversation on how these two journals conformed to the principles of the Open Science movement. The Committee approved the immediate introduction of Registered Reports for *Experimental Physiology* – an article type designed to minimise publication bias by implementing peer review prior to data collection. From an Open Science perspective, the introduction of this article type complements The Society's journals' statistics, data sharing and preprint policies, and more innovations are planned going forwards.

Stay up-to-date with our upcoming online and in-person events, grants, training and more by subscribing to our newsletters:
**https://www.physoc.org/about-us/newsletters/**

https://doi.org/10.36866/pn.119.15

# Online Learning versus classroom learning: Questioning who learns what

*Harry J Witchel*
Brighton and Sussex Medical School, UK

*Kenneth Langlands*
University of Wolverhampton, UK

*Hilary A MacQueen*
Open University, UK

*Prem Kumar*
University of Birmingham, UK

*Christopher Torrens*
Royal College of Surgeons in Ireland, Dublin

*Sarah K Hall*
School of Biosciences, Cardiff University, UK

"Before lecture capture, students only had textbooks, so live instruction functioned to curate and prioritise the vast content; nowadays, recorded lectures can do all that"

Should educators demand mandatory levels of online engagement, or "take attendance" for distance learning sessions, such as during the COVID-19 crisis? After all, when teaching in front of an undergraduate student cohort with their many laptops open, it's likely that quite a few of them are surfing the web or are on social media. Is this kind of classroom attendance really necessary? The COVID-19 crisis has highlighted this question. Even before the pandemic, the ubiquity of lecture capture broke the traditional link between classroom attendance and student exam performance.[1]

A small but vocal minority of students complain about attendance requirements. Yet many medical schools still maintain a minimum attendance requirement, although these regulations are changing school by school. We know, and there is clear research in the education literature, that some motivated students are perfectly capable of learning the knowledge tested by multiple choice questions (MCQs) without attending traditional lectures at all.[1] MCQ tests rely on cognitive recognition by providing a cue for your memory (the correct option) that bypasses the need to mentally construct the answer from scratch; so, recognition tests require less cognitive processing, and are easier (when testing the same material), than recall type tests (e.g. fill in the blank or essay). It may be that live learning only benefits problem solving and higher cognition, rather than MCQ-style recognition learning, or live learning may only add to subtle but important conceptual learning, rather than rote learning. In that case, would research based on MCQ tests even be able to detect this additional conceptual learning that is fundamental to physiology?

On the question of whether lecture attendance should be mandatory, we recognise that students in scheduled lectures may not be in a ready state for learning. We seem comfortable with students who have mitigating circumstances missing a few classroom sessions. Is that different for students who miss large numbers of classes, particularly if video lectures are available? Does this encourage laziness, disengagement, and sleeping in? The evidence is extremely mixed as to whether lecture capture does actually lead to lower attendance and subsequently lower engagement for some students.[1,2] Students at the Open University seem to cope with minimal attendance, although their engagement is strongly encouraged in other ways.

We must frame any attendance or engagement requirements in supportive rather than punitive terms. We know that the best learners use active learning strategies, which are learner-centred and so comprise additional activities (beyond passively listening or reading), in which the student formulates their own cognitions; examples include discussing, researching, self-testing, laboratory practicals or solving problems. Formal active learning strategies can range from a 5 minute in-class exercise to an entire curriculum of problem-based learning. It is worth mentioning that many undergraduates do not like or appreciate the value of formal active learning. One option for those students whose learning is online is to frame our requirements as mandatory engagement rather than attendance; we already have tools to measure online engagement. However, those students who are training to be professionals, such as in medicine, after graduation will need to attend their work daily; surely they should be prepared to accept a minimum engagement requirement now.

What, if anything, is uniquely useful about classroom attendance? Before lecture capture, students only had textbooks, so live instruction functioned to curate and prioritise the vast content; nowadays, recorded lectures can do all that. To answer whether live lectures can or should be replaced by video screencasts, we need to be specific and contextual about the purpose of each live session. Obviously there is a big difference between blended learning, such as when scripted lectures are replaced by videos in flipped classrooms, versus distance learning, when scripted lectures are replaced by videos and teaching texts such as in MOOCs. Might there be other contextual factors (such as the type of module) that determine how students learn online?

A major benefit of live/synchronous learning of knowledge is responsive teaching, including rapid teacher-to-student feedback (see Box). Another is the ability to recognise students' confusion and need for clarification; switched-on teachers are willing to abandon a teaching plan in favour of addressing student weaknesses, but this does not always happen in a PowerPoint world. Some skills (e.g. manual dexterity and communication) are less learnable online. There are "softer" benefits to live classes such as socially motivated learning, which seems fundamental for developing a community of practice. We still need to make the case for what is special about "liveness" and attending a class, irrespective of the rest of the student's engagement.


Other contextual matters include age and maturity. In the literature on how medical students learn, it is fundamental to note that USA medical students are postgraduates whereas in the UK they are usually undergraduates. This highlights the confounding factor that class attendance is often a proxy for overall student engagement. Some students may have insufficient self-efficacy or academic reserve to teach themselves. By forcing them to attend, we may increase their engagement. There is already some evidence that making lecture capture available leads to some students not attending.[3] If lecture recording does lead to lower attendance and performance, should it be instituted anyway?

Despite students' strong preference for it, maybe lecture capture is damaging. Is there strong evidence that forcing weak students to attend will cause them to engage and learn? Perhaps only good students benefit and engage more when mandated to attend. Having no recordings provides an incentive to practise good study habits for their professional careers (e.g. note-taking, attentiveness and keeping up). There is a risk that if we institute recording of all learning sessions, some students might not prepare for class, even if there are individual or team readiness assurance tests at the start of each classroom session. Some may be less inclined to join in classroom discussion if it is always recorded. However, lecture capture aids both accessibility and inclusivity. Some instructors compromise by recording lectures but not the flipped classroom sessions, so that non-attenders miss out. This seems like a retrograde step to motivate classroom attendance by making the flipped classroom the source of emphasis and knowledge curation. Many instructors have mixed feelings about lecture capture.[2]

Physiological Society Members with an interest in education are getting involved in helping to determine answers to these questions. You can too, by joining an education symposium on conceptual learning plus a classroom attendance workshop at Physiology 2021 in Birmingham. Do you think we should take charge of the educational narrative and develop recommendations and policies for different educational programmes? What are the factors that determine successful learning outside the classroom? What experiments or data would we need to determine that we are on the right track? How and where would such educational research need to take place? If you are interested in physiology education, we are keen to know your opinion and to have you contribute.

## References

1. Kauffman CA *et al.* (2018). Relationship between classroom attendance and examination performance in a second-year medical pathophysiology class. *Advances in Physiology Education* **42**(4), 593 – 598. http://www.doi.org/10.1152/advan.00123.2018
2. Morris NP *et al.* (2019). Lecture recordings to support learning: A contested space between students and teachers. *Computers & Education* **140**, 103604. http://www.doi.org/10.1016/j.compedu.2019.103604
3. Edwards MR, Clinton ME (2019). A study exploring the impact of lecture capture availability and lecture capture usage on student attendance and attainment. *Higher Education* **77**(3), 403 – 421. http://www.doi.org/10.1007/s10734-018-0275-9


https://doi.org/10.36866/pn.119.16
https://doi.org/10.36866/pn.119.16

Meeting notes

# Future Physiology 2020: Our first virtual conference

6 – 10 July 2020,
*Held online*


We hosted Future Physiology 2020 throughout the week of 6 July. An annual scheme, the Future Physiology meetings offer Undergraduate and Affiliate Members of The Society the opportunity to organise their own conference. The programme of each meeting is created to give early career researchers the chance to gain practical experience and advice to help in their physiology careers.

Unlike previous Future Physiology meetings, Future Physiology 2020 was run entirely online, making it The Society's very first virtual conference. The meeting was originally planned to take place as an in-person conference, however, with the COVID-19 outbreak, we were forced to review our events programme and make some difficult decisions as to whether our upcoming meetings should go ahead. With such a valuable programme designed for early career researchers and their professional development, we felt it would have been a great loss if we were to postpone or cancel the Future Physiology 2020 meeting and so we decided to make the move to virtual.

This year's proposal was submitted by a team of six early career researchers from Norway, Denmark, and Canada. Their chosen scientific focus for the conference was *"Physiology in a changing climate: the interdependence between physiology, behaviour and the environment."* The organising group created a fantastic programme that included nine invited speaker talks (with a focus on career progression), 15 oral communications, three ePoster sessions, and four professional development workshops.

To transform the meeting into a virtual experience, we used three new software platforms (Zoom, NetworkTables and Kubify's Learning Toolbox), which enabled us to maintain and enhance each aspect of the original programme. The Conference Hub on NetworkTables provided an environment where participants could access each of the sessions and build their own tailored agendas. Each attendee was given a profile on the Conference Hub and had the opportunity to add a photograph of themselves and some information about their interests, which helped to give the conference a personal and friendly feel. Attendees were also able to connect with one another using their profiles.

During the invited speaker talks, oral communications, and professional development workshops, we were able to offer our attendees an interactive experience, with participants having the option to submit questions and comments and upvote others' questions, as well as vote in polls (including one to select the winner of our annual Michael J Rennie Oral Communication Prize for early career researchers). For the poster sessions, we introduced innovative ePosters, formed of dynamic multimedia resources. The 77 ePosters created for the conference were available for attendees to view in the Future Physiology 2020 ePoster Showcase before, during and after the conference. Each ePoster presenter also had four mini-sessions scheduled, providing them the opportunity to discuss their research and answer questions in small groups.

Future Physiology 2020 had a total of 407 registrations from 36 countries. When comparing this with registrations from just 18 countries for Future Physiology 2019, the 2020 meeting was far more international. This can be attributed to the fact that the virtual conference model removes barriers such as a lack of institutional funding, issues in securing visas, and unavoidable conflicting commitments that would otherwise prevent researchers from attending. With no travel or venue hire that is associated with our in-person conferences, Future Physiology 2020 is also by far our most sustainable meeting to date. With all the associated benefits, the virtual model is certainly something we will build into our future events programme.

"Unlike previous Future Physiology meetings, Future Physiology 2020 was run entirely online, making it The Society's very first virtual conference"

**Mariam Jaw Mbowe, Edward Francis**
*Small Teaching Hospital, The Gambia*

Future Physiology 2020 could not have come at a better time, when the whole world is battling with the first pandemic to be caused by a coronavirus. The first ever virtual conference I happened to attend brought me a golden opportunity. I believe it was the same for many colleagues in physiology who attended. Personally, it helped me to distance myself from the COVID-19 news, which is causing a lot of stress and anxiety as the days go by; I was becoming more and more helpless and mentally fatigued. The conference gave me the opportunity for a change, to learn more about the advances in physiology and to engage in activities where the pandemic was not the centre of discussion.

As an African physiologist from the smallest and one of the least developed nations of the continent, where physiology education is not that advanced, attending this virtual conference came with a lot of unique advantages. The fact that physiologists from all corners of the world came together on one platform to promote physiology, at a time when a lot of restrictions are in place, is commendable.

Attending the conference from any location meant that I was using either my laptop, telephone, or tablet. Also, not struggling to get a visa and funding to travel was a welcome change for me, and I believe many in my shoes, especially those from low-income settings, welcomed it wholeheartedly too. It is rare for people to attend conferences nowadays at no or low cost but The Physiological Society granted me and many others this rare opportunity. The conference covered diverse topics including human physiology, animal physiology, factors that can affect the normal functioning of living organisms, mental health in academia, endocrine and metabolic disorders, the use of artificial intelligence in physiology, career paths in physiology and equipment like the HoloLens, which I hadn't heard of before.

Through this conference, despite the differences in culture, religion, ethnic and cultural backgrounds of the participants, we were able to come together as a family to share knowledge and research done in different continents and to network, all with the aim of improving lives. It was great to meet and connect with attendees through the special NetworkTables platform.

It was also exciting and inspiring to connect with colleagues from across the African continent and witness first-hand, presentations of work they have done in the field of physiology. Their research has inspired me to believe that even without many resources, something can be done to advance physiology in middle- and low-resource settings.

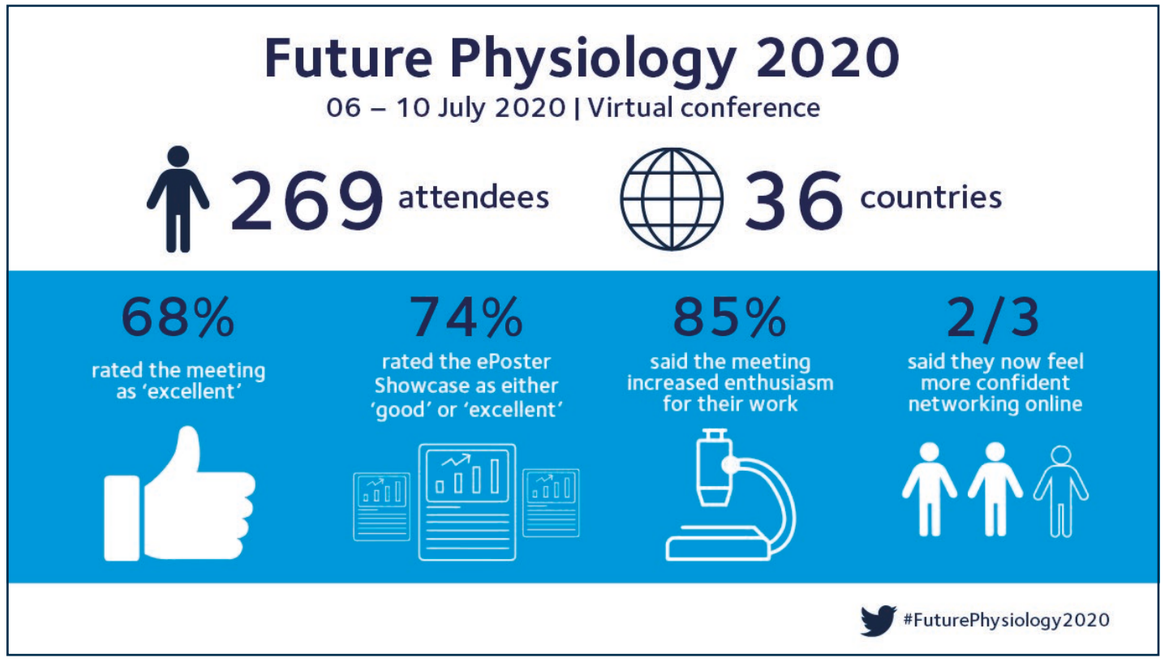
"Not struggling to get a visa and funding to travel was a welcome change for me, and I believe many in my shoes, especially those from low-income settings, welcomed it wholeheartedly too"

The learning toolbox, where all the ePosters were uploaded, give us the opportunity to go through all the presentations and be able to download them for future reference. This will go a long way in helping to increase my knowledge and how to improve myself when it comes to planning and presenting research work.

As someone who has a vast interest in metabolic and endocrine medicine, I was very happy to come across a lot of thought-provoking topics in this field. For a healthier world it is important to know what the evidence has shown so as to work towards the reduction of the morbidity and mortality associated with obesity, diabetes and hypertension.



https://doi.org/10.36866/pn.119.18
https://doi.org/10.36866/pn.119.18




All the sessions I attended were so intriguing and educational; however, the presentation of Audrey Bergouignan's work *"The physical activity transition: Global sedentarisation and increase in the prevalence of metabolic diseases in humans"* and the panel discussion around mental health stood out as my favourites during the conference.

Audrey's research, which centred on the Fulani people in rural and urban parts of Senegal where the epidemiological transition is ongoing, provided me the opportunity to learn from her work that the effects of sedentary behaviours could not be offset by physical activity. However, taking shorter breaks from sitting during the day is at least more helpful than taking one long break. These findings and later works on the topic I believe will go a long way in addressing problems of sedentary lifestyles associated with urbanisation.

Coming from a setup where mental health discussions are hardly on the table, the panel on mental health served as a stimulant for me to hold more discussions on the topic and raise awareness amongst colleagues and my community. Having discussions around mental health, and helping each other to improve our mental health and productivity, should be everyone's responsibility.

To end I want to take this opportunity to thank all the brains behind the success of Future Physiology 2020, especially The Physiological Society for keeping me sane during this pandemic with the series of educational and interactive webinars and the most recent Future Physiology. I am looking forward to many more discussions around mental health and endocrinology.

**Edward Cole**
*University of Hull*

Like most things during the spring of 2020, Future Physiology 2020 was greatly affected by COVID-19. The disease that put a halt to everyday affairs and put everybody's lives on hold made no exceptions for Future Physiology. Complicated problems require innovative solutions, and this conference was no exception. The conference was moved entirely to a virtual platform, complete with talks, workshops and ePoster sessions. This uncharted environment allowed physiologists from all over the globe to connect and acquire new knowledge in their respective fields or in a completely new area.

Future Physiology 2020 was aimed at early career researchers and wanted to give a valuable experience, together with networking opportunities for those new to the field of physiology. I was fortunate enough to have my abstract accepted and I was invited to give a presentation. My presentation was entitled *"Effectiveness of short-term heat acclimation on heat shock protein 70 in a trained female and male population."* This was my first non-student conference but having presented at the Student Thesis Conference at the University of Hull I felt some degree of confidence.

Naturally, moving the conference online generated new issues in terms of networking. Rather than sitting with a fellow researcher and discussing relevant topics over a pint or two, the networking happened largely over emails and virtual Q&A sessions. The portal that was created to allow people to choose their sessions also functioned as an area to connect with other attendees and speakers, like a physiological Facebook, by sending connection requests and sharing online business cards. It also allowed you to create a profile for yourself and illustrate your interests and areas of expertise. I was able to connect with over fifty people, over half of whom I may not have even otherwise met as they were from overseas.

In my experience, the conference was simple to access and easy to book onto.

> "I was able to connect with over fifty people, over half of whom I may not have even otherwise met as they were from overseas"

It also allowed me to view multiple talks, which in a real life I may not have been able to attend due to space or time. In addition to being able to view the conference from my computer, my mobile phone was able to connect to the talks. This meant I could be sat anywhere listening to my first talk, which was *"Movement and heart rate in the Scandinavian brown bear (Ursus arctos)"* delivered by Leslie Blanchet. I was drawn to this talk as I had never anticipated a presentation on bears to be at a physiology conference; I was pleasantly surprised at the diversity of talks available. Naturally, I was extremely interested to learn something new! The relationship between a brown bear's heart rate and the distance it travels and whether it was influenced by the environment or climate tied seamlessly into the overall theme of the conference which was *"Physiology in a changing climate: the interdependence between physiology, behaviour and the environment."*

Another talk I attended was entitled *"Human Thermoregulation: Can We Beat The Heat?"* presented by Emily Watkins from the University of Roehampton. This topic was closer to my field and as a result I was intrigued about what she had to say. Emily showed that the increase in global temperatures and frequent heat waves pose a significant risk to aging populations and those who work in hot climates such as firefighters. She explained the innovative treatments that provided a new insight into what heat acclimation can be used for aside from performance.

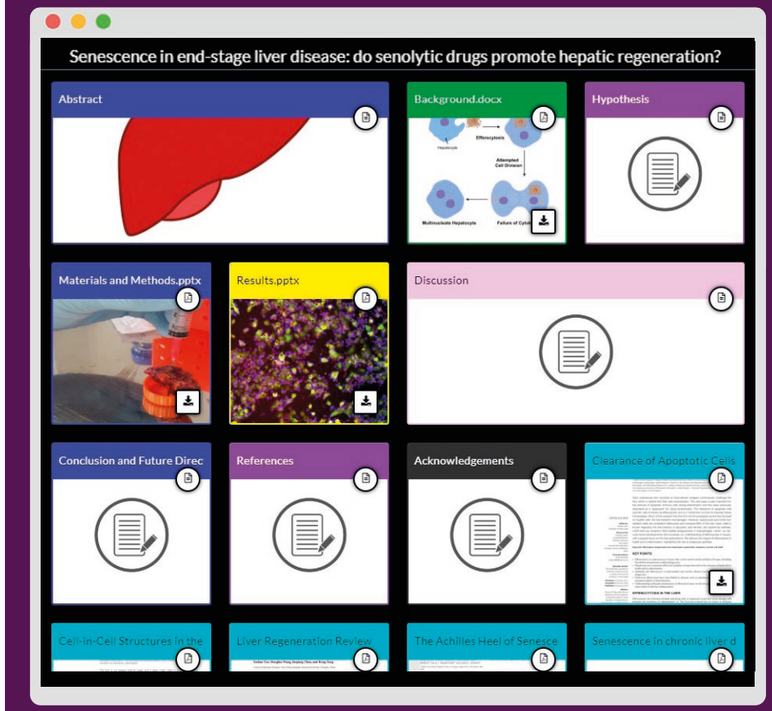
When the time came to present my talk, the daunting nature of a fully populated auditorium was suddenly replaced by the green light on my webcam. The pressure of countless eyes loomed as I progressed through my research. My talk on short-term heat acclimation highlighted that there is a given dearth in the literature when it comes to the heat shock response in females and that more research is required to ascertain the kinetics of the extracellular HSP70 response in females. In hindsight, I think I would have benefited from a presentation in a lecture theatre as I forgot to switch my screen from my face to my PowerPoint initially. Integrating a conference with technology is fraught with little human mistakes, as often happens with live television.

My overall experience of Future Physiology 2020 was a positive one. There has been a certain technological magic surrounding the online nature of this conference. I hope there are more opportunities like it where physiologists from all backgrounds and countries can come together and share their ideas. My next step, following Future Physiology 2020, is to meet the people I have connected with and have a real conversation with them and hopefully a pint as well.

**Masa Svent**
*Winner of the Michael J Rennie Oral Communication Prize, awarded at Future Physiology 2020*

Future Physiology 2020 was my first experience of a virtual conference. Attending the conference remotely allowed me to learn about a range of physiology topics and receive valuable feedback on my research, while continuing to work on my PhD. I enjoyed presenting my data to the diverse audience at the conference, and was honoured to be awarded the Michael J Rennie Oral Communication Prize for the best oral communication by an early career researcher. This was particularly rewarding as I am interested in pursuing a career in science communication. In addition to building on my physiology knowledge and presentation skills, Future Physiology 2020 also gave me additional confidence to pursue my career goals.

## Congratulations to the winners of our Future Physiology ePoster Competition




- Mia Burleigh
  *University of the West of Scotland, UK*
- Thomas Inns
  *University of Nottingham, UK*
- Qutuba Karwi
  *University of Alberta, Canada*
- Jordan Bird,
  *Mount Royal University, Canada*
- Laura Rich
  *University of Nottingham, UK*
- Taylor Bader
  *Mount Royal University, Canada*
- Timothy Olsen
  *University of California San Francisco, US*
- Siobhra Dooley
  *University of Nottingham, UK*
- Sarah Miller
  *University of Nottingham, UK*


https://doi.org/10.36866/pn.119.18
https://doi.org/10.36866/pn.119.18

DOI: 10.36866/pn.119.22

# Online tools for teaching

## From inclusive learning to "the way" to teach and assess during the COVID-19 pandemic

*Maria Toledo-Rodriquez*

School of Life Sciences,
University of Nottingham, UK

*Alison Mostyn*

School of Health Sciences,
University of Nottingham, UK

The exponential growth of computer power, combined with the development of mobile technology and fast-speed broadband has led to our increased use (and often dependence) of online platforms in every aspect of our life in higher education (HE). As with other radical changes, initially there was a very cautious (and often reticent) use of online technologies to deliver and assess learning. However, in recent years more and more academics have been embracing their use to support and enhance HE. COVID-19, has been the catalyst for almost universal use of online technology for every single aspect of our HE.

Below we'll briefly describe some of the different platforms that are enabling the delivery of higher education (HE) under "lockdown". Although some of these platforms are relatively recent, they have been used before COVID-19 and will continue to be used afterwards. Our hope is that we all reflect and build upon positive experiences during our "crash course" of online teaching and continue using these technologies to streamline our HE and management post-COVID-19. We believe this will improve our student experience while ensuring a manageable staff workload through what will be a challenging time in the HE sector.

### Delivery of content

For centuries, HE teaching has relied heavily on didactic classroom learning where information is transmitted from teacher to student, often as long monologues. The development of online video platforms has enabled lecture recording and online distribution, allowing students to learn anywhere at any time. This is particularly important for students on courses with a placement component or caring responsibilities – allowing flexible access to learning. Platforms such as **Echo360**, which uses universal capture, do not require specialised equipment, thus enabling lecture recording from most laptops by a couple of clicks. Additional features in Echo360, such as in-class polling and confusion flags facilitate student engagement and active learning. Pre-COVID-19 most academics used Echo360 to record the lectures delivered in class, so that students could access them during revision. Additionally, students with specific learning differences benefited from the ability to pause and rewind the recording when needed, so that they could process all the information at an appropriate pace. In the past, some lecturers were reluctant to record lectures as they feared it would result in lower attendance. However, our personal experience indicates a slight drop in attendance but no impact upon attainment.

Post-COVID-19, academics have relied solely on Echo360 and other lecture capture technologies to deliver their teaching. Fortunately, many of us had been already using these tools to complement our face-to-face teaching, enabling a seamless transition into "COVID-19 lecturing" where students virtually attended, at the pre-COVID-19 scheduled time/date, lectures delivered from the "comfort" of our kitchen table or home office.

Echo360 lecture capture might not be the solution for everyone, as it is not supported by relatively old computers and/or some institutions might not be able to afford the costs. Alternatives for lecture capture are **PowerPoint** with narration and **Microsoft (MS) Teams** meetings (see below).

### Learning Management Systems (LMS) for e-learning delivery, management and assessment

Lecture delivery is only one way to transfer information to students. LMSs, such as **Moodle** or **Canvas**, have been widely used in HE for management, content delivery and assessment of courses. A well-structured modular LMS guides students through their learning in the intended order with information on sequencing and timing and contact details. An LMS can work as a one stop shop for material relevant to a course (from lecture recording and slides, to videos, reading material or links to relevant resources). The material can be uploaded and accessed anytime from anywhere. LMS also allows staff to monitor students' attendance and engagement, while online forums enable dialogue between students and staff. Finally, LMSs enable material to be archived, therefore allowing the re-use of resources by academics and access to the previous year's content to students repeating a year as external candidates. During lockdown, HE educators are heavily relying on LMS to manage content delivery and assessment.


### Assessment

Arguably, one of the most challenging tasks of online teaching and learning is assessment. While more and more universities are embracing online submission and marking of coursework, exams are more challenging.

LMSs such as **Moodle** or **Canvas** enable submission, similarity checks and marking of coursework anywhere. Marking can be achieved using rubrics (with automation if required) and feedback can be provided as text, "quick marks" as well as verbally recorded. Upload of marks can be automated to Excel or university administration systems, potentially reducing workload and avoiding human error. Moreover, when combined with plagiarism checkers such as **Turnitin**, markers have the advantage of knowing whether the work is genuinely novel.

Administration of timed exams pose more of a challenge than written assessments. **Rogo** (open source project) is an e-assessment tool, which can be used to hold a bank of questions, set, run and mark exams. Rogo offers a wide range of question types including MCQ, true/false, extended matching and short answer, with the benefit of automated marking for many. In terms of quality assurance, external examiners can access, check and comment virtually on papers, first and second marking can be audited and post-exam analysis such as frequency and discrimination is available. Observed Structured Clinical Exams (OSCEs) are used widely in medicine, health and applied human sciences courses – usually to assess a specific practical or clinical skill; the administration of these online is incredibly challenging as they may rely on simulated patients, laboratory equipment and close observation by an examiner. Several pay-per-use tools exist for OSCEs and MCQs including **Practique, Maxexam** and **Speedwell**.

### Engaging with students through quizzes, polls and surveys

An important part of teaching and particularly of active learning is the monitoring of students' understanding and engagement in activities that will enable them to practise what they learn and solve problems using the knowledge acquired. While there are some low-tech options to enable this, such as show of hands or asking students to answer in post-its and stick them on a wall, online technologies are more powerful, versatile and may overcome some of the issues of face-to-face communication. Students who are anxious about speaking out in face-to-face classes may be more comfortable posting questions in an online forum. Multiple platforms enable quizzing students. **Echo360** has a built-in polling feature, however, it requires some time to become comfortable with the technology and certain animations, images and equations do not transfer well from PowerPoint Echo360 polls. **Socrative** enables students to submit short answers anonymously to questions set by the lecturer. **Kahoot** is an app widely used in secondary education and thus highly familiar to undergraduate students. The app "puts the fun in the test" by allowing the running of pub-like quizzes where students choose the correct answer as quickly as possible. **Mentimeter** is an interactive presentation software, which enables the running of quizzes as part of a presentation, analysis of the results and even creation of word clouds with the answers. Using these applications alongside the lecture helps the lecturer gauge how much the students have understood of the material taught so far, and whether some aspects need further explanation. Moreover, our experience suggests that students seem to be much more involved when their feedback is anonymous. **Slido** enables interactive Q&A and live poll sessions, where students can anonymously send their questions to the class or the lecturer. The survey software, **Polly**, can be embedded within **MS Teams** and used to run real-time polls. Most LMSs will also have quiz options to embed within learning – for example, **Moodle** offers several question types, which can be used within a quiz and marked automatically. A benefit of using quizzes embedded within an LMS is the ability to monitor student activity and understanding of a topic. **Peerwise,** a free online platform, enables students to create, evaluate and share practice MCQs thus helping them with revision and consolidation of the learned material. Finally, **Office Forms** enables staff and lecturers to collect information in a fast and efficient



https://doi.org/10.36866/pn.119.22

https://doi.org/10.36866/pn.119.22

way, making them ideal for running student surveys. Most of these apps are free or have a free version that can be used for a limited number of students and/or questions.

## Student wellbeing and sense of community

The COVID-19 lockdown and social distancing have taken a toll on the mental wellbeing of many students and staff, with some feeling isolated and cut off from their daily routines that motivated their learning. Video-conferencing apps (such as **MS Teams**, **Zoom** or **Skype**) can be used to boost student wellbeing and bolster a sense of community through virtual classes, tutorials and meetings with welfare officers and university counsellors. They also have enabled seamless continuation of External Circumstances panels or Disciplinary Procedures during lockdown.

While lecture capture enables students to "be present" at a lecture, students often don't feel the same sense of community as when they can see (and feel) their peers sitting in the lecture room. This can be resolved by combining video-conferencing tools, online data sharing and small-group work. Tasks can be assigned to small groups of students as part of a learning activity, where each group meets virtually to complete a task and then reports back the class at a virtual town-hall meeting.

We should remember that building and maintaining a sense of community will be particularly critical during autumn 2020, when it is expected that many courses will start as online-only or blended learning.

## MS Teams, the unexpected "COVID-19 must-have accessory"

While not designed exclusively for teaching and learning, **MS Teams** is being widely used by HE to enable seamless running of the day-to-day management activities, such as meetings, tutorials, live teaching, document sharing and team working. Small group teaching can be facilitated through MS Teams channels; private groups can be created within a team to enable staff organisation and discussion. Live teaching can be conducted using the "share screen" option and students can engage in the live session by virtually raising their hands or asking questions in the chat column. An MS Teams page for a module can contain links to the LMS, have embedded video, polls and undertake assessment. The nature of communication within MS Teams is similar to chat functions on social media platforms, which can appeal to *Generation Z* students who find email slow and formal. Anecdotally, students are less likely than staff to switch on their videos in Teams, which can feel isolating for the member of staff delivering the session.

## Note of caution: beware of burnout

Online learning technologies are a huge blessing for HE during the COVID-19 pandemic, enabling delivery, management and assessment of teaching while the nation is under lockdown. However, the 24/7 nature of these technologies and the increasingly blurred lines between work and home life while universities are closed means that they can easily become a curse to our mental wellbeing. It is important to set boundaries, ensuring we take regular breaks from work and try to avoid "Zoom fatigue".

## Final thoughts

Some of us might struggle with the technology or the thought of teaching without face-to-face contact; however, we should remember that millennials and particularly *Generation Z* (the majority of our student population) do not know a time without smartphones and social media. The "digital native" generations are video-centric, with technology playing an important role in their social interactions. Thus, the move to digital learning during lockdown may feel less awkward to them than staff who are "*boomers*" or *Generation X*. However, while many of our students may be digitally transformed, we must consider mature students, widening participation and those with protected characteristics. Are our online learning tools accessible to all? This will be a crucial consideration going forward into the next academic year.

Finally, the COVID-19 experience can be used to improve future teaching. There are many positive anecdotal examples to build upon, with students and staff saying that take-home exams are a better learning experience than timed exams. Moreover, we have seen that HE, a sector often viewed as "change-phobic", can be considerable agile when needed, with most HE institutions moving to 100% online teaching within 2 weeks. Thus, let's use what we have learnt during this experience to boost HE and student experience when we return to face-to-face teaching.

---

*Maria Toledo is Assistant Professor at the School of Life Sciences, University of Nottingham. She mainly teaches neuroscience students and is the Lead Senior Tutor for the School. Her current interests are boosting student's mental resilience and preparing students for a future workplace, which might be different to the one we experience today.*

*Alison Mostyn is an Associate Professor in the School of Health Sciences. She mostly teaches pharmacology to qualified health care professionals, as part of a non-medical prescribing course. She became the Deputy Director of Education and Student Experience in March 2020. She has interests in assessment, digital learning and inclusive teaching.*

"The COVID-19 lockdown and social distancing have taken a toll on the mental wellbeing of many students and staff, with some feeling isolated and cut off from their daily routines that motivated their learning"



https://doi.org/10.36866/pn.119.22

DOI: 10.36866/pn.119.25



# A case study of ADInstruments' online learning platform Lt:

## New virtual adventure in physiology practicals

*Marc Demolder*

University of Antwerp, Belgium

The Lt Online Community is a place to get together and discuss anything related to education. Our hope is that this community will be a way for educators to work together, get feedback from each other, and build stronger, more meaningful relationships in real-time - whether these are across campus, or across the globe! We spoke to Marc Demolder from the University of Antwerp about his experience using Lt, specifically during the spring of 2020 when COVID-19 hit.

**Could you tell us a little about your field of teaching?**

I teach physiology practical exercises in Pharmaceutical Sciences, Biomedical Sciences, Veterinary Sciences, Biology and Rehabilitation Sciences and Physiotherapy. The practicals I run range from neurophysiology to exercise physiology and echocardiography.

**What was your biggest concern or challenge with having to switch to online practicals?**

The most significant concern associated with the COVID-19 crisis was the total stop on any practical laboratory sessions at the University of Antwerp. As a result of the lockdown, students were not allowed access to the university campus. Lab sessions needed to be presented in a virtual environment, in order to be executed. Needless to say, lab sessions with no appropriate software environment were condemned to a PDF document with the description of the lab session and some Excel data for further analysis and reporting by the students at home.

Another challenge of switching to a purely online lab was the management of the logins for the students and the follow-up on their progress. And, of course, the lack of personal contact with the students during the lab sessions was my biggest concern because one loses the possibility to ask questions and get direct feedback from the current knowledge of students.

**How did the online-teaching platform Lt from ADInstruments help you overcome this challenge?**

We could effectively move our labs to an online model by initialising the example data feature in Lt. This feature provides model data for experiments, already stored in the Lt learning platform. The main reason why we were able to adapt our teaching online so quickly is that Lt already provides a full online environment. Even a department that still used a retired education platform - LabTutor - could comfortably switch to Lt due to easily accessible introduction lessons.

Students are normally in the lab to capture data and to interact with their teachers. The lack of personal contact between teachers and students was overcome by theoretical lessons with feedback and the pre-lab tests, which are part of a module in Lt.

https://doi.org/10.36866/pn.119.25

"The theoretical lessons in the modules are indeed a welcome addition to the lectures; they present the theory of the lectures in a different manner "

**Were there any specific modules that were particularly difficult (or easy) to move online?**

In general, all modules could be moved online. Some modules did not require any change, as no external data had to be generated, such as sensory physiology with labs on colour blindness. Other lab sessions needed a data input from transducers, but were not connected to the data acquisition system. We solved this problem by giving the students an Excel sheet with the necessary data, allowing them to introduce the data in the different data panels in the Lt virtual lab. Finally, some of the Lt virtual labs offer the possibility to activate implemented example data. We used all three approaches in our online setting.

Depending on the different courses, we had to adapt some ready-made labs in Lt. This was the case for veterinary sciences and pharmacology.

**Did you make use of the example data provided by ADI for the COVID-19 response?**

Example data is a feature we normally use as a preview of how a trace, e.g. an ECG, would look like prior to the lab. In addition, example data is a great solution to perform analysis, when live data generated in the lab were not as expected. This is often the case for hard-to-get data, e.g. with Visual Evoked Potential. Using this example data as a solution for effective data analysis in an online virtual mode was a welcome and easy-to-implement solution.

**How easy was it to set up your online practicals on Lt, with reference to the authoring process and user-friendliness?**

We used the same lab content as we would have done in a non-virtual manner. We adapted some labs like Heart and ECG, Heart Sounds and EOG (Electro Oculography), but this was an easy task. Students sometimes deleted their invitations to the platform by accident, but this could be easily managed by the course administrator. The follow-up of the student work was efficient.

**What has the student feedback been like since you started running virtual labs with Lt?**

Apart from some startup problems for a few students, everything went smoothly. The online theoretical lessons with instant feedback were highly appreciated and together with the pre-lab tests formed a smooth transition from live to online labs. Being able to perform these labs at their own pace was a welcome advantage. It increased their level of understanding. "This is certainly a way of teaching we would like to keep for next academic year", some students stated.

Overall, the feedback was positive and the students performed more lab sessions than the students of previous academic years. We also added additional labs, which were optional for students to do, e.g. EEG lab. Students were not obligated to execute these additional labs, but many did out of interest.

**What has the staff feedback been like since you started running virtual labs with Lt; how strongly would you recommend using Lt to a colleague?**

The Lt platform is very interesting, from the point of view of a professor in physiology. The theoretical lessons in the modules are indeed a welcome addition to the lectures; they present the theory of the lectures in a different manner (instant feedback on student work, real-life patient case studies). Lt encourages thinking and improves insight, as well as providing the essential information that enables students to perform the lab sessions. The lessons can be easily adapted, so for the next academic year, this way of teaching surely opens new perspectives.

Due to the COVID-19 crisis, group work is not possible anymore. However, each student now has to think about the questions in the lab for themselves, which some students don't do in a group! The number of reports to grade has doubled, which is a big workload for teachers! The fact that students cannot take measurements anymore from their own bodies is, of course, regrettable.

We started using Lt at first for the students of Pharmacology. Subsequently, we recommended its success to our colleagues, who run Rehabilitation and Biomedical Sciences courses and finally to the Veterinary Sciences department. The result was that we had more structure in the lab sessions, as well as more content due to the theoretical lessons that are included in Lt to begin with. Ultimately, Lt led to better-prepared students, with better reports.

**What things have you learned from this online teaching experience that you will bring back in the classroom, once things get back to normal?**

The interaction between the teacher and the student remains an important aspect of lab-based teaching. The level of some answers from a few students in pharmacology has dropped compared with the last academic year. The reason for the difference could well be the fact that we were not able to interact with the students due to the lockdown measures.

Another reason could be the sudden and complete change in teaching style, which can take a little bit of time for some students to adjust to. However, this problem did not occur with the students of Veterinary Sciences.

To solve this, instruction videos could be used, also available at the ADInstruments website. Another idea is to have the first session in the lab at the university and subsequent lab sessions could be performed online. In this way, we would be sure that students get the full functionality of the system and would be aware of the level at which they need to perform.

The clear pedagogical approach of the theoretical lessons in physiology of Lt inspired some teachers to take this back into the classroom.

**How would you summarise your overall online teaching experience?**

Online lab sessions in physiology had already started several years ago with LabTutor (precursor of Lt). The platform allowed students to preview the actual lab session exercises with example data in a virtual manner, on their computers at home. It also allowed them to finalise the reporting in an online setting. This was a very positive first experience with extremely positive feedback from the students. Currently, we are using the Lt platform, which has a lot more features than LabTutor, such as real-life patient cases, instant feedback for students, support for devices such as tablets and a larger variety of module collections.

The use of online teaching modules in Lt has greatly extended our online way of working and solved instant problems arising from the COVID-19 crisis in a matter of hours. The instant feedback capabilities on student work in Lt, pre-lab tests and the example data sets in the lab exercise itself have fully enabled us to work in an online manner, at a time when students could not collect live data and interact with the teacher directly. We had to act very fast, but were able to continue.

**What would be your three key tips or pieces of advice for educators that might be struggling with the move to online or looking for new solutions? And, why do you prioritise those three?**

Having a high-performance software environment is the first key to a successful online lab. Secondly, it should be easy to implement modern aspects of teaching, like blended learning, into the software. Modern data acquisition and transducers will complete the state-of-the-art aspect of an online lab.

- Moving lab sessions online demands a solid software environment with an integrated software management of logins, and follow-up of the student work.
- Easy implementation or change of the lab session content in a user-friendly software environment, which allows state-of-the-art tools to be added in the content, like videos, links and grading tools.
- The use of modern transducers and data acquisition to give the students the possibility of measuring using their own bodies. Current transducers with implemented Bluetooth or other communication protocols can open up new possibilities.

In conclusion, it was the versatile software environment of Lt, combined with the use of example data, that made the switch to virtual labs an easy and successful operation in this COVID-19 lockdown.

---

*Marc Demolder (MSc Eng) manages the practical exercises for biological science classes at the University of Antwerp in Belgium. Students get hands-on experience and gain deeper scientific knowledge, with exercises ranging from recording nerve action potentials to analysing echocardiographs to exercise physiology experiments.*



https://doi.org/10.36866/pn.119.25

https://doi.org/10.36866/pn.119.25

DOI: 10.36866/pn.119.28

# Recognition for education and teachers in universities

## Has anything changed in the last 6 years?

*Judy Harris*

University of Bristol, UK

The social distancing necessary during, and probably beyond, the COVID-19 pandemic is having major implications for all aspects of university life. Within education, lecturers are having to devise wide-ranging strategies and materials for distance teaching, learning and assessment to ensure that the quality and rigour of undergraduate education is maintained in these extraordinary times. So it is particularly timely to provide an update on The Physiological Society's work in exploring the value that universities place on education, and how they recognise and reward the staff who specialise in developing and delivering it.

This is an area in which The Society has long taken an interest. The Education and Teaching Theme surveyed Society members in 2011 and concluded that *"teaching and research achievements are rarely seen as being of equivalent status [in achieving promotion]"* (Harris, 2011). Two years later, a survey of over 250 academics across bioscience departments and medical schools was conducted by the Academy of Medical Sciences, The Physiological Society, Heads of University Biosciences and the Society of Biology. Their report concluded that "*the low status and undervaluation of teaching contributions, compared with research, disadvantages many academics who use teaching as a strand of evidence for progress in their academic career"* (Academy of Medical Sciences, 2014).

In 2019 we followed up this work by launching a cross-STEM survey to all Members of The Physiological Society, the Institute of Physics, the Royal Society of Biology and the Royal Society of Chemistry. The aim was to explore any changes in this area over the last 6 years, perhaps catalysed by the introduction of the Teaching Excellence Framework. This article presents findings from 193 respondents working as academics in either biosciences (144) or medical/health sciences (49). Focusing on the bioscience/biomedical disciplinary sub-group of STEM respondents has enabled some comparisons to be made with the data obtained in the 2013 survey, although it should be borne in mind that individual respondents in the two surveys are unlikely to have been identical.

### Demographics of respondents

Survey respondents were self-selected but nevertheless represented a good geographical spread across the UK and a wide range of institutional mission groups. Around 50% of respondents worked in Russell Group universities with the rest spread fairly equally between institutions in the University Alliance, the Million+ Group and independent institutions. There was a good gender balance (43% female, 53% male, 4% preferring not to say), and a good cross-section of both age profile and career level across the sector. 40% of the respondents were in teaching-focused roles, 57% were contractually engaged in both teaching and discipline-based research, with 3% describing themselves as research-only. This distribution of contractual roles across respondents is important in showing that the survey responses reflect the views of both teaching-focused staff and of academics for whom teaching is just one strand of their role.

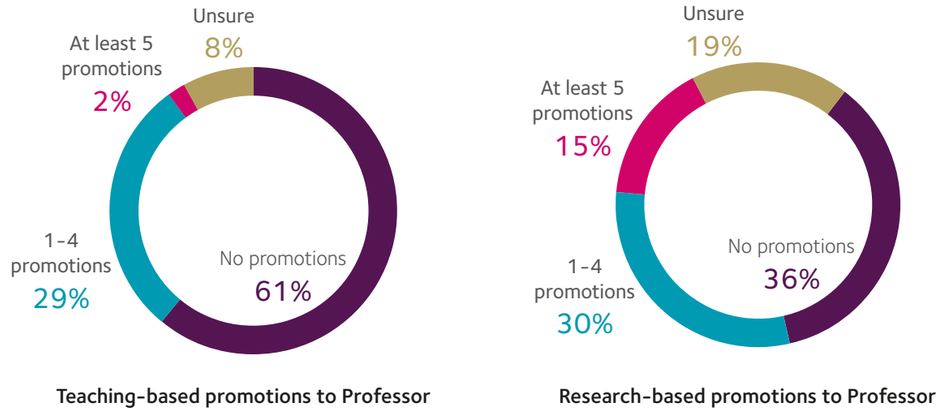



*Figure 1.* Number of promotions to Professor/Chair that respondents were aware of in the last 3 years that were based on teaching achievements (left-hand chart) or research achievements (right-hand chart).

### Career progression and recognition/reward of staff

Although many universities either have, or are in the process of introducing, a career path for teaching-focused staff, only 60% of respondents reported being aware of the existence of a career path in their institution that enabled promotion to Professor on the basis of educational achievements. In the 2013 survey that figure was 75%, which suggests that awareness amongst staff of the opportunity for such promotion has certainly not increased over the last 6 years. Fig. 1 compares the number of respondents reporting promotions to Professor/Chair in their home department on the basis of teaching versus discipline-based research achievements. It is clear that many more of the reported promotions to Professor are based on research achievements. This is likely in part to reflect the relative numbers of staff employed on teaching-focused contracts *vs* "balanced portfolio" contracts of research and teaching. However, for over 60% (118/193) of respondents to be unaware of a teaching-based promotion to Chair in their own department over the last 3 years suggests that such opportunities are thin on the ground. In the 2013 survey, 65% of respondents were similarly unaware of anyone who had been promoted to Chair via a teaching route. This suggests that very little, if any, progress has been made in this area in the last 6 years. As well as being demoralising for experienced/senior teaching-focused staff, this provides little incentive for younger staff to opt for an education-focused career path and few role models for aspiring educational leaders.

There were many free-text comments on this subject, of which the following are typical:

- As is typical in the sector it is more difficult to become a teaching focused professor than a research professor. Criteria for award of teaching professorships are not transparent, very variable across the sector and set at a very high bar so as to be almost unachievable. Universities only pay lip service to this pathway.
- While it is technically possible to get promoted to Professor/equivalent on a teaching-focused career pathway at my university, realistically it's likely to be unobtainable based on metrics against which candidates would be assessed.
- Metrics are clearer for research-focused staff and the university seems much clearer on promotion panels what they are looking for. The teaching requirement for these applicants seems much more flexible than the research criteria are for teachers with similar applications.

A recurring theme in the comments was that, whilst it is *theoretically possible* to become a teaching-focused professor, in practice such promotions are rare. This echoes the results of the 2013 survey in which 55% of respondents stated that, although a system for promotion to Professor on the basis of achievements in Teaching and Learning existed in their institution, this was largely a theoretical route rather than one that operated in practice. Another recurring theme in the current survey was that staff, external assessors and promotion panels are often unclear what needs to be achieved for teaching-based promotion and how to evaluate those achievements. There was a widespread view that this leads to confusion and disparity of practice between institutions, in contrast to research-focused promotion practices for which there is much better consensus and transparency on the metrics and criteria for promotion across the sector. Such disparity across the sector is clearly undesirable. Worryingly, over two-thirds of the teaching-focused respondents in the current survey considered that the promotion criteria on a teaching-focused pathway are harder to achieve than [for equivalent positions] on other career pathways, or are simply not achievable.

Further differences between the ways that universities recognise teaching and research achievements are revealed in Fig. 2. This shows that the award of prizes is the only indicator of excellence that is conferred to a greater extent on teaching achievements compared with research achievements. It is encouraging that the prevalence of teaching prizes seems to have increased over the last 6 years since only 62% of respondents reported their existence in the 2013 survey, compared with the current 82%. However, other rewards for excellence, for example the award of Fellowships, PhD studentships and funding for the dissemination of outcomes, are "earned" to a much greater extent by discipline-based research achievements (see Fig. 2). This disparity is important because



https://doi.org/10.36866/pn.119.28

https://doi.org/10.36866/pn.119.28

"It is particularly timely to provide an update on The Physiological Society's work in exploring the value that universities place on education, and how they recognise and reward the staff who specialise in developing and delivering it"

the latter awards are often more substantive than a one-off prize (welcome though that may be) and they often enable recipients to build on, and extend, their past success.

## Support for Continuing Professional Development

The 2019 survey revealed some troubling findings in the area of Continuing Professional Development (CPD), regardless of respondents' contractual roles. For example, less than half of all respondents (74/193) reported having been assigned an effective mentor and a quarter of all respondents (52/193) reported that no tangible support for CPD (e.g. funding to attend external research or educational conferences/ workshops) was provided by their institution. There was a very similar pattern of responses from teaching-focused staff compared with staff having a balanced research–teaching portfolio. However, the absence of institutional funding for CPD is especially significant for teaching-focused staff who are almost entirely dependent on their institution to provide such funding, whereas external research grants may provide some funds to support conference/workshop attendance by researchers. Furthermore, of the respondents whose contract specifically included the requirement to carry out Scholarship of Teaching and Learning (SoTL), 40% (23/58) of them reported that they have no time to do this because of other heavy contractual obligations. When faced with deadlines to prepare teaching, set/ mark assessments and devise courses, it is understandable that SoTL will take a back seat despite the fact that scholarship, with publication of its outcomes, is likely to be crucial for such staff to achieve promotion success.

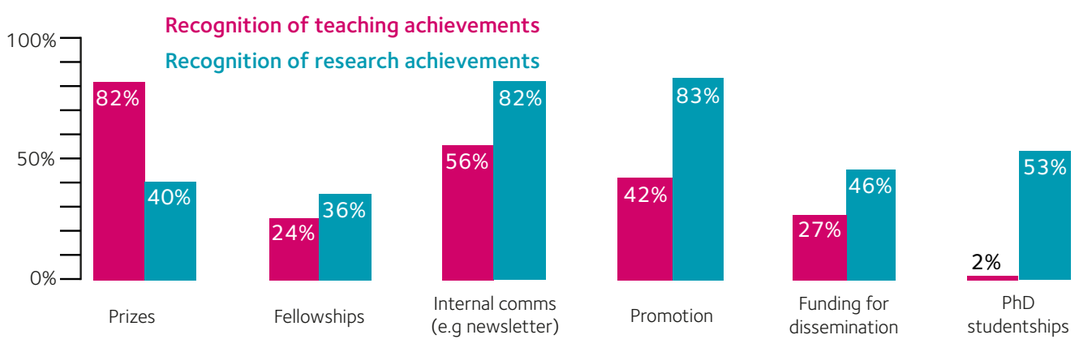



*Figure 2.* Recognition of excellence for teaching achievements (pink bars) and discipline-based research achievements (blue bars).

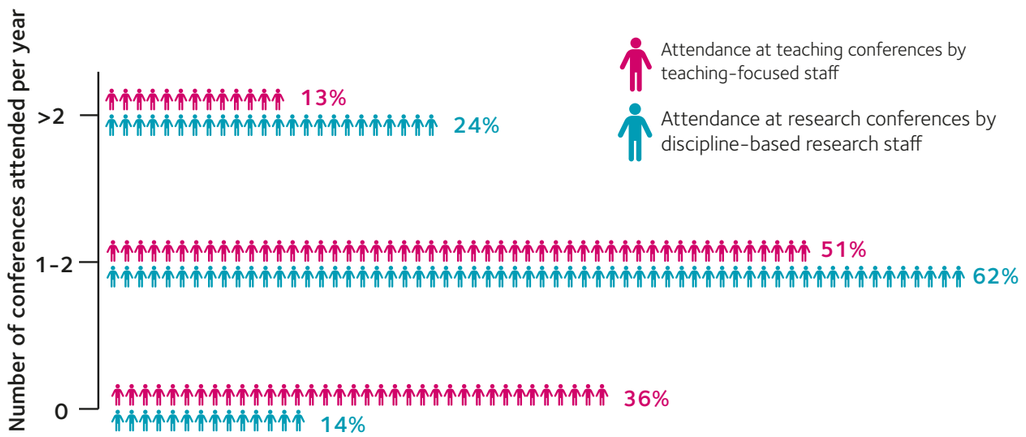



*Figure 3.* Self-reported annual attendance at relevant external conferences by teaching-focused staff ($n$ = 77; pink) and staff engaging in discipline-based research ($n$ = 113; blue).



https://doi.org/10.36866/pn.119.28

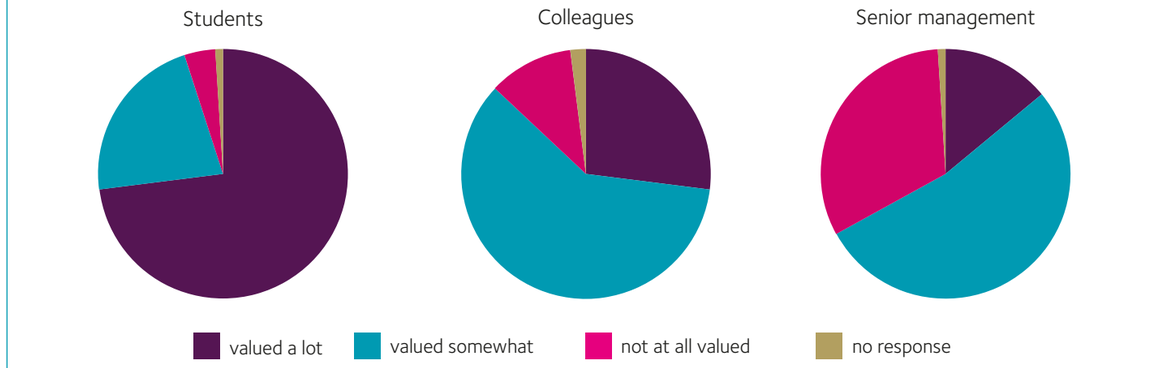



*Figure 4.* Perception of the value placed on teaching-focused staff by students (left), colleagues (middle) and senior management (right).

The outcomes of all these factors are clearly illustrated in Fig. 3 which shows that teaching-focused staff are less likely to attend teaching conferences, compared with attendance at research conferences by research-focused and "balanced research-teaching portfolio" staff. This will undoubtedly put teaching-focused staff at a disadvantage, compared with staff who engage in discipline-based research, in terms of keeping up with current developments, networking and sharing good practice, as well as building an external profile. These are important activities in achieving individual progression/ promotion on any career pathway. In education, as well as in research, they are also vital in enabling practice and knowledge to advance, and in creating the collaborations and agility so essential to the sector as a whole being able to respond to external stimuli such as the current pandemic.

## Attitude of senior management

Fig. 4 reveals a troubling, and potentially high impact, finding of this survey – nearly a third of respondents consider that teaching-focused staff are not valued at all by senior management within their institution. This perception was the same regardless of the contractual role of the respondents. It is heartening to see that the perceived value placed on teaching-focused staff by students, and to a lesser extent by colleagues, is high. However, any perceived undervaluing of teaching-focused staff by senior management is a serious concern given the impact it is likely to have on institutional practices and staff morale.

## Conclusion

In conclusion, the 2019 survey results demonstrate that there has been very little progress over the last 6 years in the way that teaching-focused staff are valued, recognised and rewarded in universities. Whilst there are undoubtedly variations between institutions in their practices and attitudes, the views of the staff who responded to this survey provide little evidence for progress across the bioscience and medical/health science sector in general. It seems that the introduction of the Teaching Excellence Framework has done little or nothing to improve the status of teaching-focused staff despite the government's aspiration in the original White Paper that *"At the institutional level, our HE and research reforms are intended to balance the incentives on institutions and establish parity for academics who build a career in teaching as well as in research or a combination of both"* (UK Department for Business Innovation and Skills, 2016). Who knows when/whether such parity might be achieved but The Society is committed to considering ways in which it could contribute. This could include facilitating the mentoring of younger, teaching-focused staff by more experienced staff and offering more support to members to share good practice at teaching-focused meetings and workshops (currently probably through virtual events). The data also highlight the need for the sector to explore how institutions might be encouraged to improve parity between research and teaching through establishing a clear career structure for university teachers, which is consistent and transparent across the sector.

## Acknowledgements

I am very grateful to Dr Chrissy Stokes, Head of Professional Development and Engagement at The Physiological Society and to Professor Derek Raine, Co-chair for the Society of Natural Sciences and Professor (Emeritus) at the University of Leicester, for all their input in designing the survey and its subsequent dissemination, analysis and interpretation. I would also like to thank staff at the Royal Society of Biology, the Royal Society of Chemistry and the Institute of Physics for their input to survey design and for publicising the survey to their members. Thanks also go to all the survey respondents for generously giving up their time to complete the survey.

*Judy Harris is an Emeritus Professor at the University of Bristol. Her teaching development activities included contributing to the development of high-fidelity simulation-based, undergraduate physiology teaching, creation of online resources for laboratory-based teaching and evaluation of histology teaching delivered using a "virtual" microscope. Her other interests include developing and evaluating the use of peer assessment in the undergraduate curriculum.*

## *References*

Harris JR (2011). The status and valuation of medical sciences teaching in academic careers: some progress but room for improvement? *Physiology News* **85**, 48 – 49.

Improving the status and valuation of teaching in the careers of UK academics (2014). Academy of Medical Sciences, The Physiological Society, Heads of University Biosciences and the Society of Biology. https://www.physoc.org/sites/default/files/page/Improving_the_status_and_valuation_of teaching_in_the_careers_of_UK_academics_WEB_version.pdf

Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice (2016). UK Department for Business Innovation and Skills. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/523546/bis-16-265-success-as-a-knowledge-economy-web.pdf

https://doi.org/10.36866/pn.119.28

DOI: 10.36866/pn.119.32

# Homeostatic teaching

## Unmasking the beauty of physiology

*Hwee Ming Cheng*

University of Malaya, Malaysia

*"The Teacher searched to find just the right words"* (Ecclesiastes 12:10) and I share this snapshot of a personal academic journey to encourage and inspire teachers and students of physiology. In our intellectual journey, we can uncover and discover together the revealed beauty, design and wonder of integrated physiology. Both students and teachers should never cease to learn, to think through, to write, express creatively and enjoy physiology.

### The immunophysiologist

I graduated with a Joint Honours in Medical Cell Physiology and Biochemistry in 1980 and completed my PhD in Immunology 1983, both from the University of Liverpool. My PhD was on the immunobiology of human placenta (nature's transplant) and I have memories of going each morning to the Liverpool Maternity Hospital to collect fresh placentas to prepare the syncytiotrophoblast membrane.

I started teaching physiology in 1985 at the Universiti Malaya, Kuala Lumpur, which had no existing immunology department at the time. The difficulty of resuming my placental research led me to work on natural physiologic autoantibodies to cardiolipin and other phospholipids (Cheng, 1994).

Colleagues in my generation will appreciate those pre-KPI (key performance index) and SOP (standard operating procedure) days. I had time to read a lot, comparing different authors' perspectives on defining and describing the wisdom of physiology in the body. I had more face-to-face time with students. I believe we need to recover what I and my colleagues experienced during this time when the demand, for documentation of matters that are less essential in an academic sense, wasn't as great.

I inculcated a habit of making notes of students' responses, both from their answer scripts, small group tutorials, and personal consultations in my office. If I experienced that several of my students found a certain aspect of physiology particularly difficult, I gathered that a misconception must be common and/or a clearer teaching is needed in relation to this topic. I have continued and evolved this practice throughout my career, which I designate *homeostatic teaching*.

### Homeostatic teaching

Over the many years of interacting with students of medicine, dentistry, pharmacy, biomedicine and nursing in the context of physiology courses, I found that it was necessary to customise the lecture contents to suit the student audience. My experience is that it is often harder to simplify physiology appropriately for the purpose of communicating it to diploma than to undergraduate students, but in both instances focus on formulating questions to probe understanding rather than factual knowledge in physiology (Cheng, 2015).

Increasingly, the younger generation writes less. This non-writing culture is not helped by the teaching practice of fewer writing evaluations in the context of physiology courses, where much of the testing now merely consists of online single best answers. Writing focuses the mind and streamlines thinking, and how our students write to express physiology provides the teacher with a much better impression of their correct or imprecise grasp in defining physiology. Take the word "buffer" as an example. The meaning or function of a urinary buffer and an extracellular fluid (ECF) buffer is different. While ECF buffers serve to maintain pH, urinary buffers do not maintain tubular fluid pH, but rather allow more excretion of total acid at the limiting urine pH of around 4.0. This exemplifies Linda Costanzo, who kindly wrote the preface to my book *Defining Physiology* (Cheng & Husof, 2018) and said *"Definitions are physiology's best touchstone."*

Furthermore, homeostatic teaching involves *re-teaching*. We continually finetune and improve our lecture notes following feedback from contact times with students, in an attempt to increase the impact of our teaching.

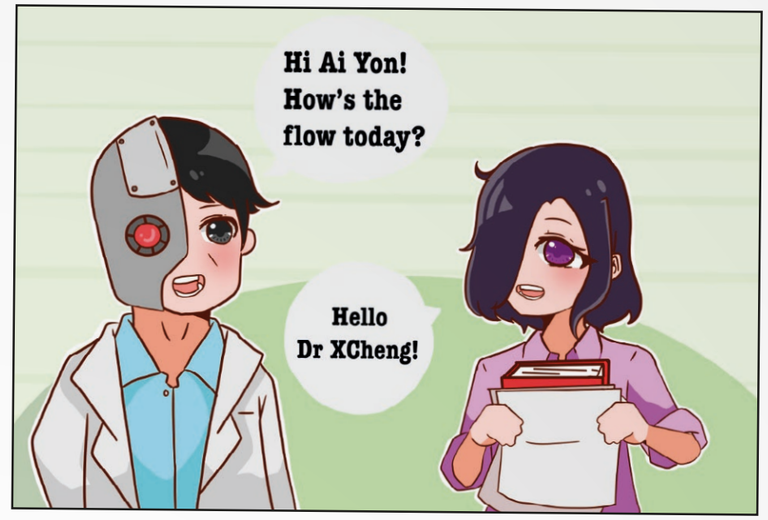
### Beautiful physiology

"A thing of beauty is a joy forever," writes John Keats in Endymion (1818), and as teachers we know the delight when we hear the "Oh wow" moments of our students when we explain various aspects of physiology. The sense of wonder in appreciating the integrative and organising design of multi-organ physiology promotes learning.

In respiratory physiology classes, I tell my students that carbon dioxide is not just merely a metabolic product, but also a vasodilator, an oxygen unloader (the Bohr effect), the major ventilation chemical regulator, and an essential ECF pH buffer component paired with bicarbonate. This gives them a bird's (or drone's) eye view of whole-body physiology. This may even be expanded to the ecological level, as the carbon dioxide from our "respiratory tree" gives life to the greenery around us.

However, with increasingly exciting details of cellular physiology, students can get overwhelmed. It is thus useful to help students see common mechanistic processes that govern different organ physiology. For example, the renal and gastrointestinal "peeing and pooing" events share common epithelial pathways to handle their luminal contents (Cheng & Hoe, 2019)

The beauty and wisdom of the body are also seen in the discernment and priority given to








https://doi.org/10.36866/pn.119.32

https://doi.org/10.36866/pn.119.32

"Teachers complain that students' attention spans are shorter these days and they become easily hyperpolarised during class (perhaps in under 20 minutes!). It is quite true, but I have noticed that the element of surprise engages our students"

survival. In severe hypovolaemia, the critical need to maintain volume overrides or masks normal osmoregulation, which results in a hypotonic contraction.

A recurring event during my physiology courses is that I take my students to "Kidneyland" and show them the two intrinsic renal events of tubuloglomerular (T-g) macula densa feedback and glomerulo-tubular (G-t ) balance. But I also show them that when vascular volume is depleted, these T-g and G-t responses are masked by the extrinsic renal sympathetic nerve and the renin-angiotensin aldosterone activation to restore ECF/blood volume and sodium balance. When euvolaemia is achieved, then the T-g and G-t intrinsic mechanisms are unmasked and observed. This is the convoluted beauty of our kidneys (Cheng & Hoe, 2016).

Regrettably, I have noted – and this is also echoed by my Malaysian and overseas colleagues – that with the introduction of the integrated curriculum with anatomy, biochemistry and pharmacology, there is an accompanying disintegration and fragmented grasp of physiology among my students. The beauty of physiology is masked.

## Engaging, enjoying physiology

Teachers complain that students' attention spans are shorter these days and they become easily hyperpolarised during class (perhaps in under 20 minutes!). It is quite true, but I have noticed that the element of surprise engages our students. To accommodate this, I have designed a number of physiology statements that appear true and ask students what they think. For example I tell them that: "Sodium concentration is controlled by aldosterone".

Most students quite quickly say it is true, and you do get their attention when you tell them otherwise. Drinking a large volume of water produces a transient hyponatremia, which is homeostatically regulated by osmoregulation. The sodium concentration (not sodium balance) is under the control of antidiuretic hormone, not aldosterone.

Interestingly, this statement when used at the International Physiology Quiz (see below) registered less than 50% correct responses. This common misperception of the difference between sodium balance and sodium concentration control was addressed in my paper entitled "Students lose balance over the yin-yang of sodium physiology" (Cheng & Hoe, 2018). Similarly, "why what's wrong" (www) physiology statements to engage students have been compiled and this has been a useful tool to help depolarise my students during class.

The questions unmask common misconceptions in physiology.

Apart from these physiology statements, which may be used during class, I and others have written physiology lyrics to popular tunes to liven up the class. My students love the one on Starling's law of the heart, which was matched to the song "O my Darling". My students homeostatically moved the lyrics to Justin Bieber's upbeat tune!

## The IMSPQ global platform and bridge

The Inter-Medical School Physiology Quiz (IMSPQ) was held in 2003 in Kuala Lumpur. From a small beginning of just seven competing universities in Malaysia, the IMSPQ now draws about one hundred medical schools from over twenty countries. This year the 18th IMSPQ scheduled for August 2020 has unfortunately also been "coronated" by the COVID-19 pandemic.

In place of the 18th Quiz, we are planning an Online Physiology Comic Challenge. A sample creation is shown here, by my students Rachael Chin Kit Yi and Wong Zhu Shi, and the script by yours truly Dr XCheng (Fig. 1).

The immense interest in the IMSPQ has catalysed National Physiology Quizzes in eleven other countries starting with Sri Lanka in 2013. Since then annual quizzes have blossomed in China (2014), Japan (2015), Indonesia, Mongolia, Philippines, Myanmar (all in 2017), Australia, Romania (2018), Spain, and India (2019). Just this February 2020, the All-Pakistan quiz was held in Lahore.

Since the 12th IMSPQ in 2014, we have added a Refresher course for all accompanying lecturers of the student competing teams. These teaching inputs were given by accomplished physiology educators who included Richard Klabunde, Kim Barrett, Susan Barman, Walter Boron, Susan Wray, David Eisner and Dee Silverthorn. Robert Carroll was to be the invited Refresher speaker at the "coronated" 18th IMSPQ.

Susan Barman, a former President of the American Physiology Society (APS) was so enthused with the IMSPQ that she initiated the first regional quiz in Michigan APS chapter in 2017. Susan is actively encouraging other APS chapters to use the quiz platform to promote physiology interest.

The IMSPQ has provided a unique, invaluable global sample of students, all responding to the same set of Physiology questions. The analysis of the IMSPQ data has given us insights and unmasked common misconceptions in learning Physiology (Cheng & Durairajanayagam, 2012).

## Land of academia

I continue on my physiological journey, happily locked down with my students due to the COVID-19 pandemic, re-teaching and researching. I end here with the same quotes as in my Inaugural lecture in 2011 (Cheng, 2011).

*"All their life in Narnia had been the cover and the title page: now at last they were beginning Chapter One of the Great Story which no one on earth has read: which goes on forever: in which every chapter is better than the one before"* (C.S. Lewis: The Last Battle, 1956)

---

*Hwee Ming Cheng (b. 1958) has a PhD in immunology from the University of Liverpool, UK (1983), and serves as Professor of Physiology at the University of Malaya, Kuala Lumpur, Malaysia. He is a renowned physiology teacher, and has written several textbooks on physiology teaching. Furthermore, he founded the Inter-Medical School Physiology Quiz in 2003, which included students from 20 countries in 2019.*

## *References*

Cheng HM (1994). Immunophysiology of Antiphospholipid Autoantibodies. RG Landes Co.

Cheng HM (2015). Physiology Question-Based Learning. Cardio, Respiratory and Renal Systems. Springer.

Cheng HM, Jusof F (2018). Defining Physiology: Principles, Themes , Concepts. Cardiovascular, Respiratory and Renal Physiology. Springer.

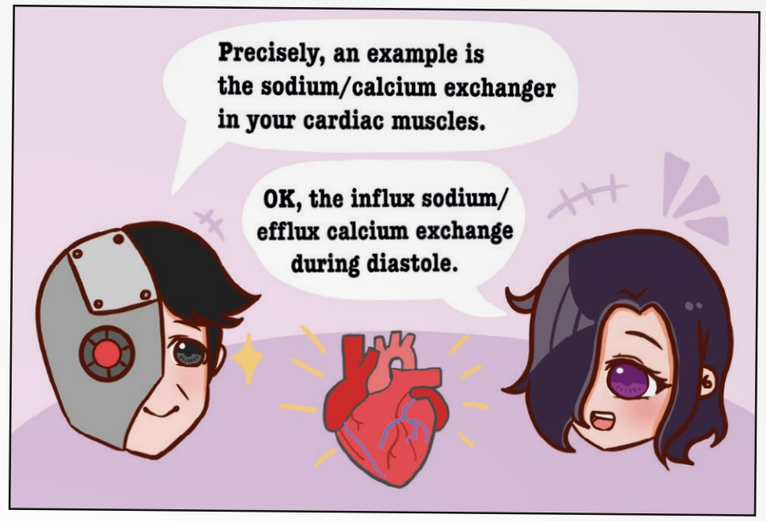
Cheng HM, Hoe SZ (2019). To pee and to poo : cross-organ principles and mechanisms in renal and gastrointestinal physiology. *BLDE University Journal of Health Sciences* **4**, 22 – 27.

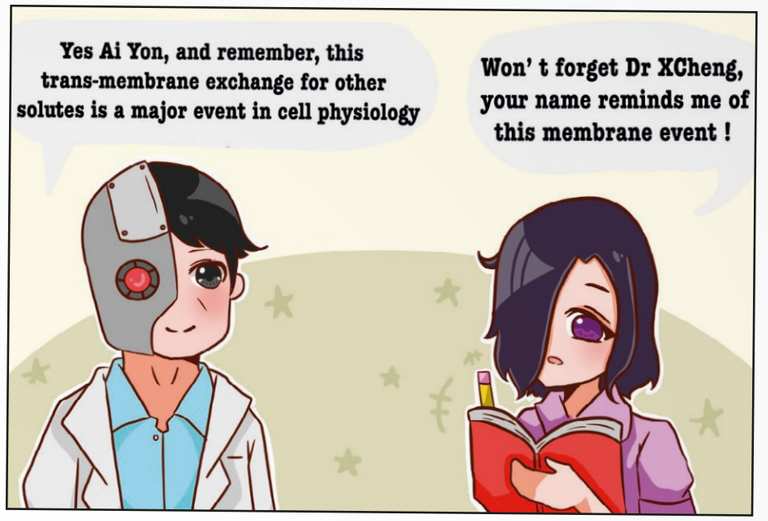
Cheng HM, Hoe SZ (2016). Students' convoluted trouble with renal autoregulation: a teaching note for students and physiology educators. *BLDE University Journal of Health Sciences* **1**, 25 – 27.

Cheng HM, Hoe SZ (2018). Students lose balance over the yin-yang of sodium physiology. *BLDE University Journal of Health Sciences* **3**, 54 – 57.

Cheng HM, Durairajanayagam D ( 2012). Misconceptions highlighted among medical students in the annual international intermedical school physiology quiz. *Advances in Physiology Education* **36**, 229 – 232.

Cheng HM. A Physiologic Journey. Inaugural Lecture Universiti Malaya 2011. https://jummec.um.edu.my/article/view/4683/2476







https://doi.org/10.36866/pn.119.32

https://doi.org/10.36866/pn.119.32

DOI: 10.36866/pn.119.36

# Batman to brain and back again

## Using superheroes to communicate science

*E Paul Zehr*

University of Victoria, Canada

*Illustrations by Kris Pearn*

It turns out that I wasn't really all that great at punching, in the beginning. I'd always been interested in martial arts, largely driven by my exposure to the fighting exploits of comic book superheroes like Batman, Captain America, Iron fist, Black Widow, and many other masters of martial mayhem. So I later leapt at the chance, during a family trip to Canada's Arctic in the summer of 1978 to visit my sister, when I had the opportunity to beg one of her friends (a black belt in some martial art I've since forgotten) to teach me how to punch and block. Of course at that time of leaping I had no idea that my first lesson in martial arts would take me into a career in science. Nor that one day I would combine science, superheroes, and education (with a dash of martial arts thrown in, of course).

### Everybody's got an origin story

I've always been fascinated with martial arts. In comics, movies, and TV shows the fights seemed pretty cool to me in my formative years (which continue anon). Usually the fights were centred around the idea of helping someone. Good versus evil. At a very early age I had a feeling that I wanted to do something in my life that would help other people. From the beginning, then, there was already a bit of a connection for the dissemination of knowledge and empowerment.

Once I truly began to study martial arts in earnest, which was several years after my Arctic experience, I became fascinated by the changes that were happening in my body and the skills and abilities I was beginning to acquire. I was enchanted by adaptive plasticity and that charm is how I got into science. Initially I was motivated to understand what was happening to my body, brain and muscles with all the training I was doing, in the skills and abilities I saw emerging in myself and already present in my teachers. It got me fascinated about the wonders of the human body and the seductive science of physiology. This led me to exercise physiology and biomechanics and eventually neuroscience. My first few publications were actually about physiology and karate.

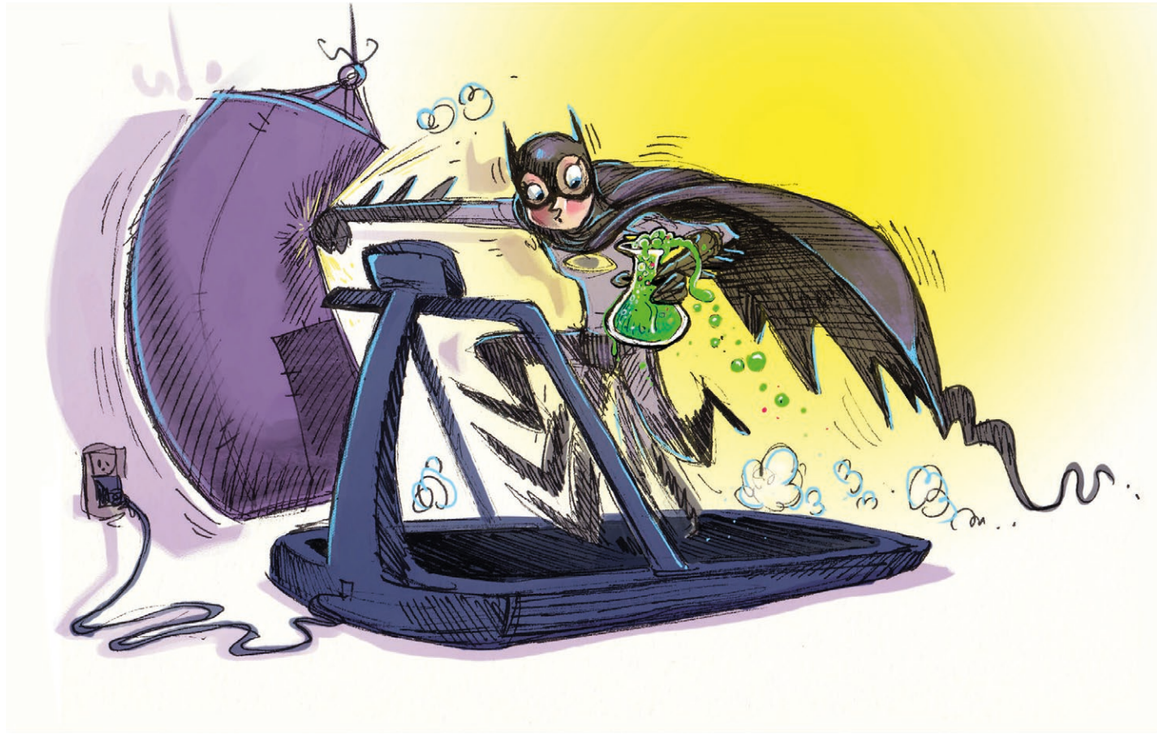
### The second act

Eventually I started my own lab and continued my scientific journey as many professors do. I got grants, mentored trainees, published papers, and taught courses. But eventually I began to question the extent of the impact I was having in society. I thought about the legacy I might leave once I retired. How many people would I truly have helped?

Please don't misunderstand me. Much of my work focuses on rehabilitation applications of neuroscience discoveries to help people and



https://doi.org/10.36866/pn.119.36



my papers are reasonably well cited. I'm grateful for the scientists and clinicians who read and cite my work.

Today I have more than 6,000 citations of my work and am doing fine on all the "metrics" we use (including the superhero-sounding H-index). So it's not like I was having no impact, but to truly have a broad impact in society takes a different kind of effort and a different approach. My books have tens of thousands of readers, and my related blog posts at magazines like *Psychology Today* and *Scientific American* have millions of page views.

It's this difference in impact and discomfort in my contribution to society that started me on the very journey I had questioned. This journey saw me embrace Batman and his superhero compatriots Iron Man, Batgirl, Captain America, and others to engage the public in scientific knowledge and especially a fascination with physiology.

### Did you hear the one about the scientist and the superhero?

People like stories. They like access points to concepts, niches and nuances that they know a little bit about to make them feel comfortable to learn or engage in something else that is new and possibly a bit threatening. When we're going to talk about science, which inherently has complex and often foreign ideas for many minds, providing some comfort as a bridging mechanism is a useful idea.

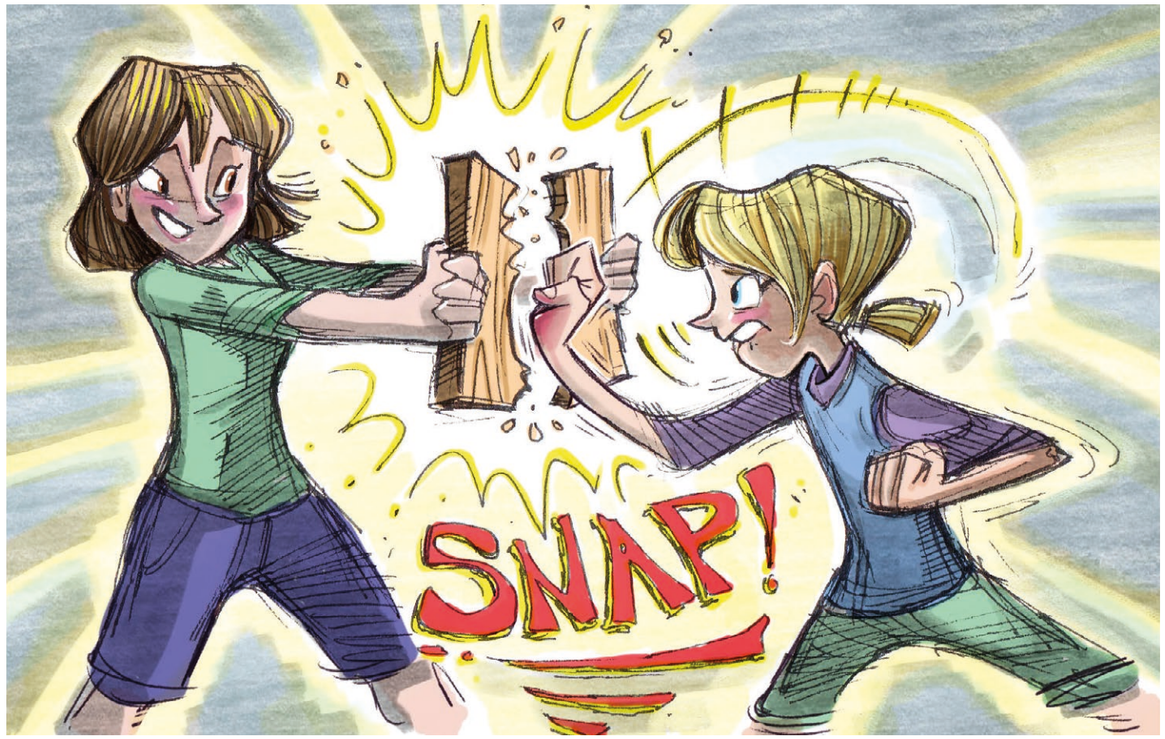
At the time I wrote my first book *Becoming Batman*, superheroes were not nearly as mainstream as they are now. But I thought then that popular culture was the right way to go if I wanted to disseminate science as widely as possible. I had a feeling that superheroes were soon to enter the mainstream in a big way and decided to combine my passions and use superheroes as metaphors, as vehicles for mass transportation of information, to communicate science to the wider public.

What I started doing at the time, and have continued since, is to embrace popular culture as a method of disseminating information widely. Hey, it is called popular for a reason! If we really want to effectively communicate something to a large group we need to understand the way that group can best be placed to understand what we're trying to say. That includes not just how we're saying what we want to say, but the stories that we use to convey and communicate science generally.

I was inspired by Carl Sagan's *The Demon Haunted World: Science as a Candle in the Dark* and I read books about science and popular culture like Jim Kakalios' *Physics of Superheroes* and Laurence Krauss' *Physics of Star Trek*. Then I wrote books about Batman (2008), Iron Man (2011), and Captain America (2018) to explore the science behind transforming humans into super humans. Whether by physical training, in the story of Batman, technological integration,

> "[People] like access points to concepts, niches and nuances that they know a little bit about to make them feel comfortable to learn or engage in something else that is new and possibly a bit threatening"

https://doi.org/10.36866/pn.119.36




"This journey saw me embrace Batman and his superhero compatriots Iron Man, Batgirl, Captain America, and others to engage the public in scientific knowledge and especially a fascination with physiology"

in the story of Iron Man, or genetic manipulation and biological engineering in the case of Captain America, these books all use the superhero backstory as a bridge to real scientific knowledge. It's important to note that when using popular culture icons it doesn't matter if the approach is "wrong" or "right", because you are going to talk about what is the correct science. In many ways, if some example is wrong it is actually more helpful for making the points you want to highlight.

Along the way I also wrote a book specifically for young adults, driven largely by the comments and questions I would get from the innumerable school visits and assembly presentations I gave in middle and high schools. Questions from folks asking "when are you going to write a book for us", where "us" meant a younger audience. This audience was especially young women, since they were the ones asking all the questions!

So in 2014 I did a fiction/non-fiction hybrid book with the director and artist Kris Pearn called *Project Superhero*. This book used diary entries of a fictional 13-year-old girl across her Grade 8 school year as she explores relationships, science, superheroes, and achieving her potential to become who she could become through effort in applied martial arts training. It's of course largely inspired by Batgirl. It was also a dismal failure in the first draft.

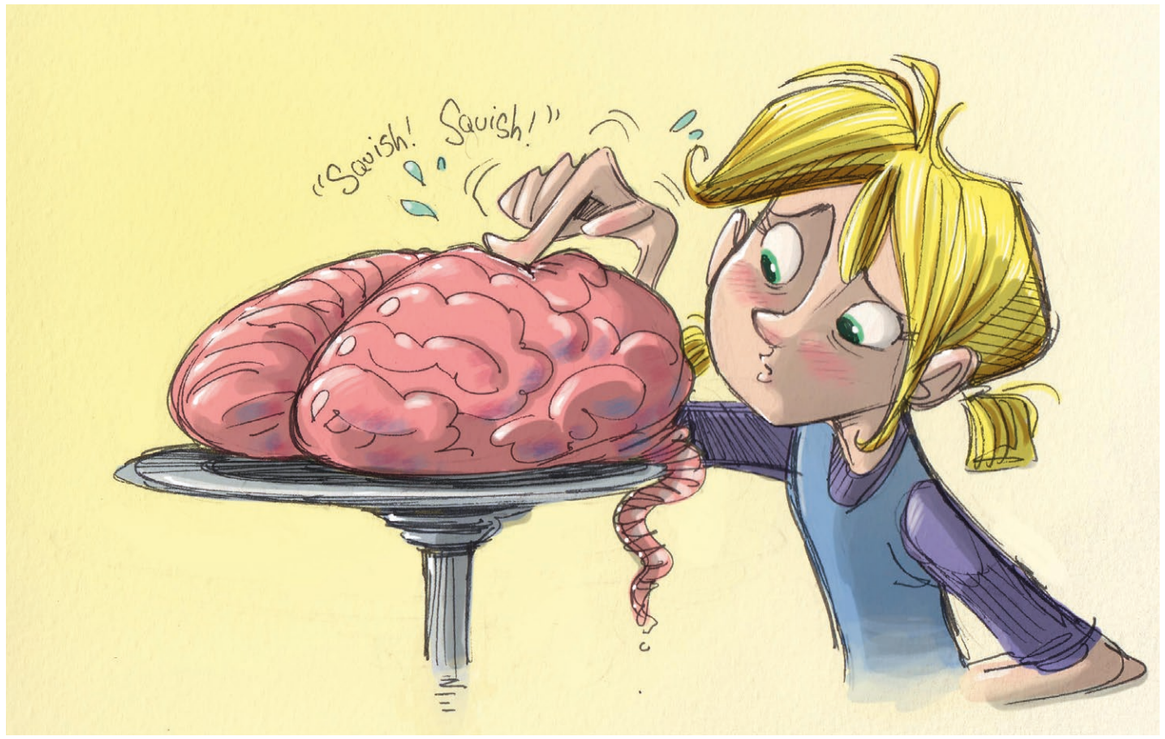
I had thought I knew about how to communicate using popular culture. After all, I had two pretty successful books under my belt already. Writing for a younger audience would be no big deal. I would just write "simpler". My agent was fairly kind to me. She said, essentially: "Paul, I appreciate your efforts. But nobody is going to read this. An 11-year-old girl is not interested in reading a book that takes an adult style and just uses smaller words and shorter sentences. You have to write what they want to read. You've got two daughters, right? Read what they are reading and then use that style." That is how I learned to read all the "diary of a..." books I could find and used that style in Project Superhero. I learned a lot from this experience.

## The medium is the message

The key issue here is figuring out how to spin what you want to in a way that is both interesting to you because you're the storyteller, but moreover must be interesting to your audience. I use superheroes, but there's no limit on the imagination of what you could use. I strongly suggest using popular culture for the reasons outlined above, but that could mean almost anything. The key to all this, the essence, is using something that is already understood as the way to transform knowledge from one mind to another. Use the known to nuance the unknown.



https://doi.org/10.36866/pn.119.36




## A punch is still a punch as time goes by

As for me, more than 40 years after that martial arts lesson in the Arctic, I continue my daily martial arts training. I'm still trying to get better at punching, to improve my knowledge, and to refine myself. As a person, a physiologist, and a science educator. It takes effort and time and a little desire to help. But as I've written elsewhere (Zehr 2008, 2011, 2015), I believe it's crucial for scientists to work towards being the primary disseminators of science.

## A call to action

It's critical to always keep in mind the discoveries we make are not owned by us, we just got to look at them first. Those discoveries only have real value, importance, and worth, when they are shared in the most widely accessible manner possible. Stan Lee, when writing one of the most famous Spider-Man stories in Amazing Fantasy Number 15 in 1962 said that "with great power there must also come great responsibility". He meant it in describing the ethics of behaviour that the young Peter Parker must learn if he's effectively going to grow into Spider-Man. Yet this concept applies equally effectively to science and scientists.

Knowledge is power and scientists discover knowledge. Thus scientists actually possess great power. Our great responsibility is sharing that power with others to improve our society and our world. What could be more superheroic than that as a mission statement? Our society continues to evolve and become more and more reliant on science and technology, not less so.

The active presence of working scientists in science education grows more and more important each day. It's imperative for all of us to embrace the idea of effective science communication and education to all demographics in all age groups and to do our best to help. This is well captured in the motto from the University of Victoria "A Multitude of the Wise is the Health of the World." In comic-book terms that all scientists and superheroes would understand, the fate of the world truly does rest in our hands.

---

*E. Paul Zehr has a passion for sharing knowledge of moving, martial arts, and the mind. His earliest scientific studies were on martial arts, but shortly into his scientific career, he shifted to the neural control of movement and rehabilitation of walking after stroke and spinal cord injury. Now he is working to see if martial arts training can help with balance, walking, and self-efficacy in Parkinson's, multiple sclerosis, and after stroke.*

## *Further Reading*

Kakalios J (2006) The Physics of Superheroes. Gotham Books, New York, New York.

Krauss LM (1995) The Physics of Star Trek. Harper-Perrennial, New York, New York.

Sagan C (1995) The Demon-Haunted World: Science as a Candle in the Dark. Random House / Ballantine Books, New York, New York.

Zehr EP (2008) Becoming Batman: The Possibility of a Superhero. Johns Hopkins University Press, Baltimore, MD.

Zehr EP (2011a) From Claude Bernard to the Batcave and beyond: using Batman as a hook for physiology education. *Advances in Physiology Education* **35**, 1 – 4. DOI: 10.1152/advan.00120.2010

Zehr EP (2011b) Inventing Iron Man: The Possibility of a Human Machine. Johns Hopkins University Press, Baltimore, MD.

Zehr EP (2014) Project Superhero. ECW Press, Toronto, Ontario.

Zehr EP (2014). Avengers Assemble! Using pop-culture icons to communicate science. *Advances in Physiology Education* **38**, 118 – 123.

Zehr EP (2016). With Great Power Comes Great Responsibility – A Personal Philosophy for Communicating Science in Society. *eNeuro.* 2016 Sep 8;3(5). pii: ENEURO.0200-16.2016. DOI: 10.1523/ENEURO.0200-16.2016.

Zehr EP (2018) Chasing Captain America: How Advances in Science, Engineering, and Biotechnology will Produce a Superhuman. ECW Press, Toronto, Ontario.

https://doi.org/10.36866/pn.119.36

# Teaching physiology in lockdown: A steep learning curve

*Laura Ginesi*

University of East Anglia, UK

*"Go home, stay there, and put your teaching online from Monday".*

Here is 6 weeks of my diary following this email from line managers.

## Week 1

**Entry 1.** My "Pathophysiology of Hypertension" workshop scheduled for Monday 0900 is out, but what should I replace it with...?

Feedback indicates my face-to-face sessions are enjoyable and engaging. Tricky when faced with 320+ nursing students, but my teaching philosophy is to facilitate active learning through questioning. I want to stay somewhat true to this, so problem solving starts now.

**Entry 2.** Online *PowerPoints* and *Discussion Board* activity may not suffice and I've no idea how to use *Echo 360* [lecture capture software] from home. The School purchased licences for *Lt suite* (ADInstruments), but the plan was not to roll it out until the second year of the revised nursing curriculum. Colleagues have not had as much as a demonstration. Next week is probably too soon for students.

I have more questions than answers. Will my students still "get" threshold concepts and be able to apply them in patient care settings? How do I transition from face-to-face to remote teaching and still capture the essence of interactive workshops and lectures? How do I encourage students who may also be feeling a bit wobbly with remote learning? What on earth will I do about practical sessions?

**Entry 3.** Despite misgivings, I spent a long weekend of repurposing and re-recording. I even felt triumphant and ready by Sunday. That was until I discovered some files are too large for *Blackboard* [online student portal] to handle! In the end, I uploaded a tried-and-tested folder of self-directed learning about cardiac output and regulation of blood pressure.

## Week 2

**Entry 1.** My online interaction with "digital native" students is not always enhancing learning. I'm starting to become familiar with *Blackboard Collaborate Ultra*, which has magically appeared amongst course tools. I spent my weekend preparing several classes – all designed to deliver virtual content about different aspects of physiology – but audio and video are problematic.

**Entry 2.** Pop-ups on my screen keep telling me to re-join my own classrooms. Half of the students are struggling to get online. Muting microphones and switching off videos is new – how do you do that? How do I find a register? Some students could not find the chat box. Others are reluctant to take the microphone. My favourite pathophysiology module students seem more intent on discussing home-schooling, preparations in ICU and A & E, and the various toddlers and pets making intermittent screen appearances. I sometimes forgot to record sessions. Another attempt to capture a live session resulted in precisely 7 seconds being saved. Disaster!

**Entry 3.** Escaping from lockdown to post a letter, I had a "socially distanced" conversation with a neighbour. As a lecturer in London, he doesn't miss commutes (silver linings?). We shared ideas about how to get the best from snail-paced, unstable, rural internet connections.

Also, I sourced new headphones, started researching USB microphones, and signed up for a MOOC about the current teaching situation. Good decisions!

## Week 3

**Entry 1.** Isn't technology wonderful? My 10-year-old iMac decides to call it a day. The video card is not compatible with *Catalina* [operating system] meaning I can't see anyone in *Microsoft Teams* meetings.

**Entry 2.** My new iMac is delivered by a man in a mask who stands at an appropriate distance and takes a photograph instead of coming close enough for me to sign. Thank goodness for *iCloud*. I can now swap files over to continue flipping the learning, download to *OneDrive*, upload to *Blackboard*, and take part in the exponentially increasing number of meetings about placements (paid or otherwise) and assessments.

**Entry 3.** The trickiest task this week was to make an exam board happen. Years of experience of paper-based ones helped me while admin teams figured out how to make *SITS* and *Tableau* work from home. Lecturers not familiar with the "old fashioned" way struggled with all the spreadsheets.

No matter how severe the pressures at work seem this week (I was often close to tears), the News brings me quickly back to earth: people are worrying about the rising incidence of COVID-19 cases and fatalities, protection, and even buying food.

My parents (aged 90) refuse to see themselves as vulnerable and I realised it may be some time before I can hug our children or granddaughter again. I organised the first of a series of quizzes with my tribe through *Zoom* and it was chaos.

## Week 4

**Entry 1.** A month into lockdown. It's hard work taking part in live online sessions for hours at a time. Students seem grateful to have the webinars and activities and are responding positively but I need to find a more sustainable strategy (see Fig. 1).

**Entry 2.** Although the SAMR (substitution, augmentation, modification, and redefinition) model provides a framework, lesson plans are not as organised as I would like. I am, at least, fully online and communicating something about physiology in various formats. Students have opportunities to draw on the whiteboards, participate using polling systems, answer true/false using icons like "thumb up/down". Despite my unreliable internet, our learning technologists are helping and I am taking part in more remote teaching support sessions.

Could I do better? Definitely. Is it stressful? Totally exhausting! I've worked every day (despite being a part-timer heading for retirement). I wish the golf course was open.

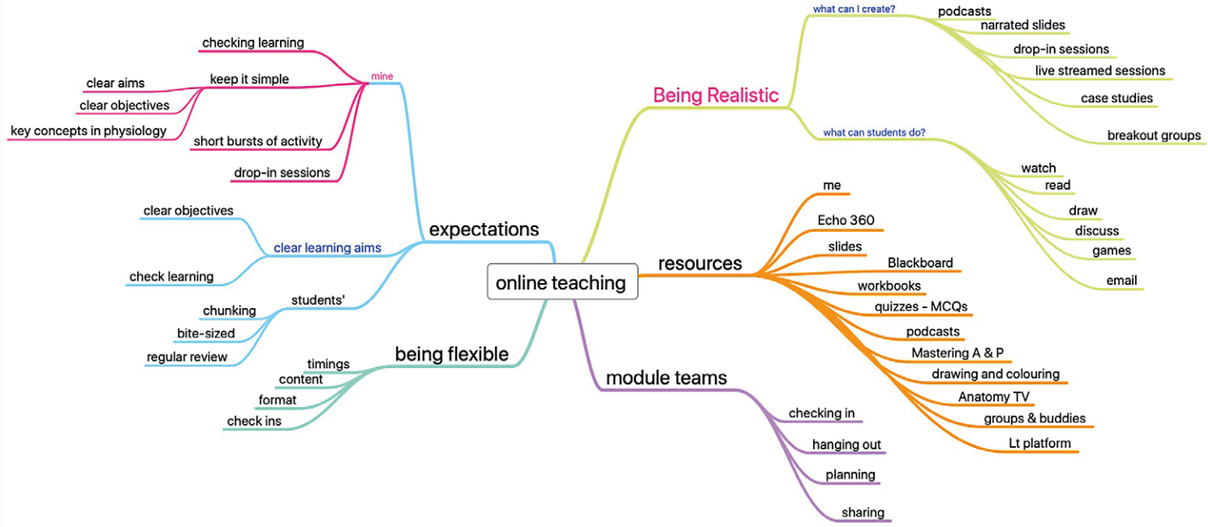



*Figure 1*. My mind map for transitioning to full online delivery

## Week 5

**Entry 1.** Students seem more confident working with technology but I still hate teaching a screen.

**Entry 2.** With a clinical colleague, I include some breakout groups in a session about the autonomic nervous system, stress and resilience. Feedback from paramedics was positive and we overran because the discussion was going so well.

With new confidence, I tried a workshop about neurotransmitters with occupational therapists and they also asked for more! This feels like progress.

## Week 6

After countless discussions about my connectivity, I eventually spoke to a kindly technician from our internet provider and things improved significantly.

Part of a hastily put together team planning a new Health & Life Sciences module due to start in September; we are now launching in June. A few weeks to grasp the nettle and plan – I love curriculum development! The first 3 weeks are timetabled and new online content will see us through until the summer break. Yay!

## Reflection

I'm supposed to retire soon and I have often felt too old to learn new tricks. Transitioning to online delivery in entirety – albeit in this emergency situation – has been one of the most challenging but strangely rewarding periods in my teaching career. Six weeks ago, I had rarely narrated a PowerPoint; now I can screencast, podcast, manage webinars and even make movies. Phew!

I miss the face-to-face contact with students terribly. What works for me is to imagine how they might feel; I try to feed off that to sustain my energy, enthusiasm, and some kind of presence that helps students to engage with the physiology topic in hand.

I owe enormous thanks to two other lecturers: my brother for helping me find the right buttons to click and an old pal for sharing the nuttiness.

*Laura is a physiologist and lecturer in Health Sciences at the University of East Anglia, UK. She gained more than 20 years experience as Senior Lecturer at City College Norwich and Birmingham City University. She is co-author of Anatomy & Physiology: An Introduction for Nursing and Healthcare (Lantern; in press) and Dementia Care at a Glance (Wiley). Laura has experience of teaching a range of topics and has been a stress management coach for decades.*

### Further reading

Berman AC (2015). Good teaching is good teaching: A narrative review for effective medical educators. *Anatomical Sciences Education* **8**, 386 – 394.

Cleveland-Innes M (2019). *The Community of Inquiry Theoretical Framework: Designing Collaborative Online and Blended Learning. In Rethinking Pedagogy for a Digital Age*. Principles and Practices of Design, edited by H. Beetham and R. Sharpe, 3rd ed., 85 – 102. Abingdon: Routledge.

Collins HL *et al.* (1999). An inquiry-based teaching tool for understanding arterial blood pressure regulation and cardiovascular function. Available online from *Advances in Physiology Education* [https://journals.physiology.org/doi/abs/10.1152/; accessed 15th May 2020].

Horrigan L (2018). Tackling the threshold concepts in physiology: What is the role of the laboratory class? Available online: https://doi.org/10.1152/advan.00123.2017

Hattie J (2009). Visible Learning: A Synthesis of Over 800 Meta-Analyses relating to Achievement. 1st Ed. Abingdon, Oxon: Routledge. p392.

Lujan HL, DiCarlo SE (2006). Too much teaching, not enough learning: what is the solution? *Advances in physiology education* **30**(1), 17 – 22.

Mason MJ, Gayton AM (2019). Flipping physiology: can we teach physiology in a different way? *Physiology News* **116**, 31 – 33.

Modell HI *et al.* (2009). In pursuit of a holistic learning environment: The impact of music in the medical physiology classroom. *Advances in Physiology Education* **33**, 37 – 45.

Puentedur RR (2006). Transformation, technology, and education in the state of Maine [Web log post]. Retrieved from http://www.hippasus.com/rrpweblog/archives/2006_11.html

Puentedura RR (2013). SAMR: Moving from enhancement to transformation [Web log post]. Retrieved from http://www.hippasus.com/rrpweblog/archives/000095.html



https://doi.org/10.36866/pn.119.40

https://doi.org/10.36866/pn.119.40

# The new normal for physiology education: Four research papers for moving teaching online

*James Clark*

King's College London, UK

Towards the end of 2019 I was the recipient of the Otto Hutter Physiology Teaching Prize from The Physiological Society. It's a great honour but would not have been possible without the support and enthusiasm of my colleagues in the department. We are very proud to have retained our physiology department at King's College London and I have benefited from such a focused environment in my teaching. Let's face it, teaching physiology is enormously engaging and Otto Hutter (University of Glasgow) was described as a "virtuoso" of small group physiology teaching, famed for throwing blackboard chalk to students to encourage participation.

I have been pondering over the past few months what pioneers of this mode of education, including Otto Hutter, will make of what is likely to come. As we start to tentatively emerge out of the COVID-19 global pandemic we can see the new education landscape unfolding in front of us. We are faced with online/remote delivery of our programmes for at least the first part of our new academic year and physiology departments all over the world are going through the same process of determining how to deliver teaching and evaluate students' learning without sacrificing quality, accessibility and equality among home and international students. So it is not surprising that I have been reading about using alternative forms of delivery and student engagement.

How do we teach human physiology, a practical subject, remotely? Whilst we have certainly been "flipping" and "blending" classes for many years, this has usually been a voluntary process and there is debate around the use of asynchronous versus synchronous delivery in physiology education. The available literature is not wholly supportive of a blended learning approach in physiology. We know however that environments where students participate in the learning process (active learning) have proven successful for most university programmes.

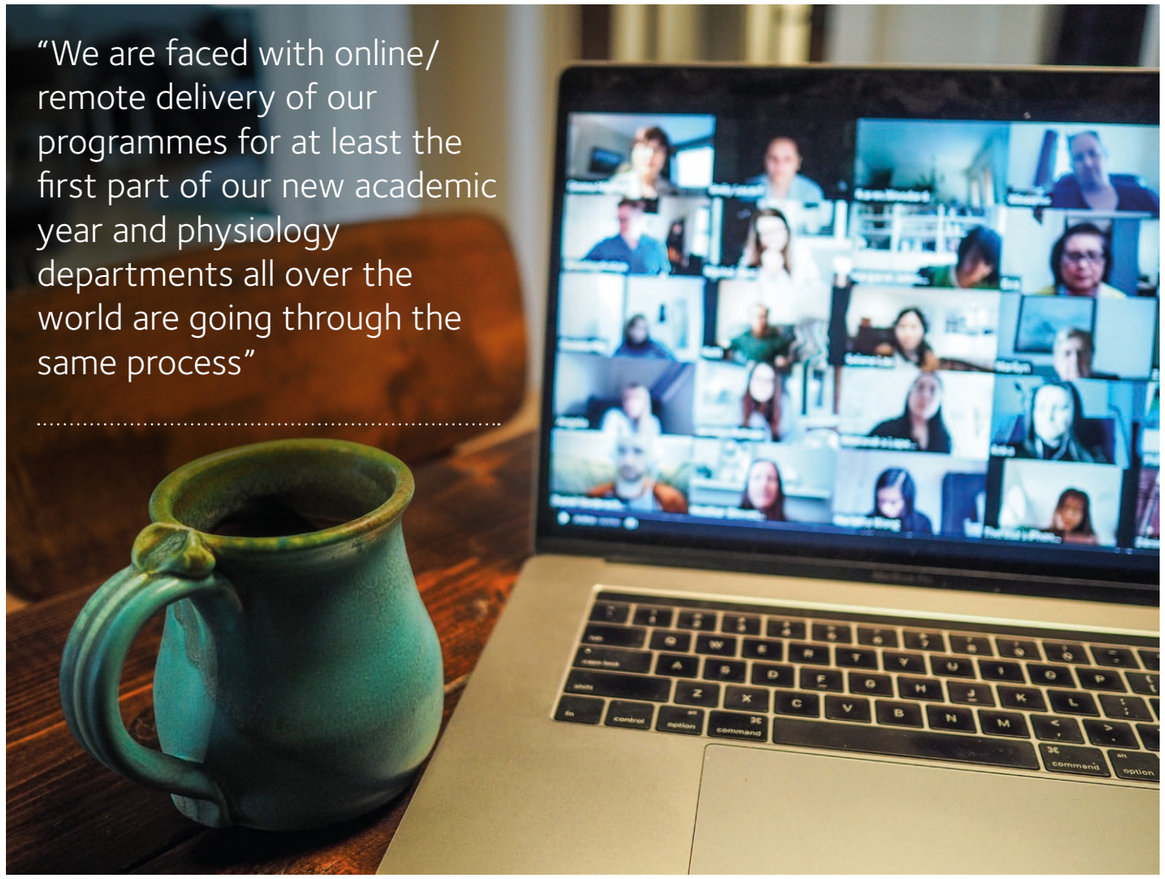
In a study published in 2019 by Joseph Rathner and colleagues, delivery and assessment of two physiology modules (neuroscience, and cardiorespiratory and renal physiology) were flipped between the 2017 and 2018 academic years (Rathner & Schier, 2020). Their method was, unsurprisingly, a combination of asynchronous, "chunked" presentations and synchronous workshops with a mix of formative and summative assessments using online tools, replacing didactic lectures with pre-recorded online delivery and synchronous small group tutorials around each topic covered. The provision of well-prepared asynchronous material (not just a re-run of last year's recorded lectures) is invaluable for flexible student engagement. We must, however, be mindful of students' access to quiet working environments and the technology required to access this material. Without any change in module content, Rathner's approach resulted in fewer fails and higher scoring passes in the cohorts studied (Rathner & Schier, 2020). I believe physiology education lends itself well to this mode and the "new normal" of flexible education, with flipped classes and a blended delivery of material, is certainly going to be our approach. It is reassuring to have published evidence to support educational approaches at a time when hasty decisions could have a major impact on our students and their learning experiences.

It is important to understand the theory behind different types of learning before redesigning a module or programme as transitioning to a flipped classroom model can be challenging for both student and instructor. A really good summary of pragmatic flipped delivery is summarised in a paper by Heather French. Whilst its context is focused on US graduate medical education, the underpinning theory and best practice for flexible delivery in adult education is outlined in a clear and unambiguous approach (French *et al.*, 2020). Heather highlights the use of virtual laboratories, the provision of real [physiological] data and worked examples of experimental approaches, data acquisition and analysis. Certainly, the use of these online tools will go some way to ensure that our students will "buy into" a more hands-off approach to physiological science at least in the short term. For the past 3 years I have been using a commercially available online e-learning system (Lt from ADInstruments) for undergraduate physiology practical classes (data acquisition and analysis) workshop preparation and both formative and summative assessment; I'm glad I invested time in researching and using this technology before now.

I have, for more years than I have been a physiologist, experimented in music composition and have produced music primarily for my own entertainment although it has at times entered my work life (see **www.youtube.com/watch?v=Q1YIYx8VBkI**). Did you know that songs about physiology can play a role in enhancing learning in science education (Crowther *et al.*, 2020)? In his 2020 publication, Gregory Crowther from Everett Community College, Washington elegantly demonstrated that musical "jingles" that describe simple physiological principles and mechanisms can be used as a useful study aid (Crowther *et al.*, 2020). We all ask students to write descriptive prose, but have you thought about asking them to write a song lyric. Maybe you should?

So, I end this by returning to Glasgow, the home of Professor Hutter, but not to the department of Physiology but that of Psychology and the work of Dr Emily Nordmann. Whatever approach you take, however you engage with your students this autumn I can wholeheartedly recommend reading Emily's paper listing 10 simple rules for supporting our new endeavour (Nordman *et al.*, 2020). This paper is, at the time of writing, published as a pre-print but is a valuable read for all academics in the current climate. As research scientists we often lean on the evidence of others to justify our work. As educators we should not be afraid of doing the same.

Stay safe and I'll see you online!




*James Clark is a Reader in Human & Applied Physiology at King's College London and the Education lead for the School of Cardiovascular Medicine and Sciences. Having graduated with a BSc in Applied Biology from the University of Bath he undertook a PhD in Surgical Research at UCL. He then moved to KCL where he undertook a BHF intermediate fellowship in cardiac signalling before securing a lectureship in Physiology in 2010.*

## References

Rathner J, Schier M (2020). The impact of flipped classroom andragogy on student assessment performance and perception of learning experience in two advanced physiology subjects. *Advances in Physiology Education* **44**, 80 – 92. DOI: 10.1152/advan.00125.2019.

French H *et al.* (2020). Perspectives: The flipped classroom in graduate medical education. *NeoReviews* **21**, e150. DOI: 10.1542/neo.21-3-e150.

Crowther G *et al.* (2020). Is memorisation the name of the game? Undergraduates' perceptions of the usefulness of physiology songs. *Advances in Physiology Education* **44**, 104 – 112. DOI: 10.1152/advan.00112.2019.

Nordmann E *et al.* (2020). 10 simple rules for supporting a temporary online pivot in higher education. Pre-print: DOI: 10.31234/osf.io/qdh25



https://doi.org/10.36866/pn.119.42

https://doi.org/10.36866/pn.119.42

# Three education research studies to inform teaching during COVID-19: Reflections from our 2018 Otto Hutter Physiology Teaching Prize winner

*Julia Choate*

Monash University, Australia

I was the 2018 recipient of the Otto Hutter Physiology Teaching Prize, awarded to a Member of The Physiological Society for innovation and excellence in undergraduate physiology teaching. In response to this, I was surprised to receive congratulatory emails from the US, Canada, UK and Australia, from collaborators, colleagues, the undergraduates I teach and highly regarded physiology professors I had never met. These emails were a welcome boost to my confidence as an educator and acknowledgement of the global recognition of The Physiological Society. When compared to scientific research, there are few education awards or grants. The Otto Hutter Physiology Teaching Prize has also enabled me to pay an assistant to support teaching innovations and to complete some education research papers. I thank The Society for this opportunity and I think that it is commendable that The Society supports physiology educators.

During these unprecedented times, when we are teaching our undergraduates remotely, synchronously or asynchronously (i.e. teaching with/without real-time interactions) and online, I found myself revisiting some education publications. These publications focussed on inquiry-based teaching, physiology core concepts, and, given the evolving crisis in graduate employability, undergraduate career development.

## Physiology inquiry-based teaching (Patil, Karve & DiCarlo, 1993)

With the desire to enhance student engagement, and to improve their understanding of integrative physiology, I developed student-centred, inquiry-based learning activities for lectures, laboratory classes and, prompted by the current COVID-19 situation, for Zoom-based online learning. My inquiry-based activities for integrative cardiovascular physiology drew inspiration from a paper by Patil *et al.* (1993). This manuscript describes a fictitious laboratory exercise that examines the cardiovascular responses to exercise in a sedentary individual, an endurance-trained athlete, an individual with quadriplegia, and a recipient of a heart transplant. Students are told that the heart transplant recipient has no autonomic innervation of the heart and the individual with quadriplegia has no sympathetic innervation of the heart (and no motor control below a spinal lesion). Based on graphical representations of the cardiovascular responses to exercise, students need to correlate each of the subjects with the relevant line on the graph. I modified the ideas from this paper to produce inquiry-based activities that follow on from the teaching of the control of heart rate and stroke volume. I have found that these activities enable students to test their understanding, plus they raise interesting "online" conversations about how the different subjects respond to exercise.

## Teaching physiology via core concepts (Michael *et al.*, 2017)

With so much physiology content and not enough room in the curriculum, as physiology educators we make decisions about the content in the curriculum. This is evident if you pick up the prescribed physiology textbook for your students – I would be lucky to teach more than half of the content in the textbook. Considering this overwhelming physiology content and student feedback that physiology is difficult to learn and understand, Joel Michael led a team that developed physiology core concepts or the "big ideas" of physiology (Michael *et al.*, 2017). They argue that physiology could be better taught by incorporating these core concepts into the curriculum. Michael *et al.* (2017) developed and defined physiology core concepts and described how they could be integrated into physiology teaching. They surveyed over 60 physiology educators about what core concepts of physiology they wanted their students to understand. This resulted in 15 core concepts for undergraduate physiology education, with "homeostasis" and "cell-to-cell communications" as top-rated concepts (see Michael and McFarland, 2011 and Table 1 for descriptions of the 15 core concepts). The concepts overlap, with multiple core concepts linked into the teaching of physiology topics, such as the regulation of blood pressure.

I find that students try to rote learn physiology, cramming their study into the day prior to a major test, and this does not help them to understand integrative physiology, nor does it help them with long-term learning. Thus, I am interested to see if I can frame the teaching of physiology around these physiology core concepts. I initially mapped the core concepts to the physiology curriculum for the physiology major of the Bachelor of Science degree programme at my university. This process identified that only a handful of the concepts were not covered in the existing curriculum. I have plans (following recommendations from Michael *et al.*, 2017) to articulate and assess the physiology core concepts, but this will need to wait until I have completed this hectic online semester!

## Supporting undergraduate career development (Dacre Pool and Sewell, 2007)

Five years ago, there was a steady stream of physiology undergraduates into my office who were anxious about their careers. Furthermore, a survey of final-year students found that a third of them were uncertain about their careers (Choate and Long, 2019). With all of this career anxiety and uncertainty, I decided that I needed to support students' career development, but I had no understanding of career development and minimal awareness about careers for physiology or biomedical graduates, aside from my own experiences as a scientist and academic. I thus teamed up with a university careers educator and we put together an in-curriculum (and assessed) career development programme (Choate *et al.*, 2019). A publication that I found invaluable for this process was Dacre Pool and Sewell's (2007) "practical model for graduate employability". This model has the acronym **CareerEDGE**, after the five key components for graduate employability: **C**areer development learning, **E**xperience of work and life, **D**egree subject knowledge, understanding and skills, **G**eneric skills and **E**motional intelligence. Students should be provided with opportunities (during their degree programme) to develop these five components, to reflect and evaluate on these experiences, and this should help them to develop self-efficacy, self-confidence and self-esteem. Taken together, these components of the CareerEDGE model are considered to provide students with "the skills, understandings and personal attributes - that make individuals more likely to gain employment" (Yorke, 2006, p.11). Indeed, when we embedded (and assessed) the components of the CareerEDGE model into our degree programme, this led to enhanced student awareness of career options and development of their employability skills (Choate *et al.*, 2019).

*Table 1.* The core concepts of physiology From Michael and McFarland (2011).

| The core concepts of physiology | Description |
|---|---|
| Causality | Living organisms are causal mechanisms (machines) whose functions are explainable by a description of the cause-and-effect relationships that are present. |
| Cell-cell communications | The function of the organism requires that cells pass information to one another to coordinate their activities. These processes include endocrine and neural signaling. |
| Cell membrane | Plasma membranes are complex structures that determine what substances enter or leave the cell. They are essential for cell signaling, transport, and other processes. |
| Cell theory | All cells making up the organism have the same DNA. Cells have many common functions but also many specialised functions that are required by the organism. |
| Energy | The life of the organism requires the constant expenditure of energy. The acquisition, transformation, and transportation of energy is a crucial function of the body. |
| Evolution | The mechanisms of evolution act at many levels of organisation and result in adaptive changes that have produced the extant relationships between structure and function. |
| Flow down gradients[2] | The transport of "stuff" (ions, molecules, blood, and air) is a central process at all levels of organisation in the organism, and this transport is described by a simple model. |
| Genes to proteins | The genes (DNA) of every organism code for the synthesis of proteins (including enzymes). The functions of every cell are determined by the genes that are expressed. |
| Homeostasis | The internal environment of the organism is actively maintained constant by the function of cells, tissues, and organs organised in negative feedback systems. |
| Interdependence | Cells, tissues, organs, and organ systems interact with one another (are dependent on the function of one another) to sustain life. |
| Levels of organisation | Understanding physiological functions requires understanding the behavior at every level of organisation from the molecular to the social. |
| Mass balance[2] | The contents of any system or compartment in a system is determined by the inputs to and the outputs from that system or compartment. |
| Physics/chemistry | The functions of living organisms are explainable by the application of the laws of physics and chemistry. |
| Scientific reasoning | Physiology is a science. Our understanding of the functions of the body arises from the application of the scientific method; thus, our understanding is always tentative. |
| Structure/function[1] | The function of a cell, tissue, or organ is determined by its form. Structure and function (from the molecular level to the organ system level) are intrinsically related to each other. |

*Associate Professor Julia Choate is the director of physiology education in the Department of Physiology at Monash University. With a passion for improving the student experience, Julia has developed and evaluated inquiry-based teaching, virtual experiments and professional development programs. These initiatives have been published and recognised with numerous teaching awards including our Otto Hutter Teaching Prize.*

## References

Choate JK *et al.* (2019). A professional development program with an assessed ePortfolio: A practical solution for engaging undergraduates' with their career development in large student cohorts. *Journal of Learning and Teaching for Graduate Employability.* **10**(2), *86 – 103*. https://doi.org/10.21153/jtlge2019vol10no2art788

Choate JK, Long H (2019). Why do science students study physiology? Career priorities of 21st century physiology undergraduates. *HAPS-Educator, Journal of the Human Anatomy and Physiology Society* **23**(1). https://doi.org/10.21692/haps.2019.010

Dacre Pool L, Sewell P (2007). The key to employability: Developing a practical model of graduate employability. *Education and Training* **49**(4), 277 – 289. https://doi.org/10.1108/00400910710754435

Michael J, McFarland J (2011). The core principles ("big ideas") of physiology: results of faculty surveys. *Advances in Physiology Education* **35**, 336 – 341. https://doi.org/10.1152/advan.00004.2011.

Michael J *et al.* (2017). The core concepts of physiology: A new paradigm for teaching physiology. New York: Springer Nature, 2017.

Patil RD *et al.* (1993). Integrated cardiovascular physiology: a laboratory exercise. *Advances in Physiology Education* **265**(6), 20 – 31. https://doi.org/10.1152/advances.1993.265.6.S20

Yorke (2006). Learning & Employability: Series One. Employability in higher education: What it is – what it is not. *The Higher Education Academy.* See: https://www.ed.ac.uk/files/atoms/files/hea-learning-employability_series_one.pdf



https://doi.org/10.36866/pn.119.44

https://doi.org/10.36866/pn.119.44

# Defining virtual, augmented and mixed reality in physiology education

*Christian Moro*

Bond University, Australia

Over the past decade, a large portion of my time has been spent working on integrating technology into physiology teaching. It has been an enjoyable and rewarding journey, especially learning how to create virtual models of organ systems and anatomical structures for students to navigate through using devices such as virtual, augmented and mixed reality. In March 2020, when social distancing was enforced and teaching conducted online, our team immediately thought it would be fantastic to convert the virtual reality lessons into online sessions to engage students within their homes. However, we soon realised that although technology can theoretically allow for learning at any time in any place, this often needs to be a specific goal during the lesson's creation. Only one of my students owned a virtual reality headset, and no-one had access to the mixed reality device I'd been planning to use, the Microsoft HoloLens, rendering these lessons unusable. As such, we had a completely virtual, engaging and interactive series of laboratories and physiology learning sessions that were completely unusable outside of the laboratory environment (Fig. 1).

The need to run classes off-campus certainly helped to motivate the conversion of many teaching resources into entirely online delivery. I am very grateful to have received the 2019 David Jordan Teaching Award to help share as many physiological resources and online learning tools as possible, and this placed me in good stead for creating a wide range of online physiology curricula. I have now been teaching through a variety of modes that are entirely free for students, such as using Instagram (@physiologywithchristian) to run informative sessions, YouTube for video content (Physiology with Dr Christian), and trialling different forms of educational media, such as converting my Physiology and Anatomy adventure game into a completely free fully online platform (**https://www.physiologywithchristian.com/game** - check it out!!).

As integrating virtual, augmented and mixed reality into our physiology classes has been a recent highlight for teaching, I thought it might be helpful in this article to explore these terms and their use in the literature.

## What is virtual, augmented and mixed reality?

One of the most confusing things to comprehend when entering the technology-enhanced space is the terminology used.

"One of the most confusing things to comprehend when entering the technology-enhanced space is the terminology used. Virtual reality, augmented reality, mixed reality, extended reality, and cross-reality are all widely contested terms"

*Figure 1*. Students in Christian's class using virtual reality to explore the structures of the spine.

Virtual reality, augmented reality, mixed reality, extended reality, and cross-reality are all widely contested terms. The most helpful source from the literature to decode some of these terms is an article by Milgram and Kishino (1994). Here, the authors describe the use of a "Reality-Virtuality Continuum". In their model, one end of the spectrum is the real environment, with the other end the virtual environment (i.e. virtual reality). Augmented reality fits in the middle, while mixed reality is employed as a somewhat *umbrella* term encompassing the entire spectra. With the introduction of new devices explicitly marketed as "mixed reality", this definition may be ageing, so I've done my best to summarise these terminologies below:

Virtual reality: The user's senses (sight, hearing and motion) are fully immersed in a synthetic environment that mimics the properties of the real world through high resolution, high refresh rate (constantly-updating) head-mounted displays, stereo headphones and motion-tracking systems (Moro *et al.*, 2017).

Augmented reality: Using a camera and screen (i.e. smartphone or tablet) digital models are superimposed onto the real-world. The user is then able to interact with both the real and virtual elements of their surrounding environment (Moro *et al.*, 2017).

Mixed reality: While augmented reality overlays digital information onto real-world elements, mixed reality allows for an additional layer of interactivity. Virtual objects placed within a mixed reality environment can be interacted with as if they were real objects. The user's hand and feet, as well as other people, become part of the environment in which all objects, real and virtual, are fully interactable (Birt *et al.*, 2018).

There remains some overlap between augmented and mixed reality, and as such, other contemporary umbrella terms have been increasingly present in the literature. In particular, the use of "XR" is a modern way to group all the modes together, even if the acronym's components remain contended. XR may represent: cross-reality; extended reality; or simply "X"-reality; but either way, having a single term to discuss these modes has been useful.

## Which "reality" mode is best for physiology teaching?

This question is tricky to answer, as each mode is unique and holds its own benefits. Virtual reality provides a fully digital environment, placing the user's eyes, ears, hands and body within a completely artificial space (Kuehn, 2018). For example, virtual reality has allowed me to create a large pair of lungs that enables students to walk inside and see the features surrounding them. On the other hand, augmented reality can be beneficial if you wish to add interactive features, such as a beating heart, to silicon models or laboratory resources. Recently, I've developed a real interest in exploring mixed reality, with this current semester set to mark the introduction of lessons using the Microsoft HoloLens. This is a new device capable of blending the benefits of both virtual and augmented reality in a head-mounted computer (Fig. 3). While this rollout has currently been delayed due to world events, once we are all back on campus, I'm very excited to see whether this technology is effective for learning.

*Figure 2*. Students in Christian's class using augmented reality to learn about the physiology of the brain and central nervous system.

*Figure 3*. Students in Christian's class using the Microsoft HoloLens, a head-mounted mixed reality device, to learn the physiology of the cardiovascular and pulmonary systems.

*Associate Professor Christian Moro is the Science Lead of the Bond University Medical Program and a urological researcher, investigating the physiology of the lower urinary tract. Christian also develops and researches evidence-based resources for medical and health sciences, such as the use of Instagram (@physiologywithchristian) and YouTube (Physiology with Dr Christian) for physiology education.*

### References

Birt J *et al.* (2018). Mobile mixed reality for experiential learning and simulation in medical and health sciences education. *Information* **9**(2), 31. https://doi.org/10.3390/info9020031

Kuehn BM (2018). Virtual and augmented reality put a twist on medical education. *JAMA* **319**(8), 56 – 758. https://doi.org/10.1001/jama.2017.20800.

Milgram P & Kishino F (1994). A taxonomy of mixed reality visual displays. *IEICE Trans. Information Systems, vol. E77-D, no. 12*, 1321 – 1329.

Moro C *et al.* (2017). The effectiveness of virtual and augmented reality in health sciences and medical anatomy. *Anatomical Sciences Education* **10**(6), 549 – 559. https://doi.org/10.1002/ase.1696

Moro C *et al.* (2017). Virtualisation devices for student learning: Comparison between desktop-based (Oculus Rift) and mobile-based (Gear VR) virtual reality in medical and health science education. *Australasian Journal of Educational Technology* **33**(6). https://doi.org/10.14742/ajet.3840



https://doi.org/10.36866/pn.119.46

https://doi.org/10.36866/pn.119.46

# Making the most of online learning in lockdown: A student perspective

*Róisín Ní Dhonnabháin*

University of Cork, Ireland

On 12 March, universities across Ireland were forced to close their doors in an effort to control the spread of SARS-CoV-2 virus. This impacted hugely on education, presenting both opportunities and obstacles to learning for all students including myself. As a third-year physiology student, I was now forced to alter my study regimen and contend with an uncertain format for examinations.

Online learning, especially in higher education, has become more prevalent over the last few years; however, the COVID-19 crisis has forced institutions at every level of education into a paradigm shift in teaching and learning. Traditional face-to-face learning, as we know it, has been abruptly truncated, and we have all had to adapt to new learning styles, and a new "normal." The rich learning experience afforded to us by conventional classes has been drastically diffused and we have suffered from the absence of practical laboratory classes, tutorials and lectures. Conventional learning prior to COVID-19 fostered an affable learning culture wherein we students could freely ask questions and seek clarification about all aspects of course material thus ensuring the synthesis of the various concepts being taught. Today, whilst our lecturers are making every effort to encourage us, students, to ask questions via email or discussion boards, many students myself included, are reluctant to do so, now, more so than ever.

In my opinion, a great degree of self-discipline is required to achieve the same grades working remotely. Personally, I am a creature of habit and once adapted to my new routine I worked quite well from home. The key for me was providing structure not only to my day but to my week: I worked consistently on weekdays and took Sundays to reflect and recuperate; ready to start afresh again on Monday morning.

I do not want to seem wholly pessimistic about the online learning platform; in the interest of balance, I have to reflect on some of the positive aspects attached to this new learning environment. I really benefited from having more time in which I could truly grasp concepts and read background literature aiding in my understanding of topics. Pre-recorded lectures allowed me to take detailed, methodical notes, pausing the lecture to write and do a quick search if I became confused or unclear about some aspect of the lecture.

I believe that the online learning forum certainly exacerbates the inequalities that already exist with our education system. As a student, I consider myself very lucky and privileged to have access to all of the technological devices essential to attain high grades whilst working remotely; I own a smartphone, laptop, textbooks, and my home has excellent broadband access. Furthermore, I live in a home environment conducive to study, affording me space for optimal concentration, productivity, and taking remote examinations. The college library is where most students go to knuckle down and accomplish the tasks at hand and it's difficult to recreate this space at home with so many opportunities for distraction. The library facilitates delineation between academic and home life both mentally and physically; online learning without this separation seems overwhelming at times.

Personally, one of my major apprehensions was the degree of uncertainty regarding how examinations would be carried out remotely. We received daily emails informing us of meetings between the relevant bodies and that all steps were being taken to ensure that online examinations would not impact our grades. A petition circulated among students calling for universities across the country to follow the actions of many universities in the UK and implement a "no detriment" policy to ensure grades would not suffer as a result of the COVID-19 pandemic. This did not occur; however, we were informed of a similar and an arguably equally fair strategy, whereby students unhappy with grades awarded following summer exams would be allowed to repeat uncapped in Autumn. This was followed promptly by emails from individual lecturers specifying requirements for each module. This consideration, and clarity by our lecturers, greatly eased the concerns of many of my classmates and myself and effectively helped to motivate us at a time when initial enthusiasm had begun to dwindle. Examinations were of an open book format focusing more on our understanding of content than the simple recall of facts.

Older generations may assume that my youth automatically implies I am a "technological genius"; however, unlike many students, I would consider myself quite traditional in my approach to learning and my study techniques. I tend to print off lecture slides, write all my notes by hand, and I refer to physical copies of textbooks rather than "e-books". I believe that my style of learning left me at a disadvantage when both learning and examinations were moved online. I often struggled with the novel mechanics of "speed-typing" during exams, and believe that those who were more tech savvy would be at an advantage. Some challenges were also presented with the exams that were to be handwritten, scanned and uploaded all within 120 mins; technical difficulties with failed scanning and uploading proving to be the main points of struggle.

One may have thought the usual pre-exam hype and the post-examination autopsy would be eliminated, but rather, these events occurred in a virtual sense, and to some extent were worse than ever before. Rather than comparing which questions we chose to answer and what information we included, the most common question asked in the year group chat was now "how many words did ye write?" The replies to this question led to an instant feeling of inadequacy. I found myself trying to reassure myself with the well-known phrase "quality over quantity" and hoped that answering the question asked was more important than including additional but irrelevant information.

The ultimate impact of online learning on students depends, I suppose, on the individual student. As I said, I'm one of the lucky ones, I'm driven and determined to do well, I have access to resources and a suitable environment to work in but I would have serious concerns for those who aren't as fortunate. I know that I will not look back on this semester as fondly as others; however, remote learning has not been all that bad for me. I certainly have not missed my hour-long morning commute, and at the time of my final exam, I had begun to adjust to this new examination format. I do hope that in time, through utilising all resources available and the expansion of our technological skills, we will adapt to and overcome the challenges presented by remote learning – if it is to be the consistent "new normal"!

*Róisín Ní Dhonnabháin, is a third-year Physiology Student from University College Cork.*



https://doi.org/10.36866/pn.119.48



# Obituary: John Bligh 1922 – 2020

John Bligh

I was standing by the window at a scientific meeting in 1983, admiring the view of the Honolulu coastline, and counting my lucky stars to be able to present my doctoral work at an international conference. After the ordeal of presenting, I spent the break exchanging pleasantries with an elderly scientist who was also admiring the view. With a look suggesting that I was probably unaware of this fact, he asked me if I knew what happened to Georg von Békésy after he received his Nobel Prize (for his discoveries in hearing). Having had a biomedical engineering background, I knew the history of the von Békésy up to the Nobel prize, but not thereafter. He smiled and suggested I should visit von Békésy laboratory (converted to a museum) at the University of Honolulu (which I did). This was how I met John Bligh, then about to take up an appointment at the University of Anchorage, just prior to retiring.

John Bligh studied physiology at University College London where he obtained a BSc and then a PhD in 1952 working with Otto Hutter. He then joined the Hannah Dairy Research Institute in Ayr, where he first became interested in the problems of temperature regulation. In 1957 he transferred to the Agricultural Research Council's Institute of Animal Physiology at Babraham, Cambridge, where he was Senior Principal Scientific Officer. Between 1972 and 1973 he held a Leverhulme Visiting Professorship in Peru, before moving to become the Director of the Institute for Arctic Biology in Fairbanks, Alaska from which he retired in 1985.

By that time, John had gained international recognition for his work in the area of temperature regulation. He is best known for his reciprocal cross inhibition (RCI) theory of temperature regulation where the balance between heat production and evaporative heat loss sets the body temperature. He considered the RCI theory as being a unifying theory, perhaps representing the functional unit in the homeostasis of all autonomic systems. He promoted this insightful idea religiously, to the extent that his colleagues even made a rubber stamp representing a diagram of his RCI theory, so that he could be more efficient in his back-of-the-envelope presentations.

The results of our work when I invited him to Simon Fraser University in 1986 further convinced him that perhaps the "set-point" theory, whilst a useful aid to the teaching of temperature regulation, was not accurate mechanistically, and he therefore modified his intricate model of temperature regulation to account for the inter-threshold range of core temperatures in which body temperature was regulated. As neatly summarised by Professor Romaine Harvey, while chairing John's invited presentation on temperature regulation at the 40th Anniversary meeting of The Physiological Society Climatic Physiology Group, "so, the salient feature of the set-point, is that it is neither a point, nor is it set?"

John never confirmed or denied his relationship with the (in)famous Captain Bligh. He certainly shared the Captain's strict adherence to rules (in John's case, of science) and remarkable ability to navigate (for John, through the scientific literature). He was a stickler for grammar, and above all proper definitions. Not surprisingly he co-edited the first *Glossary of Terms for Thermal Biology* (published in the *Journal of Applied Physiology* in 1973). This publication remains, after several iterations, of great value to the field.

Amongst John Bligh's other major contributions was his book *Temperature regulation in mammals and other vertebrates* (also published in 1973). It is an extensive review (colloquially one would even heretically refer to it as "the bible") of the prevailing knowledge of temperature regulation. Whereas this book covers all aspects of mammalian temperature regulation, one of his final contributions focused on homeothermy, with a particular emphasis on his theory of RCI. The text "Mammalian homeothermy: an integrative thesis" was initially intended to be published as a book, but appeared as a special issue of the *Journal of Thermal Biology* (**23**, 143 – 258, 1998). This was his lasting legacy to the field of mammalian temperature regulation.

John Bligh was a true "gentleman scientist", a cheerful, uplifting man, generous and insightful in his advice, a delight to be with, not least because of his sense of humour. In response to the invitation from the Chairman for questions from the floor at the Climatic Group meeting, John's retort was: "More questions? I already told them everything I know!".

> "More questions?
> I already told them everything I know!"

As a mentor, John taught us that, in research, the investment in people is much more important than investment in infrastructure and instrumentation. He was a powerful advocate for honesty in science. He will be remembered by all who had the privilege of working with him as a kind, approachable, and extremely helpful and supportive mentor. He always had time for people. His wisdom provided guidance not only in our research, but also in our daily interactions as scientists and colleagues, something that today is not always offered by mentors and not always appreciated by the mentored.

Written by Igor B Mekjavic (Department of Automation, Biocybernetics, & Robotics, Jozef Stefan Institute, Ljubljana, Slovenia), who was John Bligh's host, colleague, student, and most importantly - his friend.

https://doi.org/10.36866/pn.119.49

# Obituary: Nicholas Beresford Standen 1949 – 2020

Nicholas Beresford Standen

Nick Standen is probably best known for uncovering the mechanism of action of vasodilators used for the treatment of hypertension and heart failure. This study, started when he was on research leave in Mark Nelson's laboratory at the University of Vermont in 1987, showed that adenosine triphosphate-sensitive potassium ($K_{ATP}$) channels in arterial smooth muscle open in the presence of the vasodilator cromakalim. Cromakalim was known to relax airway, intestinal, and uterine smooth muscle and so $K_{ATP}$ channels were probably physiologically active in many smooth muscle types (Standen *et al.,* 1989). Nick Standen and Peter Stanfield, co-founders of the renowned Ion Channel Group at the University of Leicester, together with Austen Spruce had already shown that $K_{ATP}$ channels were present in frog muscle membranes but it was hard to establish that they operated under physiological conditions. The link to the high potassium permeability seen during rigor displaced the hypothesis that it was caused by increased cellular calcium. This idea had arisen from the discovery of calcium-activated potassium currents by Nick and his PhD supervisor Rob Meech, reported to The Physiological Society in 1974.

Perhaps less well known is Nick Standen's key role in understanding mechanisms of calcium channel inactivation. Nick had explored the voltage sensitivity of the mechanism during the course of his PhD work but recent studies suggested it might depend not on membrane potential directly, but on calcium ion entry. Whether it was a consequence of the passage of calcium across the cell membrane or of increased levels of intracellular calcium was as yet unknown. Nick showed that inactivation of this pathway could be produced by direct injection of calcium into the cell (Standen, 1981). Then he, Tim Plant and Tom Ward excluded possible side effects of cellular acidification and presented a simple model in terms of calcium binding to intracellular sites.

This survey cannot do justice to the sheer volume of Nick Standen's output but a recurring theme is the link between membrane channels and cell metabolism. Both calcium-activated potassium currents and calcium-dependent calcium inactivation provide a direct link between neuronal activity and the metabolic processes that regulate intracellular calcium; in the case of $K_{ATP}$ channels Nick was intrigued by possible links between metabolic factors and the regulation of blood flow.

Establishing a physiological role for $K_{ATP}$ channels gave Nick the greatest satisfaction for he was essentially a practical person who wanted most of all to solve medical problems. His sister Olivia recalls that in his early life he was greatly influenced by his grandfather who farmed near the family home in Oxford. It was his grandfather who taught him how to shoot and skin rabbits and let him capture wild animals. At one time his pets consisted of a vole, a weasel, a shrew and a mouse, all of which he kept in his bedroom. He studied the nocturnal behaviour of the mouse by rigging up an electric circuit to signal each time the animal left its cage. He wanted to add a ferret to his menagerie but his good-natured parents drew the line at that. He conducted a persistent campaign, endlessly dropping the word "ferret" into the conversation, but determination was clearly inherited and the parents never weakened. Instead Nick made do with a magpie, and the numerous guinea pigs that he sold to local pet shops. In his adult life he enjoyed mountaineering, rock climbing and deer stalking.

Nick's skills as an experimentalist contributed to the success of the highly influential Microelectrode Techniques Course at Plymouth Marine Station and he was an editor (with Peter Gray and Michael Whitaker) of the first edition of its Handbook. No one could collaborate with Nick without becoming a friend. His relaxed manner but forceful intellect earned respect from colleagues and students alike, and this was sustained by a keen work ethic. He was loyal and supportive to his research staff, endlessly fighting for funding to maintain their posts. Undergraduate students appreciated his enthusiastic teaching, and he was keen to ensure they always received the best training. His intellect and his efficient deployment of it, his practical skills and his determination were clear from childhood, impressed his teachers at Cambridge and were recognised by everyone who met him.

Nick's forced retirement due to ill health was a tremendous loss, not only to his friends and colleagues but also to science in general. Among the honours he received were the GL Brown Prize Lecture in 1990/91 and the International Prize Lecture in 2001. From 1991 to 1994 he was Chairman of the Editorial Board of *The Journal of Physiology.* He was elected to the Academy of Medical Sciences in 2001 and was made an Honorary Member of The Physiological Society in 2010.

Nick Standen was born on 8 December 1949 in Oxford, went to the Dragon School and then Magdalen College School. In 1971 he was awarded a first-class degree in Natural Sciences while at Queens College Cambridge. After PhD studies in the Zoology Department, Cambridge and a brief period at Nottingham, he was appointed in 1976 to a lectureship at Leicester and remained there until retirement in 2009. His wife Alison and his three children, Jonathan, Claire and Jessica, sustained him during a prolonged period of poor health. As a father they remember him as being "oodles of fun". He died on 2 April 2020 following a respiratory tract infection.

---

Written by Robert Meech, Ian Forsythe and Noel Davies. Nicholas Standen was Robert Meech's first PhD student at the Zoology Department at Cambridge. Robert describes him as an exceptional student who hardly needed any supervision. Ian Forsythe is head of the Department of Neuroscience, Psychology and Behaviour at the University of Leicester. He and Noel Davies started their careers at Leicester as post-docs in the Ion Channel Group, which was led by Nicholas Standen and Peter Stanfield.

Photograph taken in May 1998, provided by Mark Nelson.



https://doi.org/10.36866/pn.119.50

# Obituary: Gerhard Giebisch 1927 – 2020

Professor Gerhard Giebisch, Sterling Professor Emeritus of Cellular and Molecular Physiology at Yale School of Medicine, died peacefully near his home in Connecticut on April 6th 2020 at the age of 93 years.

Gerhard Giebisch (second from left) flanked by three of his former research fellows (L to R, Carsten Wagner, Institute of Physiology, Zurich, Robert Unwin, UCL, and Matthew Bailey, University of Edinburgh) during a visit to London in 2010.

Gerhard was born in Vienna in 1927 and obtained his medical degree at the University of Vienna in 1951. He emigrated to the United States and took up a clinical internship in Milwaukee in 1952, which is also where he married his wife of over 50 years, Ilse Giebisch. They moved to New York where Gerhard gained a postdoctoral fellowship in the Department of Physiology at Cornell University Medical College with the distinguished renal physiologist Professor Robert Pitts, who had taken over from the celebrated Homer Smith. There, Gerhard acquired his abiding interest in renal physiology and published his early studies with Pitts on the renal excretion and volume of distribution of dextrans, the extrarenal response to acute respiratory acid-base changes, and the effect of adrenal steroids on bicarbonate reabsorption. Gerhard subsequently learned tubular micropuncture with Phyllis Bott, a technique that eventually underpinned his highly original work on potassium transport with his long standing collaborator and friend, Gerhard Malnic. Gerhard's early micropuncture studies also included measurements of transepithelial voltage to better understand the driving forces for ion transport.

Gerhard's academic career and stature progressed at Cornell and in 1968 he was appointed Professor and Chairman of Physiology at Yale School of Medicine, overseeing a critical period in its growth and development. Gerhard was appointed Sterling Professor, Yale University's highest academic rank, in 1970 and in 1973 he stepped aside as department chairman to encourage and foster new talent and careers. This was typical of Gerhard and he continued to offer clear-sighted support during the department's expansion and increasing reputation in physiology. With the opportunity to deepen his own research interests without too many administrative distractions, his laboratory flourished and became a much sought after destination for trainees in renal physiology. The studies conducted in his laboratory during this period have laid the foundations for much of our current understanding of potassium homeostasis.

Another eminent figure in renal physiology, Robert (Bob) Berliner, had become Dean of Medicine in 1973 and he and Gerhard became life-long friends and worked closely together throughout their time at Yale. The Department of Physiology changed its name to the Department of Cellular and Molecular Physiology in 1989, which preserved the independence of physiology during a time of change in which the creation of large amalgamated "Biomedical Departments" was popular. But the new name also reflected the direction of physiological research that Gerhard had embraced, as he continued his pioneering research on renal potassium handling well beyond his retirement.

That Gerhard made important and lasting research contributions in renal physiology is undisputed, but almost as important was his impact on individuals. He directly mentored more than 75 postdoctoral fellows, many of whom went on to illustrious research careers of their own worldwide. For many, Gerhard was an inspirational figure and became a valued friend: colleagues were impressed by his scientific knowledge and acumen, and appreciated his thoughtful and generous nature. His understanding of people and unfaltering guidance, support and advice, ensured that all who worked with him soon became his devoted followers.

Gerhard was a stickler for clear, correct and well-written prose in his publications and would often present young fellows with a gift of *The Elements of Style* by Strunk & White and Homer Smith's *The Kidney*; he would also ask Bob Berliner to proofread potential publications with a critical eye, which was often a painful lesson in good English - a common mistake would be the incorrect use of "tubule", the noun, for "tubular", the adjective. Moreover, Gerhard himself admired Hemingway's style and liked short sentences, claiming that this suited the shorter attention span of many American readers!

Gerhard's personal office was always open, providing us all with a wonderful source of physiological literature and the chance to encounter the many leading physiologists from all over the world who would visit regularly. All this made for a fascinating, exciting and stimulating environment, and not forgetting the many international fellows, all with their own projects, yet working together. Another important legacy of Gerhard's is his well-known textbook of renal physiology edited with the equally renowned Donald Seldin, *The Kidney: Physiology and Pathophysiology*. Referred to colloquially as "Seldin & Giebisch", this book continues to be a valuable "go to" reference source in renal physiology and nephrology.

Gerhard was elected to the American Academy of Arts & Sciences in 1983 and to the National Academy of Sciences in 1984. He was a founder member of the American Society of Nephrology (ASN), and served as President; he received numerous prestigious awards and honorary doctorates throughout his career. He became an Honorary Member of The Physiological Society in 1999 and gave the 2004 Bayliss-Starling Lecture. Gerhard lectured extensively and often wrote out his lectures in full to ensure clarity and pace, which was always appreciated.

Outside of science, Gerhard had a great passion for art, literature and music, especially opera, and he would travel regularly to the Metropolitan Opera in New York and encourage others to join him. He was an example to follow in almost every respect, as a scientist, a teacher, a diplomat, and above all a mentor. All this plus his gentle and wry sense of humour will be greatly missed.

Gerhard's wife Ilse died in 2008 and he is survived by his two married children Christina and Robert, and four grandchildren.

---

Written by Robert Unwin, Emeritus Professor at University College London, UK.

https://doi.org/10.36866/pn.119.51

# Physiology 2021
## Your annual conference

"We look forward to welcoming you to our vibrant city of Birmingham! The conference venue is in the heart of the city centre with easy access from the train station and airport, and to the city's many bars and restaurants."

Andrew Coney, Carolyn Grieg and Gareth Wallis, University of Birmingham, UK and Andy Powell, Birmingham City University, UK

- Engage with cutting edge physiology
- Present your work to over 1000 scientists
- Expand your network and forge new collaborations

Abstract submission is open from **1–31 March 2021**

**Physiology 2021** | 12 –14 July 2021 | ICC Birmingham, UK

**events@physoc.org**
**+44 (0)20 7269 5710**
**www.physoc.org**

physoc
@ThePhySoc
the-physiological-society
physocTV
@ThePhySoc

The Physiological Society