Online learning versus classroom learning: Questioning who learns what

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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 underscored the importance of digital tools and technology. Educators have adapted to this 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 constraints imposed by the pandemic. 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 “lab” 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 Green’s diary of events around lockdown “Go home, stay there, and put your teaching online from Monday” (p. 11) describes 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 Alston Mostyn provide us with a valuable perspective (p. 24) of available online technologies to support teaching and learning. All aspects are covered here, from teaching to assessment, OSCIs (objectively 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 Choots 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, Rónín Ní Dhamhábláin (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 transferrable 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 inform future practice. A good place for readers to start would be participating in Harry’s education symposium at Physiology News: Medical Technology Special Issue.

Equally important are two thoughtful contributions from 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 professional 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) the 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 for this fascinating issue of Physiology News.
Lessons for The Society from COVID-19

650 people taking part from 33 countries – a truly international endurance!

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 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 next 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 lock down 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.

At the best wishes for the future

Bridget Lamb
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 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 preparing 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 medicines 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 helped explain why dexamethasone has been hailed as a “ground-breaking treatment” for hospital patients seriously ill with COVID-19

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 front line 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 got the 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.

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.

“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”
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 early career. The 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.

Read more here: https://www.physoc.org/careers/
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. 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 units to a new, emergent-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 Biosciences 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 accreditation criteria for BSc degrees. Now any format of capstone, including those that are team-based, is acceptable provided it includes opportunities for analysis, synthesis and critical evaluation of research, 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. In mass replacement with critical literature reviews is not acceptable; less than 10% of students would select this option given the choice. 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 webinars 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 publicly available (e.g. health, environment) or School/Faculty research (e.g. neuronal recordings) datasets, e.g. https://bit.ly/OADatRep.

- **Computational modelling/Simulations:** Investigate the physiological or pharmacological modulation of existing models or simulations of systems, organs or tissues (e.g. intact animals, heart, neurons). This could include the evaluation of the scientific accuracy and educational benefits of simulations currently used in education, e.g. https://bit.ly/2yoeBiologicalPracticals or accuracy of automated data tracking/scoring systems (e.g. OptiMouse).

- **Grant proposals:** Rather than grant proposals, organisations expect the principal output. Sections within it are those in real grant applications to funding bodies, e.g. BBSRC or MRC. “Plot” 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 literature 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 included: 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 to 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 students and patients in the development of Digital Health Apps (the latter was innovative in its use of social media 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://badriilla.com/project-lancer/landing-page/ or the US journal Nature paper 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 publicly available information to write a grant proposal for funding bodies, e.g. BBSRC or MRC. “Plot” data comes from previous studies in the supervisor’s lab.

- **Professional Education:** Development of education and training resources for researchers (e.g. The Reproducibility Crisis https://www.youtube.com/watch?v=OwmiD2lFy9s, 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). This could include the 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 to face.

For more details on any of the above and additional opportunities, see: https://mymedia.leeds.ac.uk/Mediasite/Play/a3a0c1d53dc34120a989f30b6b70b1b or contact me (d.lewis@leeds.ac.uk).

The critical question is what do students think of this? As the above alternative capstones become the principal output. Sections within it are those in real grant applications to funding bodies, e.g. BBSRC or MRC. “Plot” data comes from previous studies in the supervisor’s lab.

So rewarding, the highlight of my whole education! I enjoyed being able to look at 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 needs of students, and to better prepare 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 development 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 Otto Hutter Teaching Prize and is an AdvanceHE National Teaching Fellow.

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1. Lewis DI (2020). Final year undergraduate research project or a “Capstone Experience”? Time for a re-think. Behav. Biol. (in press). Available at: https://doi.org/10.12462/bbb.2020-10782


“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.”
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**Number 1 Most Accessed 2019**

"Applying learning theories and instructional design models for effective instruction" by Mohammed K. Khalil and Ihan A. Elkhoury from the University of South Dakota 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 section, 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 22,269 times.

**Number 2 Most Accessed 2019**

"Teaching with educational multimedia: effective strategies for classroom or distance learning delivery" by Barbara E. Goodman, M.D. 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 organizing chair for the APS Institutes on Teaching and Learning and the Physiology Educators Community Of Practice blog site (https://blog.lifescitrc.org/peop/

This article presents a Personal View by reviewing the literature on the "common knowledge" and "consensus" that there is a decline in students' attention in class time (up to 15 minutes). The author believes that the most consistent variable in student attention arises from differences among 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 17,819 times.

**Number 3 Most Accessed 2019**

"Classroom embeds for remote teaching: a pedagogical strategy for peer learning supplement" by Paul Lewis and Dave Lewis from the University of Leeds, UK published on 5 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 in class time (up to 15 minutes). The author believes that the most consistent variable in student attention arises from differences among 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 13,910 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 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 Etan A. Tarsney 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.

"Of all the APS family of journals, 7 out of the 10 most accessed articles (full-text accesses) during 2019 were published in Advances"
Mapping the landscape for physiology students and graduates

Chrsissy 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 careers physiologists. This role has gained in significance as the number of named physiology degrees and physiology-related areas 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) and the high proportion of physiology-named course that students can choose advanced physiology (reported by Cardiff University).

The modules selected. 29% of Society Reps 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. 28% of responding Reps also reported that their institution offers a physiology-named course that students can switch to mid-degree or as an exit degree.

The TAFG has now reported to the Education, Public Engagement and Policy Committee and many of the recommendations from this 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.

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 this 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 intention was 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. 28% of responding 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 acceptable 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 haysmacintyre to gain a deeper insight into UK and RoI routes into 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 80 at A-level for a Sports and Exercise Science degree to 144 UCAS points or A and A in Mathematics and 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 biologists 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 many of the recommendations from this 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.

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 Buzzaccott 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 student articles of Association and Regulations.

April 2020
The Conferences Committee met on 22 April using a phone conference call. The meeting was dominated by the impact of COVID-19 on conferences and events. The current climate means that few plans can be on this group.

The President, Bridget Lumb, reported on the impact of COVID-19 on conferences and events. The current climate means that few plans can be made for the Society’s annual Meeting Physiology 2020 was discussed since it had been pivoted from an in-person to a virtual conference. A new programme of webinars and a virtual conference was developed and plans were made for 2021.

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The Publications Committee met virtually in April 2020, chaired by Debbie Baines. The impact of COVID-19 was a recurring theme. In light of the financial challenges resulting from new Editors-in-Chief, mid-pandemic, the Committee agreed to extend the term 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 a 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 that aims 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’ data sharing and preprint policies, and more innovations are planned going forwards.

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Online Learning versus classroom learning: Questioning who learns what
Harry J Witchel
Brighton and Sussex Medical School, UK
Kenneth Langlands
University of Wolverhampton, UK
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Christopher Torrens
Royal College of Surgeons in Ireland, Dublin
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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 recording the knowledge tested by multiple choice questions (MCQs) without attending traditional lectures at all! 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 all 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-related recognition learning, or live learning may only add to subtle but important conceptual learning, rather than rote learning. In that case, 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 recognize 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 that compromise additional activities (beyond passively listening or reading), in which the student formulates their own cognitions; students 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 the question, live lectures can educate on conceptual learning, whereas lecture capture can lead to video screencasts, which seem 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 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. 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 motivated 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.3,4

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 experiences or data would we need to determine that we are on the right track? How and where should 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
Future Physiology 2020 was run entirely online, development workshops.

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 organize 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 organizing 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.

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

To transform the meeting into a virtual experience, we used three new software platforms (Zoom, NetworkTables and Kubefy’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 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.

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.

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.

“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”

Cristiana Bercea
Francesco Tamagnini
Monica Trondrud
Ben Blesdale
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 at 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, or 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 changing climate: the interdependence between physiology, behaviour and the environment.”

Another talk I attended was entitled “Human thermo-regulation: Can We Beat The Heat?” presented by Emily Watkins from the University of Roehampton. This talk 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 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 off 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.

Massa Svent
Winner of Michael J Renne 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 Renne 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 Burligh
  University of the West of Scotland, UK
- 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
- Sarah Miller
  University of Nottingham, UK
From inclusive learning to “the way” to teach and assess during the COVID-19 pandemic

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.

Online tools for teaching

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Below we 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 then, that we 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 the 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 on 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 have the funds 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 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 is usually uploaded and accessed anytime from anywhere. LMS also allows staff to monitor students’ attendance and engagement, while the examiners can 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 LMSs 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 automated marking if required) and feedback can be provided as text, “quick marks” as well as verbally recorded. Upload of marking is 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 wider 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 exams 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
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. The mental wellbeing of many students and staff, with some feeling isolated and cut off from their daily routines that motivated their learning. While not designed exclusively for teaching and learning, MS Teams is being widely used by HE to enable seamless running of 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 chat functions. 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, 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” generation 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.

**Marc Demolder**

**University of Antwerp, Belgium**

**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 basic exercise physiology and echocardiography to home exams which are often 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 Lts 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.

**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 Excel data for further analysis and reporting by the students at home.

**How did the online-teaching platform Lts 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 - Lab Tutor - 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.
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.

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 is not available. However, each lab was 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 staff 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. ECG 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 far the next academic year, the way of teaching surely opens new perspectives.

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

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 ADiInstruments 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.

• 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 biology, anatomy and physiology classes at the University of Antwerp in Belgium. Students get hands-on experience and gain deeper scientific knowledge, with exercises ranging from recording nerve activity to analysing echocardiographs to exercise physiology experiments.
Recognition for education and teachers in universities

Has anything changed in the last 6 years?

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 dearth of 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. It aimed to examine 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 biosciences/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 evenly 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.

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 only teaching 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 5 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 this survey considered that the promotion criteria on a teaching-focused pathway are harder to achieve than (for achievement in) research or discipline focused 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 conferenced 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

References

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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).
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.

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 (52/239) 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.

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 practices 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.

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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


Homeostatic teaching
Unmasking the beauty of physiology

“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 immunophysicologist
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 students 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 & Hsu, 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 a metabolic product, but also a vasodilator, an oxygen unloader (the Bohr effect), the major ventilatory 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 pooping” events share common epithelial pathways to handle their luminal contents (Cheng & Hoo, 2019).

The beauty and wisdom of the body are also seen in the discernment and priority given to...
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. The beauty of physiology is masked.

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 ‘Di Darling”. My students homeostatically moved the lyrics to Justin Bieber’s uptown tune!

The IMSQP 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 IMSQP 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 Ratchail Chen Kit Yi and Wong Zhu Sh, and the script by yours truly Dr CH Cheng (Fig. 1).

The immense interest in the IMSQP 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 IMSQP 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 Klubunde, Kim Barrett, Susan Barman, Walter Baron, Susan Wray, David Eisner and Dee Silverthorn. Robert Carroll was to be the invited Refresher speaker at the “coronated” 18th IMSQP.

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

The IMSQP has provided a unique, invaluable global sample of students, all responding to the same set of Physiology questions. The analysis of the IMSQP 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 Narva 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).

References


To be continued

Precisely, an example is the sodium/calcium exchanger in your cardiac muscles.

Oh, the influx sodium, efflux calcium exchange during diastole.

Won’t forget Dr XCheng, your name reminds me of this membrane event!
Using superheroes to communicate science

Using superheroes to communicate science

Batman to brain and back again

Using superheroes to communicate science

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?

Don't misunderstand me. Much of my work focuses on rehabilitation applications of neuroscience discoveries to help people and 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 we’re saying what we want to say, but 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,
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 talking 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 how about 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.

A punch is still a punch as time goes by

As far as I, 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 physician, and a science educator. It takes effort and time and a little desire to help. But as I’ve written elsewhere (Zehr 2006, 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 effectivelly 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 greater 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 the best we can. 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.

Further Reading

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
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 09:00 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 native students is not always enhancing participation. 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 forget to record students names. 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 using old microphones and signed up for an online course about intuitive teaching.

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 screen cast, podcast, manage webinars and even make animations. Pheew!

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 their energy, enthusiasm, and 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 alternative solutions to courses that normally require hands-on activities and my sister for her great encouragement. All in all, we are managing just fine.

Further reading


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 I have benefited from such a focused 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 universities 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 & Scher, 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 therefore ensure our 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 & Scher, 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 materials. It 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 (Llt 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, experienced 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=Q11Yx8BvBjI). Did you know that song 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 that 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 endeavours (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!

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42 Physiology News / Summer 2020 / Issue 119 https://doi.org/10.36866/pn.119.42

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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. Teaching physiology, I am 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 colleagues, collaborators, 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 how science educators teach a physiology core concept 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 was a fictitious laboratory exercise that examines the cardiovascular responses to exercise in a sedentary individual, an endurance-trained athlete, an individual with quadruplegia, 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 quadruplegia has no sympathetic innervation of the heart (and 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 rather interesting “online” conversations about how the different subjects respond to exercise.

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

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 to rethink career education, 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 physiology and biomedical graduates, from my own experiences as a scientist and academic. I thus teamed up with a university careers educator to rethink career education, 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 core concept of the CareerEDGE model, that is, “to 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).

Supporting undergraduates 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 to rethink career education, 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 core concept of the CareerEDGE model, that is, “to 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).

References

Table 1: The core concepts of physiology (Michael & McFarland, 2011)

<table>
<thead>
<tr>
<th>Core concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causality</td>
<td>Living organisms are causal mechanisms (machines) whose functions are explainable by a description of the cause-and-effect relationships that are present.</td>
</tr>
<tr>
<td>Cell-cells communications</td>
<td>The function of the organism requires that cells pass information to one another to coordinate their activities. These processes include endocrine and neural signaling.</td>
</tr>
<tr>
<td>Cell membrane</td>
<td>Solute membranes are complex structures that determine what substances enter or leave the cell. They are essential for cell signaling, transport, and other processes.</td>
</tr>
<tr>
<td>Cell theory</td>
<td>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.</td>
</tr>
<tr>
<td>Energy</td>
<td>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.</td>
</tr>
<tr>
<td>Evolution</td>
<td>The mechanisms of evolution act at many levels of organisation and result in adaptive changes that have produced the vast relationships between structure and function.</td>
</tr>
<tr>
<td>Flow down gradients</td>
<td>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.</td>
</tr>
<tr>
<td>Genes to proteins</td>
<td>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.</td>
</tr>
<tr>
<td>Homeostasis</td>
<td>The internal environment of the organism is actively maintained constant by the function of cells, tissue, and organs organised in negative feedback systems.</td>
</tr>
<tr>
<td>Interdependence</td>
<td>Cells, tissues, organs, and organ systems interact with one another (are dependent on the function of one another) to sustain life.</td>
</tr>
<tr>
<td>Levels of organisation</td>
<td>Understanding physiological functions requires understanding the behavior at every level of organisation from the molecular to the social.</td>
</tr>
<tr>
<td>Mass balance</td>
<td>The contents of any system or compartment in a system is determined by the inputs to and the outputs from that system or compartment.</td>
</tr>
<tr>
<td>Physics/chemistry</td>
<td>The functions of living organisms are explainable by the application of the laws of physics and chemistry.</td>
</tr>
<tr>
<td>Scientific reasoning</td>
<td>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.</td>
</tr>
<tr>
<td>Structure/function</td>
<td>The function of a cell, tissue, or organ is determined by its form. Structure and function (from the physical organisation from the molecular to the social.</td>
</tr>
</tbody>
</table>


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 experiences and professional development programs. These initiatives have been published and recognised with numerous teaching awards including our Otto Hutter Teaching Prize.
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 and 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 2018 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. 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 changing, 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 (constant-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 interactive (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.

Associate Professor Christian Moro is the Science lead of the Bond University Medical Program and a uroligical 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 (https://www.instagram.com/@physiologywithchristian) and YouTube (Physiology with Dr Christian) for physiology education.

References


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

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 HoloLenses, a head-mounted mixed reality device, to learn the physiology of the cardiovascular and pulmonary systems.
On 12 March, universities across Ireland were forced to close their doors. Today, while 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 had 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 students could freely ask questions and seek clarification about all aspects of course material thus ensuring the synthesis of the various concepts to be taken forward. Now, as our lecturers are making every effort to encourage us, students, to ask questions via email or discussion boards, many students, including myself, 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 papers. 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 environment, after all I have benefited from having more time in which I could truly grasp concepts and read background literature while delving into my understanding of topics. Pre-recorded lectures allowed me to take detailed, methodical notes, pausing the lectures to write and do a quick search at lost moments. 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 for us with our educational systems. As a student, I consider myself very lucky and privileged to have access to all of the technological devices essential to attaining 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 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.

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 that was now “how many words did you write?” I often struggled with the need to instantly clarify and to some extent was unaware of this fact, he asked me of what happened to Georg von Békésy after he received his Nobel Prize (because of 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, and then go up to take 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 Dary 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 recognition of the “set point” theory of temperature regulation where the balance between heat production and evaporative heat loss is not surprising. He considered the RCI theory as being a unifying theory, perhaps representing the functional unit in the constellations of all autonomic systems. He promoted this insightful idea religiously, to the extent that his colleagues even suggested creating 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, 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 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 theory,” was initially intended to be published as a book, but appeared as a special issue of the Journal of Thermoregulation (23, 143 – 258, 1998). It 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 work with, not least because of his sense of humour. In response to the invitation from the Chairmen for questions from the floor at the Climatic Group meeting, John’s retort was “More questions? I already told them everything I know”!

Obituary: John Bligh 1922 – 2020

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 Miljevic (Department of Automation, Biocybernetics, & Robotics, Jozef Stefan Institute, Ljubljana, Slovenia), who was John Bligh’s host, colleague, student, and most importantly - his friend.
but on calcium ion entry. Whether it was work but recent studies suggested it might of calcium channel inactivation. Nick had activated potassium currents by Nick and his by increased cellular calcium. This idea displaced the hypothesis that it was caused potassium permeability seen during rigor physiological conditions. The link to the high present in frog muscle membranes but it was had already shown that K<sub>calc</sub> channels Nick was intrigued by possible links between metabolic factors and the regulation of blood flow.

Establishing a physiological role for K<sub>calc</sub> 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 some apparatus 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. He wanted to add a ferret to his menagerie but his good-natured parents drew the line. He wanted to add a ferret to his menagerie but his good-natured parents drew the line. He wanted to add a ferret to his menagerie but his good-natured parents drew the line. He wanted to add a ferret to his menagerie but his good-natured parents drew the line. He wanted to add a ferret to his menagerie but his good-natured parents drew the line. He wanted to add a ferret to his menagerie but his good-natured parents drew the line. He wanted to add a ferret to his menagerie but his good-natured parents drew the line.
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