PROGRAMME AND ABSTRACT BOOK

CREATIVITY IN SCIENCE TEACHING

12–14 DECEMBER 2016
CHARLES DARWIN HOUSE,
LONDON, UK

SOCIETY FOR EXPERIMENTAL BIOLOGY

CREATIVITY IN SCIENCE TEACHING

ORGANISED BY:
PROF GRAHAM SCOTT
UNIVERSITY OF HULL, UNITED KINGDOM
DR SARA MARSHAM
NEWCASTLE UNIVERSITY, UNITED KINGDOM

DELEGATE INFORMATION

BADGES

Participants are required to wear name badges at all times for proof of registration, security purposes and catering identification.

CATERING

Lunch and refreshments during the symposium are included in your registration fee and will be served in the breakout area.

The conference dinner on **13 December** will be held at Kitchin N1, 8 Caledonia Street, Kings Cross, London, N1 9DZ. It is a 15 minute walk from Charles Darwin House and the closest tube station is Kings Cross/St Pancras.

CERTIFICATE OF ATTENDANCE

Delegates requiring a certificate of attendance should visit the SEB registration desk on their departure.

VENUE

Charles Darwin House,
12 Roger Street, London,
WC1N 2JU
Tel: +44 (0)207 685 2600

The scientific sessions will be taking place in the Charles Darwin Lecture Theatre on the ground floor. The poster session will be taking place in the breakout area.

LIABILITY

Neither the Society for Experimental Biology nor Charles Darwin House will accept responsibility for damage or injury to persons or property during the meeting. Participants are advised to arrange their own personal health and travel insurance.

PHOTOGRAPHY

No photographs are to be taken of the speakers and their slides during the symposium.

**Please note: The SEB will be taking photos during the event for promotional purposes. If you have any concerns, please visit the SEB registration desk.*

POSTER SESSION

The poster session will be taking place in the breakout area between **17:25 – 19:30** on **Monday 12 December 2016**. Poster presenters are invited to hang their poster on their arrival (Velcro will be provided) and are asked to remove their posters by **12:00** on **Wednesday 14 December**. Any posters left behind will be disposed of.

REGISTRATION

The registration desk will be open during the hours of the symposium and a SEB staff member will be on hand during the refreshment and lunch breaks should you require any assistance.

TWITTER

We're looking to increase the conversation at the meeting using Twitter so please get tweeting!
Follow the conversation **#SEBCST16**
SEB – **@SEBiology**

WI-FI INTERNET ACCESS

Internet access is available during the meeting and free of charge. The log in details are:
Network: **CDH**
Password: **time2work**

PROGRAMME

MONDAY 12 DECEMBER

14:00 REGISTRATION AND REFRESHMENTS

15:00
Welcome

Prof Graham Scott
(Teaching and Learning Convenor, SEB+)
Dr Sara Marsham
(Committee Member, SEB+)

CHAIR: PROF GRAHAM SCOTT

15:15
Prof Mark Langan
(Manchester Metropolitan University, United Kingdom)
Adult play and learning: is it time to grow up?
SEB+16.1

15:45
Dr Roy H J Erkens
(Maastricht University, Netherlands)
Education That Moves You: a standing approach to teaching and learning
SEB+16.2

16:05
Dr Pam Megaw
(James Cook University, Australia)
Instructor creativity in producing learning activities for a diverse cohort of first year anatomy and physiology students
SEB+16.3

16:25
Dr Lucy Tallents
(University of Oxford, United Kingdom)
Building ideas for student collaboration, together!
SEB+16.4

17:05
Discussion

17:20
End of day 1

17:25–19:30
Poster session and buffet dinner
Location: Breakout area

TUESDAY 13 DECEMBER

08:30 REGISTRATION

09:00
Welcome

Dr Sara Marsham
(Committee Member, SEB+)

CHAIR: DR PETER LUMSDEN

09:10
Dr George R Littlejohn
(University of Plymouth, United Kingdom)
Aesthetics and choice in microscope-based biology teaching and research
SEB+16.5

09:40
Dr Gemma Anderson
(Falmouth University, United Kingdom)
Drawing as a way of knowing in biology
SEB+16.6

10:10 REFRESHMENT BREAK

10:40
Dr Mark J Feltham
(Liverpool John Moores University, United Kingdom)
Drones, bones and mobile phones: maker education and creative learning in science
SEB+16.7

PROGRAMME

11:10
Dr John Wedgwood Clarke
(University of Hull, United Kingdom)
A poet in the lab: Creative writing and the biology student
SEB+16.8

11:40
Mr John R A Smith
(University of Westminster, United Kingdom)
Art/Science collaboration: life in a new light
SEB+16.9

12:00
Dr David E Whitworth
(Aberystwyth University, United Kingdom)
Beyond creation learning: enhancing students' creative self-efficacy
SEB+16.10

12:20 LUNCH

CHAIR: DR SARA MARSHAM

13:20
Dr Chris Willmott
(University of Leicester, United Kingdom)
Student-generated videos: an authentic assessment
SEB+16.11

13:50
Dr Pam Megaw
(James Cook University, Australia)
Student creativity in assessment of an anatomy and physiology subject: the digi-explanation
SEB+16.12

14:10
Prof Mark O Clements
(University of Lincoln, United Kingdom)
Unpredictable outcomes: when art and science collide
SEB+16.13

14:30 REFRESHMENT BREAK

15:00
Dr Peter Lumsden
(University of Central Lancashire, United Kingdom)
Staff find their creative spark through digital tools which increase student engagement
SEB+16.14

15:20
Ms Erin A McKenney
(Duke University, United States)
Student-centered course design leverages creativity for effective, enhanced education
SEB+16.15

15:40
Dr Anne M Tierney
(Edinburgh Napier University, United Kingdom)
You call THAT a big class? Teaching large biology classes creatively
SEB+16.16

16:00
End of day 2

18:30
Conference dinner
Location: Kitchin N1

WEDNESDAY 14 DECEMBER

08:45 REGISTRATION

09:00
Welcome

Prof Graham Scott
(Teaching and Learning Convenor, SEB+)

PROGRAMME

CHAIR: PROF GRAHAM SCOTT

09:10
Mrs Jane C Gurman
(Sheffield Hallam University, United Kingdom)
A creative approach to enabling student creativity in the Biosciences through an entrepreneurial challenge
SEB+16.17

09:30
Mr Nieky Van Veggel
(Writtle University College, United Kingdom)
Teaching animal nutrition through product development and design
SEB+16.18

09:50
Prof Norman J Jackson
(Creative Academic, United Kingdom)
Creativity and learning ecologies: what value does this idea have for higher education teaching and students' creative development and achievement?
SEB+16.19

10:10 REFRESHMENT BREAK

10:45
Summary discussion and action planning

12:00
Close of meeting

POSTER SESSION MONDAY 12 DECEMBER

Dr Samson O Ojo
(University of Ibadan, Nigeria)
Variations in levels of communication in conservation science among secondary school students in Ibadan, Nigeria
[SEB+16.20]

Dr Linda Ferrington
(Queen Margaret University, United Kingdom)
Using educational digital games to improve the engagement and performance of students in an undergraduate cell biology course
[SEB+16.21]

Dr Linda Ferrington
(Queen Margaret University, United Kingdom)
Can optional online quizzes increase student engagement, retention and performance in an undergraduate cell biology and physiology course?
[SEB+16.22]

Ms Valerie K Harris
(Arizona State University, United States)
Exploring cellular cooperation and cancer using rule-based art
[SEB+16.23]

Dr Irina Strizh
(Moscow State University, Russia)
Creativity in science teaching: be yourself and just create your own teaching program
[SEB+16.24]

Dr Sarah J Rayment
(Nottingham Trent University, United Kingdom)
Are multimedia resources an effective way to support bioscience laboratory learning?
[SEB+16.25]

Prof Zaure G Aytasheva
(Al-Farabi Kazakh National University, Kazakhstan)
Molecular biology in English at Kazakh universities: using mini-projects
[SEB+16.26]

Dr Ana D Caperta
(LEAF - Instituto Superior de Agronomia University of Lisbon, Portugal)
College Food Farming and Forestry (3), a platform for interdisciplinary education: nutritious seeds for a sustainable future
[SEB+16.27]

Dr Thomas P Howard
(Newcastle University, United Kingdom)
The PCR Simulator: Teaching software for design of experiments and statistical analysis
[SEB+16.28]

Dr Fadil Ghazi Alswedi
(Qadisiyah University, Iraq)
Advanced and supportive incomes to aid in student version of medical materials
[SEB+16.29]

CREATIVITY IN SCIENCE TEACHING

SEB+16.1 ADULT PLAY AND LEARNING: IS IT TIME TO GROW UP?

MONDAY 12 DECEMBER 2016 **15:15**

MARK LANGAN (MANCHESTER METROPOLITAN UNIVERSITY, UNITED KINGDOM)

@ M.LANGAN@MMU.AC.UK

The benefits of playful behaviour in childhood have been documented extensively, including extensive research for children's education. However, adult playfulness has been afforded much less attention. Some adult educators explicitly incorporate playfulness into the curriculum, suggesting it could be a valuable approach for teaching in higher education. As an ecologist who has evolved into an educational researcher, I will use this presentation to share some of my unformed ideas about adult play by taking a dip into the biological and pedagogical research.

SEB+16.2 EDUCATION THAT MOVES YOU: A STANDING APPROACH TO TEACHING AND LEARNING

MONDAY 12 DECEMBER 2016 **15:45**

ROY HJ ERKENS (MAASTRICHT SCIENCE PROGRAMME, MAASTRICHT UNIVERSITY, NETHERLANDS), NICOLAI MANIE (EDLAB MAASTRICHT UNIVERSITY, NETHERLANDS), HANS HCM SAVELBERG (FACULTY OF HEALTH MEDICINE AND LIFE SCIENCES, MAASTRICHT UNIVERSITY, NETHERLANDS)

@ ROY.ERKENS@MAASTRICHTUNIVERSITY.NL

The traditional university settings for learning and teaching are lecture halls and smaller tutorial rooms. These settings changed little over the past decades. The teaching style in these rooms is often characterised by physical inactivity for longer periods of time. Given what we nowadays know about the learning process we can wonder if this static environment is optimal for learning. At Maastricht University (The Netherlands) teaching is done in small groups of maximum 12 students using a Problem Based Learning approach. Students discuss the provided problems mostly sitting during two hour sessions. Teachers observe that during these sessions not all students contribute equally to the discussion and that discussions become less energetic towards the end. Both factors are detrimental to the learning process. The Education That Moves You (ETMY) project aims to turn the classroom into a more dynamic space to improve the learning experience of students. Two important dimensions of ETMY are that excellent education engages the student in their learning process and that physical activity has a stimulating effect on cognitive processes. As a radical change to the traditional all-sitting tutorials ETMY has experimented with all-standing education. Students are standing for two hours in class while working in a more dynamic setting on their scientific problems. Here we will present the first findings on this dynamic setup based on teacher and student evaluations. Furthermore, we will discuss how this approach impacts students´ learning experiences and how it leads to rethinking of common educational practices and learning spaces.

SEB+16.3 INSTRUCTOR CREATIVITY IN PRODUCING LEARNING ACTIVITIES FOR A DIVERSE COHORT OF FIRST YEAR ANATOMY AND PHYSIOLOGY STUDENTS

MONDAY 12 DECEMBER 2016 **16:05**

PAM MEGAW (JAMES COOK UNIVERSITY, AUSTRALIA), MONIKA ZIMANYI (JAMES COOK UNIVERSITY, AUSTRALIA), MARTIN VAN DER MEER (JAMES COOK UNIVERSITY, AUSTRALIA), KATHRYN MELDRUM (UNIVERSITY OF LANCASTER, UNITED KINGDOM)

@ P.MEGAW@SOTON.AC.UK

We co-teach first year anatomy and physiology to 320 allied health students studying 4 different programs (Occupational Therapy, Physiotherapy, Speech Pathology, and Sport and Exercise Science). The cohort is comprised of just over half first-in-family students, with diverse academic backgrounds, as evidenced by a broad range of university entrance scores (Australian Tertiary Admission Rank (ATAR) 99.95-35, with just under half of ATAR 87 or lower). Historically the subject has been characterised by student disengagement, and a high failure rate. As an initial strategy to address this issue, in 2015 we introduced activity-intensive workshops as part of flipped-classroom learning experiences. The activities were designed to increase visualization of concepts. The instructor needs both a solid understanding of the concept and a high degree creativity when designing these activities. For example, orange safety mesh was used to model the cell membrane for a role play on cellular transport processes and simple garden irrigation equipment used to simulate a nephron. Students also used a high degree of creativity in producing posters for case studies, which were utilised as another strategy to enhance student learning and engagement. Students were surveyed regarding their experiences in both 2015 and 2016. They were ambivalent about how useful the different activities were in helping understanding of concepts in 2015. In 2016 we increased the instruction around how the exercises should be utilised and this resulted in the students gaining much more satisfaction from the activities.

SEB+16.4 BUILDING IDEAS FOR STUDENT COLLABORATION, TOGETHER!

MONDAY 12 DECEMBER 2016 **16:25**

LUCY TALLENTS (UNIVERSITY OF OXFORD, UNITED KINGDOM)

@ LUCY.TALLENTS@LINACRE.OXON.ORG

Academic teaching can be a solitary pursuit, but with multi-disciplinary courses on the rise and digital tools offering ever more varied means of connecting and creating, we can anticipate more networked teaching and learning in the future. This hands-on interactive workshop will give you a taste of the energy and inventiveness that emerges from building learning activities together. You'll work in small teams to develop ideas for collaborative classroom-based learning activities. Using the combined experience of your team, you'll consider how to support your students to adopt more imaginative ways of reaching their learning objectives. What might students gain from being given the freedom to create? How might you need to adapt the feedback and/or assessment processes to encompass this creativity? Recognising that online learning gives students more choice about where and when they study, you'll reflect on how to adapt your classroom activity for a distance course. How might the learning environment (face-to-face versus online) affect the way you guide the activity, and the students' experience of it? By sending an ambassador to another team, you'll draw on wider expertise to fill knowledge gaps and refine your ideas. After reporting back to the room, we'll share the honed ideas online, forming a record for future reference and perhaps even a basis for future collaboration!

SEB+16.5 AESTHETICS AND CHOICE IN MICROSCOPE-BASED BIOLOGY TEACHING AND RESEARCH

TUESDAY 13 DECEMBER 2016 **09:10**

GEORGE R LITTLEJOHN (UNIVERSITY OF PLYMOUTH, UNITED KINGDOM)

@ GEORGE.LITTLEJOHN@PLYMOUTH.AC.UK

Science is a creative practice and that is reflected in the words we use to describe the best examples. The highest praise we can give to an experiment is to describe it as elegant or beautiful; to use the kind aesthetic language normally reserved for works of art. This talk will draw parallels between the production of images in the arts and biological imaging and discuss the roles experience and choice play in the production of images and how that experience may be creatively fostered in students.

SEB+16.6 DRAWING AS A WAY OF KNOWING IN BIOLOGY

TUESDAY 13 DECEMBER 2016 **09:40**

GEMMA ANDERSON (FALMOUTH UNIVERSITY, UNITED KINGDOM)

@ GEMMA.ANDERSON@NETWORK.RCA.AC.UK

This talk presents drawing as a way of knowing for art and science, as it has been cultivated in my own practice through the development and dissemination of drawing practices that extend understanding of, and engagement with, the diversity of natural form. The approach encompasses a set of methods that feed on each other and include interdisciplinary collaboration, museum collection study and participatory workshop design, often within the context of scientific institutions such as the Natural History Museum. Original artistic research led to the development of two interlinked bodies of artistic research and practice: Isomorphology, the observational study of the shared forms and symmetries of animal, mineral and vegetable species, and Isomorphogenesis, the systematic representation of dynamic form through drawing. As they were being developed, these practices have been shared with artists, natural scientists, students and the general public, to encourage their application and diffusion, through participatory workshops, and more traditional outputs such as conferences, publications and exhibitions. This way of working with drawing brings art and science together, by sharing a set of sensibilities and related methods with which the inquirer can reflect and understand the subject of investigation differently. To ground these ideas in concrete examples, I will focus on how this practice was shared as an experimental educational model through the Cornwall Morphology and Drawing Centre project and conclude by exploring some current research interests.

SEB+16.7 DRONES, BONES AND MOBILE PHONES: MAKER EDUCATION AND CREATIVE LEARNING IN SCIENCE

TUESDAY 13 DECEMBER 2016 **10:40**

MARK J FELTHAM (LIVERPOOL JOHN MOORES UNIVERSITY, UNITED KINGDOM), CAROLINE KEEP (FUTURE TECH STUDIO WARRINGTON, UNITED KINGDOM)

@ M.J.FELTHAM@LJMU.AC.UK

In the 21st century economy, science fiction technologies are becoming everyday realities and this new, knowledge and innovation driven economy requires, not only new skill sets but, an education system that focuses more on critical thinking, problem solving, communication, collaboration and initiation and less on knowledge acquisition and regurgitation. The idea that we need a paradigm shift in education is not new and it has long been recognised that at the heart of this shift lies a return to more creative, student centric ways of teaching and learning. The Maker Movement is a technological and creative learning revolution taking place around the world that has exciting implications for education. It focuses on hands-on learning by providing learning environments (Makerspaces) in which learners are given access to new tools and technology, such as 3D printing, robotics, microprocessors, wearable computing, e-textiles, "smart" materials, and programming languages to support the creation of tangible, physical artefacts. Such Maker Education (MakerEd) gives students opportunities to brainstorm, invent, design and build: and then time to fix mistakes, improve, test and improve again as part of their formal education and hence provides us with an exciting opportunity to develop new, flexible pedagogies in which the creativity of the student as hacker/maker can flourish. Here we report on, and showcase, a range of student MakerEd projects and signpost the wealth of opportunities for future development, cross-curricular collaboration, enterprise and community outreach.

SEB+16.8 A POET IN THE LAB: CREATIVE WRITING AND THE BIOLOGY STUDENT

TUESDAY 13 DECEMBER 2016 **11:10**

JOHN WEDGWOOD CLARKE (UNIVERSITY OF HULL, UNITED KINGDOM)

@ JOHN.CLARKE@HULL.AC.UK

Does a limpet have a 'tragic mouth' or an 'anterior, ventrally directed buccal cavity'? Or both, depending on who we're talking to? Does the starfish still contain uncharted territory? And how much depends on communicating the importance krill play in mixing the sediments between ocean layers. These are just a few of the questions I found myself considering as I worked with students on an aquatic zoology module while Leverhulme Artist in Residence at the University of Hull.

In this paper I'll consider the benefits of bringing a creative-writing perspective into the lab. I will argue that the techniques it offers enable the integration scientific study into the wider concerns of the individual student, and that by doing so, enhances both their 'ownership' of the material and their ability to communicate findings confidently and effectively.

Art and science, in their attentiveness to both material phenomena and their own interpretive processes, have shared much in common throughout their history. New poetic metaphors are made by connecting previously unrelated material, and scientific developments can occur when different, previously discrete disciplines, are allowed to intersect and share their different ways of conceptualising the world. I'll be offering some practical suggestions to help renew this old, open-minded and productive relationship.

SEB+16.9 ART/SCIENCE COLLABORATION: LIFE IN A NEW LIGHT

TUESDAY 13 DECEMBER 2016 **11:40**

JOHN R A SMITH (UNIVERSITY OF WESTMINSTER, UNITED KINGDOM), SARAH COLEMAN (UNIVERSITY OF WESTMINSTER, UNITED KINGDOM), PALLAVI RAMSAHYE (UNIVERSITY OF WESTMINSTER, UNITED KINGDOM)

@ SMITHJ1@WMIN.AC.UK

Art/Science Collaboration is an optional module at the University of Westminster. It uses student-centred, autonomous learning; tutors play facilitative roles. Students from various disciplines engage in skills exchange and peer teaching. Multidisciplinary teams form, researching and developing interdisciplinary project work. Learning outcomes and assessments focus on learning and development processes rather than products. A weekly three-hour timetabled session includes workshops, seminars, external visits, tutorials and presentations, supported by online resources including blogs and social media. Migration between and within physical, virtual and conceptual learning spaces is a disruptive but essential element of the pedagogic model. Hierarchies and received wisdom are challenged. Life in A New Light was a 2016 collaboration between students from BSc Biochemistry, BSc Photography and Digital Imaging Technologies and BA Photography. Visible light, ultraviolet and infrared photography and false colour imaging were employed to question the objectivity and subjectivity of vision, scientific imaging and visual representation; the impossibility of perceiving the world as it is perceived by another species became apparent. Throughout the project students overcame various challenges including access to specialist equipment; motivation, organisation and time management; and, not least, research ethics. Successful completion of the project required a creative approach throughout. The development of transferrable skills including problem solving, negotiation and communication is inherent in such a project but these are not taught; they are learnt through experience, supported by the structure of the module. This presentation is a collaborative exercise; a conversation between student and tutors; a manifestation of the ethos of Art/Science Collaboration.

SEB+16.10 BEYOND CREATION LEARNING: ENHANCING STUDENTS' CREATIVE SELF-EFFICACY

TUESDAY 13 DECEMBER 2016 **12:00**

DAVID E WHITWORTH (ABERYSTWYTH UNIVERSITY, UNITED KINGDOM), SIMON PAYNE (ABERYSTWYTH UNIVERSITY, UNITED KINGDOM)

@ DEW@ABER.AC.UK

Science graduates need to be creative, but there are problems in defining, developing and assessing their creativity. A demonstration of creativity requires the production of novelty, which should be assessed by or against that of peers. However a related phenomenon to creativity is 'creative self-efficacy', which is one's self-belief in producing creative outcomes, or how creative an individual believes themself to be.

We wished to identify aspects of the teaching environment that promote creative self-efficacy in students. To that end we deployed a laboratory practical activity, wherein students designed and implemented their own experimental protocols. The exercise was designed to provide a social, safe and well-scaffolded opportunity to innovate, with the fruits of that innovation not directly assessed (low-stake).

Students filled in a questionnaire at the beginning and end of the module, and responses were compared to control modules, where there were no overtly creative activities. Compared to the control modules, the 'creative' module significantly increased students' perceptions of their own creativity, and their perceptions of whether their degree schemes had increased their creativity. The exercise also significantly increased student's confidence in meeting scheme learning outcomes, for instance the ability to design their own experiments, and to work productively in an unfamiliar laboratory.

Somewhat surprisingly, even the most creative students were unable to accurately link their creative self-efficacy with assessment marks, implying that they had a poor understanding of the relationship between creativity and success, potentially due to a lack of creativity-related keywords in generic marking criteria.

SEB+16.11 STUDENT-GENERATED VIDEOS: AN AUTHENTIC ASSESSMENT

TUESDAY 13 DECEMBER 2016 **13:20**

CHRIS WILLMOTT (UNIVERSITY OF LEICESTER, UNITED KINGDOM)

@ CJRW2@LEICESTER.AC.UK

During this past decade, affordable cameras and the widespread availability of non-linear editing software have made it possible for everyone to become a film-maker. Since 2008, second-year Medical Biochemists have been asked to carry out an assessed assignment in which they work in teams to produce a 5 minute video on the science and ethics of a development in biomedicine. This activity has resulted in production of a substantial number of introductory films about a variety of contemporary issues. The best films are released via YouTube (www.youtube.com/BioethicsBytes) and embedded in a bioethics-focused website. In this way the students are bona fide producers of new resources for the wider community. Both the quality of the completed films, and feedback from the participants, indicate that this has been a successful means to enhance their engagement in an "authentic assessment" (that is to say, one where the real-world relevance is self-evident). This presentation will explain the rationale behind various aspects of the project and demonstrate how it could be readily adapted for use in learning about a broader range of topics.

SEB+16.12 STUDENT CREATIVITY IN ASSESSMENT OF AN ANATOMY AND PHYSIOLOGY SUBJECT: THE DIGI-EXPLANATION

TUESDAY 13 DECEMBER 2016 **13:50**

PAM MEGAW (JAMES COOK UNIVERSITY, AUSTRALIA), RYAN HARRIS (JAMES COOK UNIVERSITY, AUSTRALIA), MARTIN VAN DER MEER (JAMES COOK UNIVERSITY, AUSTRALIA), MONIKA ZIMANYI (JAMES COOK UNIVERSITY, AUSTRALIA)

@ P.MEGAW@SOTON.AC.UK

We co-teach first year anatomy and physiology to 320 allied health students studying 4 different programs (Occupational Therapy, Physiotherapy, Speech Pathology, and Sport and Exercise Science). The cohort is comprised of just over half first-in-family students, with diverse academic backgrounds, as evidenced by a broad range of university entrance scores (Australian Tertiary Admission Rank (ATAR) 99.95-35, with just under half of ATAR 87 or lower). Historically the subject has been characterised by student disengagement, and a high failure rate. As part of a continuing strategy to address these issues, we included a group based digi-explanation (which involves the students making a video) in the assessment regime. Digi-explanations harness the skills and creativity students already possess in terms of being able to manipulate digital resources for social purposes. Groups of 4-6 students were tasked with producing a 3 minute video which explained a specific topic covered in the subject. The topics were tailored for the different cohorts to increase relevance of the exercise for the students. Instructional documentation was produced to assist the students in this process. Students could assemble a composite video from public domain materials, or film and produce an entirely original video. Most groups used a mix of public domain materials and original footage for their videos. Students were surveyed regarding their digi-explanation experiences and 75% of students found the exercise was useful for exploring their understanding of the material, and that it increased the relevance of the material to their degree.

SEB+16.13 UNPREDICTABLE OUTCOMES: WHEN ART AND SCIENCE COLLIDE

TUESDAY 13 DECEMBER 2016 **14:10**

MARK O CLEMENTS (UNIVERSITY OF LINCOLN, UNITED KINGDOM

@ MCLEMENTS@LINCOLN.AC.UK

Science is an innately creative subject, however, the traditional way the science curriculum is taught often only provides limited opportunities for students to explore their discipline creatively. So, what would happen if art and science students were given the freedom and space to work collaboratively on interdisciplinary projects? This presentation will answer that question, exploring the value and challenges of creating a space for art and science students to work together. It is based on observations captured during an art/science education and research project 'Broad Vision' which ran at the University of Westminster from 2012-2015. Examples of project work generated during the module will be used to illustrate how science students were challenged to view the world around them through a 'different lens', and through their collaboration with artist, found original ways to express their ideas freed from scientific conventions.

SEB+16.14 STAFF FIND THEIR CREATIVE SPARK THROUGH DIGITAL TOOLS WHICH INCREASE STUDENT ENGAGEMENT

TUESDAY 13 DECEMBER 2016 **15:00**

PETER LUMSDEN (UNIVERSITY OF CENTRAL LANCASHIRE, UNITED KINGDOM)

@ PJLUMSDEN@UCLAN.AC.UK

Student engagement is critical for learning to take place, yet all too often traditional teaching approaches fail to achieve this, with students being passive participants. Where efforts are made to engage a class, questioning being the most widely used approach, engagement is limited by social barriers, in particular, reluctance to put oneself forward in front of peers. At the same time, staff cite pressures of work, and the breadth of the curriculum, as barriers to their generating creative approaches/material which would increase engagement.

Technologies which allow students within a class to contribute anonymous responses to questions, and hence circumvent the social barriers to engagement, have been in existence for a number of years. These can be accessed through mobile devices, phones and tablets. To develop the competence of staff in using these applications, a series of hands-on workshops has been delivered to tutors in the schools of medicine, dentistry and pharmacy, providing guidance in the setting up and use of the interactive technologies Lumi viewpoint 'clickers'; polleverywhere.com; and MeeToo. All of these have plug-ins to Powerpoint, hence allowing staff to introduce interaction to their classes with minimal creation of new material.

Here I report on the creative teaching approaches that use of these tools has engendered, together with initial reactions from students. The nature of the engagement that results is also considered, whether it is physical, social, or cognitive, or a combination.

SEB+16.15 STUDENT-CENTERED COURSE DESIGN LEVERAGES CREATIVITY FOR EFFECTIVE, ENHANCED EDUCATION

TUESDAY 13 DECEMBER 2016 **15:20**

ERIN A MCKENNEY (DUKE UNIVERSITY, UNITED STATES)

@ ERINAMCK@GMAIL.COM

Inquiry-based teaching encourages creativity through open-ended discussion, problem-solving, and experimental design. I designed a microbiome research curriculum to cultivate critical thinking through active learning and to expose students to current techniques and paradigms to foster practicing scientists. Students evaluated published articles, assimilated complex and/or abstract concepts by completing hands-on activities, and applied principles of microbiome ecology by designing original research projects. Students first completed a series of "jigsaw exercises" to survey the existing literature. Jigsaw exercises enabled students to scaffold new material by promoting peer-led discussion of several research articles concurrently. I encouraged students to draw a "big picture" conceptual diagram to visually synthesize the major points from each paper, which we discussed together at the end of each class. I punctuated the semester with hands-on activities designed to make abstract concepts more tangible. For example, students drew tiles from a word game (i.e. Scrabble) and graphed the cumulative new "species" encountered with each sampling effort to explore the relationship between community structure, sample size, and rarefaction. After establishing the rules of microbiome ecology, students designed novel research projects to investigate a specific microbial community or phenomenon of personal interest. In this way, student-driven research provides a formal framework to promote creativity in tandem with cultivating scientific practices. One student commented that there was "more intellectual freedom in this course than is typical of an undergraduate course so I feel like I was more engaged in learning."

SEB+16.16 YOU CALL THAT A BIG CLASS? TEACHING LARGE BIOLOGY CLASSES CREATIVELY

TUESDAY 13 DECEMBER 2016 **15:40**

ANNE M TIERNEY (EDINBURGH NAPIER UNIVERSITY, UNITED KINGDOM)

@ A.TIERNEY@NAPIER.AC.UK

The massification of higher education has resulted in large undergraduate classes, which may be seen as impersonal and isolating. Especially in first year, this may impact negatively on retention and progression rates. However, there are ways to make large undergraduate biology classes seem friendlier and more accommodating, resulting in a more cohesive group. This paper draws on the author's two decades' experience with large first year biology courses in the UK and New Zealand, offering suggestions on how to make large undergraduate classes more manageable and student-friendly places to be.

SEB+16.17 A CREATIVE APPROACH TO ENABLING STUDENT CREATIVITY IN THE BIOSCIENCES THROUGH AN ENTREPRENEURIAL CHALLENGE

WEDNESDAY 14 DECEMBER 2016 **09:10**

JANE C GURMAN (SHEFFIELD HALLAM UNIVERSITY, UNITED KINGDOM), SUSAN CAMPBELL (SHEFFIELD HALLAM UNIVERSITY, UNITED KINGDOM)

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Creativity can be low on the agenda for first year semester 1 laboratories where the focus tends to embed the basics, technically and safely: here we show how the artistic talents of students can be used positively within the lab setting. After years of the Apprentice and Dragons Den we produced a group work exercise where a simple enzymatic reaction was adapted to mimic a test in an industrial scenario. The student groups must take the basic protocol and transform it into one suitable for use as a commercial kit. Students take on the roles found in a company e.g. advertising and marketing director and, in a time limited, lab based experience, they must produce a working kit. They make a suitably decorated presentation box, insert, instructions, quality control and health and safety information. Student groups present in a Dragon's Den like environment where they can be randomly challenged on the financial projections, marketing and advertising strategy, health and safety policy, or risk analysis. Students are asked to personally reflect on group work, how they can articulate their understanding of entrepreneurship and commercial enterprise to a future employer and the role of creativity. We show that students respond positively to this type of work and gain from the creative aspects expected of the task and extend their skill base while seeing that the creative mind in science also encompasses that from

SEB+16.18 TEACHING ANIMAL NUTRITION THROUGH PRODUCT DEVELOPMENT AND DESIGN

WEDNESDAY 14 DECEMBER 2016 **09:30**

NIEKY VAN VEGGEL (WRITTLE UNIVERSITY COLLEGE, UNITED KINGDOM), TRACEY COOP (WRITTLE UNIVERSITY COLLEGE, UNITED KINGDOM), ROSA VERWIJS (WRITTLE UNIVERSITY COLLEGE, UNITED KINGDOM)

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Students enrolled on Veterinary Physiotherapy, Animal Therapy or HE Equine courses at Writtle University College share an introductory animal nutrition module in the second semester of their first year. In order to encourage development of both subject-related and transferrable skills in their curriculum, this module includes coursework which asks the students to analyse a new animal feed in the laboratory, after which they are required to design a package and a commercial video for this product. This was a group exercise.

The assessment was supported by lectures on nutrition for various life-stages in dogs and horses and legal requirements for packaging, lab practical sessions to help understand the nutritional values, and workshops to support the design process and use of various software packages involved in video editing. At the end of the semester, student groups were asked to present their commercial video, submit a hard copy of their package and were questioned on various nutritional aspects of their product. They received peer feedback and staff feedback on their work, covering both product design and subject-specific matter.

Student feedback on this assignment was positive. They enjoyed the opportunity to be creative and demonstrate their understanding through product design. Some students went as far as to role-play their commercial video or create a 3D model a feed package. There was a good spread of marks, and staff feedback was very positive.

SEB+16.19 CREATIVITY & LEARNING ECOLOGIES: WHAT VALUE DOES THIS IDEA HAVE FOR HIGHER EDUCATION TEACHING AND STUDENTS' CREATIVE DEVELOPMENT AND ACHIEVEMENT?

WEDNESDAY 14 DECEMBER 2016 **09:50**

NORMAN J JACKSON (CREATIVE ACADEMIC, UNITED KINGDOM)

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Applying the idea of ecology to learning, personal development and achievement is an attempt to view a person their purposes, ambitions, goals, interests, needs and circumstances, and the social and physical relationships with the world they inhabit, as inseparable and interdependent. Our ecologies for learning and achieving are also the means by which our creativity emerges from the particular circumstances of our life e.g. a higher education programme.

My talk will introduce the idea and present an explanatory model, illustrate the idea using a student's higher education experience to show how the concept can be used to understand their opportunities for creative development and achievement, and consider the relevance and value of the idea for higher education teachers who want to encourage and enable their students to use their creativity.

POSTER SESSION MONDAY 12 DECEMBER

SEB+16.20 VARIATIONS IN LEVELS OF COMMUNICATION IN CONSERVATION SCIENCE AMONG SECONDARY SCHOOL STUDENTS IN IBADAN, NIGERIA

MONDAY 12 DECEMBER 2016

SAMSON O OJO (UNIVERSITY OF IBADAN, NIGERIA)

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A total of 900 students from 24 schools were survey using open-ended questionnaires and randomly administered in Ibadan Metropolis. Students monitoring and evaluation was also conducted insitu. Most conservation questions have been designed to attempt to develop and implement monitoring and evaluation systems, often with mixed results. One problem seems to be that organizations are trying to build their systems from scratch, overlooking lessons learned from the many efforts to develop useful and practical monitoring and evaluation approaches. About 67% of the respondents have a good knowledge about conservation. Means of communications involved TV (45%), magazines (15%), Internet (14%), and school subjects (26%) respectively. Subject combination choice 45.3±056 was a major linkage factor discovered, 69% of the respondents were male students suggesting their level of inquisitiveness. Conservation community should continue support of collaborative initiatives to improve monitoring and evaluation, establish clear definitions of commonly used terms, clarify monitoring and evaluation strategies.

SEB+16.21 USING EDUCATIONAL DIGITAL GAMES TO IMPROVE THE ENGAGEMENT AND PERFORMANCE OF STUDENTS IN AN UNDERGRADUATE CELL BIOLOGY COURSE

MONDAY 12 DECEMBER 2016

LINDA FERRINGTON (QUEEN MARGARET UNIVERSITY, UNITED KINGDOM), MELANIE STEFAN (UNIVERSITY OF EDINBURGH, UNITED KINGDOM), SZU-HAN WANG (UNIVERSITY OF EDINBURGH, UNITED KINGDOM), KAREN MEYER (ABERTAY UNIVERSITY, UNITED KINGDOM)

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Using interactive activities to engage students is favoured over long-established objectivist teaching approaches. Technology features prominently in students lifestyles through use of social media, online gaming and other online multimedia; this playful aspect of technology could be harnessed to support teaching and learning. Results from game-based learning are promising but suffer from poor design of both game and research. We aim to test whether a digital game can improve student engagement and performance in a first year, undergraduate cell biology and human physiology module. The game design incorporates mental representations of course material (mental schema), which can improve learning clarity, and systemic rehearsal, a key method for lengthening memory retention, hypothesised to enable effective knowledge consolidation.

Students (n~180) will be randomly assigned to play the game, or complete an appropriate control task. Data collection will include; students' performance in course content knowledge tests and final examinations; in–game analytics on students' game engagement; interviews/focus groups to assess attitudes and value judgements of the game. The impact of the game will therefore be measured in terms of level of engagement with course material and overall course performance.

This represents a unique interdisciplinary project combining experts in Cell Biology, Game Development, Psychology and Education to provide an interactive computer tool to facilitate learning. Short term goals involve developing a prototype, determining its benefit in a single institution and disseminating outcomes. Long-term goals are to expand the learning content, making it widely available and benefiting the wider education community.

SEB+16.22 CAN OPTIONAL ONLINE QUIZZES INCREASE STUDENT ENGAGEMENT,RETENTION AND PERFORMANCE IN AN UNDERGRADUATE CELL BIOLOGY AND PHYSIOLOGY COURSE?

MONDAY 12 DECEMBER 2016

LINDA FERRINGTON (QUEEN MARGARET UNIVERSITY, UNITED KINGDOM), MELANIE STEFAN (QUEEN MARGARET UNIVERSITY, UNITED KINGDOM), CALUM MCMULLEN (QUEEN MARGARET UNIVERSITY, UNITED KINGDOM), SZU-HAN WANG (EDINBURGH UNIVERSITY, UNITED KINGDOM), COLIN D ETCHELLS (UNITED KINGDOM)

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Some university students fail to engage with their learning from an early stage for multiple reasons. One of the critical reasons is academic challenge, which includes the difficulty to conceptualize complex information covered in classes and retain the information. Based on learning theory, retrieval of learnt materials can engage a second opportunity to consolidate the memory, and the use of tests has been shown to be an effective tool to engage the retrieval process and help to identify learning gaps. We hypothesize that using carefully designed, optional, online quizzes which utilize key concepts from course material can effectively remind students what they learn and improve learning outcomes, such as engagement, retention and performance in a first year, undergraduate cell biology and physiology module.

Highly visual quizzes are developed from lectures which all students (n~180) attend and students are directed to complete quizzes following each lecture. Each quiz question is time stamped, resulting in collection of data on time spent completing the quiz and time spent to complete each question. Number of individual attempts at each quiz is also recorded, thus a pattern of engagement with the material can be tracked. Students complete a final exam incorporating material from all lectures/quizzes across the semester, and online quiz data will be correlated with exam scores.

In the short-term this study aims to improve student engagement and performance within a single module; longer-term goals are to expand the learning context to other modules and institutions, and to improve retention of first year students.

SEB+16.23 EXPLORING CELLULAR COOPERATION AND CANCER USING RULE-BASED ART

MONDAY 12 DECEMBER 2016

VALERIE K HARRIS (ARIZONA STATE UNIVERSITY, UNITED STATES)

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Teaching the science of cellular cooperation within complex biological tissues requires the synthesis of numerous abstract concepts derived from the fields of social psychology, evolutionary biology, histology, and economics. Successful understanding of the concepts within cellular cooperation requires a fundamental understanding of dynamics at both a spatial and temporal level from the perspective of multiple independent actors. Using rule-based games and art to encourage collaborative engagement and discussion among interdisciplinary students has shown to be extremely effective in promoting student understanding of abstract and multifaceted scientific topics. Students can also explore these topics by challenging the established rules of the games and experiencing the effects of changing parameters in real-time. Rule-based games and art have a low cost-of-entry and are easily integrated into existing classroom schemas and as such, they represent a valuable tool that can supplement traditional pedagogical methods.

SEB+16.24 CREATIVITY IN SCIENCE TEACHING: BE YOURSELF AND JUST CREATE YOUR OWN TEACHING PROGRAM

MONDAY 12 DECEMBER 2016

IRINA STRIZH (MOSCOW STATE UNIVERSITY, RUSSIA)

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We do have many knowledge and examples from Famous Teachers and Researchers in Physics, Math, Biology and Social and Psychological sciences as well how to promote students, teach them better and encourage them as well. We also have a plenty of textbooks that should support students to learn better. We do follow these recommendations. Last years fancy and easy teaching via Internet became very popular. Teaching "like a clown" also was encouraged some years ago. So, classical readers and researchers were forced to provide "paid educational services" for students who wasn't engaging in the education at all. Everybody has been tried to make educational process better, but sometimes there were no any success. It's became not interesting for the clever students, not for the encouraged teachers, readers and scientists, neither for the not engaged students also. Why? The problem is not in students or teachers, not in the books, but in the teaching programs that have been approved about twenty or even more years ago and that got to be followed still nowadays and everyone got to follow old programs. We must to introduce new courses, with new aims and goals for modern students to force them to be creative and knowledgeable in any biological discipline that they want to be involved in. Creativity in Science teaching - in my opinion, means to be yourself, to have your own point of view instead of following the "old school" program, and create students able to create the new paradigms in science.

SEB+16.25 ARE MULTIMEDIA RESOURCES AN EFFECTIVE WAY TO SUPPORT BIOSCIENCE LABORATORY LEARNING?

MONDAY 12 DECEMBER 2016

SARAH J RAYMENT (NOTTINGHAM TRENT UNIVERSITY, UNITED KINGDOM), JENNIFER EVANS (NOTTINGHAM TRENT UNIVERSITY, UNITED KINGDOM), SANDRA H KIRK (NOTTINGHAM TRENT UNIVERSITY, UNITED KINGDOM), SHIVA SIBRASUBRAMANIAM (NOTTINGHAM TRENT UNIVERSITY, UNITED KINGDOM), KAREN MOSS (NOTTINGHAM TRENT UNIVERSITY, UNITED KINGDOM)

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In bioscience education, laboratory teaching has many benefits for students: including development of practical skills and contextualisation of theoretical concepts. However practical classes can have a high cognitive load making learning difficult. Use of pre-lab sessions and exercises are known to reduce cognitive load through familiarisation, enhancing student learning. Having surveyed STEM subject modules in UK HE institutions, over half of responses within biosciences indicated they did use pre-laboratory sessions. In addition, pre-laboratory exercises were used to prepare students for bioscience laboratories in over half of the modules surveyed. A common pre-laboratory activity was use of multimedia resources such as videos. However, the data suggests that within bioscience, video was used less frequently than in other STEM subjects. A pilot project was undertaken using pre- and post- intervention surveys to investigate whether lab videos can be used to improve student lab learning (by reducing cognitive load) and therefore represent an effective form of pre-laboratory exercise. First year undergraduate bioscience and forensic biology students were given access to videos specifically tailored to their laboratory activities before, during and after their lab sessions. Preliminary data suggests that students found access to the videos ahead of the lab sessions useful for helping to familiarise themselves with expected tasks and, reported feeling more confident and had greater focus on the task at hand when in the lab. In addition, students were asked whether they thought the videos were useful to their learning and all students (n=10) either agreed or strongly agreed with this statement.

SEB+16.26 MOLECULAR BIOLOGY IN ENGLISH AT KAZAKH UNIVERSITIES: USING MINI-PROJECTS

MONDAY 12 DECEMBER 2016

ZAURE G AYTASHEVA (AL-FARABI KAZAKH NATIONAL UNIVERSITY, KAZAKHSTAN), ERIKA D DZHANGALINA (AL-FARABI KAZAKH NATIONAL UNIVERSITY, KAZAKHSTAN), BEIBITGUL A ZHUMABAYEVA (AL-FARABI KAZAKH NATIONAL UNIVERSITY, KAZAKHSTAN), GALIYA A SHALAKHMETOVA (AL-FARABI KAZAKH NATIONAL UNIVERSITY, KAZAKHSTAN)

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Molecular biology is essential course including topics on DNA structure and replication, transcription and RNA exit to cytoplasm, gene and genome stability, protein synthesis with following translocation of the product to intracellular organelles to be traced by a number of websites, software sources, online research communities and special journals. Current thesis shows how it is possible to attract students by means of inviting them to study molecular biology through the focus on the genome or an individual gene. Such offer would help the audience in acquiring molecular biology course besides experiencing initial skills in project management. Maximal scoring reaches 30 per student throughout the term. This maximum is therefore reachable only by an individual mini-project holder or the leader of a teams. However, there may be exclusions. For example, one of the projects submitted was dedicated to the topic "From Dinosaurs to Birds" presented by two students. It has impressed the instructor by a range of hypotheses and new views on evolutionary issues regarding inter-relationships of ancient dinosaurs and modern birds to be used in future lecturing on paleobiology, molecular biology, and developmental genetics. That is why both of the students were accessed equally high. Implication of mini-project approach to molecular biology and other biological courses is regarded to be perspective for profound teaching, fostering student's independent and team work as the ability to search and retrieve required databases, undertake small-scale comparative studies and put forward own hypotheses or far going conclusions.

SEB+16.27 COLLEGE FOOD FARMING AND FORESTRY (3), A PLATFORM FOR INTERDISCIPLINARY EDUCATION: NUTRITIOUS SEEDS FOR A SUSTAINABLE FUTURE

MONDAY 12 DECEMBER 2016

ANA D CAPERTA (LEAF – INSTITUTO SUPERIOR DE AGRONOMIA, UNIVERSITY OF LISBON, PORTUGAL), AMÃÉLIA BRANCO (ISEG – SCHOOL OF ECONOMICS AND MANAGEMENT, UNIVERSITY OF LISBON, PORTUGAL), IDALINA SARDINHA (ISEG – SCHOOL OF ECONOMICS AND MANAGEMENT, UNIVERSITY OF LISBON, PORTUGAL)

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The creation of collaborative platforms incorporating multi and interdisciplinary knowledge in life sciences may contribute to a holistic learning and social environmental awareness. The College Food Farming and Forestry (F3) – University of Lisbon, is the current operationalization of a platform of 12 diversified disciplines schools of high education created in 2015, which gathers professors, lecturers and researchers. Main College vision is to enhance students' competencies to think in inter and transdisciplinary way as well as creatively, responding to present challenges in biology, agro-food and forestry sciences. Legumes emerged as a topic to inter-schools seminars, debates and workshops promoting a dialog between several scientific areas. Given, legumes are an essential part of human diets and feed, with a strong cultural and historical relevance, and an economic value, they emerge as a topic for promoting a multidisciplinary dialogue. Those experiences when used for developing new strategies in both undergraduate and graduate biology teaching may produce novel synergies triggering creativity. As results of this gathering, creativity in pedagogical and research practices on life sciences will be illustrated and discussed.

SEB+16.28 THE PCR SIMULATOR: TEACHING SOFTWARE FOR DESIGN OF EXPERIMENTS AND STATISTICAL ANALYSIS

MONDAY 12 DECEMBER 2016

THOMAS P HOWARD (NEWCASTLE UNIVERSITY, UNITED KINGDOM), HAROLD M A FELLERMANN (NEWCASTLE UNIVERSITY, UNITED KINGDOM), BENJAMIN SHIRT-EDISS (NEWCASTLE UNIVERSITY, UNITED KINGDOM), MATTHEW LINSLEY (NEWCASTLE UNIVERSITY, UNITED KINGDOM), DENNIS LENDREM (NEWCASTLE UNIVERSITY, UNITED KINGDOM), NATALIO KRASNOGOR (NEWCASTLE UNIVERSITY, UNITED KINGDOM)

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Successfully delivering increasingly ambitious life sciences projects requires understanding and quantifying complex interacting systems. Design of Experiments (DOE) is a statistical method that provides a framework for efficient experimentation and analysis of such systems. DoE can minimise experimental effort whilst maximising knowledge gained. It efficiently separates real effects from experimental noise, can improve lab-to-lab reproducibility and uncover multifactorial interactions. It has many advantages over traditional methods of investigation, yet it is difficult for researchers to commit to a programme of multifactorial experimentation. Often we rely on varying one factor at a time, despite knowing the pitfalls of such an approach. We recently delivered the first of three annual workshops to motivate researchers to implement sequential, statistical techniques. Our approach was to recognise that experimental design and data analysis are related but different activities that are not taught equally. We sought to re-dress the balance using several methods, including real life experimentation, a webcast and group work. Here we discuss our use of virtual environments to simulate experimental systems. We developed a PCR simulator to allow participants to manipulate an experimental system familiar to biologists. Virtual experimentation allows the participant to easily compare the efficiencies of different experimental strategies. Moreover, the complex, interacting nature of the PCR simulator led to a high degree of competitiveness amongst participants to generate the highest DNA yield. Combined with the introduction to multifactorial experiments and data analyses presented in the workshop, this provided an unexpected motivation for participants to engage in advanced statistical methodologies.

SEB+16.29 ADVANCED AND SUPPORTIVE INCOMES TO AIDIN STUDENT VERSION OF MEDICAL MATERIALS

MONDAY 12 DECEMBER 2016

FADIL GHAZI ALSWEDI (QADISIYAH UNIVERSITY, IRAQ)

The study involved construction of more than 2 flexible, advanced and supportive incomes to aid in student version of medical materials. Firstly, a bank of intertwined medical descriptions, classifications and practice questions were created, and secondly the process of deriving, handling and manipulating medical data was planned using assessment software to allow students to negotiate the progression with immediate feedback carried at each step. These teaching and learning aids were made available to 60 level 4 UG medical students, to 40 PGT clinical medical students and were moreover used within proper classes. Outcomes were assessed by student feedback and by comparing grades for the medical component relative to other assessed features of the course as a means of controlling for different followers. The total grades improved by an average 15% across both associates while other assessed areas of the course persisted stable and provided validation for the targeted improvement in medical.

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- CLIMATE CHANGE AND AQUATIC LIFE: EFFECTS OF MULTIPLE DRIVERS, FROM MOLECULES TO POPULATIONS
- INTERACTIONS BETWEEN OSMOREGULATION AND ACID-BASE BALANCE IN AQUATIC ORGANISMS

BIOMECHANICS, PERFORMANCE AND BEHAVIOUR
- THE OBLIGATION OF ACTIVITY - HOW DO ANIMALS GET FIT, AND WHAT TAKES THEM OVER THE HILL?
- NATURALLY OCCURRING EXPERIMENTS: USING LIFE HISTORY EVENTS TO UNDERSTAND LOCOMOTOR PERFORMANCE
- CONSTRAINTS ON ADAPTATION AND PERFORMANCE: FROM INDIVIDUALS TO POPULATIONS

OTHER ANIMAL SESSIONS
- INTEGRATIVE MODELLING APPROACHES TO THE FISH CARDIO-RESPIRATORY SYSTEM UNDER ENVIRONMENTAL CHANGE - IS IT TIME FOR A FISH PHYSIOME INITIATIVE?
- BIOLOGICAL ADHESIVES: FROM BIOLOGY TO BIOMIMETICS

- OPEN BIOMECHANICS

- OPEN ANIMAL BIOLOGY

CROSS DISCIPLINARY - PLANT AND CELL BIOLOGY

CELL BIOLOGY
- PLANT CELL BIOLOGY
- CELL CYCLE AND THE CYTOSKELETON

MEMBRANES
- MEMBRANES
- LIFE AT THE INTERFACE: PLANT MEMBRANE-PROTEIN DYNAMICS/ INTERACTIONS DURING ENVIRONMENTAL CHANGE

MODELLING GROWTH
- CROP MODELS IMPROVEMENT WITH BIOLOGICAL KNOWLEDGE: WHICH, WHY, AND HOW?
- MODELLING CELLS
- MOLECULAR CONTROL OF PLANT GROWTH DURING ABIOTIC STRESS
- PHOTOSYNTHETIC RESPONSE TO A CHANGING ENVIRONMENT - TOWARDS SUSTAINABLE ENERGY PRODUCTION

OTHER JOINT PLANT-CELL SESSIONS
- GENERAL PLANT AND CELL BIOLOGY

CELL BIOLOGY

- IMAGING PATHOGENESIS
- PALAEOGENOMICS AND ANCIENT DNA

PLANT BIOLOGY

- CARNIVOROUS PLANTS - PHYSIOLOGY, ECOLOGY, AND EVOLUTION
- FROM GENOTYPE TO PHENOTYPE

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- EDUCATIONAL SESSIONS
- SCIENCE WITH IMPACT
- CAREERS DAY WORKSHOP FOR YOUNG RESEARCHERS

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