



International Union of Biochemistry
and Molecular Biology



מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

Federation of European
Biochemical Societies



New Horizons in Biochemistry & Molecular Biology Education

September 6-8, 2017

Weizmann Institute of Science, Israel



PROGRAM

Wednesday, September 6

08:00-09:00 **Registration**

09:00-10:15 **Opening Session**

Chair: **Israel Pecht**, Weizmann Institute of Science, Israel

09:00-09:15 **Opening and greetings**

09:15-10:15 **Bruce Alberts**, UCSF, USA

Plenary talk: Why science education is more important for the world than most scientists realize?

10:15-10:45 **Coffee Break**

10:45-12:45 **Session 1- Mini-symposium:
Key Knowledge and Skills for Molecular Life Scientists**

Chair: **Keith Elliott**, Manchester, UK

10:45-12:45 **Robin Wright**, University of Minnesota, USA

Scientific teaching: Strategies for applying education research to improve student engagement and performance in science classes

Frank Michelangeli, University of Birmingham, UK

Skills and key knowledge for the molecular life sciences degrees

Ross Nehm, Stony Brook, NY

Assessing key knowledge and skills in large lecture courses

Panel: **Robin Wright, Frank Michelangeli, Ross Nehm,
Jean-Luc Souciet, Winnie Eskild, Martin Stone**

12:45-14:00 **Lunch break and poster session**

Wednesday, September 6

14:00-16:00 **Parallel workshops**

14:00-16:00 **Workshop 1: Team based learning: Where the magic happens with group work that works!**

Ferhan Sagin, Turkey

📍 Gerhard M.J. Schmidt Lecture Hall

14:00-16:00 **Workshop 2: Lecture 3.0: Activating your lectures to engage all learners**

Robin Wright, University of Minnesota, USA

📍 Wix Auditorium, Jean Goldwurm 3D Room

14:00-16:00 **Workshop 3: Challenges for biochemistry and molecular biology education in the developing world**

Gracia Fe B. Yu, University of the Philippines, Manila, Philippines

Phillip Nagley, Monash University, Australia

📍 Presidential Reception Room

14:00-16:00 **Workshop 4: Publishing on education**

Chair: **Janet Macaulay**

Erin Dolan, CBE Life Sciences Education

Phillip Ortiz, BAMBED

Angel Herraez, FEBS Open-Bio

Luciane Mello, FEBS Open-Bio

Mia Ricci, Wiley

📍 The Helen and Martin Kimmel Hall

16:00-16:30 **Coffee Break**

Wednesday, September 6

16:30-18:30 **Session 2- Mini-symposium: Pre-University Biology Education**

Chair: **Anat Yarden**, Weizmann Institute of Science, Israel

16:30-18:30 **Ravit Golan Duncan**, Rutgers, USA

How learning progressions can inform the teaching and learning of molecular genetics

Jo Ellen Roseman, AAAS, USA

Toward high school biology: Helping students make sense of biological growth in terms of atom rearrangement and conservation

Gilmor Keshet, Ministry of Education, Israel

Overview on the teaching and learning of molecular biology in schools in Israel

Panel: Benefits and Challenges in teaching molecular biology to high school biology majors

Irit Sadeh, Ministry of Education, Israel

Nadira Sahaka, Al-Nahdah Al- Ahliyya Ateed School, Kfar Qara

Shiri-Rivka Masa, Hashalom high-school, Mitzpe-Ramon

Maya Mayrose, Hadash Holon in the spirit of HTH

Omer Choresh, Harishonim High School, Herzliya

19:00-22:00 **Trip to Jaffa including dinner**

Thursday, September 7

09:00-10:00 **Plenary session**

Chair: **Frank Michelangeli**, University of Chester, UK

09:00-10:00 **Robert Harris**, Karolinska, Sweden

Plenary talk: The future of the doctorate

10:00-10:30 **Coffee Break**

10:30-12:30 **Session 3- Mini-symposium: PhD training – New Prospects**

Chair: **Gul Guner Akdogan**, IEU School of Medicine, Turkey

10:30-12:30 **Michael Mulvany**, Aarhus University, Denmark

Trends in PhD training in Europe and North America

Suzanne Ortega, Council of Graduate Schools, USA

Preparing versatile scientists

Panel: **Michael Mulvany, Joel Sussman, Suzanne Ortega, Laszlo Dux, Beata Vertessy, Andy Wang**

Joel Sussman, Weizmann Institute of Science, Israel

Proteopedia: Interactive Tool to Communicate BioMolecular Concepts in 3D

12:30-14:00 **Lunch break**

13:00-14:00 **Round table discussion on "Teaching the physics behind cell biology in introductory level courses"**

Sam Safran and **Edit Yerushalmi**,
Weizmann Institute of Science, Israel

Thursday, September 7

14:00-16:00 **Parallel workshops**

14:00-16:00 **Workshop 5: On research integrity: Concept and principles**

Tien-Hsien Chang, Taiwan

📍 Presidential Reception Room

14:00-16:00 **Workshop 6: Enlightening macromolecular structure-function relationship with Proteopedia**

Joel Sussman, Weizmann Institute of Science, Israel

Angel Herraes, Spain

Jaime Prilusky, Weizmann Institute of Science, Israel

📍 The Feinberg Graduate School, Room B

14:00-16:00 **Workshop 7: Training the PhD trainers**

Robert Harris, Karolinska, Sweden

Michael Mulvany, Aarhus University, Denmark

📍 The Helen and Martin Kimmel Hall

14:00-16:00 **Workshop 8: Students as partners and peer learning: enhancing students' transferable skills during postgraduate training**

Lucian V. Mello, University of Liverpool, UK

📍 Wix Auditorium, Jean Goldwurm 3D Room

16:00-16:30 **Coffee Break**

Thursday, September 7

16:30-18:30 **Session 4- Mini-symposium: Research in Undergraduate Education**

Chair: **Janet Macaulay**, Monash University, Australia

16:30-18:30 **Erin Dolan**, University of Georgia, USA

When undergraduate research becomes the curriculum

Susan Rowland, University of Queensland, Australia

Escaping the silo: Science students in a novel work integrated learning program learn to transfer their skills and attributes to new contexts

Jane Saffell, St George's, University of London, UK

Research identity as a transformational educational resource

Panel: **Erin Dolan, Susan Rowland, Jane Saffell, Jerka Domic.**

19:00-21:00 **Gala Dinner**

Friday, September 8

09:00-10:30 **Session 5- Mini-symposium: Rethinking Postdoctoral Training**
Chair: **Michael Walsh**, University of Calgary

09:00-10:30 **Uri Alon**, Weizmann Institute of Science, Israel
Into the unknown, together

Beata G. Vertessy, Budapest University of Technology and Economics, Hungary

"There is a tide": Tasks and responsibilities of supervisors and young scientists during the postdoctoral stage

Panel: **Uri Alon, Beata Vertessy**

10:30-11:00 **Coffee Break**

11:00-12:00 **Plenary session**

Chair: **Joan Guinovart**, Institute for Research in Biomedicine, Barcelona, Spain

11:00-12:00 **Ada Yonath**, Weizmann Institute of Science, Israel
Next generation environmental friendly antibiotics

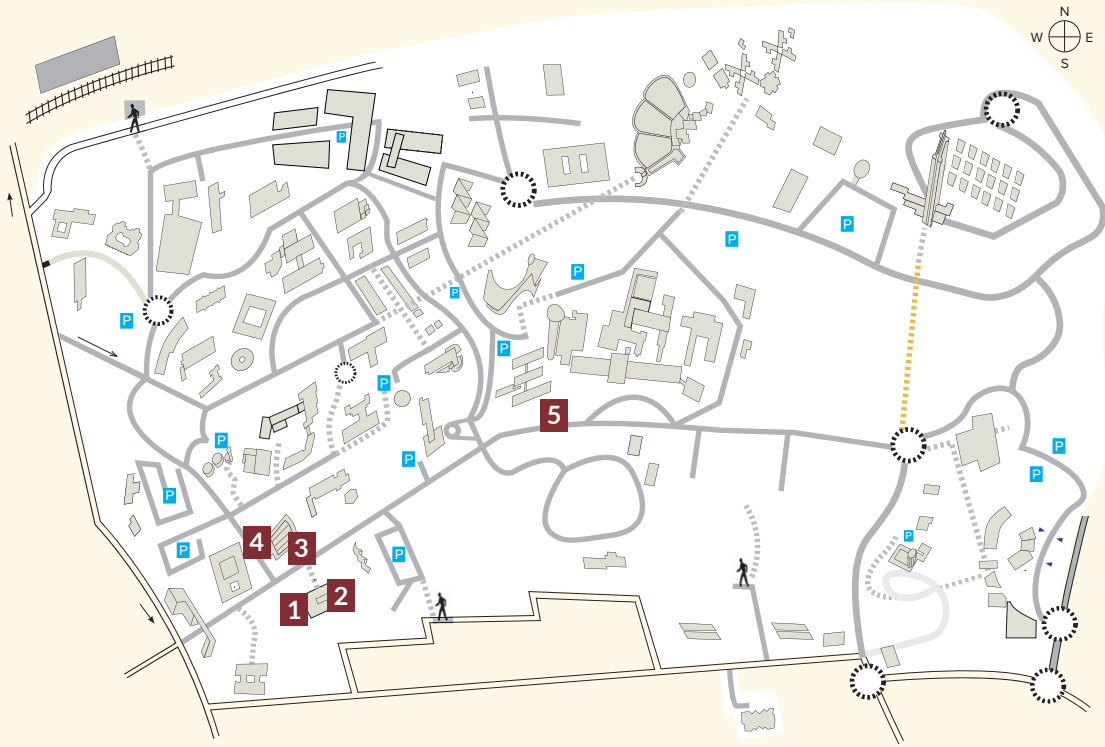
12:00-12:15 **Closing remarks**

Anat Yarden, Janet Macaulay, Gul Guner

12:15-13:00 **Lunch**

13:00-13:05 **Transportation to Jerusalem**

Campus Map



- 1** The Helen and Martin Kimmel Hall
- 2** Presidential Reception Room
- 3** Wix Auditorium
- 4** Jean Goldwurm 3D Visualization Theater
- 5** Feinberg Graduate School



PLENARY
TALKS

Why science education is more important for the world than most scientists realize

B. Alberts

Department of Biochemistry and Biophysics, University of California San Francisco;
San Francisco, CA, USA

The knowledge and the problem-solving skills of scientists are critical for every nation – no matter how rich or poor. Thus, for example, science has produced a deep understanding of the natural world that often enables an accurate prediction of the consequences of current actions on the future. In addition, every society needs the values of science: honesty, generosity, and an insistence on evidence while respecting all ideas and opinions regardless of their source of origin. To spread such values, science education needs to be redefined at all levels, with much less emphasis on the memorization of science facts and terms. Instead, we should be providing empowering experiences in problem-solving that take advantage of the curiosity that children bring to school and increase a student’s understanding of the world. Closely related changes in the introductory science courses in college, emphasizing “science as a way of knowing,” are the key to driving these reforms.

Even more broadly, we must focus on making a science out of education, which means creating continuously improving education systems at all levels, based on evidence-based analyses of how people learn and what works in actual classrooms. None of this can be expected to happen without the permanent involvement of each nation’s scientists, in close partnerships with science teachers at all levels.

The future of the doctorate

R. A. Harris

Karolinska Institutet / ORPHEUS. Sweden

The Doctoral degree is over 200 years old. During the last 20 years the sequential technical revolutions in research science have provided early stage researchers with unprecedented potential to explore the wonders of biomedicine and expand the boundaries of scientific knowledge. However, the increasing demands for innovation, publication excellence and global competition, together with the increasing cases of scientific fraud and worsening economic prospects for safe career development provide institutions with several new challenges. Historical, current and future perspectives of Doctoral training will be reflected on, and recommendations of how institutions can keep the Doctoral degree relevant in an ever-changing scientific and social landscape will be presented.

Next generation environmental friendly antibiotics

A. Yonath

Department of Structural Biology, Weizmann Institute of Science, Rehovot, Israel

Resistance to antibiotics and the spread of antibiotics' metabolites are severe problem in contemporary medicine. In addition to structures of complexes of eubacterial ribosomes with antibiotics paralyzing them that illuminated common pathways in the modes of antibiotics inhibitions, synergism, differentiation and resistance. Moreover, recent structures of ribosome from a multi-resistant pathogenic bacterium identified features that can account for species-specific diversity in infectious-diseases susceptibility. Careful analysis and comparisons to ribosomes from benign bacteria indicated novel paths for the design of environmental-friendly degradable antibiotics, which are species-specific,, thus preserving the microbiome.



MINI-
SYMPOSIA

When undergraduate research becomes the curriculum

E. Dolan

Department of Biochemistry and Molecular Biology, University of Georgia, Athens, GA, USA

Engaging undergraduates in the practices of science is seen as critical for preparing the next generation of scientists and a scientifically literate, global citizenry. Undergraduate research experiences (UREs) are seen as particularly compelling contexts for involving undergraduates in science practices because students are addressing research questions or problems of interest to the scientific community alongside practicing scientists. Yet, the traditional, apprenticeship structure of UREs, in which faculty or other scientists provide one-on-one supervision of an undergraduate researcher, limits the number of students who can participate in research. This has prompted faculty to develop scalable approaches to engaging undergraduates in research, called Course-based Undergraduate Research Experiences, or CUREs. This seminar will offer a definition of CUREs, describe what makes them distinctive from other learning experiences, outline the state of knowledge about CURE effectiveness, and highlight results from a study of the Freshman Research Initiative as a unique and highly impactful CURE model.

How learning progressions can inform the teaching and learning of molecular genetics

R. G. Duncan

Graduate School of Education & the School of Environmental and Biological Sciences
Rutgers, the State University of New Jersey, NJ, USA

Arguably the most significant changes in biology over the past century have been in molecular and cell biology. These amazing conceptual and technological advances raise the bar for scientific literacy in molecular biology. Schools and higher education institutions are thus tasked with finding ways to help students develop deep and meaningful understandings of molecular interactions underlying cell processes. Such knowledge must include mechanistic and generative understandings that can form the basis for students' future learning beyond schooling and throughout their life. However, learning and teaching molecular genetics is difficult and students struggle to understand core ideas in this domain. The scholarship on learning progression can inform education efforts in teaching and learning genetics. Learning progressions are developmental models of learning over extended periods of time that describe levels of progressively more sophisticated understandings in a domain. As such they can inform the conceptualization and design learning environments that can promote the learning of complex ideas (like those in molecular biology) across grades and grade bands. There are several learning progressions for genetics that together span elementary to twelfth grade. Research on these progressions provides much needed insights about student learning in genetics, in particular what are the productive intermediate ideas en route to normative understandings, and how can we support deep and meaningful learning in this domain.

What are the key skills and knowledge required of a graduate in the Molecular Life Sciences?

F. Michelangeli

Department of Biological Sciences, University of Chester, Chester, UK

In this presentation I will discuss the requirements of graduate level employers in both the bioscience and non-science sectors to key skills and knowledge they are looking for in their employees.

I will present the findings of several recent reports published by UK governmental and industry-representing bodies that highlight what employers really want from their employees. These reports also present data to indicate where perceived short comings are in their higher education training and suggest what areas need to be more fully addressed during the degree studies.

Finally I will present some findings from discussion groups of molecular bioscience academics from across Europe (via FEBS workshops) which focuses on more subject-specific knowledge and skills that are considered essential for a molecular bioscience degree programme. I will conclude with highlighting some new FEBS initiatives to help molecular bioscience educators develop their teaching of the subject.

Trends in PhD training in Europe and North America

M. J. Mulvany

Department of Biomedicine, Aarhus University, Aarhus, Denmark

The PhD degree was established in Berlin 200 years ago and has since spread across the whole world. While there is general agreement that the degree is awarded in recognition of successfully completed research training there have been significant differences in the way doctoral training programs have developed in different countries. There is, however, a clear global tendency to follow the programs currently used either in Continental Europe or in North America. To determine more clearly how European and North American PhD programs are both similar and different we have used a validated questionnaire to analyze biomedical PhD programs in four representative institutions at Karolinska Institutet, Medical U. Graz, U. Vanderbilt, and U. Manitoba. The analysis is based on 63 detailed questions concerning the research environment, outcomes, admission criteria, content of programs, supervising (US: *mentoring*), the PhD thesis, assessment of the thesis and PhD school structure. The results reveal that while there is considerable overlap in the aims and content of PhD programs there are also considerable differences regarding the structure of PhD programs, supervision and assessment of PhD theses. These differences will be presented to provide a foundation for discussion of their relative advantages and disadvantages, with a view to providing a platform for discussion of best practices.

Assessing key knowledge and skills in large lecture courses

R. H. Nehm

Institute of STEM Education, Stony Brook University, Stony Brook, NY, USA

Critical evaluation of claims using diverse forms of evidence is a hallmark of scientific inquiry. Claims central to biology learning relate to two overarching questions: (1) What do students know prior to instruction? and (2) What impacts has instruction produced (positive and negative)? In the United States, reconceptualization of the key knowledge and skills that students need to know has stimulated the development of new assessment tools and technologies for generating the forms of evidence necessary for rigorous analysis of student understanding and learning. This talk will provide an overview of assessment models for large lecture courses, illustrate examples of how assessment tools may be employed within these models, and examine case studies showing how these models and tools may be used to help instructors teaching large lecture classes. This framework can be used to determine what knowledge and skills students know prior to beginning a course and how student understanding changes as students progress in a course. Existing assessment resources, next-generation assessments, and new analytical approaches will be illustrated.

Preparing versatile scientists

S. Ortega

Council of Graduate Schools, Washington DC, USA

Changes in the global workforce, the way science is produced and disseminated, and shifting demographic patterns will all shape how STEM graduate education evolves throughout the 21st century. Dr. Ortega will address trends affecting how biomedical PhD students should be trained, with an emphasis on employment patterns and their implications for rethinking doctoral curricula and professional development programs.

Toward high school biology: Helping students make sense of biological growth in terms of atom rearrangement and conservation

J. E. Roseman

American Association for the Advancement of Science (AAAS), Washington DC, USA

As more and more biological phenomena come to be understood at the molecular level, biology instruction requires an understanding of basic chemical concepts. Studies show, however, that many students fail to grasp ideas about atom rearrangement and conservation during chemical reactions or the application of these ideas to biological systems. These difficulties persist into undergraduate and even graduate education. Textbooks available for pre-college education offer little help: more than a decade of studies of textbook quality indicate that currently available middle and high school curriculum materials are unlikely to help students develop the chemical foundation that is needed for building a molecular understanding of biology. In an attempt to address these issues, AAAS and BSCS partnered to design and test an eight-week replacement unit for 8th graders that develops and connects core chemistry and biochemistry ideas to help students build a strong conceptual foundation for their study of biology in high school and beyond. The *Toward High School Biology* unit, which is being published by NSTA Press this fall, engages students in (a) observing first hand and analyzing data related to physical and life science phenomena that explicitly target the ideas to be learned and address specific misconceptions and (b) using evidence, models, and science ideas to interpret and explain those phenomena in terms of atom rearrangement and conservation during chemical reactions. The presentation will describe and illustrate the unit's key features and show results of a study demonstrating the unit's promise in improving student understanding of the science ideas, reducing common misconceptions, and improving students' ability to use the science ideas to explain other related phenomena.

Escaping the silo: Science students in a novel work integrated learning program learn to transfer their skills and attributes to new contexts

S. Rowland

The University of Queensland, St Lucia, Australia

Work Integrated Learning (WIL) can help students unlock employment pathways and understand the world of work, but access to the science workplace often impedes WIL for Science students.

We addressed the problem of science workplace access by developing a novel WIL program that allows Science students to draw on their extant, non-science work for WIL. A pilot of this program ran in 2016 with 15 student participants who worked in a wide variety of different part-time jobs.

The structured program engaged students in reflective practice, peer mentoring, and literature readings. We aimed to increase the students' understanding of career management strategies, their career options, and their own employment-related strengths and weaknesses.

Despite concern from science colleagues that this program would not be appropriate for science students, the student feedback was overwhelmingly positive. The students' attitudes around presenting themselves as skilled professionals and engaging with the workplace were profoundly changed. In addition, the students were able to articulate the ways they engaged in high-level cognition during their program involvement. Perhaps most importantly, students described their processes for acquiring skills and attributes, and then transferring these to new contexts.

This program allows students to explore their identities as scientists and their immense value to the world of work outside the science silo. In this talk I will describe the curriculum, the evaluation of student gains, and the new learning progression for skill and attribute transfer that we have developed from student-provided evidence.

Research identity as a transformational educational resource

J. Saffell

St George's, University of London, London, UK

In this session, Jane will consider how a person's identity, experiences and ways of thinking are a resource with the power to transform learning. Drawing on insights gained as a neurobiology researcher, bioscience educator and leader, she will propose that sharing bioscientist identity with students, and the ways of thinking and practicing in the biosciences, is a teacher's most powerful resource. This will be illustrated by examples from Jane's practice such as whole-class mini-research project modules where students design their own experiments in groups, use of authentic assessments aligned with bioscientist practice, and sessions that show students behind the scenes to the sociopolitics of research and how knowledge is generated. She will outline the results of research into the value of these approaches for student development.

Enlightening macromolecular structure–function relationship with Proteopedia

J. L. Sussman¹, A. Herráez² & J. Prilusky³

¹Dept. of Structural Biology, Weizmann Institute of Science, Rehovot, Israel; ²Biochemistry and Molecular Biology, Department of Systems Biology, University of Alcalá, Alcalá de Henares (Madrid) E-28871, Spain; ³Life Science Core Facilities, Weizmann Institute of Science, Rehovot, Israel

Students and scientists are now able to access images of biomacromolecules both in journal and on the web. However, rather than just relying on text and 2D images to try to understand the function of biomacromolecular structures, it is more effective to be able to interact with a 3D model. To this effect, one can use a collaborative website called *Proteopedia*^{1,2} which is a **free resource** that links written information & 3D molecular models. This wiki web site, <http://proteopedia.org>, interactively displays structures of proteins, other biomacromolecules and supramolecular complexes. These displays are surrounded by descriptive text containing hyperlinks that change the appearance of the adjacent 3D structure to reflect the concepts

discussed in the text. This makes the complex structural information readily accessible and comprehensible, even to non-structural biologists. By authoring content in *Proteopedia*, one can easily create descriptions linked to the 3D structure, e.g., see a page on the ribosome structure/function, <http://proteopedia.org/w/Ribosome>. Pages can be viewed on PCs, MACs & LINUX computers and even on iPads via the molecular viewer JSmol³, e.g., a page on HIV-1 protease, http://proteopedia.org/w/HIV-1_protease. It is an invaluable tool for teaching and getting students excited about structural biology⁴.

Content is being added by Proteopedia's >3,500 users, in 60 different countries, in a dozen different languages, including Russian, Chinese, Arabic, and Hebrew: [http://proteopedia.org/w/1eve_\(Arabic\)](http://proteopedia.org/w/1eve_(Arabic)) & [http://proteopedia.org/w/1eve_\(Hebrew\)](http://proteopedia.org/w/1eve_(Hebrew)). A number of journals and book publishers are using *Proteopedia* to complement their printed and web papers via *Proteopedia*'s "Interactive 3D Complements" (I3DCs) - see, e.g., http://proteopedia.org/w/Journal:Molecular_Cell:1.

Scientists and students are invited to request a *Proteopedia* user account, at no cost, in order to edit existing pages and to create new ones, see: <http://proteopedia.org/w/Special:RequestAccount>.

References:

- 1 Hodis, E., Prilusky, J., Martz, E., Silman, I., Moulton, J. & Sussman, J. L. Proteopedia - a scientific 'wiki' bridging the rift between 3D structure and function of biomacromolecules. *Genome Biol* **9**, R121 (2008).
- 2 Prilusky, J., Hodis, E., Canner, D., Decatur, W. A., Oberholser, K., Martz, E., Berchanski, A., Harel, M. & Sussman, J. L. Proteopedia: A status report on the collaborative, 3D web-encyclopedia of proteins and other biomolecules. *J Struct Biol* **175**, 244-252 (2011).
- 3 Hanson, R. M., Prilusky, J., Renjian, Z., Nakane, T. & Sussman, J. L. JSmol and the Next-Generation Web-Based Representation of 3D Molecular Structure as Applied to Proteopedia. *Israel J. Chem* **53**, 207-216 (2013).
- 4 Herráez, A. Proteopedia: life in 3D, and teaching too [in Spanish]. *SEBBM J* **180**, 35-39 (2014) [English version: <http://bit.ly/P14paper>].

“There is a tide”: Tasks and responsibilities of supervisors and young scientists during the postdoctoral stage

B. G. Vértessy

Department of Applied Biotechnology, Budapest University of Technology and Economics (BME), and
Institute of Enzymology, RCNS, Hungarian Academy of Sciences, Budapest, Hungary

For young scientists, the relevant choice of adequate postdoctoral position will greatly contribute to building a successful research carrier. To quote the Bard: “There is a tide in the affairs of men. Which, taken at the flood, leads on to fortune”. How to ride the good tide is a complex problem wherein – in optimal cases - supervisors and the young scientists need to work together.

There are numerous issues to consider both on behalf of the young scientist who wishes to apply for a postdoctoral position as well as for the senior scientists (previous and future supervisors). First of all, it is of high importance that the supervisor recognizes the need of the young scientist to pursue independent research in a new field and in a different lab. The supervisor may facilitate choice of the cognate and relevant future host for the young scientist relying on their research network.

Also, the supervisor can help the young scientist by proposing new research fields and promoting possibilities in applications for postdoctoral studies, and may contribute greatly to all aspects listed below. However the major part and responsibilities lie with the young scientists themselves.

Among these responsibilities, some of the most important factors are the following:

- 1 Identification of interesting, currently yet open, and widely influential research areas
- 2 Finding a good postdoctoral position, with a relevant supervisor who is capable of building a mutually beneficial partnership with the young scientist. In this respect, carriers of previous post postdoctoral fellows in the lab will be highly revealing.
- 3 Working on publication skills. Publications are of course the very measure of the success of research studies, so care needs to be taken to proceed with these skills both in manuscript writing and conference presentations
- 4 Consideration of future possible carrier stages, choice and preparation.

The present talk will focus on a potential distribution of tasks and responsibilities between supervisors and young scientists before, during and right after the postdoctoral stage.

Strategies for applying education research to improve student engagement and performance in science classes

R. Wright

Department of Biology Teaching and Learning & Department of Genetics, Cell Biology, and Development
University of Minnesota, Saint Paul, MN, USA

Scientific teaching, using science to teach science, can solve classroom challenges, from student motivation to deep learning. This session will introduce key principles of scientific teaching: learning objectives, assessment, and inclusive teaching. We will then consider how findings in cognitive science require us to provide social and emotional support in science classrooms. We will end with a review of the Biochemistry and Molecular Biology learning outcomes developed by the American Society for Biochemistry and Molecular Biology, as formatted for the journal, *CourseSource*.



WORKSHOPS

On research integrity: Concept and principles

T-H. Chang

Institute of Biochemistry and Molecular Biology, Academia Sinica, national Yang Ming University, China

In recent years, the numbers of paper retractions and reports of scientific misconduct appear to have significantly increased. Several high-profile cases, such as the stem-cell research scandals, were extensively covered in mainstream media. While most graduate schools teach students to survey the scientific literature, identify meaningful scientific questions, and devise experiments to solve the problems, few offer systematic training to instill a keen sense of research integrity and to deal with allegations of scientific misconduct. This workshop seeks to address this important issue through an interactive process of presentation and discussion.

Students-as-partners and peer-learning: Enhancing students' transferable skills during postgraduate training

L. V. Mello

University of Liverpool, School of Life Sciences, Liverpool, UK

This workshop will discuss the development of transferable skills during PhD training. Teaching experience is increasingly becoming a key factor in determining the likelihood of employment following postgraduate study. However, there is a contrasting lack of experience provided throughout standard PhD training. A teaching intervention in a bioinformatics postgraduate module provided PhD students with the opportunity to act as co-producers of knowledge. The study was centred on the experiences PhD students who had previously taken the module and applied knowledge and skills gained from it to their own research. Students- as-partners and peer-learning were the educational approaches used supporting postgraduate students' skills development, further developing their career prospects. Importantly, this approach is not limited to bioinformatics, and has already been exploited in different contexts, such as research placements and statistics education. The workshop aims to provide a forum for participants to develop pedagogic ideas by exploring the transferability of this teaching intervention to their own disciplines.

Training the PhD trainers

M. Mulvany¹, R. A. Harris²

¹Department of Biomedicine, Aarhus University, Aarhus, Denmark; ²Karolinska Institutet / ORPHEUS, Sweden

This workshop will provide participants with the tools needed to set up supervisor training courses regarding the content of the courses and the manner in which they can be initiated. The workshop will therefore be of particular interest to those responsible for graduate schools, but will also provide insight to PIs about the manner in which they can optimize the supervision process. The workshop will be led by two facilitators and will be interactive with participants being assigned to discussion groups to discuss various aspects of supervisor training.

Publishing in Biology and Biochemistry Education

P. Ortiz (Biochemistry and Molecular Biology Education)¹, E. Dolan (CBE - Life Science Education)², A. Herráez (FEBS Open Bio)³, L. V. Mello (FEBS Open Bio)⁴

¹State University of New York, Albany, NY, USA; ²Department of Biochemistry and Molecular Biology, University of Georgia, Athens, GA, USA; ³Biochemistry and Molecular Biology, Department of Systems Biology, University of Alcalá, Alcalá de Henares, Madrid, Spain; ⁴University of Liverpool, Liverpool, UK

Panelled by the editors of *Biochemistry and Molecular Biology Education*, *CBE Life Science Education*, and *FEBS Open Bio*, this publication session will provide an overview of the submission, review, and publication processes of your education papers, including common reasons manuscripts are rejected at the editorial level or after peer review. Learn about features of education manuscripts that maximize the likelihood of a favourable review and the common mistakes that authors make. Become familiar with the manuscript review process at several education journals, with tools for tracking article use, and with strategies for maximizing discoverability of your publications.

Team-based learning: Where the magic happens with group work that works!

F. Sagin

Ege University, Medical Faculty, Department of Medical Biochemistry, Izmir, Turkey

Team-Based Learning™ (TBL) is an active learning strategy that focuses on application of knowledge through a structured sequence of events (pre-class individual work, teamwork and immediate feedback). It can be used in large classes without requiring additional faculty or other resources. This workshop is designed to introduce TBL to educators in life and health sciences. After a brief introduction of the principles of the technique, the participants will interactively experience all of the key components of the process: pre-assigned reading; team formation; individual and team readiness assessment and application exercises. During the session, enough time for questions and clarifications about this relatively new method will be allocated. Additional resources (guidelines and printed material) will also be provided to participants to enable them to shift their classroom from didactic to TBL.

Lecture 3.0: Activating your lectures to engage all learners

R. Wright

Department of Biology Teaching and Learning & Department of Genetics, Cell Biology, and Development
University of Minnesota, Saint Paul, MN, USA

Cognitive science and direct studies of student learning lead to the unavoidable conclusion that a lecture-only approach to teaching is not effective for most learners. Does this observation mean that we should throw out all of our excellent lectures and start over from scratch? In my experience, the answer is “No.” During this workshop, we will review some of the science behind learning. Using that foundation, you will work on transforming one of your lectures into a more engaging activity that incorporates active learning and assessment. By replicating this strategy in your other lectures, you can increase the overall impact of your teaching, as measured by increases in student learning. Please bring your laptop and a copy of the lecture presentation that you want to work on!

Research studies are conclusive and unavoidable: for most students, a lecture-centered teaching approach is not optimal for their learning. However, even faculty who accept the evidence are often puzzled by what to do instead of just lecturing. This workshop will help educators start with their lecture material, converting part of it into an activity that engages students and measures their understanding. This general approach can then be replicated in each lecture. By starting with adding just one activity per lecture, educators can experience the power of active learning and, if they choose, continue down that path to full implementation of active learning.

Participants will

Through participating in an interactive lecture about the science of learning, participants will examine key features of cognitive science and the implications for teaching. They will list and discuss active-learning strategies used in the mini-lecture. Then, working in small groups, they will focus on converting a 10-minute portion of one of their own lectures into an activity. They will receive peer feedback about their ideas and then revise/update their plans. Finally, they will create an action plan for how to replicate this process for their entire course

Challenges for biochemistry and molecular biology education in the developing world

G. F. B. Yu¹, P. Nagley*²

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In developing countries, science and technology is important for sustained economic growth. Biochemistry and Molecular Biology (BMB) underlies many aspects of medicine and agriculture. Nonetheless biochemistry is not popular for study in developing countries for two prime reasons: first, BMB is regarded as a field of study presenting great conceptual and practical obstacles; second, for qualified biochemists and molecular biologists who proceed to exhibit excellence in this field, job opportunities are scarce in the home country. What are the challenges that biochemical educationists face in the developing countries? In this Workshop forum, challenges posed by a series of factors common to developing countries (relating to various issues concerning government, institution, course structure, teachers and students) in teaching Biochemistry are to be addressed. In the Workshop, after presentation of several case studies, focused interactive small group discussions will be held to define the challenges and draw up practical recommendations for strategies in teaching BMB effectively in developing countries. Important outcomes of the Workshop will be the dissemination world-wide of the recommendations of the Workshop and the establishment of a directory of international BMB educationists that will constitute an ongoing vibrant network, to continue productive initiatives regarding BMB education in developing countries.



POSTERS

Challenges facing biochemistry and molecular biology education in Nigerian universities

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The challenges facing Biochemistry and Molecular Biology Education in Nigeria are enormous and typical across the education landscape in Nigeria Universities. These include: attitude of the students, duplication of Biochemistry Departments in Science and Health Science Colleges, student population beyond the admission benchmark, lack of professional bodies (graduates of other specialized courses are preferred in the workplace), dearth of equipment for cutting-edge research, unstable electricity to run experiments, dearth of power back-ups, inadequate supply of requisite reagents and chemicals for basic research, poor maintenance culture in terms of installation, (re-) calibration, quick-response servicing and repairs, non-presence of major manufacturers of research tools in the country, inadequate representation of such manufacturing companies, lack of local producers of molecular biology tools, difficulty in paying for shipment orders of equipment and consumables, delay in delivery of shipment orders and inventories of reagents and consumables (6 to 10 weeks post-payment), flux of unprofessional, political, businessmen-vendors who supply imitations and low-grade research materials, sharp practices in contract award and procurement processes, preponderance for joint laboratories within cognate departments, too many non-functional laboratories or work benches, failure of research leaders to deploy research grants appropriately. All these and more have frustrated genuine commitments to quality teaching and research. For instance, by the National University Commission benchmark, the basics of protein and nucleic acid biochemistry should be taught in the 2nd Year of undergraduate study, so are the basic instrumentation techniques such as spectrophotometry, centrifugation, and electrophoresis. However, because of the challenges, laboratory tours are embraced to show them equipment as a follow-up on the theories taught in class. Until the 4th Year, the students may not get to use the equipment for their research project, depending on the research interests of the project supervisor. So where is the pedagogy?

Teaching Agriculture Biochemistry as blended subject using problem-based learning

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The move towards postgraduate veterinary medicine courses in Australia has required the development of a one-semester biochemistry subject that covers the basic topics in biochemistry. The early development of this subject has been based on human medical examples and animal and agricultural science students disengaged with its content. I have been responsible for redesigning this biochemistry subject which is titled 'Biochemistry for Agricultural and Animal Sciences' (AGR2BAA). The new design uses a "blended" format with a focus on animal and plant examples. It includes on-line reading material, and a quiz to encourage understanding. Then a 3-hour face-to-face "Lectorial" is given each week, which is a combination of a lecture and a tutorial. The lecture is framed around reinforcing the principles in the on-line readings, while the tutorial component works on a real-life problem linked to the readings, that requires a biochemical understanding and a biochemical solution. Student feedback on this new style of teaching has been mixed with some students struggling to understand the content, while others really enjoying how they can apply biochemical understanding to solve the problem involving animals and agriculture.

An example of applying wet-lab special study module in Dokuz Eylul school of medicine: The apoptotic effects of Epigallocatechin-3-gallate on glioblastoma multiforme cells

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Developing world accompanies some basic necessity changes, especially in the education field. The new educational approaches including active, interactive, innovative laboratory exercises besides classical learning are adopted and supported by many Medical Schools for instance; Queen's University Belfast, University of Leeds, University of Edinburg, Oxford University and Dokuz Eylul University. Special Study Modules (SSMs) are a learning method in which the students are given opportunity to search, study and carry out some experiments regarding their own interests. Since 1997, SSMs have been implemented in Dokuz Eylul University medical curriculum.

Here, we describe an example of a wet-lab SSM. The SSM was entitled "The investigation of the apoptotic effects of epigallocatechin-3-gallate on glioblastoma cells". The main purpose of this SSM was to teach the students:

- how to do effective literature search,
- how apply for ethical approval,
- how to do experimental plan,
- basic cell culture rules and applications,
- interpreting data obtained,
- preparing final report and a scientific poster.

This SSM was planned as a mini-research project, and seven medical students worked together for it. They carried out cell culture experiments and applications: WST-1 assay and Annexin V staining. In the end, they gave some feedback.-They described the laboratory as a kitchen, their mentor and supervisors as cooks, and themselves, as cookies. The main outcome of this SSM is the following: the medical students learned that if they really wanted to help their patients and see the whole picture, they had to dig deeper in the laboratory.

Going mobile in the lab with Michaelis and Menten

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Kinetic analysis of an enzyme is common in practical courses of biochemistry. It involves some biological extract, a detectable product, and mixtures with increasing substrate. Measurements are plotted as velocity vs. concentration and a graph like the double reciprocal plot is used to estimate the Michaelis constant and the maximum velocity. Although the procedure fulfils educational aims and reinforces lectures, the reliability of results may be very poor; furthermore, the statistical flaw of linearised plots is well established. The argument that it is the only feasible procedure with inexperienced students and limited means is no longer defensible nowadays, and hence we propose to give students a 21st century approach to data processing.

A web application was created that calculates the best fit to Michaelis and Menten equation, without mathematical transformation of the raw data, using nonlinear regression. In a second stage, the application has been adapted to smartphones. Hence the students get their final results while they are in the lab, without additional equipment; they just need internet in the phone.

The application, both in webpage and smartphone formats, runs effectively with student-generated data, even with significant experimental errors. A graph is presented with data points and the fitted curve, and the progress of the fit is checked both visually and with computed indicators. The resulting values of K_m and V_{max} come with their standard error.

The application has proved straightforward to use and the calculation is robust even with low quality data. For instance, experiments without replicates, inexperienced and inaccurate pipetting, data that do not approach saturation. The most important gain is to use a statistically sound method, and hence teach the students good data processing practice. Secondly, the results have a proper description of value plus standard error, therefore providing a clear perception of how reliable the estimate is.

The relationships between students' conceptions of a genetic phenomenon and their ability to learn the underlying mechanism

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Understanding genetic mechanisms establish the ability to provide causal explanations for genetic phenomena. These mechanisms are difficult to teach and learn. It has been shown that students sometimes conceive genes as traits or as traits bearing particles. We termed these conceptions "non-mechanistic" conceptions since they do not allow the space required for a mechanism to exist. In this study we examined the relationships between non-mechanistic conceptions and the ability to learn the mechanism. We found that students with non-mechanistic conceptions succeeded less in learning the mechanism leading from gene to trait compared to students with mechanistic conceptions. Our results suggest that non-mechanistic conceptions form a barrier for learning the mechanism.

Greetings from foodland: Teaching food and nutrition biochemistry to undergraduates in Italy

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CONTEXT. Biochemistry have always been a mandatory topic within undergraduate courses at UNIMI aimed at food/nutrition students, namely: Food Science & Technology (BS and MS); Catering Sciences (BS); Human Nutrition (MS). Addressing these targets requires: i) a specific focus on topics that are seldom considered in courses offered in bio-medical settings;

ii) a close integration with other area disciplines; iii) a complementary array of elective courses that cover various specific aspects of biochemistry that cannot be presented otherwise.

INITIATIVE. Lectures take into account specific requirements of each curriculum. For instance, protein chemistry is presented at the BS level by using food proteins of known structure, and discussed in terms of structural features in the raw materials and in changes occurring upon processing (at the household, restaurant, or food industry level). Along the same lines, metabolic pathways and their regulation are presented starting from widespread metabolic disfunctions (such as obesity, diabetes, or inheritable conditions). Much attention is paid also to molecular issues related to food safety (including food allergies and intolerances). The same "hands on" approaches is used for lab classes, that are an integral component of each course - covering about one third of total credits - and aim at providing fundamental- type information by analyzing common practical situations.

METHODOLOGY. Academic and non-academic experts from businesses, regulatory agencies, and hospitals are invited to offer specific information on selected topics. Some of them - such as metabolic diseases - are part of the regular courses, and involve formal lectures by biochemists in our medical schools. Others are indicated by the students themselves, or selected among themes emerging from the media. Non-medical experts are typically recruited among our own former students. All teaching materials (including those provided by non- UNIMI personnel) are made accessible to registered students through a dedicated UNIMI platform. Links are provided to significant external websites.

OUTCOME & PERSPECTIVES. In spite of their inherent complexity and volume, biochemistry courses score very well with the students in their mandatory anonymous survey. Apparently, our approach to biochemistry courses make the students "visualize" the practical implications of concepts learned in other courses within the same curriculum (including general, organic, and - in some cases - physical chemistry) or in previous studies (many of our Human Nutrition MS students have a medical BS). The students' appreciation is circumstantially confirmed by the sizeable attendance to elective and specialized biochemical-themed courses.

Evaluating the scientific knowledge of students who use Jmol to visualize proteins

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Jmol enables visualization of molecular structures. As a result of using Jmol and presenting molecular models of proteins, students can acquire three components of scientific knowledge: content knowledge of domain specific ontological concepts about proteins; procedural knowledge, which combines using Jmol features and decoding the symbolic language composing a visual representation (VR) and spatially manipulating it; and epistemic knowledge, which includes understanding the model's role and its limitations.

The aim of this study is to examine whether learning about proteins using two web-based Jmol learning activities can leverage possible changes in students' knowledge about proteins' structure and function. In this context we asked: i) did students' understanding of protein structure and function change as a result of using Jmol and how? ; and ii) did engagement with an inquiry project lead to any improvement in students' understanding of protein structure and function?

11th grade students from five high-schools in Israel, majoring in biotechnology, learned about proteins during the academic year 2015-2016. They engaged in answering questions that were included in two web-based activities that make use of Jmol. Sixty-nine students were asked to freely draw a protein molecule prior and following answering questions included in the activities. The students' population was subdivided to two distinct subpopulations according to inquiry projects that they carried out. Thirty-seven students from two schools were engaged with investigating paroxonase-1(PON1). Thirty-two students from the other three schools were engaged with yeast fermentation during the production of beer. Students' drawings were coded and validated based on 20 different VRs that the students drew. Subsequently, the students' VRs were classified to categories based on the VRs' structural attributes and their frequencies were determined.

The average frequencies of the VRs' structural attributes prior and following students' use of Jmol indicated that students' VRs describe secondary and tertiary structures of proteins. Students drew less VRs of primary structure following learning, although this change was not significant. Two differences between the two subpopulation of students were observed: i) The PON1 project students drew greater number of VRs, compared to the students participating in the yeast project; ii) The PON1 project's students drew several unique features of PON1, such as calcium ions or beta-propeller structures, while the yeast project's students did not. These results imply that students who engaged with the PON1 project stabilized their prior knowledge more efficiently than the yeast project students while learning using Jmol.

An innovative approach to assessment using student produced videos

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Science is a creative endeavour with scientists taking creative approaches to discovery, problem solving and inquiry. Critical thinking is an essential element of deeper learning and also an essential attribute of science graduates. Laboratory classes address a number of core learning outcomes including: the ability to think creatively about problems and critical thinking through data analysis and interpretation. Significant improvements are being made in the design of laboratory classes however written reports with minimal opportunities for creativity or critical thinking are still common.

Assessment of learning is a critical component of education and is acknowledged to drive/guide students. Therefore improved design and implementation of effective and innovative assessment strategies should lead to improved student learning.

Videos are a media students are very familiar with and are used routinely in teaching, but predominantly as instructional tools. There is an increasing body of work reporting learning “with” videos as opposed to learning “from” videos. These studies report the use of student generated videos where students research a topic and produce videos for the presentation of their research to replace traditional written or oral presentations used for assessment.

We report an innovative assessment designed to engage biochemistry students with laboratory classes (theoretical understanding, data analysis and presentation) which provided enhanced opportunities to develop creative and critical thinking through student produced videos instead of traditional written reports.

Observation of student behaviour during the laboratory classes found students were filming/photographing their experiments and appeared far more engaged with the actual experiments than in previous years. Many student videos demonstrated high levels of creativity and critical thinking. Student perceptions, collected through anonymous surveys showed 53% of students agreed that it was an interesting approach to assessment and 63% agreed that it allowed them to think creatively. When asked, “What aspects of the practical did you find most enjoyable and interesting?” one student wrote: “*The creative process and trying to communicate the results in a way that was understandable to the viewer*”. However not all students liked the innovative assessment and in fact a small cohort were very unhappy with the introduction of this video project, in particular with the time it took.

The student produced videos did provide an opportunity for creative and critical thinking but there are still aspects to be improved.

Development of a e-learning platform for undergraduate biochemistry courses adopting flipped-classroom pedagogy

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There has been a rapid change in the tertiary education sector of Hong Kong over the past decade. It includes the implementation of 3-3-4 Education System, adoption of Integrated-Framework for curriculum development, and the launch of Broad-based Admission Scheme in universities. These new policies brought with them many challenges to the university science education. For example, course teachers have to adjust their pedagogies and curricula for the enlarged class-size and diversified learners' academic background. Departments also have to deal with the demand for more laboratory space and equipment. The learning activities of courses have to be designed to enhance interactions among students and teachers. Flipped-classroom is a pedagogy proposed to reverse the traditional learning environment by delivering instructional content outside of the classroom. It moves the learning activities such as collaborative work and case-studies into the classroom. A comprehensive e-learning platform, called LEARNBIOCHEM, was developed to facilitate the implementation of flipped-classroom pedagogy in biochemistry courses. It is the first strategic effort from a major teaching programme in CUHK to address these emerging challenges. The e-learning platform provides various learning modules for the training of generic and professional skills. Over the years, it has been adopted in more than 70% of the major courses offered by the Biochemistry Programme. Feedbacks collected by questionnaire survey and focus-group interview showed that the e-platform has been well received among student users. The e-platform provides an exemplary work on the production and integration of diversified materials to benefit the teaching and learning in biochemistry education.

When meaningful and rote learning butt heads or an old threat of “test tyranny” in a new reality of Ukrainian medical education

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Background. Over the past decades Ukrainian higher education has been changed dramatically due to the fundamental society transformation and challenges of the world globalization. Longstanding modernization of higher medical education has resulted in a combination of some elements of European Credit Transfer-Accumulation System with American testing. For 16 years, the National Testing Center has been conducting an objective external independent evaluation of the professional competence of future physicians, dentists and pharmacists. This licensed integrated exam "Step" includes one, two or three separate test exams depending on the qualification level - "Step 1" (3rd year), "Step 2" (6th year), "Step 3" (interns), "Step M" (junior Specialists) and "Step B" (Bachelors).

Practice: Biochemistry is a component of “Step 1” with eight other fundamental subjects. Significance of the testing in the learning process was increasing gradually. At the first step this strategy was used at the current sessions and its contribution to the overall students’ assessment was minimal.. At the second step the testing became a screening stage to midterm and final exams. At the next step it replaced the final exam and then the exams at the end of both terms of Biochemistry studying. This has reoriented the students' motivation to mechanically test memorizing.

Evaluation methods: evaluation of module examinations and testing, assessment of final examination and testing, analysis of “Step 1” exam, undergraduate students’ questionnaire.

Outcomes: Biochemistry is getting more and more complicated for medical students as the methodological approaches of teaching contradict the education tasks and peculiarities of information perception by a new generation of undergraduate students. Understanding and perceiving large amounts of academic textual information seemed to be the most problematic task for the students. Traditional lectures and note taking of the main questions during the preparation to practical classes based on the rote learning are losing their efficiency and value. Testing is also based mostly on the rote learning and its domination in the learning process and evaluation of students’ successfulness cannot motivate the undergraduates to deeper studying such a theoretical subject as biochemistry. This great disadvantage of the testing must be balanced by pedagogical strategies of meaningful learning through transformation of demonstrative lectures into interactive ones, replacement of opened tests for closed ones, enhancement of the role of situational problems (case-method) and introduction of mind mapping.

Analysis of educational article titles in ‘Biochemistry and Molecular Biology Education’ journal – What do the last 5-year’s trend show?

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A trend analysis of the titles and/or keywords in relevant scholar publications are frequently used to observe trends and/or shifts and/or priorities in any field. The aim of this study is to analyse the last 5 years’ titles of publications in Biochemistry and Molecular Biology Education (BAMBED) (a journal of the International Union of Biochemistry and Molecular Biology), one of the leading journals that publishes educational research in life sciences.

As BAMBED is indexed in PubMed, we reached the full article list (n=339) by using search tools as journal name (‘BAMBED’) and years (‘last 5 years’). The title list as well as the abstracts were analysed in regard to areas of educational research (undergraduate/graduate or theoretical courses/laboratory practicals). Trends in educational strategies were also investigated. All bibliometric data other than the titles were then excluded and the title list was transferred to a free online tool (<http://www.wordclouds.com>) to create a wordcloud and to analyse the word trends and frequencies in the titles of the published work.

In regard to level of studies, the majority of the articles (95%, n=322) were related to undergraduate education in the field. In regard to kinds of courses, number of scholarly work related to laboratory practicals (33%, n=106) were emerging. There were a large variety of new educational technologies used in published articles like e-learning (n=13), visual aids (n=11), 3D physical modelling (n=6) / computer modelling (n=22), simulation (n=4), online databases (n=2). New educational strategies involving problem solving or problem-based learning (n=19), inquiry-based learning (n=13), active-learning (n=12), case-based learning (n=4) and flipped learning (n=3) were also noted.

Analysis of publications in any scientific field in a set period of time can highlight the trends in scholarly research of the field. It is of note that research questions related to undergraduate education is still in the center of life sciences educators. Student-centered learning and active-engaging approaches are emerging titles in recent educational research published in BAMBED.

Investigations in the biochemistry lab: An opportunity to enhance student engagement with method of science and procedural understanding

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Biochemical investigations in the undergraduate labs are generally performed with a deterministic approach. In such investigations, students perform experiments with pre-set objectives, provided materials and protocols. Although, such exercises engage students and also help improve their hands-on skills, they can prove to be much more meaningful if one follows a path of:

‘Observation → hypothesis making → designing an experiment to test the hypothesis → verifying the hypothesis by performing the experiment’ instead of following pre-determined protocols with pre-determined goals.

Two such investigations involving enzyme-catalyzed redox reactions are presented here. The experiments in these investigations do not require sophisticated instruments and can be easily performed by teachers or students in an interactive mode.

For each investigation, we discuss designing and performing the experiment, analyzing and extrapolating each result. The procedural understanding as well as understanding of concepts would be further probed using specially designed Multiple Choice Questions (MCQs).

The experiments can either be demonstrated, presented in Power Point using projector or performed by each participant using test tubes and plastic droppers. New ideas from participants could also be discussed.

Practice of "reading, discussing and practicing" in biochemistry course teaching

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"Reading, discussion and practice" is guided by the modern educational philosophy. It links reading, discussing and training into the teaching to build students conducive to self-learning curriculum teaching model.

Teachers introduce many reading materials, including biochemistry classic materials, academic monographs, cutting-edge papers and network resources, etc., according to the contents of the teaching section to provide students in batches. Teachers, if necessary, specify the main reading literature, indicate the chapter must be read, to guide students to focus on the forefront of science and development trends. Meanwhile, the students should write their reading notes for examination.

Divide the class into study groups consisting of 4-6 people. In the first two weeks of the discussion, according to the requirements of the syllabus, to develop class discussion topics. Require each group to collect information, discuss analysis, production PPT, limited time trial, classroom discussion, Q & A interaction. Classroom discussions have detailed plans and clear topics, and are related to "reading" contents. As far as possible to expand the scope of student participation. Students can analysis of the relevant topics from the multi-faceted, multi-angle, deepen and improve the understanding of a problem by class discussion.

After the completion of each chapter, around the main content of teaching, layout operations, as the focus of review thinking, so that students consolidate knowledge in a timely manner. Second, combined with "reading" and "discussion", expand the theme, complete a course paper or reading report. In addition, combined with classroom unit testing, test students to learn the results. Through the implementation in biochemistry courses in three year practice, the teaching mode of "reading, discussing and practicing" is to cultivate and enhance the autonomy and inquiry of students' learning.

Should I perform genetic testing? A qualitative look into the decision making considerations of religious Israeli undergraduate students

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The aim of this study is to draw a picture of the concerns that guide the decision making of Israeli religious undergraduate students and the complex considerations they take into account while facing the need to have genetic testing or to attend a genetic counseling session.

Decision making in these issues is influenced not only by medical recommendations, but also by religious values, tradition, and the religious rules to which people are committed.

We have chosen to focus specifically on the religious population, in an attempt to broaden our understanding of decision making in the domain of genetic testing and genetic counseling.

We examined how the religious affiliation of the students influences their perceptions toward genetics and how these are expressed.

Qualitative data was collected from 51 semi-structured interviews with students, in which recurring themes were identified using 'thematic analysis.' The codes from the thematic analysis were obtained according to 'grounded theory'. Our results show that religious undergraduate students' decision making in these issues is influenced by factors that fall under three main categories: "knowledge and perceptions", "values" and "norms".

In order to include all the components of influence, we created the Triple C model: "Culture influences Choices towards genetic Counseling" which aims to generalize the complex decision making considerations that we detected. Our model places religion, as part of culture, as its central point of influence that impacts all three of the main categories we detected. It also traces the bidirectional influences that each of these main categories have on one another. By understanding and using the model, teachers will be able to lead discussions based on the students' prior genetic knowledge and perceptions, their values and their norms. Such discussions will encourage learners to be involved, to voice an opinion, and to see how

the contents connect to their own world and are relevant to their lives. Eventually, the aim of this meaningful teaching is to help students make informed decisions in the field of genetic testing and genetic counseling.

A “top down” approach to effective teaching of biochemistry concepts and skills for life sciences students

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Traditionally biochemistry has been taught following a “bottom up” approach, in which an understanding of cellular biochemistry is built up from knowledge of chemical principles, through biomolecular structure and function, to cellular pathways and regulation. While this approach can be effective for students with solid preparation in chemistry, it is not necessarily accessible or motivating for students whose primary interest is in the life sciences. Therefore, we are developing an alternative “top down” approach, in which biochemistry is taught in the context of biological narratives. We describe our progress towards developing this new curriculum (at second year university level). The curriculum is designed to foster the development of core conceptual understanding and knowledge as well as practical biochemistry skills and transferable, critical-thinking skills. We present inventories of concepts, knowledge and skills considered essential to a biochemistry curriculum at this level. We describe the proposed two-semester curriculum. Semester One follows the narrative of cellular replication and growth to develop: knowledge of cellular components; understanding of how they are produced and organized during replication; practical skills focused on identification, quantification and localization of biomolecules; and hypothesis-testing skills focusing on biosynthetic processes. Semester Two follows the narrative of energy production and utilization to develop: knowledge of cellular respiration and energy metabolism; understanding of mechanisms of biochemical processes, pathways, regulation and coordination; practical skills focused on measurement of enzyme function, metabolism and signalling; and critical-thinking skills related to analysis of biochemical pathways and networks. The proposed curriculum will be delivered using mixed modes including online mini-lectures, assigned reading, pre- and post- class exercises, interactive workshops and practical laboratory sessions. To evaluate the effectiveness of this curriculum change, questionnaires and focus groups will be used to qualitatively assess engagement and motivation and quantitative assessment tools will be used to evaluate understanding of key concepts.

A special study module in medical education: Investigation of oxidative stress in a model of peritoneal fibrosis

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Special Study Modules (SSM) are integrated into the first three years of Dokuz Eylul University School of Medicine and are offered in four different fields: literature search, clinical research, laboratory research, and social responsibility SSMs. We planned a SSM for two second-year students in the category of laboratory research entitled "A special study module in medical education: investigation of oxidative stress in a model of peritoneal fibrosis". The objectives of this SSM were to train the students in independent learning, the basic principles of scientific methodology and written and oral presentation of the results of scientific research. With this aim, the peritoneum tissues from our previous study performed on a model of peritoneal fibrosis in rats were used in this SSM. In order to investigate the role of oxidative stress in peritoneal fibrosis, malondialdehyde (MDA), known as a lipid peroxidation marker, was analysed by high performance liquid chromatography (HPLC) in the control group (n=8) and peritoneal fibrosis group (n=8). The MDA levels were significantly higher in the fibrosis group compared to the control group. After finishing the project, the students prepared a written report and presented orally their results at the final of the SSMs period. The student feedback results showed that the students faced, at the beginning, a bit of difficulty reading the scientific articles. However, they felt that they learned how to read and discuss the scientific articles, they were happy with the wet laboratory, and the research skills that they acquired. Additionally, students gained awareness related to molecular mechanisms underlying diseases with this SSM. The tutors found this educational activity fruitful and rewarding.

A low cost innovative approach in teaching some biochemistry courses

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Teaching some Biochemistry and Molecular Biology (BMB) courses in the Philippines is not an easy task. It is not a popular course because it is not just a difficult subject but has less opportunity to land in this field of job. It also requires skilled and competent Educationists with complete laboratory facilities. Government support for scientific research had been scarce to different institutions henceforth, a teacher- centered approach is still being employed in teaching especially in remote areas where teachers may lack advance trainings and laboratory facilities. What were the outcomes of the teacher-centered approach?

Most students were not motivated and they got bored. A student-centered approach however, is not stimulating or inspiring because the students may not discuss deeper the subject and could be thinking that the teachers are escaping from lecturing. What was introduced? Both approaches were merged to introduce a new hybrid of teaching. A short lecture on the concepts is presented followed by a round table discussion with open internet wherein the students interactively discuss, argue, and clarify the issues presented. A case study is presented to recapitulate the objectives of the course. This approach is applied to all Biochem courses taught by the author. Evaluation of the course is through student reporting, written exams and active participation in the round table discussion of the issue in that subject matter.

Student evaluation of the course was overwhelming because the students were able to discuss by themselves the important issues, learned how to interact, ask questions and integrate all the concepts presented. Most students continued this field of interest by having their thesis related to this course. Such innovation with the use of internet and round table discussion do not require a huge budget to implement and motivate students to appreciate the study of biochemistry.

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New Horizons in Biochemistry & Molecular Biology Education





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