

## Editorial (Biology Education Futures) – Volume 22, Issues 2 and 3

The 21<sup>st</sup> century is considered by many as the century of Biology. While advances in Physics and Chemistry remain thrilling, we are entering the century where advances in cellular and molecular biology will continue to eradicate disease and transform lives. We sit on the cusp of not only understanding but correcting genetic diseases and increasing longevity<sup>1</sup>. We will continue to explore life in the deepest parts of our oceans and we will need to bring biological life with us on our journey through this and the next century. Scientists such as Attenborough and Dawkins see humans as Earth's last and best hope to save biodiversity because we can take a long term view and if we don't plan for the future of the planet, no other species will.

While Attenborough, Dawkins and EO Wilson speculate on plans for the future, what is our plan for the future of biology education? Internationally, both the UK and USA have biology education journals such as 'The American Biology Teacher'. Since its inception in 1938, thousands of biology educators have shared their teaching experiences with colleagues<sup>2</sup>. Similarly, the 'Journal of Biology Education' in the United Kingdom<sup>3</sup> has so far produced 48 volumes where the gap between research and educational practice is narrowed. These journals provide information, ideas and opinion, in addition to critical examinations of advances in biology research and education<sup>4</sup>.

In Australia, commentary on biology education, the one discipline area present in almost all undergraduate science degrees, is missing. Although there has been a rapid expansion in the content of biology, conversations about what and how students learn in biology has not kept pace with these changes<sup>5</sup>.

This two-issue special edition volume of the International Journal of Innovation in Science and Mathematics Education (IJISME) seeks to communicate ideas in key areas of biology education for the future. The first issue highlights key considerations in the design of the biology curriculum at the first year level. The articles by Danny Liu and Charlotte Taylor and Tracey Kuit and Karen Fildes focus on the redesign of the biology curriculum at the first year level. Issues addressed include moving from a traditional curriculum where students rote learn lots of information to curricula based on discovery and inquiry, relevant to the diverse degrees of students enrolled in first year biology. Gerry Rayner reviews whether students with little prior knowledge of biology experience greater anxiety and lack confidence, which can impact on their performance in first year biology. In an age of increasing class sizes and accelerating costs, Karen Burke Da Silva argues the need to maintain field-based experiences for biology students, often the favourite components of a biology degree, whether students major in ecological or molecular sub disciplines. The use of animals in laboratory classes and the alternatives are discussed by Ashley Edwards, Susan Jones, Fiona Bird and Laura Parry. Fiona Bird's review of 'assessment' – a key driver in the whole biological experience – emphasises the role of different types of assessment on the development of critical thinking skills. The eternal, intractable problem of teaching and assessing referencing, set in the all too familiar context of large first year biology classes, addressed by Prasad Chunduri and colleagues completes the first issue.

While the first issue focuses on curriculum development, the second focuses on strategies to more actively engage students in the content of biology in the context of large lectures. A review of students' perceptions of the effectiveness of clickers is summarised by Alejandro Lopez, Christopher Love and Dianne Watters. These authors highlight the difficulty in designing robust empirical studies to determine whether learning gains are achieved by biology students who use clickers. Innovative and creative ways to help students remember biological concepts through hand movement and mnemonics, are documented by Kerry Dickson and Bruce Stephens. New models that include explicit teaching strategies to assist the professional development of biology academics, translating to greater student retention in biology units, are outlined and tested by Kathy Tangalakis, Katie Hughes, Claire Brown and Kerry Dickson. The value of research experiences early in their degrees is

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<sup>1</sup> E.O. Wilson <http://earthsky.org/human-world/e-o-wilson-on-the-future-of-biology>  
<http://reason.com/archives/2001/08/15/richard-dawkins-and-the-future>

<sup>2</sup> <http://www.nabt.org/websites/institution/index.php?p=26>

<sup>3</sup> <https://www.societyofbiology.org/education/jbe>

<sup>4</sup> <http://www.tandfonline.com/action/journalInformation?show=aimsScope&journalCode=rjbe20>

<sup>5</sup> <http://www.sciencedaily.com/releases/2014/06/140602132120.htm>

highlighted by Beth Loveys and colleagues. The unenviable task of improving the quantitative skills of students so that they better think and practise as biologists and are less fearful of mathematics is tackled by Rebecca LeBard, Rachel Thompson and Rosanne Quinnell. Finally, strategies to provide feedback to biology students more quickly and in ways which are meaningful are presented by Zoia Hristova and Deborah O'Mara and colleagues. These strategies allow academics to improve the quality of assessments and students to receive constructive feedback on their learning journey.

This is the first time in many years that biology academics in Australia have collectively communicated key issues in tertiary biology education. It needs to be a re-boot, rather than the final commentary of where we are headed. As lead editor, I can already envisage other issues for conversations about the challenges of e-learning in a discipline where practicals and hands-on experiences for students and academics are essential

This special edition is a collaborative production. My co-editors, Vicky Tzioumis and Michelle Coulson, have made substantial contributions to arrive at the 14 published manuscripts. Completion of this publication would not have been possible without the keen eye and thoroughness of Brianna Clynick, whose excellent analytical skills made us all stop and think about the meaning of results and sentences. This two-issue biology education publication is a product of Vision and Innovation in Biology Education (VIBENet), a discipline network funded by the Office for Learning and Teaching.

I hope you enjoy reading this two issue special edition and look forward to conversations to come about the future direction of tertiary biology education in the 21<sup>st</sup> century.

Sincerely,  
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