

Collaborative practice re-energises bioscience teaching in schools



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This year marks the first decade of operations for the Gene Technology Access Centre (GTAC). The decade has seen a grassroots initiative by a small group of eminent research scientists and dedicated personnel from the University High School in Melbourne grow into a specialist education centre in cell and molecular biology that attracts over 6000 students and their teachers each year. GTAC has not only refocused student and teacher attention on the



School students work at the laboratory bench under the watchful eye of their scientist mentor. Teachers consistently rate the opportunity for their students to meet and work with young and passionate research scientists as the key to student engagement in learning.

interdisciplinary nature of contemporary biology, but has also highlighted how a ‘centre model for learning’, based upon collaboration and partnerships, can exist within ‘the school system’ and meet the needs of students and teachers from across Victoria and beyond.

The key feature of the GTAC learning environment is the role scientists, from postgraduates to eminent research scientists and other professionals play in redefining ‘science learning’ for both students and teachers. Haga¹ in her review of *Teaching Resources of Genetics* points out that:

... the use of scientists ... as an educational resource is probably under-exploited by the educational system, perhaps because of the absence of liaison between professional scientists and teachers, or because of scientists’ lack of knowledge on how to become involved. [They can] ... provide experience and guidance with laboratory experiments, lead discussions about ethical, legal and social implications, promote careers in science or provide insights about the life of a scientist.

The pivotal role that research scientists can play in redefining the teaching of science in the school classroom was recognised by Professor Suzanne Cory, the former Director of the Walter and Eliza Hall Institute of Medical Research (WEHI) and Professor Dick Strugnell and his colleagues from the Department of Microbiology & Immunology at The University of Melbourne. Inspired by her visit to the Dolan DNA Learning Centre at Cold Spring Harbor Laboratories on Long Island New York in 1995, Professor Cory and her colleagues at WEHI established a pilot program in DNA Science for senior school students from selected schools. Encouraged by the enthusiastic response from students and teachers, Professor Cory teamed up with Professor Jim Pittard from the Microbiology and Immunology Department of the University of Melbourne. In 1996 they initiated a week-long DNA Science Summer School for secondary school teachers to update their knowledge of DNA science.

In 2000 the then Principal of University High School, Bronwyn Valente, and I held discussions with Professor Suzanne Cory and Professor Dick Strugnell. These discussions resulted in a joint application, under the Victorian government’s Science in Schools Partnership (SIS), to establish programs, accessible to all Victorian secondary students and teachers, in contemporary molecular cell biology, under the GTAC banner, at the University High School. The GTAC logo depicting the four letters that constitute the genetic code not only represented the nature of the specialisation, but also reflected how teaching and learning objectives would link vision to practice.

Genes (and other biomolecules)

The molecular basis of life not only reflects the focus of much of contemporary biological research but highlights the interdisciplinary nature of contemporary biology. GTAC places particular reference on the role played by the physical sciences and information technology in the emerging fields of genomics, proteomics and chemical biology. A raft of programs introduces students to DNA manipulation techniques and basic microbiology through to tracing primary and secondary antibody responses to a vaccine through the use of an ELISA protocol. Many programs have a 'real life scenario focus'. In the Bacteria Bandit, Year 10 students investigate an outbreak of food-borne disease at a music festival and employ diagnostic microbiology tools to identify the species and strain of bacteria responsible, based on morphology and biochemistry. On elucidating the identity of the bacteria bandit, they use molecular techniques to determine the source of this outbreak and recommend control measures to stop the spread of this food-borne pathogen.

Technology

Technologies are used to highlight the nature of contemporary bioscience and to present concepts using highly visual multi-modal representations that capture student interest and assist learning. ICT is used to visualise higher order concepts in cell and molecular biology through animations, simulations and website resources. GTAC was the first to develop a range of bioinformatics tasks for students and teachers that use global databases in real time. In addition, teachers and students have access to visual representations and podcasts via our website to assist teaching and learning.

Access

Programs not only provide all Victorian teachers and students with quality resources that assist the learning and teaching of molecular and cell biology, but also provide school students with the opportunity to work in small groups with young scientists at the laboratory bench. GTAC conducts one of the largest mentoring programs in the country, with over 50 postgraduate students working with school students on a weekly basis throughout the school year. The building of a positive and supportive learning environment that engages the student builds confidence and promotes a dialogue that informs the student about the nature of the scientific enterprise and the diversity of scientific career options. Of equal importance is the opportunity the programs provide for postgraduate students to engage in 'an outreach activity' that develops their communication and presentation skills.

Teacher professional learning programs give teachers access to eminent research scientists and provide them the opportunity to update their skills and knowledge and so enrich classroom practice and to reconnect with their academic discipline. Over 100 of the country's eminent research scientists have inspired teachers

with their research stories. Programs delivered by University of Melbourne staff from the Department of Microbiology & Immunology include presentations and workshops on the innate and adaptive immune responses, vaccine technology and case studies of current local issues such as the Bairnsdale Ulcer and the H1N1 influenza virus.

Centre, collaboration and culture

The strength of formal and informal partnerships with stakeholders and supporters from tertiary and scientific research sectors has ensured that the centre is not only well resourced physically beyond the 'school norm', but is also knowledge-rich. Collaborative work practices have resulted in a learning environment that spans the secondary and tertiary education and research sectors. GTAC is indebted to the teaching and research staff from the Department of Microbiology & Immunology and to their many postgraduate students who have acted as 'scientist mentors' over the years. They have given generously of their time, intellectual property and resources to assist GTAC staff in the development, implementation and delivery of programs for students and teachers. Haga concludes that *partnerships between scientists and teachers and school systems are probably the most effective way to advancing science education*.

GTAC is an exemplar model of such a partnership in action.

To find out more about GTAC visit
<http://www.gtac.edu.au>



Reference

1. Haga, S.B. (2006) Teaching Resources for Genetics, *Nat. Rev. Genet.* 7, 223-229.

Biography

Mr Stevenson has taught biology and chemistry for over 35 years and has headed semi-autonomous sub-school structures to facilitate student management and learning in various Victorian government schools. In addition he has been chemistry and biology method lecturer in the Faculty of Education at the University of Melbourne. Mr Stevenson has played a pivotal role in the establishment of GTAC and is currently GTAC Director. He was a member of the VCAA Biology Study Design Review Committee in 2004 and previously a member of the Cold Spring Harbor DNAi International Advisory Panel that recommended the production of the DNA Interactive DVD as a classroom teaching tool. Mr Stevenson is author of *Talking Molecules*, a student workbook that promotes student understanding of the molecular concepts in the senior biology curriculum. He is a recipient of the Australian Federation Medal for his work in the establishment of GTAC and more generally in the promotion of contemporary biotechnology education. Mr Stevenson has been twice nominated for the Prime Minister's Prize for Excellence in Science Teaching in Secondary Schools.