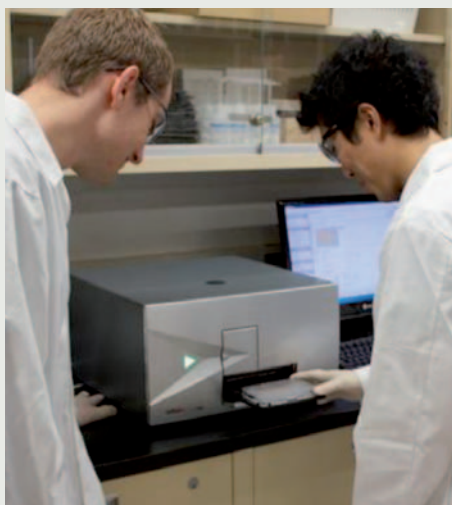


# Undergraduate studies enter a whole new world

Tecan's Infinite® M200 PRO multimode microplate readers are helping McMaster University to introduce chemical biology undergraduates to some of the most advanced techniques routinely used in today's laboratories.



Chemical Biology undergraduates William Denk and Kevin Yin get to grips with the Infinite M200 PRO microplate reader



Inspiring Innovation and Discovery

“Using the Infinite microplate readers is a revelation for our students.”

In 2008, McMaster University in Hamilton, Canada, launched a new undergraduate program, Chemical Biology, with an emphasis on the development of a detailed understanding of the molecules governing biological phenomena. A series of integrated experiments, specifically designed to explore interactions between small organic molecules and large biochemical macromolecules, introduces the fundamental aspects of the subject and provides students with hands-on experience of sophisticated analytical techniques. John Brennan, Canada Research Chair in Bioanalytical Chemistry and Biointerfaces, explained: “When we established the Chemical Biology program, we were in the fortunate position of being able to start from a completely blank piece of paper, so we could do almost anything we wanted to. That gave us the opportunity to be innovative in the way we set up the course, rather than following a conventional structure.”

“The first term of the second year includes an analytical course that teaches subjects including fluorescence, high throughput screening and plate-based assays. Although much of the practical work includes fairly conventional analytical techniques – such as titration, spectrophotometry and electrochemical measurements – we also wanted to introduce the students to the concept of high throughput bioassays. Therefore, in the second term, students begin to work with the Infinite M200 PRO microplate readers, equipped with absorbance, top and bottom reading fluorescence intensity and luminescence capabilities. Undergraduates learn the basics of plate reading, including the issues associated with using the outer wells, how to set up duplicates and where to place the controls, as well as the optimization of instrument settings such as broad or narrow bandwidths and top or bottom reading.

They realize that using cuvettes with three or four milliliters of reagent is not necessary; laboratories just don't work that way anymore.”

“We designed an 11 week program which is essentially one big experiment, as all the individual aspects are integrated together. The first few weeks are spent performing a natural product extraction, which is followed by the synthesis of a compound library where every student in the lab makes one variant of a particular compound. Over the next couple of weeks, they develop two different 96-well plate assays; a ligand binding assay and a kinetic assay. The ligand binding assay uses a dansyl glycine probe and BSA to introduce fluorescence measurement. If the dansyl glycine is displaced as a result of ligand binding, then a decrease in fluorescence intensity is observed; it's a very straightforward assay. The kinetic assay is a colorimetric acetylcholinesterase assay which uses the Ellman reaction to produce a yellow color when DTNB – 5,5'-dithiobis-(2-nitrobenzoic acid) – reacts with thiocholine. In this assay, the Infinite readers are used to measure absorbance. Developing these assays provides an opportunity to put theory into practice, for students to discover changes in intensity or wavelength for themselves, and to determine  $K_m/V_{max}$  and establish a Lineweaver-Burk plot. The remaining weeks are spent using these assays to screen both the natural products and synthetic compounds. The data is pooled and, if the initial extraction has been done correctly, they may be able to find a hit from the natural product and go on to do an  $IC_{50}$  determination as well. More importantly, the synthetic library is designed to allow students to perform a small QSAR (quantitative structure-activity relationship model) to work out which functional groups are actually important for enzyme inhibition.”



John continued: “The third year lab builds on this knowledge, reinforcing the concept of making and screening molecules, and introducing cell-based assays. Students use an *E. coli*-based bioluminescent reporter, gaining experience in performing cell-based assays in a plate reader setting. We introduce additional aspects of fluorescence measurement – such as spectral shifts and how they can be used in assay development – and study the merits of monochromator- and filter-based readers.”

“The Infinite M200 PRO was an obvious choice for our undergraduate laboratories. We already had a lot of Tecan equipment, including two Freedom EVO® liquid handling platforms, a Safire™ and an Ultra Evolution™,

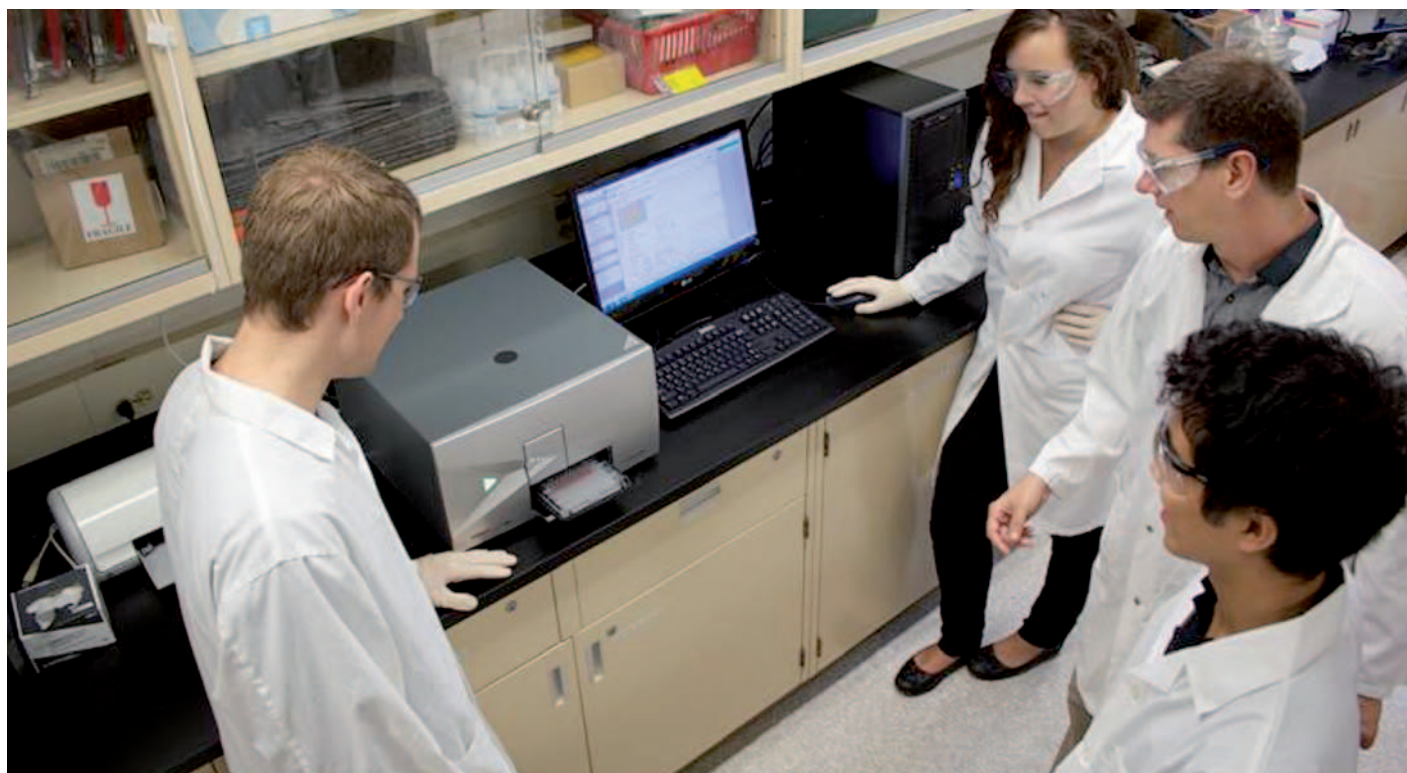
as well as a couple of Infinite M1000s that are used as research instruments, and we particularly wanted monochromator-based instruments so that we could study spectra and look at using spectral shifts as a way of getting an assay to work. Students use the Infinite M200 PROs to begin with and, by the fourth year, will be using the Infinite M1000s with the additional features, such as fluorescence polarization. The software is almost identical, so it is a pretty simple transition from one instrument to the other. The instruments are also very robust, which is vital in an undergraduate environment.”

“Using the Infinite microplate readers is a revelation for our students. After spending

the first year performing basic analyses with large volumes of reagent, miniaturization – performing assays in 96-well plates with microliter reagent volumes – is a completely new experience, and they begin to realize what can be achieved using a liquid handling platform, such as the Freedom EVO, with 384- and 1,536-well plates. It’s a whole new world,” concluded John.

To find out more on Tecan’s Infinite microplate readers, visit [www.tecan.com/detection](http://www.tecan.com/detection)

To find out more about Chemical Biology at McMaster University, visit [www.chemistry.mcmaster.ca/undergraduate-](http://www.chemistry.mcmaster.ca/undergraduate-)



Left to right: William Denk, Anya Todic, John Brennan and Kevin Yin using the Infinite M200 PRO microplate reader