

New possibilities for biological surfaces research

Two Freedom EVO® 200 workstations are helping researchers at McMaster University's Biointerfaces Institute to investigate novel biomaterials and biointerfaces. The Institute's high throughput, multi-faceted approach is borrowed from the pharmaceutical industry, and relies on the flexibility and modularity of its Tecan workstations.



The Biointerfaces Institute at McMaster University in Hamilton, Canada, is a state-of-the-art facility offering large-scale screening and characterization of biologically active surfaces and biomaterials. Officially opened in April 2013, the Institute uses high throughput screening techniques and advanced characterization methods more commonly found in the pharmaceutical industry, and was created to exploit this multi-faceted approach for the development of new biomaterials and biologically derivatized surfaces. Dr John Brennan,



The Biointerfaces Institute's approach relies on the flexibility of its Freedom EVO platforms

Director of the Institute and Canada Research Chair in Bioanalytical Chemistry and Biointerfaces, described their approach: "We first looked at using high throughput 'pharmaceutical research' techniques in 2007, and couldn't believe that nobody was applying this approach to the development of biomaterials and biointerfaces. You begin by screening many materials, followed by detailed analyses on positive results or 'hits', to give a better understanding of why a particular interaction occurred. This downstream analysis – using techniques such as advanced fluorescence imaging, mass spectrometry and solid-state nuclear magnetic resonance spectroscopy – is vital. Putting this approach into practice meant creating a multidisciplinary team with expertise in all these interconnected fields, and this was the founding principle of the Biointerfaces Institute. We then looked at the best way to create an efficient, high throughput workflow and decided on two main technologies; microarrays and nanoparticles. As both of these technologies are fairly labor intensive, we needed specialized automated platforms that would enable us to achieve the necessary throughput to really move forward with our surface chemistry investigations."

The Institute chose a pair of Freedom EVO 200 platforms as the foundations of its research, taking advantage of the instruments' modular design and open architecture to develop flexible, high throughput solutions. John explained: "Our Freedom EVO workstations lie at the heart of everything we do; each platform provides walkaway automation of liquid handling and primary analysis. The microarray-based platform is set up for front-end assays and high throughput screening in microplate or microarray formats. Preliminary fluorescence-

based analysis is performed using either an Infinite® M1000 microplate reader or LS Reloaded™ microarray scanner, both of which are integrated into the workstation. Hits from the high throughput screening are then investigated downstream with more data-rich, medium throughput imaging methods, including X-ray photoelectron spectroscopy, MALDI mass spectroscopy, surface plasmon resonance and infra-red spectroscopy. The other platform is geared towards nanoparticle-based formulation and synthesis, and uses specially configured liquid handling tools that can work with viscous solutions, nanoparticle suspensions, and other non-conventional liquids. The Freedom EVO 200 is used in tandem with a fluorescence activated cell sorter (FACS) for selecting nanoparticles with interesting properties. This set-up gives us detailed information on surface chemistry, particle size and distribution, and elemental composition of surfaces."

"Tecan is the only company able to offer this level of configurability."

Dr Fred Capretta, Associate Professor of Chemistry and Chemical Biology, explained why the Institute chose the Freedom EVO workstations to automate its workflow: "Within the team we had previous experience with virtually every supplier of laboratory automation equipment, and there were two main factors that made Tecan our first choice of supplier. Firstly, the Tecan team was very willing to customize the instruments to exactly meet our requirements, creating systems that perfectly matched our workflow. The Company is well known for being able to



Automation provides the high throughput necessary for effective characterization of biomaterials

successfully integrate all kinds of third-party devices onto its systems, and we were keen to take advantage of this flexibility. The deck of our synthesis workstation has also been modified to accommodate METTLER TOLEDO MiniBlocks®, allowing us to use tubes as well as microplates and microarray supports.”

“Secondly, the user-friendly Freedom EVOware® software allows complicated experiments to be set up relatively quickly and left to run unattended on the Freedom EVO. This is very important for our work, giving us the ability to perform complicated manipulations and precisely control the pipetting and immobilization of many different types of molecules – including proteins, DNA, small molecules, polymers and viscous precursor solutions – directly onto substrates that are also manipulated on the deck of

the instrument. We are now beginning to explore the advanced settings within Freedom EVOware, setting up the different liquid classes and customizing the pipetting functions, and this is already proving helpful for our development of new sol-gel derived materials, which are very sensitive to a range of conditions; ionic strength, pH, water-to-silica ratio and humidity.”

“The precision and control offered by automation will be critical for synthesis condition screening, helping us to systematically work across a wide variety of reaction parameters to discover effects of combinations of conditions,” John concluded. “The Freedom EVOs’ modularity also makes them easily reconfigurable to perform a number of different procedures, allowing us to quickly set up the workstations for

novel applications. This flexibility is just as important as throughput as the workstations are a communal resource that will potentially be used by 20 or 30 different research groups, and Tecan is the only company able to offer this level of configurability.”

To find out more on Tecan’s liquid handling solutions, visit www.tecan.com/liquidhandling

To find out more about the Biointerfaces Institute, visit biointerfaces.mcmaster.ca