Reprogramming nature

Researchers in the Synthetic Biology Center at the Massachusetts Institute of Technology are using a Freedom EVO® workstation to aid the development of genetic circuits. By automating the laborious liquid handling protocols, the platform has increased throughput from just a few samples to hundreds of experiments a day.

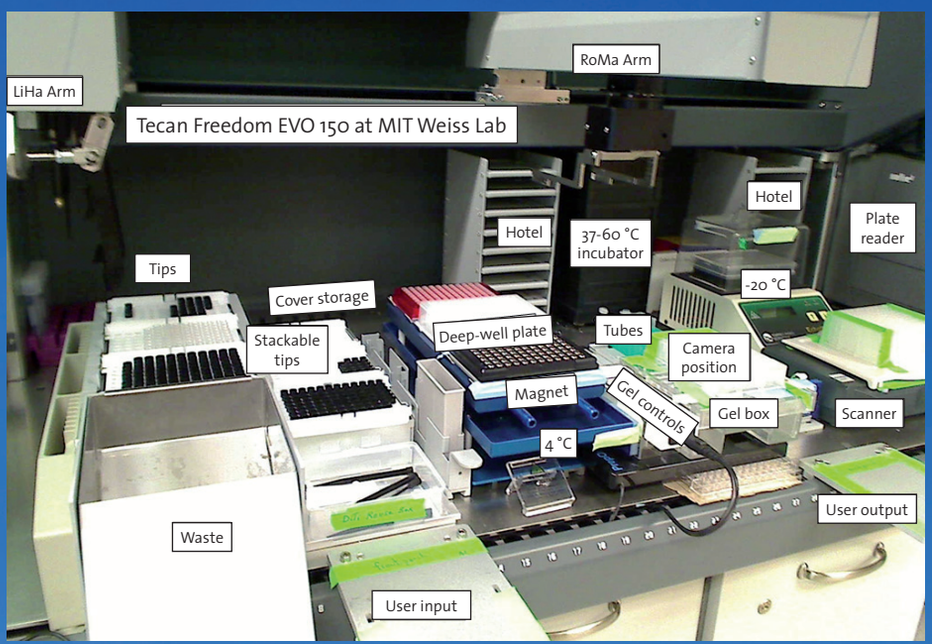
Genetic circuits are an exciting area of synthetic biology, with potential applications in areas as diverse as biofuel production and medicine. These plasmid constructs have the ability to regulate the function of host bacterial, yeast or mammalian cells, reprogramming them to produce novel substances, change appearance or exhibit different behavior. Researchers in the Synthetic Biology Center at the Massachusetts Institute of Technology (MIT), USA, are working on several collaborative projects to develop genetic circuits for a variety of applications. Dr Jonathan Babb, a researcher at MIT, explained: "If you think about it in engineering terms, we are building a machine by taking specific DNA sequences and putting them together in different combinations to form genetic circuits. A collection of these circuits can then be loaded into a host cell, reprogramming it. The Weiss Laboratory at MIT recently published an example of this approach, where a genetic circuit triggers apoptosis in cancer cells, but not in healthy cells, offering diagnosis and treatment in one step. Another potential application is in biofuel development, re-engineering bacteria to efficiently produce fuels such as biodiesel."

"Although we use a modular approach, development of these genetic circuits is still very time-consuming and labor-intensive, and so we purchased a Freedom EVO 150 platform to meet our liquid handling needs. This platform effectively transforms what is already done in electronics – pushing buttons to activate software and hardware to produce the desired circuit – to our synthetic biology experiments. Scaling up this process on a robotic system also gives us higher throughput and repeatability without the variability inherent in manual procedures."

"We specifically chose a Tecan system for this application because the software and hardware are easy to extend, and we wanted the flexibility to experiment with different combinations of modules. The Freedom EVOware® software has an open architecture, making it easy to write and develop scripts and connect the instrument to our own systems and software, and the design of the hardware undoubtedly helps with the integration of our own modules and apparatus onto the worktable. For example, we wanted to be able to store enzymes at -20 °C on the deck, and were able to get an

automation-friendly chiller that could do this at fairly low cost, without having to make any major modifications to the platform."

"We have also been able to devise our own colony picking procedures for cell-based screening, and to set up and run an ordinary, low-cost gel station on the platform. The Freedom EVO is able to automatically load and run gels on the gel station, despite the lack of a communication port on this device, eliminating the need for a lot of expensive additional hardware. The flexibility and programmability of the Freedom EVO are invaluable for this, allowing us to rapidly develop in-house solutions and create the elaborate algorithms that are required to perform the many different steps necessary for the assembly of genetic circuits. We have successfully demonstrated that every step in the process can be automated and run completely unattended, and are now scaling up to high throughput mode, which will see multiple 96-well plates processed per day."



The MIT Weiss Laboratory's Freedom EVO platform

"Tecan's technical expertise has also been important to the success of our work, and we receive excellent application support from the Company. My colleagues and I attended a Tecan users' meeting in Boston last October, specifically to find a solution to the complex issue of pipetting minute volumes of our suspensions on the Freedom EVO platform with the existing liquid classes. Tecan's application specialists were able to give us a new liquid class that would not only be able to handle the volume and viscosity we wanted, but also direct the pipette tip to twist around and tap the side of the vessel, so that any drop of liquid would come off. We also have very good ongoing support from Tecan locally – for general advice and troubleshooting – and are kept up-to-date with new technologies and solutions which could further our research."

To learn more about Tecan's genomics solutions, visit **www.tecan.com/genomics**

To find out more about the Synthetic Biology Center at the Massachusetts Institute of Technology, visit **synbio.mit.edu**