Cyanobacteria see the light

Scientists at Berlin's Technical University of Applied Sciences Wildau have established a screening platform for phototrophic organisms on a Freedom EVO® 200 liquid handling platform equipped with an Infinite® M200 PRO microplate reader.

Germany's Technical University of Applied Sciences Wildau (TH Wildau) is the largest university of applied sciences in the state of Brandenburg. Historically, with its origins in locomotive construction, TH Wildau was an engineering university, but today it has developed to offer a wide range of modern, forward-thinking courses, including biosystems technology and bioinformatics. Professor Marcus Frohme's Molecular Biotechnology and Functional Genomics group is engaged in several studies including one in collaboration with an industrial partner, Algenol Biofuels, looking at adaptive evolution in cyanobacteria. The University's researchers have established a screening platform for phototrophic organisms on a Freedom EVO workstation with an integrated Infinite M200 PRO for this project. Ulrich M. Tillich, a PhD student based at TH Wildau, explained: "Our group needed a screening platform for phototrophic organisms for the cyanobacteria study. Although commercially available cultivation platforms for heterotrophs and eukaryotes exist, there was nothing suitable for phototrophic organisms, and so we designed and tested a custom-built system."

Ulrich continued: "Initially, we used a Genesis™ RSP 150 liquid handling system with a GENios™ Plus plate reader, but this instrument was old and had been superseded by more advanced liquid handling platforms; system support was also ending. We then invested in a Freedom EVO 200 workstation equipped with Robotic Manipulator (RoMa) and Liquid Handling (LiHa) Arms, an Infinite M200 PRO reader, a HydroFlex™ washer and a Hettich® ROTANTA centrifuge, all controlled by Freedom EVOware®, and integrated a custom-built cultivation chamber that can accommodate two 96-well plates. The main advantage of the new platform is its flexibility; it provides a simple user interface for day-to-day operation, as well as allowing in-depth programming, enabling a broad range of

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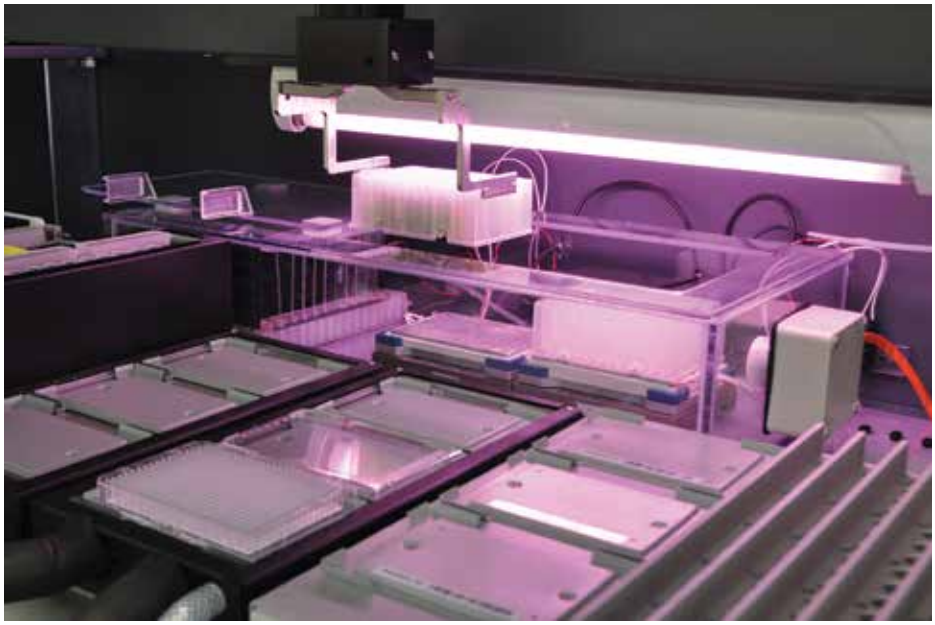
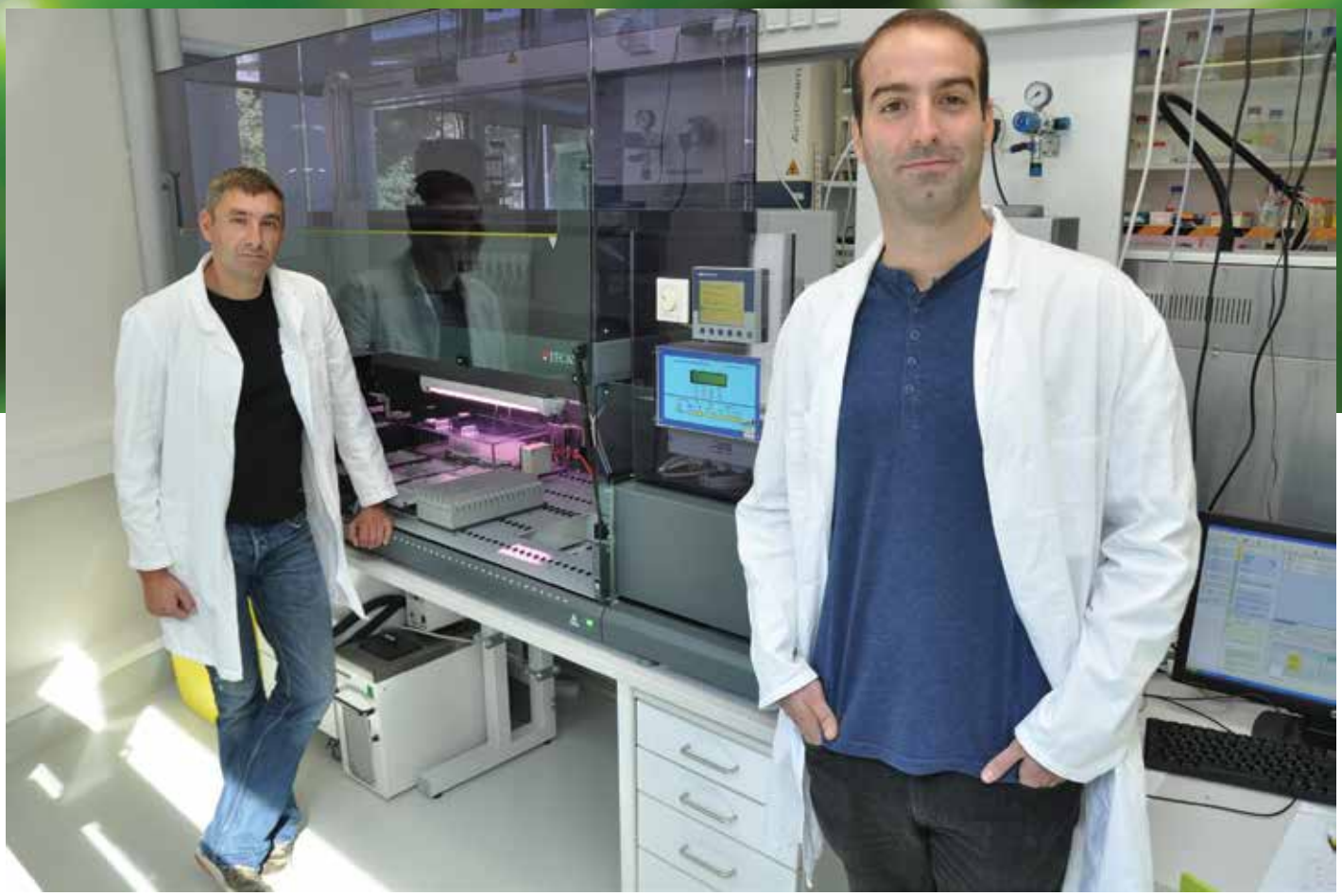


The Molecular Biotechnology and Functional Genomics group integrated its custom-designed incubation chamber into a Freedom EVO workstation



Nick Wolter (left) and Ulrich M. Tillich with the Freedom EVO-based screening platform

different requirements to be accommodated. We can also add additional modules, such as a 96-channel pipetting head, at a later date if necessary. It is a great improvement on the old liquid handling system. The analytical capabilities of the Infinite M200 PRO are also good; with a monochromator-based system you are not tied to the available filters, which allows for more experimentation. You can just try things and see if you get the result you need, without spending a lot of money on a filter that you may never use again."

Nick Wolter[1], a specialist for automation in life sciences at TH Wildau at the time, took up the story: "The system is used to monitor cell growth, chlorophyll content and cell vitality, to prepare samples for MALDI-TOF analysis and to make back-ups of the cultures – small agar plates for use in the immediate future allowing results to be rapidly validated, and 96-well plates for longer term cryopreservation. Initially, we found it harder than expected to keep the cultures in suspension and tried using different shaking patterns – bi-linear and circular – but always had problems with cell sedimentation; adding glass beads to each well of the microplate was the answer."

"Our screening platform includes an automated dilution step, and it is important to minimize any errors due to evaporation. The RoMa removes the microplates from the cultivation chamber at least once a day, to allow any loss of liquid due to evaporation to be determined by the LiHa's conductive disposable tips, before it automatically refills the wells to full volume with sterile water. This eliminates the potential for errors due to evaporation during subsequent optical density (OD) measurements and dilutions; the OD is used to determine the cell density, and this value forms the basis of the automated dilution. Previously, we had to take the measurements and then manually input the values for the dilution. With Freedom EVOware, the process is fully automated, which saves a lot of work; instead of taking a whole day to calculate values for two 96-well plates, everything can be done in around two hours."

Ulrich added: "The screening platform is essentially a proof of concept, establishing that the process can be fully automated. We have successfully used the system to screen a pool of mutants for strains with the highest thermal tolerance, culturing cyanobacteria in deep-well plates in the integrated cultivation chamber, while controlling parameters such as light intensity, carbon dioxide, temperature and plate shaking. Currently we can handle a maximum of two 96-well plates, although it should be very easy to scale this up further." Nick concluded: "Before automation, we were screening for temperature-tolerant mutants in small cell culture bottles by a more traditional method, and had a maximum throughput of just 27 cultures; automation makes high throughput possible."

To find out more about Tecan's cell biology solutions, visit
www.tecan.com/cellbiology

To learn more about the Molecular Biotechnology and Functional Genomics group, visit
www.th-wildau.de/molekularbiologie

[1]Nick Wolter is now an application specialist at GFE Blut mbH, working on robotic systems for automated analysis of blood donations.