

# Biology meets engineering

The High Throughput Omics Platform is an advanced microbial cultivation and sampling system designed to accelerate the development of novel biotechnology applications. Created as a collaboration between LISBP and the Tecan Integration Group, this unique system is being harnessed to investigate potential biofuels, biomaterials and biochemicals.



The Laboratoire d'Ingénierie des Systèmes Biologiques et des Procédés (LISBP) is part of the French National Institute of Applied Sciences in Toulouse, and uses a multi-disciplinary approach to develop novel solutions to real-world problems across the material science, environmental and life science sectors. Working closely with a wide range of academic and industrial partners, both within France and internationally, LISBP has the flexibility and the diverse skill-base necessary to exploit the metabolic

pathways of micro-organisms for innovative biotechnological processes.

LISBP's MetaSys team, headed by Jean-Charles Portais, is a core facility offering the tools, expertise and support necessary to engineer micro-organisms for the conversion of renewable resources into useful end-products – biofuels, biomaterials and biochemicals. Working primarily with *E. coli* as a 'cell factory', the team designs synthetic metabolic pathways for the consumption or production of molecules of interest, using 'omics'-based approaches to understand and optimize how these pathways operate within biological systems.

Stéphanie Heux, a researcher in the MetaSys team, explained: "Our work requires the creation of a large number of microbial strains with synthetic modules that convert renewable carbon resources into biomolecules of interest for wider applications, such as biofuel production. We originally analyzed these metabolic pathways manually, but were very limited in the number of cultivations we could perform in parallel. We needed a high throughput platform for rapidly processing engineered bacterial cells on a larger scale, to analyze large numbers of bacterial strains under different conditions more efficiently."

"In 2009, we approached a number of laboratory automation companies to design a bespoke system that would meet our needs. The Tecan Integration Group (TIG) provided us with a clear outline of the proposed solution, with a detailed and precise project specification document that enabled us to understand exactly how the robotic platform would look and operate. The Tecan offering was also very compact and flexible – with



The High Throughput Omics Platform offers rapid, large-scale processing of cell cultures



three robotic arms on a single workstation – and this, combined with the level of technical support on offer, made the choice easy for us. We worked closely with the TIG team to develop the concept further, with both parties suggesting changes to improve speed and efficiency, and the High Throughput (HT) Omics Platform is the result of this work.”

Controlled by Tecan’s advanced Pegasus software, the HT Omics Platform has a range of modules to enable precise and flexible operation, including a custom bioreactor block, an eight-channel Liquid Handling Arm, a Pick and Place Arm, a Robotic Manipulator Arm, a HydroFlex™ plate washer, a Sunrise™ absorbance reader, a centrifuge and a barcode scanner. The system also has both heating and cooling devices, as well as carriers and storage racking for microplates and labware. Stéphanie continued: “We run several types of metabolomic and fluxomic experiments on the platform, all of which can be carried out on up to 48 cultivations in parallel. We can perform direct measurement of physiological parameters

such as growth, oxygen and pH, monitor and analyze extracellular metabolites by HPLC, analyze intracellular metabolites by mass spectrometry, and study isotope patterns in metabolic end-products using NMR.”

“TIG tailored the Pegasus software to fit each application, as the sampling process is closely linked with the growth of each *E. coli* strain within the bioreactor, which cannot be easily predicted. The HT Omics Platform carries out large-scale analysis of the activity of each strain; preparing, running, monitoring and controlling the fermentations, and adjusting the pH, temperature and stirrer speed for 48 micro-scale (10 ml) fermentations in parallel. The robotic system also features fully automated metabolite harvesting and extraction for downstream analysis.”

“The system is highly reliable and easy to use, and automating the whole process has greatly improved throughput and robustness, avoiding the errors inherent in manual operation. It operates 24/7, offering continuous parallel processing for 48 *E. coli*

strains with little human supervision, including overnight analysis, and releases the equivalent of five full-time staff to develop and analyze even more bacterial strains. It was really nice working with the TIG team, because they were always available to respond to our numerous requests, and had the creativity and biological and technical backgrounds needed to understand our expectations. We are very happy with the system,” concluded Stéphanie.

To find out about the Tecan Integration Group, go to [www.tecan.com/tig](http://www.tecan.com/tig)

For more information on LISBP, visit [www.lisbp.fr](http://www.lisbp.fr)

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The custom bioreactor block can be accessed by the system’s LiHa Arm