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Table of Contents

32 bioreactors in the smallest space.....	1
Fact and Figures.....	2
People.....	2
Funded Projects.....	3

32 bioreactors in the smallest space

31.05.2010 –

The increasing growth in automation in recent years has enormously expanded the possibilities of biotechnology. Standardised assays or microtiter plates allow thousands of molecular biological tests to be carried out in a very short time. With the support of the Federal Ministry of Education and Research (BMBF) through the initiative SME innovative, the biotechnology arm of automobile supplier Vulkan Technic, Abbis, has developed a fully automated assay plate. The environmental conditions can now be customised and monitored in each of the 32 wells, used to test cells, for example. This could help accelerate the scaling-up of biotechnological production processes from the laboratory to large-scale production. A prototype of the bioreactor in chip format is set to be introduced in 2010.

Assay plates are indispensable for modern biotechnology, and are essential above all for diagnostics research. Scientists use them to find specific protein molecules in biological samples, to identify novel antibiotics, and to observe the reactions of different molecules with each other, among many other purposes. Assay plates are also used to systematically identify the most suitable environmental conditions for specific cell cultures. This also an important parameter for making biotechnological production process as efficient and cost-effective as possible. A high number of different growth conditions for cells must be screened to find the optimal growth conditions, above all in the developmental phases. Without automated screening and process development tools, this would be a mammoth task.

The automotive sector and biotechnology

This automation is made possible by the use of assay plates, which consist of a uniform arrangement of a large number of cavities, known as wells. Among other uses, these are commonly filled with cells together with the required nutrients, which are then methodologically tested under a variety of different environmental influences. Assay plates offer the advantage of allowing processes to be examined in the smallest possible volumes (0.1 to 1 ml), saving both time and material. Having to work with assay plates does also have its disadvantages, however. For example, if researchers want to change the pH of the medium, they must manually pipette acids or bases into the wells, which can easily result in errors. Supplying nutrients and additives is a notoriously complex and unpopular task among researchers. The biotech arm of the owner-operated Abbis at automotive supplier Vulkan Technic in Wiesbaum, in cooperation with the Aachen-based biotechnology company m2p-labs, are hoping to remedy this situation with a fully automated assay plate.

Although Vulkan normally operates in the automotive industry, for example developing robots that can apply tape to automotive parts, the company is certainly no novice in the field of biotechnology. The company first stepped outside of its traditional field in 2001 when a biotechnology company put out a request for specialised equipment. In the meantime, the biotech division of Abbis makes up about one third of the company's sales of around eight million euros. In 2009, the development of a novel device for cancer diagnosis using blood samples was awarded with the Medical Technology Innovation Award, which Abbis shared with two other companies and the University Hospital Eppendorf.

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Funded Projects: [KMU-innovativ: New therapy for Alzheimer's](#)

Continuously monitoring cell growth

Abbis was supported by the BMBF within the framework of the SME Innovative initiative during the development of the novel assay plate. The initiative was launched in 2007 to extend a helping hand to small

and medium-sized enterprises undertaking difficult and expensive research. 300 million euros has been made available for the initiative up to 2015. Abbis is planning to use the funding to press ahead with the completion in 2010 of a first prototype that combines systems engineering with biotechnology in minimal space. Here, the wells on the plate are equipped with very thin tubes that allow for accurate control of nutrient levels and pH value. What makes this device special is not only the fully automated control system, but the fact that it is connected to an optical sensor. This means that cell growth and the quantity of fluorescent-marked marker proteins produced can be continuously monitored.

In addition to this, the assay plates can be continuously shaken, ensuring an improved gas exchange between the cells and their environment. "The idea was to control growth individually in each respective well. This means that practically every well becomes a bioreactor," says Berit Cleven, Project Manager at Abbis. And the wells are not round in this case, but instead are flower-shaped. "This gives us better oxygen saturation in the individual wells," says Cleven. The shape selection was made following testing by m2p-labs, who tested over 30 different forms for their mass transfer properties, with the flower-shaped form eventually triumphing. The unique shapes function in a similar manner to so-called "baffles", plates used in the bioreactor to remove turbulent flow, and which favour mixing properties and mass transport by counteracting the formation of dead mixing points.

A demonstration unit is currently being tested at m2p-labs. The automated, high throughput-enabled micro fermentation system is intended to allow the quick determination of appropriate environmental conditions for cell cultures, and thus simplify the development process in biotechnology research and the pharmaceutical and chemical industries.

Fact and Figures



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[Background](#)

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[People](#)

Funded Projects



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