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An automated perfusion bioreactor system for oxygen-controlled cultivation of 3D-cell cultures

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Bioreactor systems are an important factor for the successful cultivation of 3D-cell cultures, since they are able to overcome limitations of static cell culture, by providing proper nutrient and oxygen levels. A bioreactor, which is suitable for the reproducible generation of tissue engineered grafts (TEGs), as well as for the optimization of culture conditions, has to meet several requirements, such as built-in measurement instrumentation and control technology, high throughput and high flexibility. In the present study, a perfusion bioreactor system, which allows for the oxygen-controlled cultivation of up to four TEGs in independently operating bioreactors, was designed and manufactured using rapid prototyping technologies. A uniform flow distribution in the developed microbioreactor was shown using computational fluid dynamics. The integrated measurement instrumentation and control technology allows for the cultivation at pre-set oxygen levels. Furthermore, an automated cell-seeding protocol ensures a homogeneous initial cell distribution and thus a reproducible workflow. The developed microbioreactor system opens up new possibilities in the field of tissue engineering by enabling more reproducible experiments, the investigation of optimal oxygen levels in 3D cell cultures and by allowing for the generation of artificial tissue in an oxygen-controlled environment.

Speaker Biography

Jakob Schmid is a PhD student at the center of applied tissue engineering and regenerative medicine (CANTER) at the Munich University of Applied Sciences. He earned his BSc in biotechnology at the Weihenstephan University of Applied Sciences and his MSc in pharmaceutical biotechnology at the Ulm University. CANTER is a cooperative research lab of the Technical University Munich, the Ludwig-Maximilians-University Munich and the Munich University of Applied Sciences. The main focuses of CANTER are to investigate methods of three-dimensional printing for tissue engineering to open new possibilities and applications for tissue engineering research and to characterize tissue and cell-cell interactions on a biophysical level to increase knowledge about macromolecular functions in tissue.

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