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Chips-in-organs: Monitoring onset of bone healing kinetics and early transplant rejection using implantable titanium dioxide-coated bio-impedance sensors

In Western societies, the steady increase in human life expectancy is posing a significant socioeconomic challenge to maintain existing medical therapy standards and health care solutions for senior patients. It is also well known that elderly patients exhibit a significantly higher risk of complications following surgery. To prevent postoperative and long-term medical complications, an important strategy of medical traumatology involves repeated follow-up examinations using a variety of in vivo imaging technologies and *in vitro* assessment methods of biopsies. To improve early diagnosis of failed implant integration and tissue rejection, we have developed two implantable titanium dioxide-coated bio-impedance sensors to enable personalized therapeutic interventions during impaired bone healing and organ transplant rejection. In the case of endosseous implants, which are routinely applied in tissue reconstruction after long bone, spine and craniomaxillofacial injuries, the development of a prognostic non-invasive imaging technology capable of monitoring dynamic bone formation in situ is expected to deepen our understanding of osseous integration at the implant-tissue bio-interface. Results of our study revealed distinct differences between granulation and soft tissue formation within two weeks after implantation, thus allowing the accurate assessment of bone healing prior the formation of a cortical bone layer in subcritical defects of rabbit calvaria. Every transplanted tissue and solid organ bears the risk of rejection, which can finally result in the loss of the transplant with falling back into disability or even death. Tissue biopsies are used today to detect and monitor tissue or solid organ rejection episodes. Detection of early stages of rejection and continuous monitoring can therefore prevent severe organ impairment or even loss of function. To overcome limitations of the state of the art rejection monitoring methods, we have developed titanium-dioxide coated implantable biosensors for transplant rejection monitoring.

Biography

Peter Ertl holds an Engineering degree in Biotechnology (BOKU, Austria), a PhD in Chemistry (Univ. Waterloo, Canada) and has received his Post-doctoral Training as a Biophysicist from University of California at Berkeley (US). In 2003, he co-founded a biotech start-up company where he served for many years as Director of Product Development in Kitchener-Waterloo (CAD) developing bench-top sized cell analyzers. In 2005, he started working as a Senior Scientist in the BioSensor Technology Unit at the AIT Austrian Institute of Technology. In 2016, he was appointed as the Professor for Lab-on-a-Chip Systems for Bioscience Technologies at Vienna University of Technology, where his research focuses on the development of Organs-on-a-chip and Chips-in-organ systems for Biomedical Research.

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