Bern University of Applied Sciences

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Wearables and Digital Biomarkers

for Cardiovascular Diseases and Neuroscience

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János Vörös is a Professor in the Institute for Biomedical Engineering of the University and ETH Zurich (Department for Information Technology and Electrical Engineering) heading the Laboratory for Biosensors and Bioelectronics since 2006.

János Vörös has studied Physics at the Eötvös Loránd University in Budapest. After receiving a diploma in Physics in 1995, he was a doctoral student at the Department of Biological Physics of the Eötvös University (in collaboration with Microvacuum Ltd.) where he received his PhD in Biophysics in 2000. Since 1998 he was a member of the BioInterface group in the Laboratory for Surface Science and Technology at the Department of Materials of ETH Zurich as visiting scientist, postdoc, and from 2004 as group leader of the Dynamic BioInterfaces group until 2006.

Prof. Vörös is interested in research and teaching in the areas of bioelectronics, biosensors, and neuroscience. His group focuses on the development of novel biosensor techniques for diagnostics and single molecule sequencing; on bottom-up neuroscience; as well as on stretchable biohybrid electronic devices.

Stretchable bioelectronics – material aspects and medical applications

A new class of electronic devices based on stretchable materials can interact with the soft human body in an unprecedented manner. They are highly suitable for epidermal electronics because they can be designed to conform closely to and with the irregular shape of the skin, providing an improved functional interface even during motion, while being imperceptible to the user.[Error! Reference source not found.,2]

For example, metal nanowires embedded in silicon elastomers have interesting strain-response that could lead to applications in stretchable electronics and in strain sensing.[3] Here, advanced imaging with coherent X-rays in combination with machine learning based data evaluation helped to provide a full theoretical understanding of the strain-response and to build a model with predictive value.[4] In addition, a simple filtration-based methodology allows for easy fabrication of various devices and circuit boards.[5,6]

The stretchability of this composite also provides benefits for *in vivo* applications:[7,8]

Stretchable and biocompatible transparent microelectrode arrays can be realized that enable stimulation and recording of brain activity directly from the cortex both electronically and optically.[9,10]

The technology also allows for creating strain sensors with up to 500% stretchability and Gauge factors of over 100 that can be used as smart and passive RFID tags to measure the filing level of the bladder in handicapped users, or to record the volume of the heart during operation.[11,12]

Finally, metal infiltrated elastomers in the form of conductive fibers can be used to create a suturable capacitive strain sensor for monitoring tendon behavior *in vivo*.[13]

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