Biomedical Engineering in the 21st Century and in the Future

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Abstract: Biomedical engineering, in the context of the evolution and understanding of medicine, experienced its fastest growth at the turn of the millennium and can be expected to continue to grow in the 21st Century. This talk describes the current and historical aspects of the evolution of biomedical engineering and outlines the present and future of instrumentation and medical engineering in the future.

In particular, the lecture discusses the possibilities of spatial imaging in medicine, miniaturization in digestive tract diagnostics and the improvement of whole-body diagnostics. A new area in imaging is technology using THz diagnostics with respect to material analysis and composition of substances as well. The advances and perspectives of laparoscopic and robotic assisted surgery with the possibility of collagen adhesives instead of conventional suturing techniques in surgery are presented. One of the breakthrough areas is the non-invasive imaging of the vascular system in the subcutaneous tissue, which is essential in pediatric, cancer patients with Vein Viewer technology. Although immortality may seem like a nonsensical approach from a biomedical perspective, it has long been laid on a scientific foundation and may be one of the options for saving humanity in the colonization of space, with the new science of cryonics. Could nanotechnology also be a way to self-monitor and improve the quality of life, as outlined by Richard Feynman back in 1959? Quite possibly so, and we will show how. Nevertheless, the human aspect and joint cooperation in the development and application of new technologies is very important and should be above all!

Bio:

Marek Penhaker is the professor in Biomedical Engineering at VSB – Technical University of Ostrava. He studied Measurement and Control in Biomedicine at VSB-TU Ostrava and finish his Ph.D. in 2000. In October 2000 he started working as a professor assistant at VŠB – TUO in the field of biosignal measurement, transmission and processing. Since 2002 he is Guarantee of M.Sc. specialization Measurement and Control in Biomedicine, from 2003 he is vice-director for research and science of Department Measurement and Control at VSB-TUO. Currently he is guarantee of Biomedical Engineering study program at VSB – Technical University of Ostrava. He worked at Ostrava University – Medical Faculty, University of Hradec Kralove, Czech Technical University in Prague, Silesian University of Technology Gliwice in Poland, and Roma Tre University in Rome. In 2018 he became full Professor at Czech Technical University in Prague and lead Remote Home Care Monitoring Systems Group. His main interests are Medical devices and electromechanical surgery tools and biomedical sensors. (ORCID profile: https://orcid.org/0000-0001-9527-4642)

Marek Penhaker is member of IEEE Engineering in Medicine and Biology Society, Member of International Society for Computational Biology, Member of International Alliance „European Alliance for Medical and Biomedical Engineering and Science, Member of Czech Society for Medical Technology, Member in Cartography of Medical and Biological Engineering in Europe, Member in European Alliance for Education Harmonization BIOMEDEA, National Coordinator in Association for the Advancement of Assistive Technology in Europe, Member of Steering Board of Society for Biomedical Engineering and Medical Informatics Czech Medical Society.

Through his career he published more than 260 original research papers including over 60 peer reviewed journal articles (ResearcherID: C-3751-2016). He is author and co-author of more than 15 books, 33 Czech national patents. He received several awards, among them the Siemens in Study of Drive Gear at Mobile Mount with Fuel Cell (2006), IFBME Young Investigation Competition of the paper award (2008), Outstanding paper award for the paper "Sensitivity Analysis in Sensor HomeCare Implementation" at IFBME conference in Singapore (2008), Commemorative Award 7th International Exhibition of Inventions in Kunshan, China. (2012), INVENTO Prague 2013 GOLD MEDAL on International Exhibition of Inventions (2013).