

Tissues with the human body are continuously subjected to physical forces that can lead to the formation of micro-cracks in given tissues. Under natural conditions, the tissue regenerates, however, the ability for this process taking place depends on both the tissue type as well as the extent of the damage. The moment the natural tissue is replaced with an implant the arising micro-cracks in the composite material do not regenerate but they are occupied by surrounding tissues. In the longer term this carries a risk of fatigue of the implanted material and new cracks that ultimately can lead to a need for re-transplantation.

The natural scaffold tissue – Extracellular Matrix (ECM) - is composed of an organic (protein, polysaccharide) and inorganic (i.e. hydroxy-apatite) components that when combined with the cells forms a tissue. A scaffold is an integral part of every tissue and a reinforcement for the cells. It bestows the tissue with elasticity, flexibility and durability. The process of producing tissue scaffolds obtained from biodegradable polymers has become a very intensively researched area for the past several years. Most of the current work focuses on the design and preparation of scaffolds with use of various production technologies and different natural materials like chitosan, collagen, elastin and different synthetic ones like PCL, PLA, PEO.

In the project the biodegradable polymers will be combined with organic and inorganic additives which when in interaction with electrical voltage may turn out as a promising tissue substitute in the future according to the obtained preliminary results of the research. Biomaterial and electrical combinations like that can be exceptionally useful in the future attempts to replace the inter-cellular tissue matrix with tissues bio-electrically or bioelectro-mechanically active such as active elements of nervous system, cardiac muscle, skeletal muscle or smooth muscle and in that case e.g. forming part of structures of stomach, intestines, bladder or other ones.

A very promising preliminary research results as well as the need of taking under profound investigation the cause-and-effect relationships and interactions taking place on the boundary of biomaterial and a cell both inspired and laid the grounds for the project. Thanks to the joined forces, knowledge and experience of members participating in the project from Pomeranian Medical University in Szczecin (PUM) and Institute of Non-Ferrous Metals in Gliwice (IMN) ensures the implementation of the project at the highest possible level. The carried out work in borderland of medicine and technology fields will lead to the broad spectrum of interdisciplinary publications which will allow to reach out for a wide range of audience.