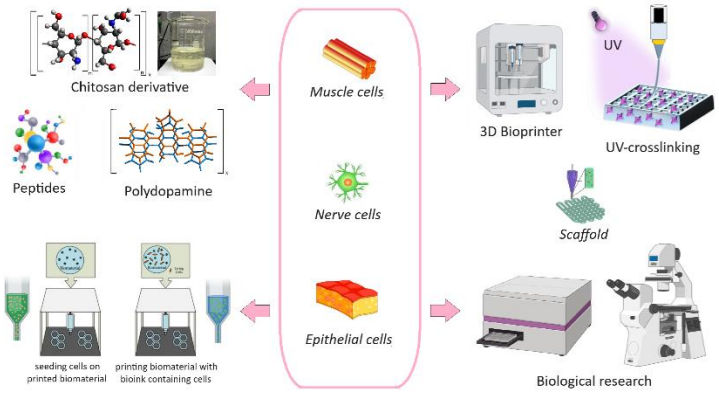
The main aim of the project is to develop an innovative class of multifunctional bioinks for 3D/4D bioprinting with a completely new chemical structure followed by controlled biological activity which will be achieved through the obtainment of novel chitosan and poly(dopamine) derivatives containing double bonds in their structure further modified with growth factors and ATPs – antibacterial tripeptides. The aim of the project will be achieved by delivering 3D/4D outprints containing viable cells. Performed photochemical modification during manufacturing process will result in the enhanced mechanical properties, prolonged biodegradation/bioresorption and gradient structure well fitted to soft tissues requirements. Introduction of bioactive additives to the bioinks will give the possibility to increase the cell survival and adjust variable requirements of a living bioconstruct in time.

The project is based on three hypotheses:

1. Dopamine autooxidation polymerization followed by chemical modification of the poly(dopamine) and chitosan leading to introduction of the double bonds inside their structure making them photosensitive polymers combined with coupling with antibacterial tripeptides gives the possible to obtain a completely new composite biomaterial with enhanced both physiochemical and biological properties capable of viable cells incorporation and controlled bioactive substance release enabling adjustment to current living cell-containing 3D constructs needs.
2. 3D/4D bioprinting of newly developed bioinks containing growth factors enables obtainment of the biomaterial with advanced, gradient structure without chemical structure degradation and biological properties deterioration of the components thus increasing survival rate of the cells placed in the polymeric pre-mixes.
3. Bioactivity-controlled biomaterial based on biocompatible chitosan and dopamine derivatives containing growth factors which will be released in a controlled manner will help to deliver a powerful tool for the regeneration and/or reconstruction of the soft tissues disfunctions and creating a successful method for civil diseases aftereffects treatment.



Significance of the project: Tissue engineering (TE) is powerful tool which can replace traditional transplantology and is one of the most important issues in modern medicine. This field of science develops extremely rapidly and provides regeneration or reconstruction of the damaged tissues and organs with the exact mechanical, physicochemical and biological properties comparing to healthy ones. It uses biocompatible 3D scaffolds which play supportive role for proliferating cells. Biological material can be of different origin. For example, stem cells can be subjected to controlled differentiation during 3D culture on appropriate 3D substrates. They may be derived from bone marrow, umbilical cord blood or adipose tissue. Also, cells obtained through the biopsy may be applied such as fibroblasts, keratinocytes, and others [1-6]. Number of scientific publications and patents proves that there has been a great development achieved in such areas such as skin, nerve, and bone tissue engineering but surprisingly there are still many other extremely important areas where such dynamic progress in biological structures regeneration is not observed. Some fields of medicine only recently have started to use TE to treat various diseases. **The project presenting a novel strategy of damaged/lost tissues by the means of TE will address the need for new, bioactive customized 3D/4D scaffolds well-mimicking soft tissues**.

Project is divided into 4 Work Packages namely: 3D/4D bioinks obtainment and their characterization; WP2 3D/4D bioprinting using novel class of bioinksWP3 Detailed characterization of biomaterials physicochemical properties and WP4. Biological properties study.

Newly developed, 3D/4D bioprinted via DLP technique biomaterials based on chitosan and PDA derivatives will be investigated over their physicochemical properties as well as cytocompatibility in vitro with different cell types such as Schwann Cells, Endothelial Cells and Mesenchymal Stem Cells.

The main effect of the Preludium Grant will be development of the **novel 4D biomaterials with an extraordinary chemical composition and spatial structure as a result of new class of bioinks 3D/4D printing** as well as detailed characteristics of the products at each stage.