

Funding

Project partners

Project title

Project description

Expertise

Project structure and goals

Dissemination

Teams

Contact

Programme for interregional collaboration

Bavaria – Czech Republic

Ziel ETZ 2014-2020 (INTERREG V)

European Fond for Regional Development (EFRE)



Europäische Union

Evropská unie

Europäischer Fonds für regionale Entwicklung

Evropský fond pro regionální rozvoj

Ziel ETZ

Cíl EÚS

Ziel ETZ | Cíl EÚS

Freistaat Bayern – Tschechische Republik

Česká republika – Svobodný stát Bavorsko

2014 – 2020 (INTERREG V)



Universitätsklinikum Regensburg

Laboratory for experimental trauma surgery,
Clinic and policlinic for trauma surgery,
University medical centre,
Regensburg, Germany

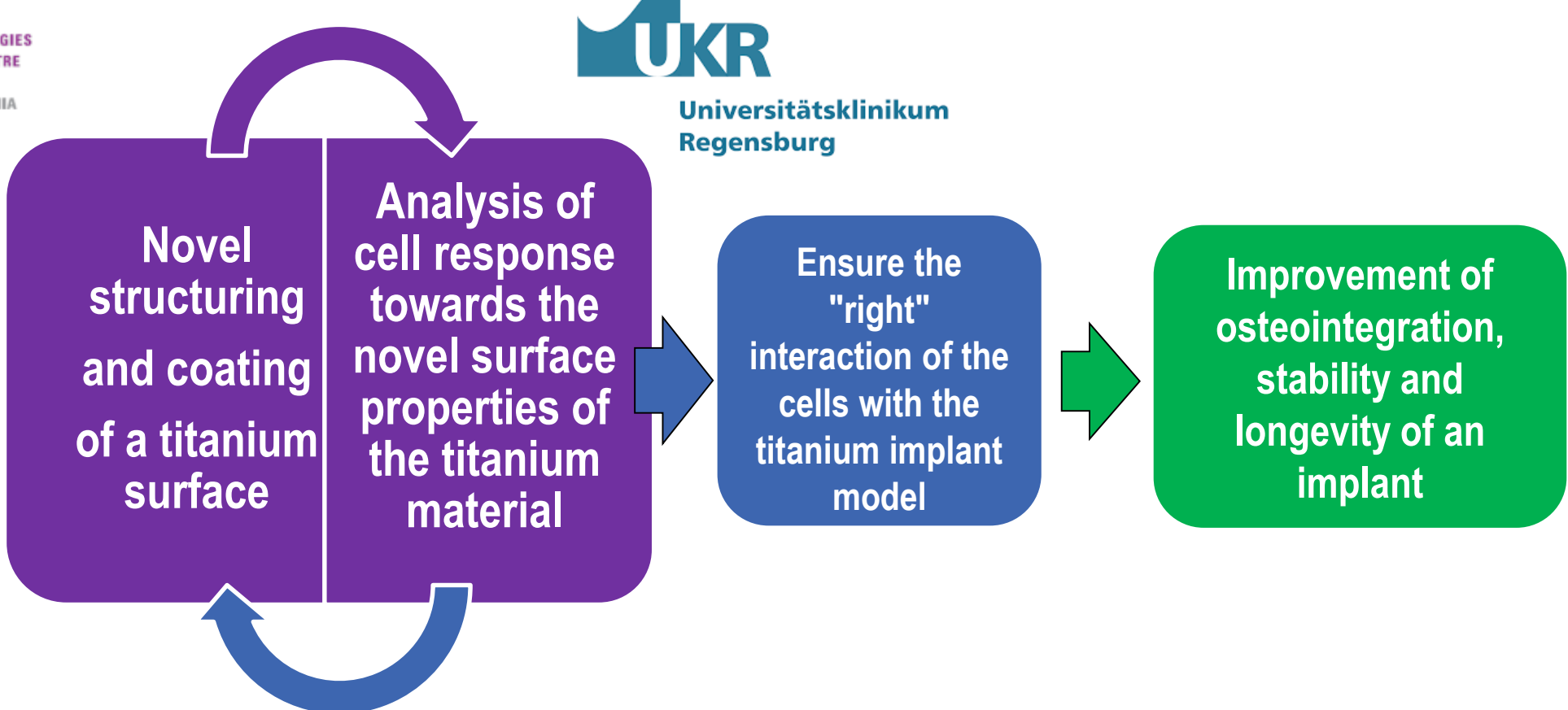


NEW TECHNOLOGIES
RESEARCH CENTRE
UNIVERSITY
OF WEST BOHEMIA

New Technology Research Center,
University of West Bohemia,
Pilsen, Czech Republic

Project 201: MATEGRA

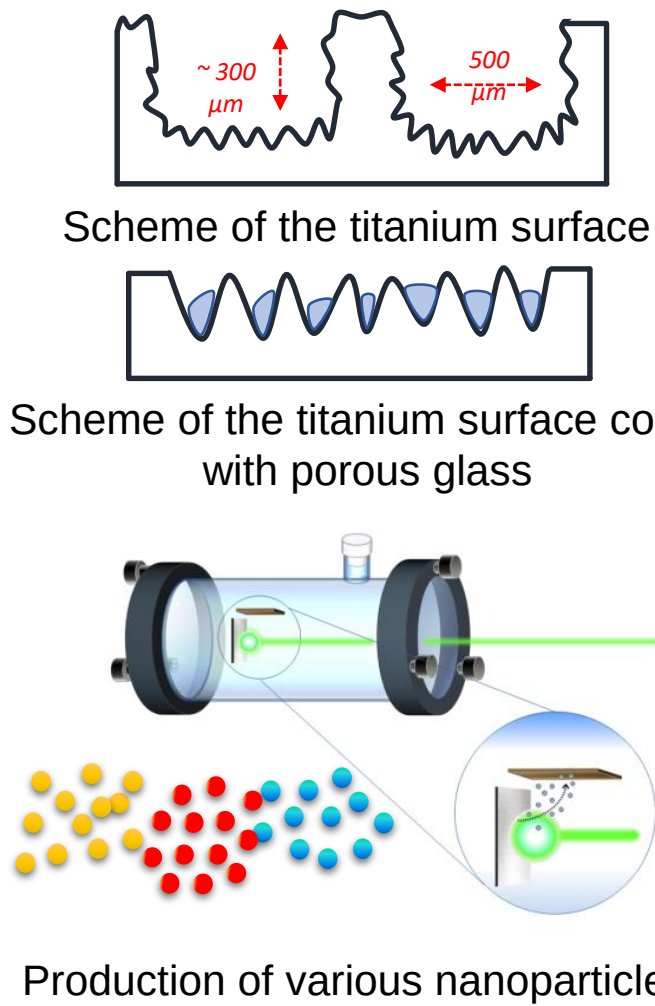
Enhanced porous biomaterials functionalized with stem cells for an improved osteointegration of implants



The MATEGRA project focuses on the development, optimization and testing of new types of biocompatible surfaces of titanium implants for improved osteointegration and bone tissue adhesion.

Parameterization

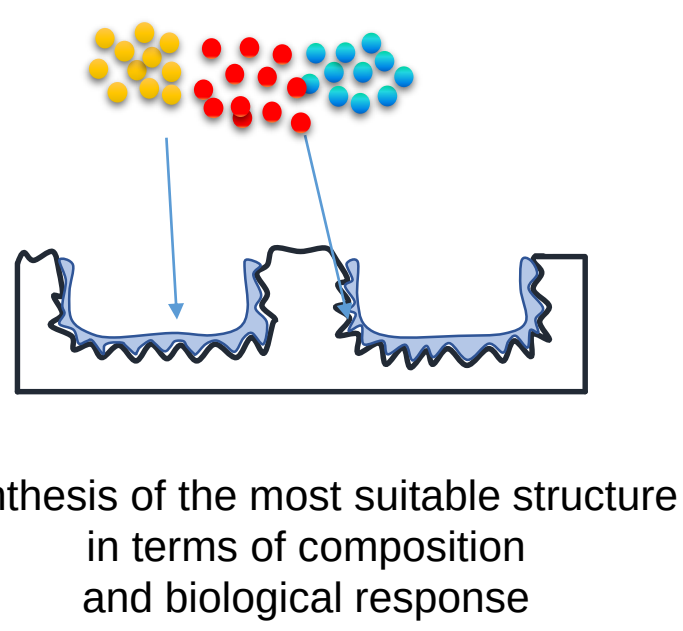
Identification of the most important technological parameters for the production of open-pore titanium surfaces, the porous glass and the nanoparticles.



Production of various nanoparticles

Optimization

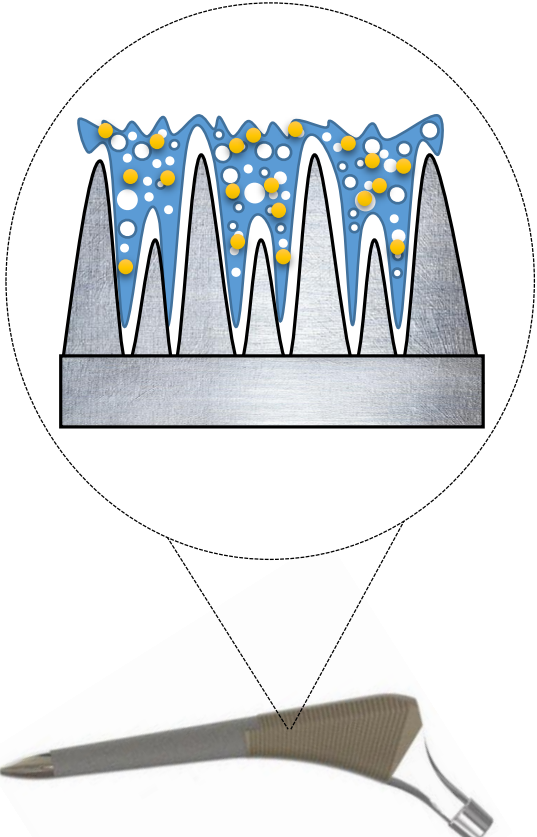
Optimization of the manufacturing process of porous materials. Determination of the most important material properties and embedding of nanoparticles in porous structures.



Synthesis of the most suitable structure in terms of composition and biological response

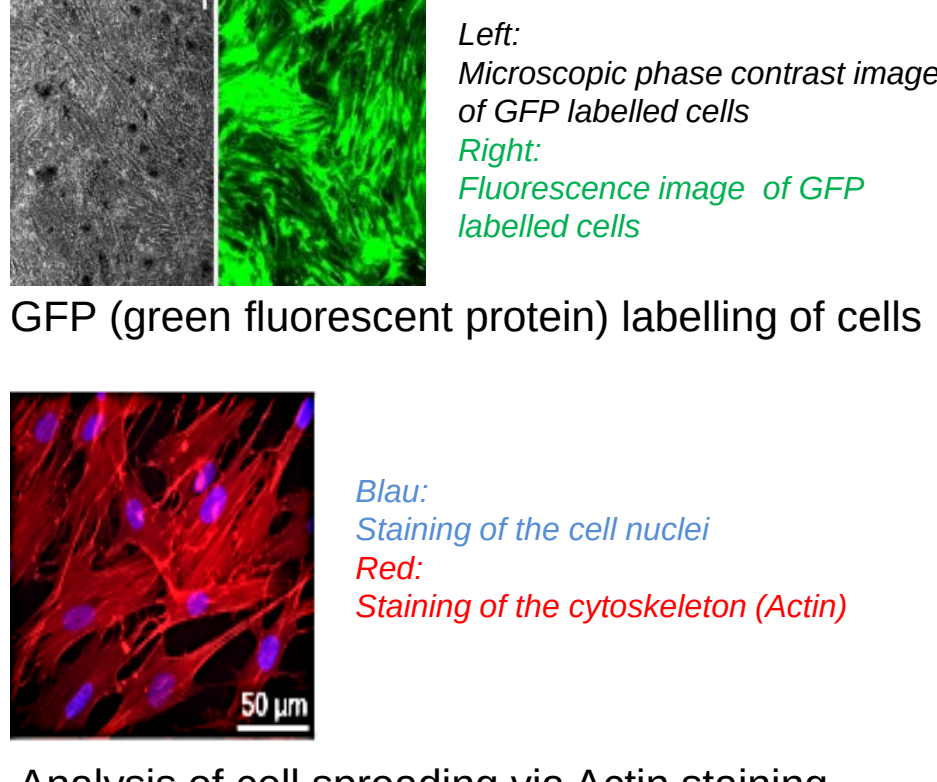
Porous Systems

Production of complex porous systems. Testing of the application possibilities on implants



Primary cellular response

Different cell types (stem cells, periosteal cells and osteoblasts) are collected, expanded, labelled (osteoblasts) and characterized during the project. Subsequently, these cells are used for initial analysis of cell distribution, adhesion and propagation.



GFP (green fluorescent protein) labelling of cells
Analysis of cell spreading via Actin staining

Cell phenotyping

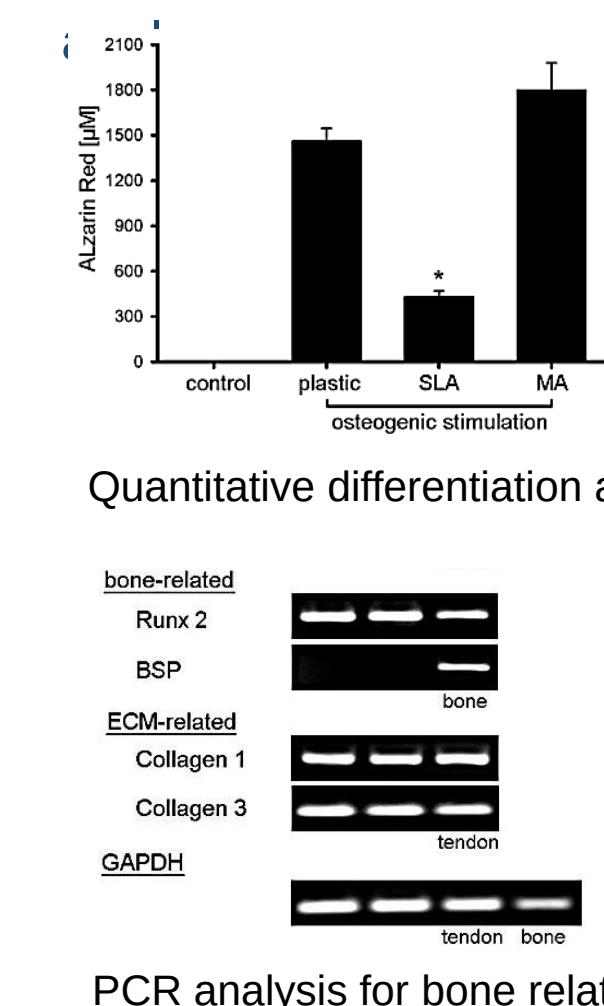
Phenotyping by detailed in vitro studies of cell survival, proliferation, differentiation and mineralization



Live/dead staining
Analysis of mineralization via specific staining of deposited matrix

Osteointegration

Determination of the success rate of differentiation via quantitative assays as well as gene and protein expression

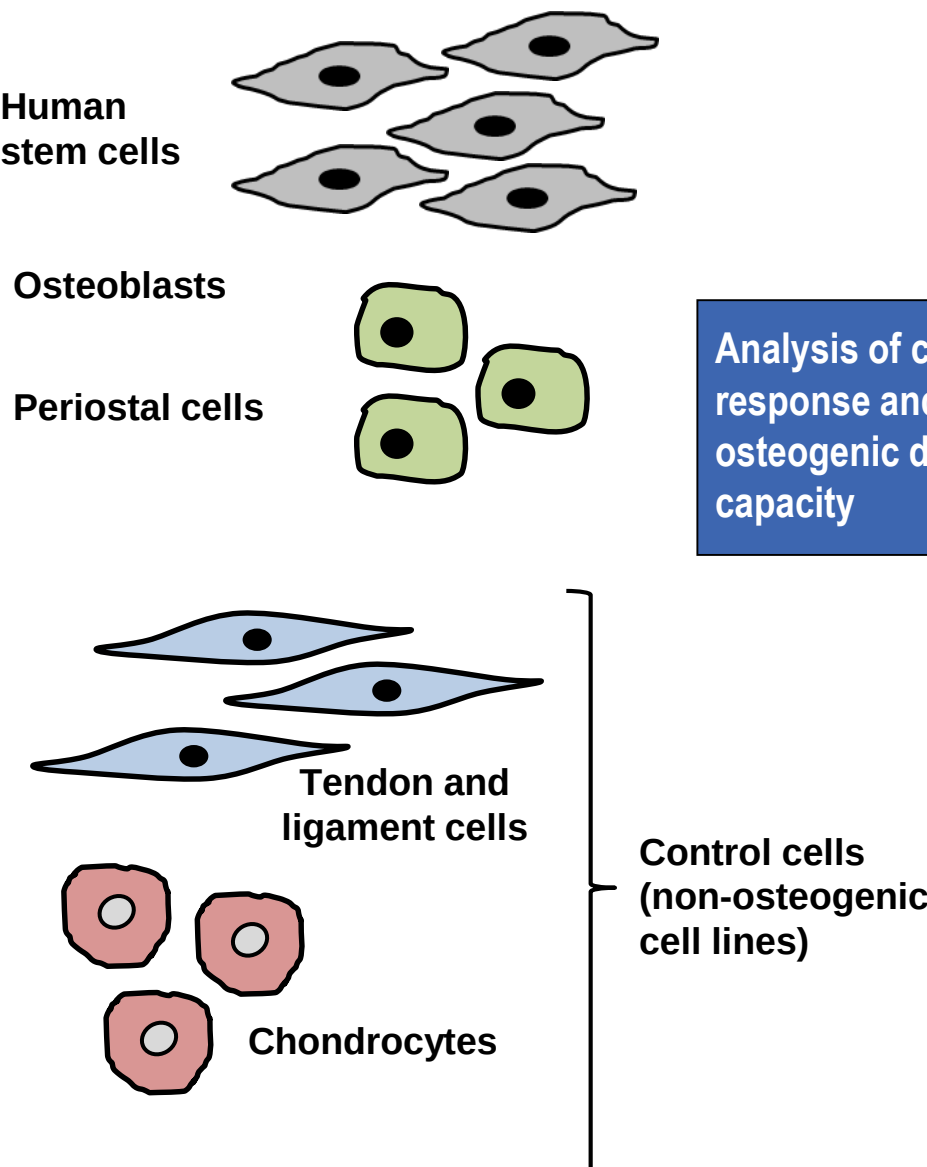


Quantitative differentiation assay
PCR analysis for bone related genes

Testing of cell activity, biocompatibility and differentiation ability of stem cells on the manufactured materials throughout the whole project

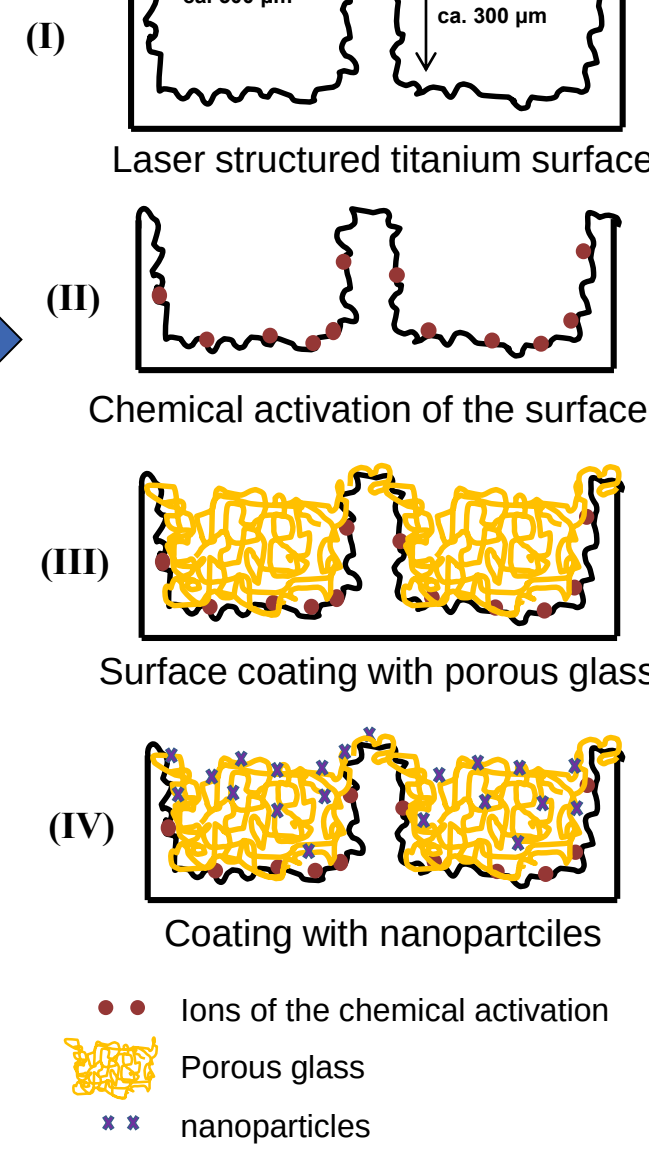
The UKR team carries out the biocompatibility testing of the manufactured materials and the verification of the suitability of the new materials for clinically relevant in vivo bone repair models.

The research goals of this part are:
A) Cultivation of primary and genetically labeled (GFP) mesenchymal cells, which are precursor cells of the skeleton and primary osteoblasts (differentiated bone cells), as well as various non-osteogenic control cell lines
B) Testing the biocompatibility of the material through cell distribution and deposition analyzes
C) Testing cell survival and cell proliferation on these materials
D) Investigation of cell response in relation to stem cell differentiation towards osteoblasts including gene and protein expression



Analysis of cell response and osteogenic differentiation capacity

Titanium scaffolds (commercially pure titanium and titanium alloy)



The NTC team takes over the task of developing and producing the material samples.

The research objectives of this part of the project can be divided into several steps:
A) Production of a rough and porous titanium surface, generated by laser treatment.
B) Chemical activation of the structured surface (e.g., by means of calcium ions).
C) Applying Sol-gel polymerized titanium and silicon precursors to the surfaces to provide rough and porous two-phase titanium silicate structures.
D) Laser-induced introduction of selected bio-active nanoparticles (SiOx, TiOx and their hydrated forms) to stimulate bone growth.

Educational seminars



Seminar on stem cell biology and the osteogenic differentiation process
Seminar on biomaterials and their osteointegration



Project seminars



Final seminar for the presentation of all research results of MATEGRA at the UKR



Preparation of a scientific paper for presenting the research outcome and the resulting new knowledge

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