Laboratory of Cell-Biomaterial Interactions

Offer

- Evaluation of material biocompatibility
- Cytotoxicity measurement
- Evaluation of cell adhesion and migration on bio-materials
- Cell viability measurement
- Cultivation of commercial available cell lines
- Fluorescent and confocal microscopy, including real-time monitoring
- Measurement of protein expression by ELISA and Luminex techniques
- Eukaryotic cells transformation – transfection, electroporation
- Image analysis (e.g. objects counts, lengths, areas or angels, image stitching, picture thresholding)
- Consultation and advisory during study design
- Cooperation with data interpretation

Expertise

Description of the influence of the material properties on the cell:

- Survival, adhesion, growth and differentiation – biocompatibility
- Entry and release of the cell – pharmacokinetics
- Localization in the cell
- Specificity of the cell targeting by various tested materials

Tested materials:

- Nanodiamond
- Silicon nanoparticles
- Hyaluronan complexes

Potential applications of our research:

- Smarkers in fluorescence microscopy
- Vehicles for drug delivery
- Coatings for bone implants improving the healing process
- Biloelectronic devices and biosensors (thanks to controllable electrical conductivity of these materials)

Research Area & Excellence

The research of the group is mainly focused on interactions between human cells (osteoblastic cell line, primary fibroblasts, mesenchymal stem cells, etc.) and surfaces or nanoparticles prepared from different biocompatible materials with controlled properties.

Used materials are tested as solid surfaces for interaction with adherent cells (implantology, sensing, etc.) and as nanoparticles for sensing, imaging and drug delivery. Knowledge gained from our research can be also utilized in fabrication of coatings for

bone implants improving the healing process, moreover, thanks to controllable electrical conductivity of these materials, in construction of bio-electronic devices and biosensors.

Thus their biocompatibility, their entry and release of the cell, cellular localization, specific cell targeting are deeply studied using following materials: .

- carbon (nanocrystalline diamond and graphene)
- titanium (nanostructured and ultra fi ne titanium)
- biodegradable nanocomposites (based on aliphatic polyester nanofibers with collagen, calcium phosphate nanoparticles and sodium hyaluronan)
- silicon (silicon nanoparticles doped with boron and phosphorus)
- hyaluronic acid (hydrogels, complexes with surfactants).

Members

- Assoc. Prof. Marie Hubálek Kalbáčová, Ph.D., M.Sc. – Research Group Leader
- Tereza Bělinová, M.Sc.
- Iva Machová, Ph.D., M.Sc.
- Pavla Sauerová, M.Sc.
- Lucie Vrabcová, M.Sc.

Selected Publications

- Hubalek Kalbacova M., Verdanova M., Broz A., Vetushka A, Fejfar A., Kalbac M.: *Modulated surface of single-layer graphene controls cell behaviour*, Carbon, 72: 207–214, 2014
- Kalbacova M, Broz A, Kong J, Kalbac M,: *Graphene substrates promote adherence of human osteolbasts and mesenchymal stromal cells*, Carbon, 48: 4323–4329, 2010
- Jin H, Heller DA, Kalbacova M, Kim J-H, Zhang J, Boghossian AA, Maheshri N, Strano MS,: *Detection of single-molecule H2O2 singaling from epidermal growth factor receptor using fluorescent single-walled carbon nanotubes*, Nature Nanotechnology, 5: 302–309, 2010
- Pytlik R, Stehlik D, Soukup T, Kalbacova M, Rypacek F, Trc T, Mulinkova K, Michnova P, Kideryova L, Zivny J, et al.,: *The cultivation of human multipotent mesenchymal stromal cells in clinical grade medium for bone tissue engineering*, Biomaterials 30: 3415–3427, 2009
- Kalbacova M, Rezek B, Baresova V, Wolf-Brandstetter C, Kromka A,: *Nanoscale topography of nanocrystalline diamonds promotes differentiation of osteoblasts*, Acta Biomaterialia 5: 3076–3085, 2009

Patent

- Patent EU – EP 2 288 699: Method of making arranged cell structures

Are you interested in this expertise?

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Experts and their department

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