

UNIVERSITAS
CAROLINA
PRAGENSIS

Charles University

About Charles University

- Founded by the Roman Emperor and the Bohemian King Charles IV in 1348;
- The oldest university in Central Europe;
- **17** faculties;
 - + **4** institutes;
 - + **5** other teaching and research centres
- **4,600** academic and research staff;
- **50,000+** students;



Research at Charles University

- **3,970** articles indexed in WoS;
- **5,151** articles indexed in Scopus;
- **76** is value of H-Index at CUNI;
- participation in **over 100** projects funded by the EU's 7th Framework Programme and **35** H2020 projects (8th Framework Programme);
- **New University Centres for International Research:**
 - Medicine Centre UNIMEC in Pilsen opened in 2014
 - Medicine Centre MEPHARED in Hradec Králové opened in 2015;
 - BIOCEV near Prague opened in 2016,

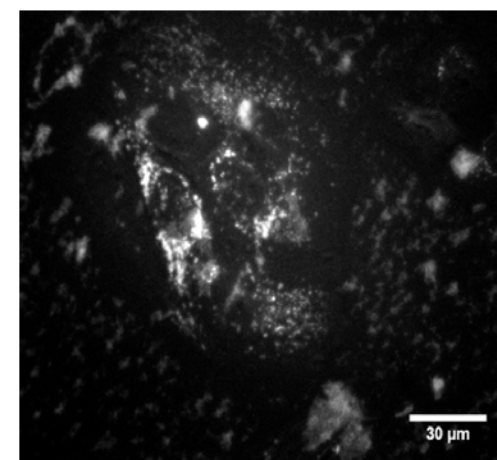
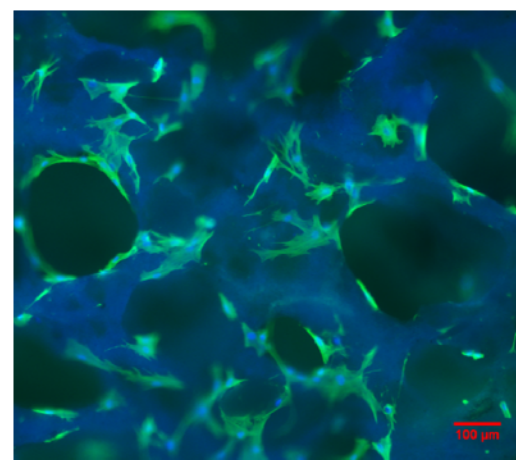
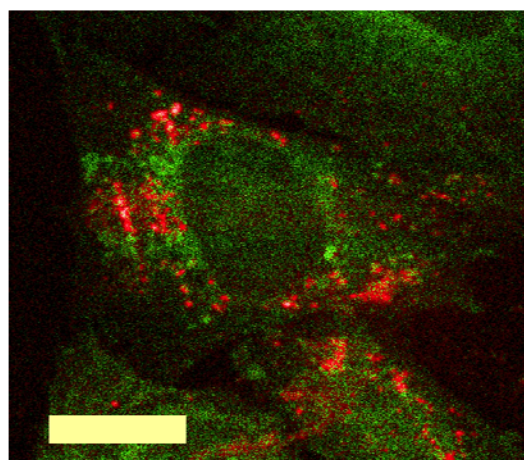
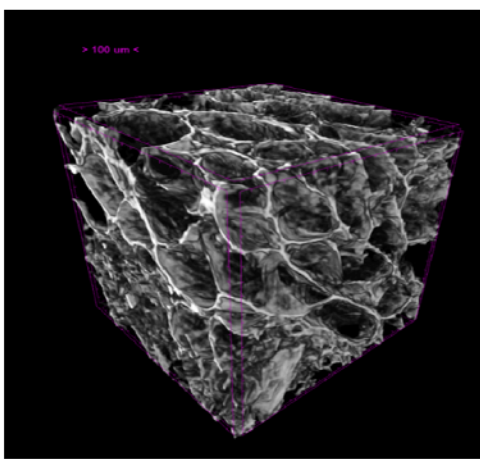




- Faculty of Medicine in Pilsen;
- Focus on research and development in replacement and regeneration of vital organs;
- Two research programmes:
 1. Replacement and support of vital organ functions,
 2. Regeneration and repair of vital organs;
- Opened in September 2014.

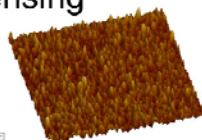
Laboratory of Cell-Biomaterial Interactions

Assoc. Prof. RNDr. Marie Hubálek Kalbáčová, PhD.

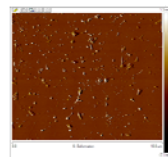


Solid substrates (surfaces)

 **Nanocrystalline Diamond** – implantology, biosensing

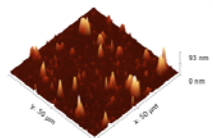


 **Graphene** - implantology, biosensing



 **Titanium nanotubes**- implantology

 **Ultra-fine Titanium** - implantology



 **Biodegradable Nanocomposites** – orthopedics, stomatology

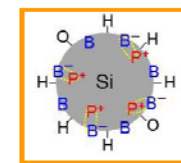


Nanoparticles

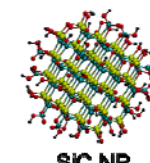
 **Hyaluronic Acid- Surfactant Complexes** - drug delivery, DNA/RNA delivery, cosmetic industry



 **Silicon Nanoparticles** - imaging, nucleic acid delivery, drug delivery

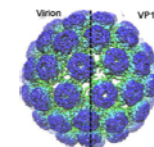


P- B- co-doped Si NP



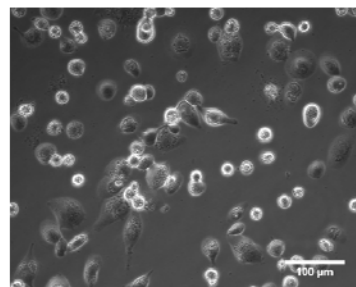
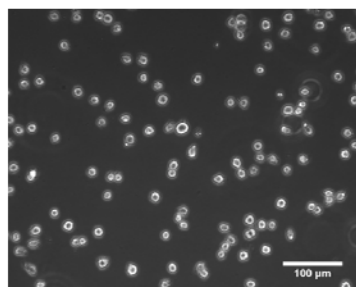
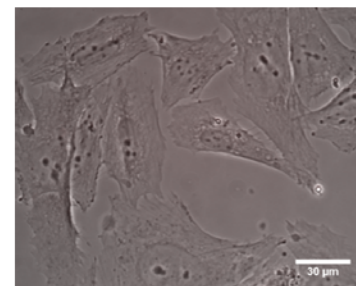
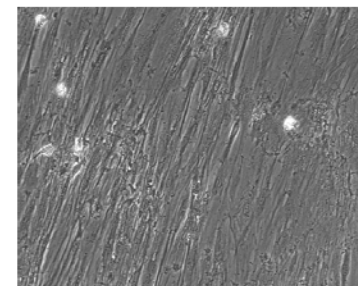
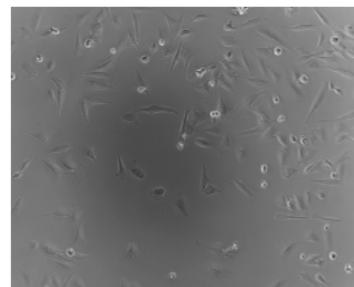
SiC NP

 **Viral-based Nanoparticles** - nucleic acid delivery, drug delivery

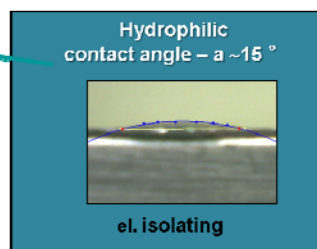
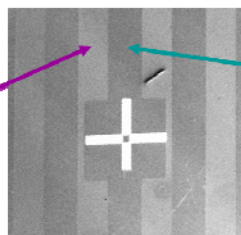
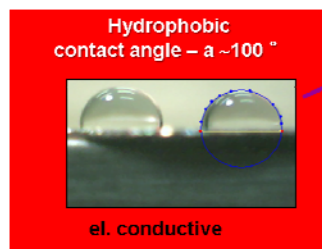


Cells

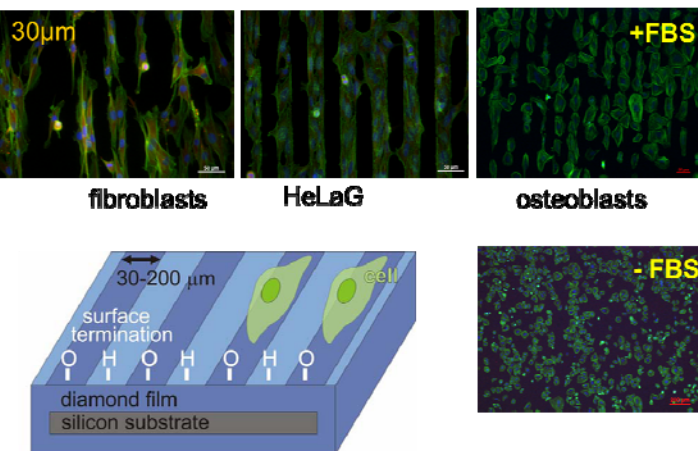
- **Osteoblasts** - SAOS-2 – human osteosarcoma cell line
- **Mesenchymal stem cells** – human and porcine
- **Fibroblasts** - NHDF – human primary cells (abdomen, leg, etc.)
- Malme-3 – cell line
- **Keratinocytes** - HaCaT – human skin cells
- **Monocytes/macrophages** - THP-1 – human leukemic monocytes / macrophages



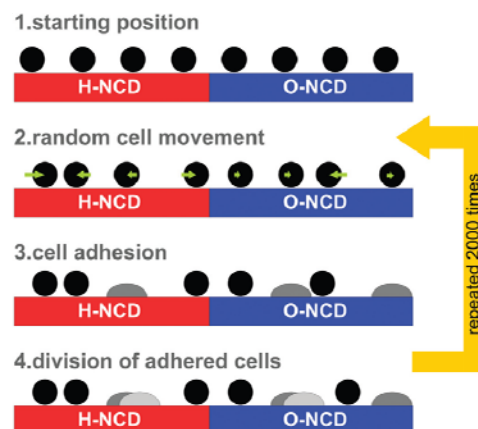
Nanocrystalline Diamond



Cell Arrays



Stochastic Model of Cell Arrays on H/O-diamond Patterns

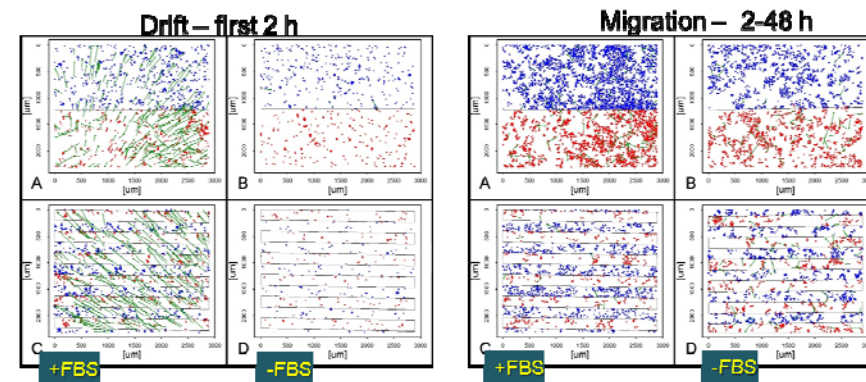
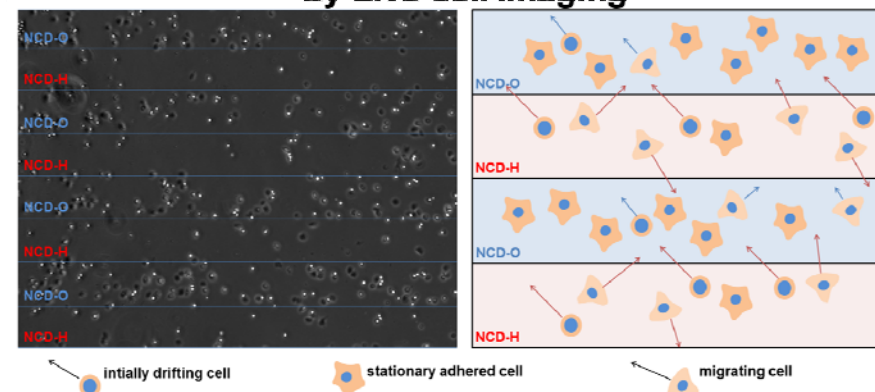


Kalbacova et al., P68(b), 2008
Razek et al., Sensors, 2009

Ukrainets et al., Biomaterials, 2016

www.biomedic-plzen.cz

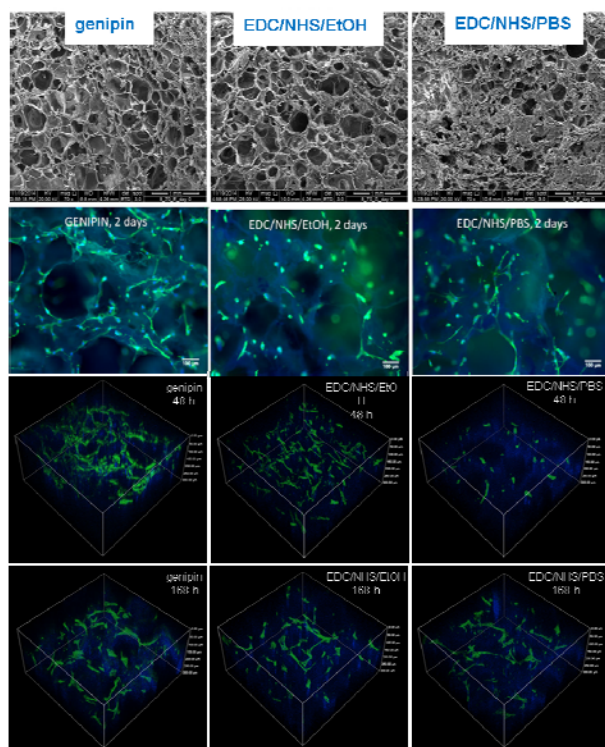
Osteoblast Adhesion, Migration and Proliferation by Live-cell Imaging



Broz et al., J Biomed Mater Res: A, 2017

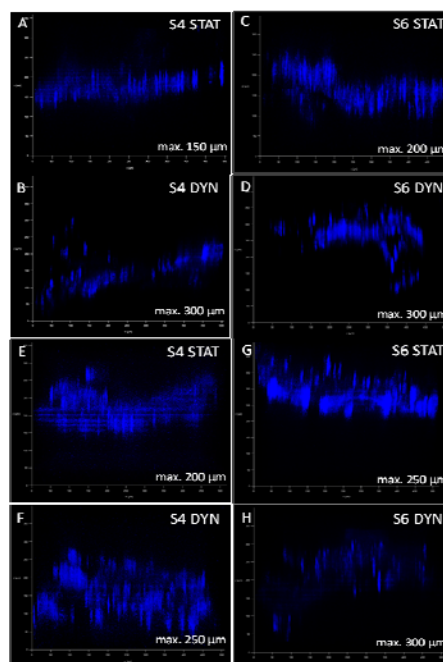
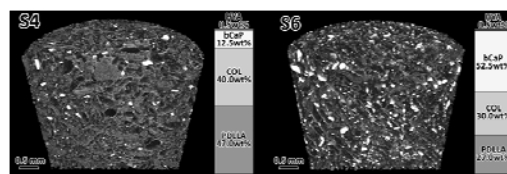
Biodegradable Nanocomposites

Different Cross-linking of Collagen-based 3D Scaffolds



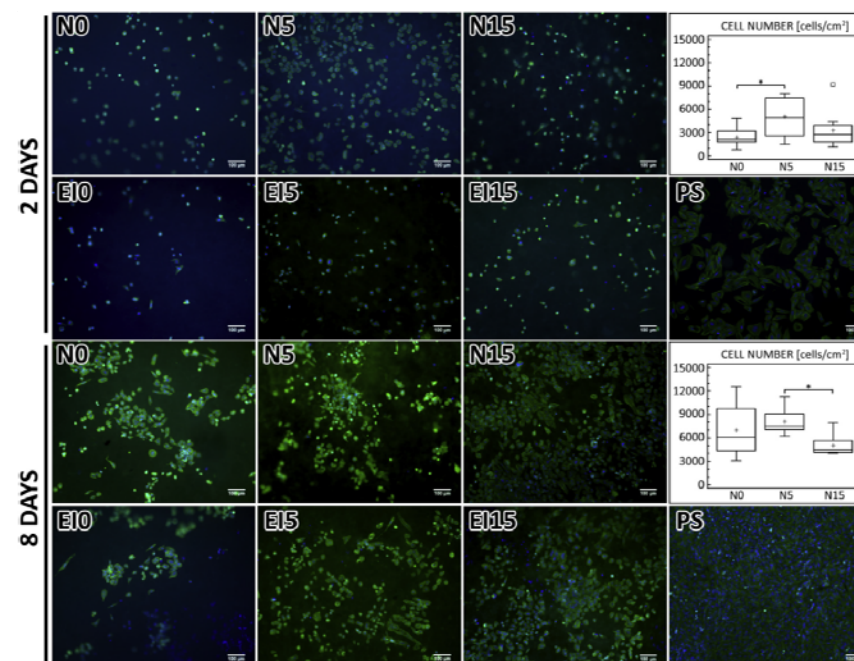
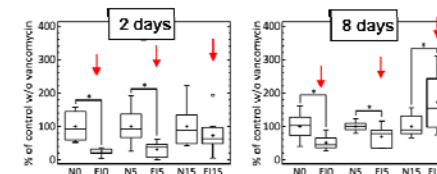
Suchy et al., Biomed Mater, 2016

Different composition of Collagen-based 3D Scaffolds and cultivation conditions



Saureva et al., manuscript in preparation

Vancomycin impregnated Collagen/HA electrospun layers

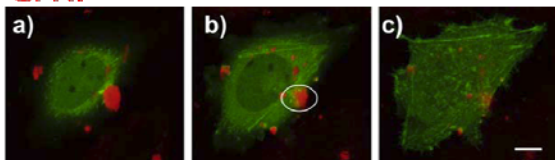


Suchy et al., E J Pharm Sci, 2017

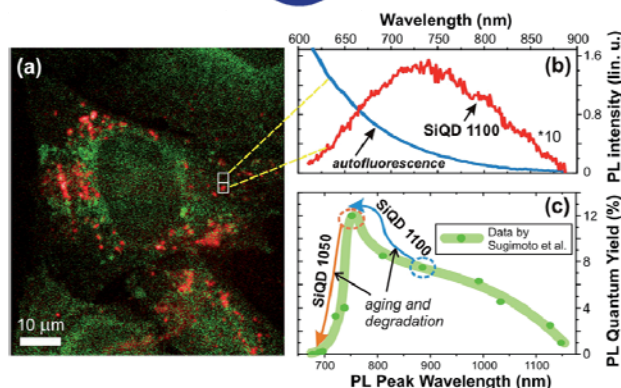
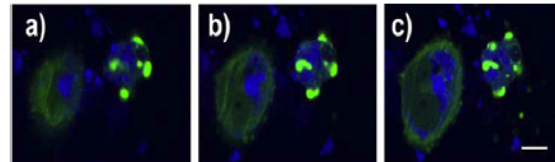
Silicon Nanoparticles



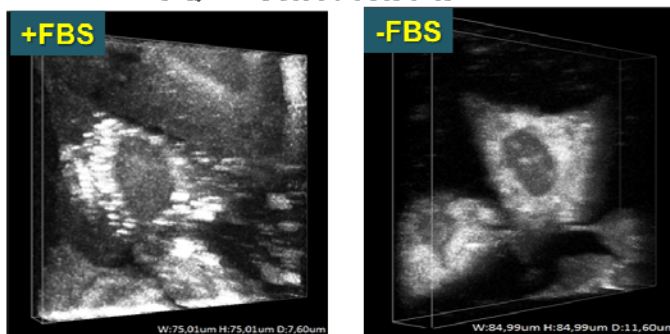
Si NP



Diamond NP



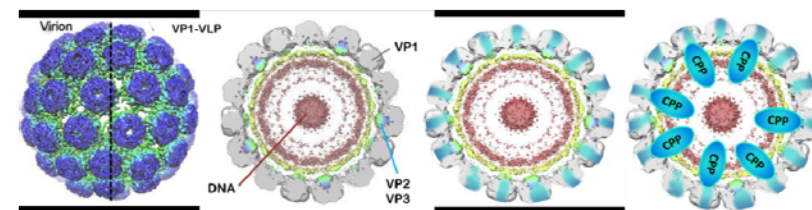
SiQD In Osteoblasts after 24 h



Ostrovská et al., RSC Adv, 2016

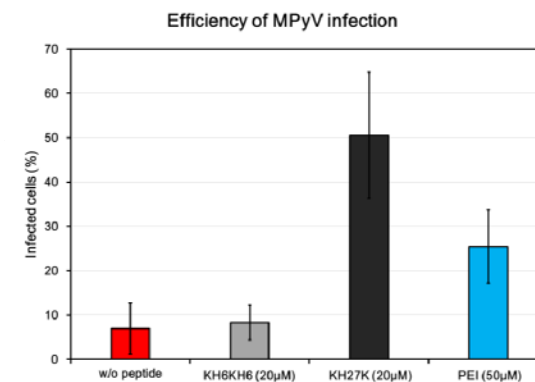
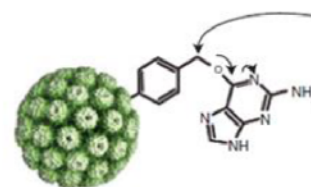
Viral-based Nanoparticles

Cell penetrating peptides - CPPs



Histidine rich peptides – ↑ - infectivity of MPyV
(KH27K, KH6KH6)

↑ - ER-endosome-lysosome escape



Thank you for your attention

