

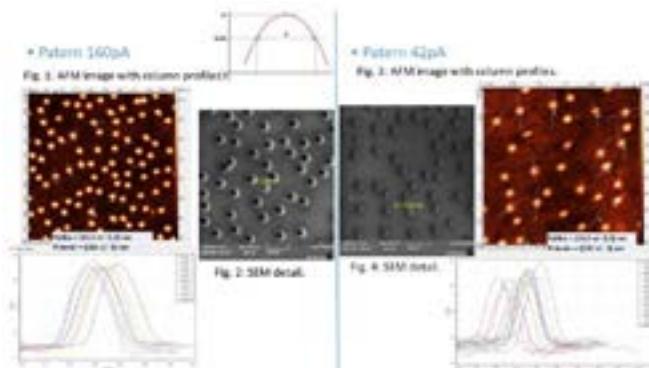
Exploration of the potential for nanostructured hydrogel surface in prevention of cell upregulating cytoskeletal structures and loosing transparency

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The secondary cataract occurs when cells begin to accumulate on the back surface of the Artificial Intraocular Lens (IOL). Ideally, the IOL should be designed to maintain high transparency of the cells on its surface as it is the case of the natural lens. The standard IOL features unnaturally smooth surface from the manufacture process. Cells are known to respond to smooth surfaces in tissue culture by upregulation of cytoskeleton proteins,

e.g. doubling of actin and actinin and forming conspicuous stress fibres.

For the proposed IOL, we use lithography to create a nanostructured form with pyramid depressions. The form is then used to mold PHEMA and then we visualize the PHEMA surface with AFM to confirm that the material is suitable for the nanostructure. The validated material will be used in nanostructured form with pyramids approximately 50 nm in size distributed in an arrangement that does not allow adherent cells to form straight actin cables in any direction. We have already proposed an initial pattern with the arrangement of a 5-pyramid star cluster repeating irregularly. The cluster of 5 pyramids has one central pyramid and the remaining 4 are located in the direction NNW, WNW, SSE and ENE. Human fibroblasts will be used to analyze cellular responses to topology followed by epithelial cells. Cell transparency will be measured in bright field microscopy each day after seeding the cells on the nanostructured surface of the PHEMA for a certain period of time. The surrounding smooth surface will serve as a control. The cells will finally be fixed and stained for F-actin using Alexa Flour 488 Phalloidin and visualized with a laser scanning confocal microscope. The presence of F-actin fibres will be quantified and correlated with the transparency of the living cells.



References

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Biography

Marketa Suranova has her expertise in Optometry. Her project is based on design and produce nanostructured hydrogel and visualize the life cell response to this topography evaluating actin cytoskeleton and transparency. This the nanostructured surface on the intraocular lens material is expected to prevent cytoskeleton enrichment and maintain high cell transparency and thus creating a potential to produce intraocular lens resistance to secondary cataracts. The foundation is based on (Meek and Knupp, 2015) a paper about corneal structure and transparency where they proposed models based essentially on the fact that the collagen fibers in the corneal stroma were associated with six adjacent proteoglycan fibers at regular axial intervals. Defined lengths of proteoglycans would force the fibrils to a perfect hexagonal lattice to ensure corneal transparency. We are creating a similar model for the design of the surface the intraocular lens.