GUIDING OF ENDOTHELIAL CELLS TARGETED WITH SEMICONDUCTOR MATERIAL NANOPARTICLES

T. Braniste[1,*], I. Tiginyanu[1], T. Horvath[2], S. Raevschi[3], O. Gridenco[1], S. Cebotari[2] and A. Hilfiker[2]
[1]*National Center for Materials Study and Testing, Technical University of Moldova,*
[2]*Leibniz Research Laboratories for Biotechnology and Artificial Organs (LEBAO), Department of Cardiothoracic, Transplantation and Vascular Surgery, Hannover Medical School, Germany*;
[3]*Department of Physics and Engineering, State University of Moldova*
*E-mail: tudor.braniste@cnstm.utm.md

In this paper we report on the interaction of living endothelial cells (EC) and semiconductor material based nanoparticles (NP). The investigated nanoparticles are based on GaN and Fe_2O_4Zn. GaN NP with the dimensions ranging from 50 to 100 nm have been obtained in a single HVPE growth process, where GaN layer was deposited on ZnO sacrificial NP. After the growth process ends the ZnO core is being decomposed at high temperatures in H_2 flow. Fe_2O_4Zn NP with the dimensions less than 100 nm have been purchased from Sigma Aldrich. All the experiments have been performed using porcine aorta EC, which have been isolated and labelled as described previously [1,2]. The ECs, passage 6 – 9, were incubated with different doses of floating in the medium NP. It was found that the suitable working concentration of nanoparticles floating in the medium in the process of incubation with EC is less than 100 μg/ml, the higher concentrations affect cells as they diminish the proliferation rate more than 50% comparing with the control group. All the NP are uptaken by the cells within a couple of hours of incubation. We show (see figure 1a) that using a continuous magnetic field it is possible to move targeted cells in a desired manner. In the figure 1b we show the random distribution of the EC after three days of incubation with NP and without any magnetic field influence. The insert in the figure 1b represents the SEM image of EC with uptaken NP. The controlled recellularization represents a great advantage for the further development of tissue engineering applications [3].

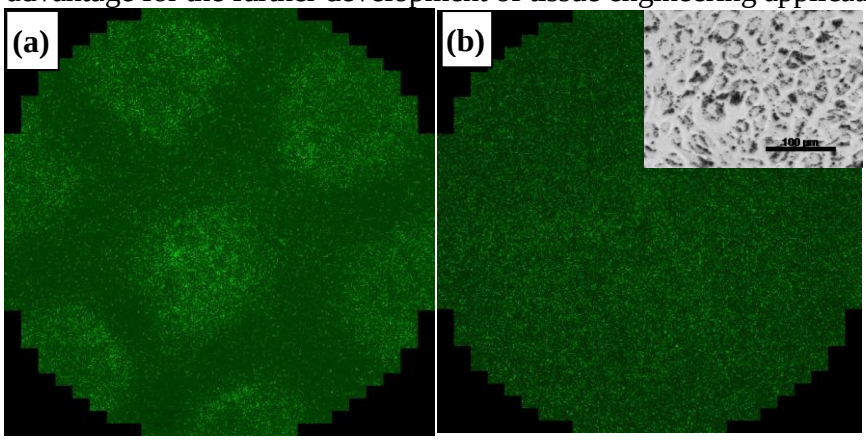

Figure 1. Endothelial cells after three days of incubation with Fe_2O_4Zn nanoparticles. In (a) are presented cells which were exposed to continuous magnetic field and in (b) cells in the control group. The insert from (b) shows the uptaken nanoparticles in the endothelial cells.

Conclusions. We found that ECs attract free NPs and, depending on the NP concentration, the cellular activity is slowed down resulting in lower cellular mobility. Nevertheless, cellular proliferation does not seem to be affected as cells continue to divide even when relatively large number of NPs are internalized. Guiding cells targeted with nanoparticles was demonstrated, which represent a step forward to the cellular therapy applications.

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