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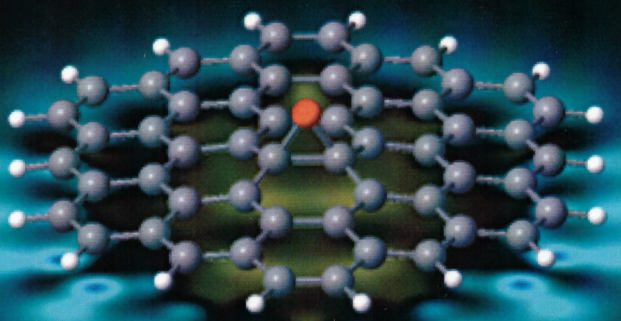

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EFFECTS OF $GdYVO_4:Eu^{3+}$ NANOPARTICLES ON THE METABOLIC ACTIVITY OF SPLENOCYTES AND BONE MARROW CELLS

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Abstract. There is accumulating evidence that $GdYVO_4:Eu^{3+}$ nanoparticles can be used as nano-based theranostic agents in the treatment of cancer. However, the study of their clinical effectiveness should be preceded by the evaluation of their cytotoxicity.

Aim. The study was intended to assess the cytotoxicity and the impact of $GdYVO_4:Eu^{3+}$ nanoparticles on the metabolic activity of splenocytes and bone marrow cells.

Materials and methods. Bone marrow cells were collected from the femur of 8 WAG rats. Splenocytes were isolated from the spleen of animals. The isolated and filtered bone marrow cells and splenocytes were separately resuspended in RPMI 1640 enriched with 10% fetal bovine serum. Antibiotic and antimycotic agents were added.

Splenocytes and bone marrow cell cultures were incubated with solutions of $GdYVO_4:Eu^{3+}$ nanoparticles for 24 hours (n = 8) in ascending order of concentrations (0-20-40-80-160-320 μg/ml). MTT assay was used to assess the cytotoxicity of nanoparticles. The ability of viable, metabolically active cells to convert 3-(4,5-dimethylthiazol-2-yl)-3,5-diphenyltetrazolium bromide into formazan by mitochondrial dehydrogenases, primarily succinate dehydrogenase, underlies the principle of this assay. After incubation with MTT, the absorbance was measured in the samples at 570 nm. The obtained numerical data were statistically processed using Kruskal-Wallis and Dunn's criteria.

Results. Cell cultures used in this research are shown in Figure 1.

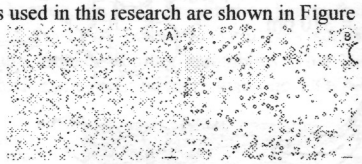

Figure 1. Representative images of splenocytes (a) and bone marrow cells (b) used in this study. The scale bar is 20 μm.

Quantitative analysis revealed that lower concentrations of nanoparticles (0-160 μg/ml) had no impact on the metabolic activity of bone marrow cells. This conclusion is based on the absence of statistically significant differences ($p>0.05$) in the optical density values of samples, which reflect the concentration of formazan and, thus, the ability of cells to convert MTT into formazan. Meanwhile, the highest concentration of nanoparticles (320 μg/ml) used in this study increased the metabolic activity of bone marrow cells by 60% ($p<0.0001$).As for splenocytes, all concentrations of $GdYVO_4:Eu^{3+}$ nanoparticles were found to reduce the optical density values of samples. However, the difference was statistically insignificant ($p>0.05$) suggesting the absence of cytotoxic effects of nanoparticles towards spleen cells.

Our findings indicate that $GdYVO_4:Eu^{3+}$ nanoparticles at the concentrations of 160 μg/ml and below show no cytotoxic effects towards splenocytes and bone marrow cells. At the same time, they increase the metabolic activity of bone marrow cells at 160 μg/ml without affecting their viability.

Conclusions. Low concentrations of $GdYVO_4:Eu^{3+}$ nanoparticles (0-160 μg/ml) affect neither viability, nor metabolic activity of splenocytes and bone marrow cells.