

“Nanochemistry and biotechnology”

Effect of gold nanoparticles on tumor cells viability and formation of multicellular tumor spheroids

**O.M. Yakymchuk¹, N.O. Vdovichenko¹, O.V. Yastrebova¹,
O.M. Perepelytsina¹, N.A. Volkova², E.V. Pavlovich²,
M.V. Sydorenko¹, A.N. Goltsev².**

*1 Department of biotechnical problems of diagnostic IPCC NAS of Ukraine.
Prospect Nauki, 42/1, Kiev-03028, Ukraine.*

E-mail: elenayakymchuk13@gmail.com

*2 Institute for problems of cryobiology and cryomedicine NAS of Ukraine,
23, Pereyaslavskaya str., Kharkov, Ukraine 61015*

Aim To investigate the impact of different concentrations of gold nanoparticles (NPs Au), to determine bio-safety of NPs Au on monolayer (2D) and spheroid (3D) culture of tumor cells line.

The **objects** of the study were tumor cell line of colon adenocarcinoma (HT 29), gold nanoparticles and single-walled carbon nanotubes (SWCNT). NP Au was kindly provided by Institute for problems of cryobiology and cryomedicine NAS of Ukraine, SWCNTs - by G. V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine. Cell culture was handled in standard tissue culture conditions. The generation of multicellular tumor spheroids (MTS) was performed with 0.24% carboxy-methyl-cellulose (CMC) (Bio-Rad, USA). To determine the kinetics of cell population growth and proliferative activity was used MTT-test and trypan blue staining. MTSs volume was estimated by formula of B'yerkvig [1] and program Axio Vision Release 4.7 from Stemi 2000 (Zeiss, Germany).

As **results** it was determined that NPs Au in concentrations ranging from 1.0 to 7.0 µg/ml does not affect the viability of tumor cells in 2D culture. In 3D culture increasing concentrations of NPs Au from 1.0 to 7.0 µg/ml led to decreasing the volume of tumor cell spheroids from $7,18 \times 10^{-3} \text{ mm}^3$ to $4,95 \times 10^{-3} \text{ mm}^3$, it was accompanied with increasing number of MTS. Influence of NPs Au was compared with impact of SWCNTs. Concentrations of SWCNTs from 1.0 to 7.0 µg/ml, alternatively, stimulated the formation of a small number of tumor spheroids with volume from 4.0 to $6.8 \times 10^{-3} \text{ mm}^3$. The data confirmed the statistical definition of Pearson` correlation coefficient [2]. The correlation coefficient of MTS volume for the NPs Au concentrations was -0.48 and for SWCNTs was 0.82.

1. R. Bjerkvig // Spheroid culture in cancer research, CRC Press 1992: 335.
2. Devlin Susan J., Gnanadesikan R., Kettenring J.R./ Robust estimation and outlier detection with correlation coefficients // Biometrika 1975: 62(3): 531-545.