FIRST INTERNATIONAL CONFERENCE ON ELECTRON MICROSCOPY OF NANOSTRUCTURES

ELMINA 2018

ПРВА МЕЂУНАРОДНА КОНФЕРЕНЦИЈА О ЕЛЕКТРОНСКОЈ МИКРОСКОПИЈИ НАНОСТРУКТУРА

August 27-29, 2018, Belgrade, Serbia
27–29. август 2018. Београд, Србија

FIRST INTERNATIONAL CONFERENCE

ELMINA 2018

PROGRAM

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BOOK OF ABSTRACTS

Rectorate of the University of Belgrade, Belgrade, Serbia
August 27-29, 2018
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Organized by:
Serbian Academy of Sciences and Arts and Faculty of Technology and Metallurgy, University of Belgrade

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FIRST INTERNATIONAL CONFERENCE
ELMINA 2018
Program and Book of Abstracts

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At the beginning we wish you all welcome to Belgrade and ELMINA2018 International Conference organized by the Serbian Academy of Sciences and Arts and the Faculty of Technology and Metallurgy, University of Belgrade. We are delighted to have such a distinguished lineup of plenary speakers who have agreed to accept an invitation from the Serbian Academy of Sciences and Arts to come to the first in a series of electron microscopy conferences: Electron Microscopy of Nanostructures, ELMINA2018. We will consider making it an annual event in Belgrade, due to this year's overwhelming response of invited speakers and young researchers. The scope of ELMINA2018 will be focused on electron microscopy, which provides structural, chemical and electronic information at atomic scale, applied to nanoscience and nanotechnology (physics, chemistry, materials science, earth and life sciences), as well as advances in experimental and theoretical approaches, essential for interpretation of experimental data and research guidance. It will highlight recent progress in instrumentation, imaging and data analysis, large data set handling, as well as time and environment dependent processes. The scientific program contains the following topics:

- Instrumentation and New Methods
- Diffraction and Crystallography
- HRTEM and Electron Holography
- Analytical Microscopy (EDS and EELS)
- Nanoscience and Nanotechnology
- Life Sciences

To put this Conference in proper prospective, we would like to remind you that everything related to nanoscience and nanotechnology started 30 to 40 years ago as a long term objective, and even then it was obvious that transmission electron microscopy (TEM) must play an important role, as it was the only method capable of analyzing objects at the nanometer scale. The reason was very simple - at that time, an electron microscope was the only instrument capable of detecting the location of atoms, making it today possible to control synthesis of objects at the nanoscale with atomic precision. Electron microscopy is also one of the most important drivers of development and innovation in the fields of nanoscience and nanotechnology relevant for many areas of research such as biology, medicine, physics, chemistry, etc. We are very proud that a large number of contributions came from young researchers and students which was one of the most important objectives of ELMINA2018, and which indicates the importance of electron microscopy in various research fields. We are happy to present this book, comprising of the Conference program and abstracts, which will be presented at ELMINA2018 International Conference. We wish you all a wonderful and enjoyable stay in Belgrade.

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Transmission Electron Microscopy in Evaluation of Curcumin Nanoparticles Cellular Uptake

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Curcumin, a principal active component of an Indian spice is known for its anticancer properties [1]. With the use of transmission electron microscope (TEM) we here analyzed cellular uptake of blue light (470 nm, 1 W)-irradiated curcumin nanoparticles (NC), using U251 glioma cells as targets. TEM imaging was performed on Morgagni 268D electron microscope (FEI, Hillsboro, OR), operated at 80 kV. Nanocurcumin colloid was prepared using tetrahydrofuran/water solvent exchange method [2]. Tumor cell line U251 were maintained at 37°C in a humidified atmosphere with 5% CO_2, in a RPMI 1640 cell culture medium supplemented with 5% fetal calf serum and 1% penicillin/streptomycin. Cells were detached by the conventional trypsinization procedure, resuspended in culture medium without (control) or with NC (5 μg/ml), and the obtained suspensions were illuminated using the in-house-built blue lamp with 1 W blue LED (465–475 nm) for 1min. After irradiation, cell suspensions were diluted in cell culture medium and transferred to 96-well plates (2 x 10^4 cells/well in 200 μl). After 30 min incubation, cells were fixed in 3% glutaraldehyde, postfixed in 1% osmium tetroxide, dehydrated in graded alcohols, and then embedded in Epon812. The ultrathin sections were

stained in uranyl acetate and lead citrate, and examined with TEM. Although most of the NC were washed in the process of preparation for the TEM analysis, few nanoparticles remained in the intercellular space, but none of them were found in the cytoplasm of NC treated cells in the absence of irradiation. However, nanoparticles were detected in the cytoplasm of NC-treated tumor cells irradiated with the blue light as soon as 30 min after treatment. Having in mind that the intracellular nanoparticles were not observed within vesicles, it seemed that endocytosis was not responsible for their uptake. Importantly, the cell membrane appeared intact on the electron micrographs, arguing against the possibility that NC passively entered the cells through the damaged membrane. In malignant cells with internalized NC disintegrated mitochondria were observed indicating cell damage induced by NC. Our results thus suggest that the blue light irradiation stimulates the cellular uptake of NC. However, it remains to be investigated whether the changes in nanocurcumin itself and/or tumor cells induced by irradiation were responsible for its uptake [3].

References:

[1] WH Lee *et al*, Curr Neuropharmacol **11** (2013), 338–378.
[2] ZM Markovic *et al*, J Serb Chem Soc **79** (2014), 1–11.
[3] The authors acknowledge funding from the Ministry of Education, Science and Technological Development of the Republic of Serbia (grants 41025, 172003, and 173053), by the SASPRO Program project 1237/02/02-b and the People Program (Marie Curie Actions) European Union's Seventh Framework Program under REA grant agreement No. 609427 (grant to ZM). Research has been further co-funded by the Slovak Academy of Sciences.

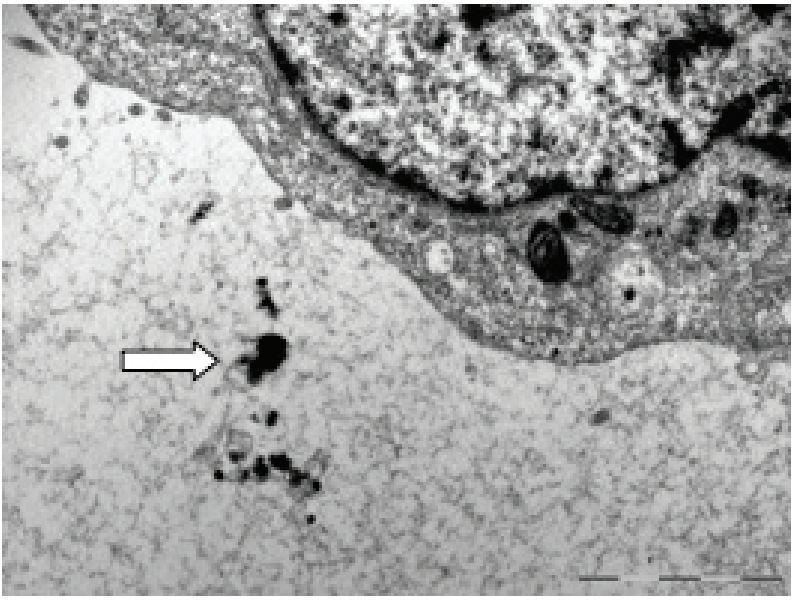

Figure 1. TEM ultramicrograph of U251 cells incubated with NC (5 μg/ml) showing NC out of the cells (arrow); magnification 11000x, scale bar 2 μm.

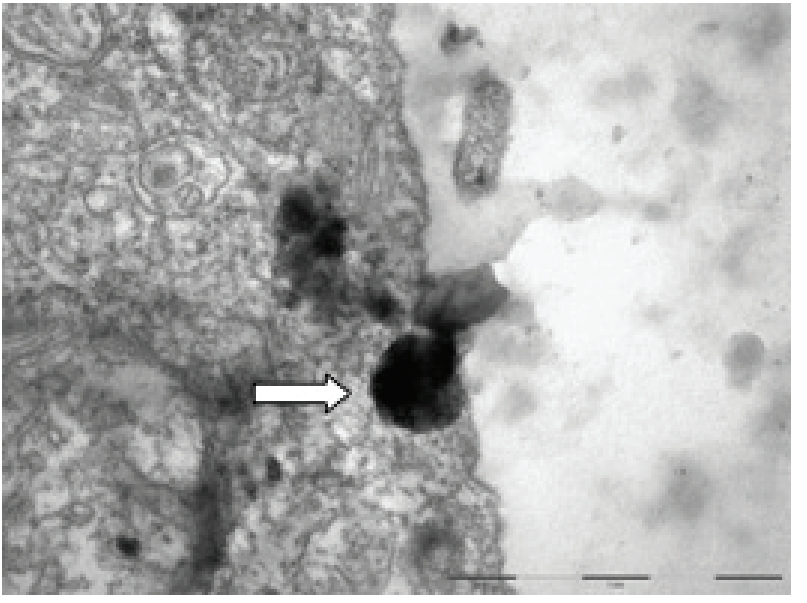

Figure 2. TEM ultramicrograph of U251 cells incubated with NC (5 μg/ml) and irradiated with the blue light (470 nm, 1 W) for 1 min showing NC inside of the cell cytoplasm (arrow); magnification 36000x, scale bar 1 μm.

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