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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Ultrastructural Analysis of Large Graphene Quantum Dots Internalization in Hepatocytes

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Graphene, carbon allotrope consisting of a single layer of carbon atoms in a honeycomb structure, has gained considerable attention in nanomedicine as a potential diagnostic and therapeutic tool [1]. Graphene quantum dots (GQD) are graphene sheets with lateral dimensions less than 100 nm, containing one or more graphene layers [2]. Large nanoparticles are mainly eliminated through liver, either by hepatocytes via the biliary system, or by phagocytic Kupffer cells, while smaller nanoparticles are more likely to be excreted in urine, thus enabling fast elimination from the body and preventing excessive accumulation in organs and tissues [3]. Furthermore, the use of large nanoparticles is preferable in treatment of inflamed tissues, which generally present with leaky blood vessels that, as opposed to the vasculature in healthy tissues, allowing selective extravasation of nanomaterials with sizes of up to 400

nm [4]. We investigated the effect of large (40 nm) graphene quantum dots (GQD) *in vitro* in liver cells, macrophages and in lymphocytes using HepG2 hepatocytes, J774 macrophages and Jurkat T cells. Cell cultures were incubated overnight in cell culture medium, and then treated with GQD (100 μg/ml). After 1 h, cells were fixed with 3% glutaraldehyde in cacodylate buffer, 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 were examined using a Morgagni 268D electron microscope (FEI, Hillsboro, OR). Large graphene dots were seen in cytoplasm of all the examined cells as electron dense particles with diameter of 20-70 nm. Electron microscopic detection of cellular uptake of large graphene dots by hepatocytes, macrophages and lymphocytes could give reason for the use of large graphene dots in inflammatory disease of liver [5].

References:

[1] D Bitounis *et al*, Adv Mater **25** (2013), 2258–226.
[2] LA Ponomarenko *et al*, Science **320** (2008), 356–358.
[3] M Longmire *et al*, Nanomedicine **3** (2008), 703–717.
[4] LY Rizzo *et al*, Curr. Opin. Biotechnol **24** (2013), 1159–1166.
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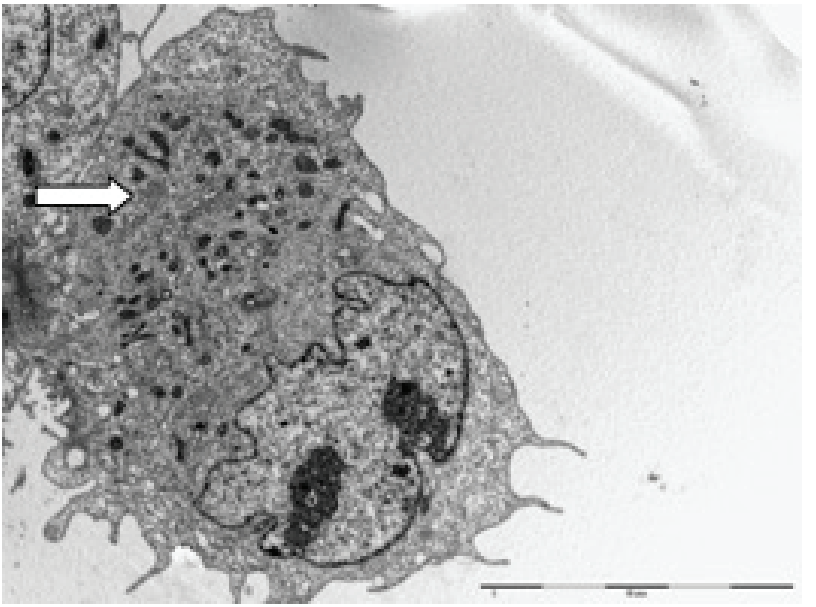

Figure 1. TEM ultramicrograph of HepG2 cell treated with GQD; arrow point at GQD present in intracellular vesicle (diameter 20-70 nm); magnification 3500x, scale bar 10 μm.

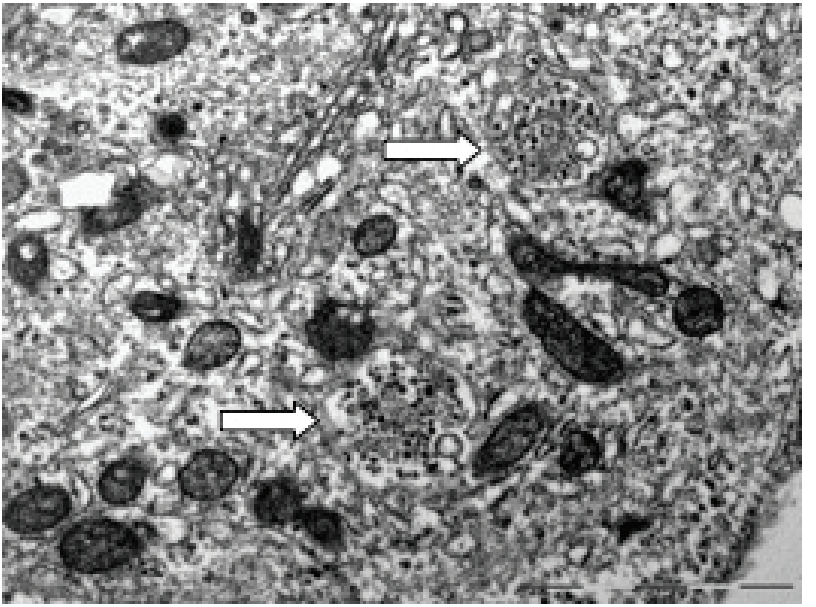

Figure 2. TEM image of the HepG2 cell cytoplasm with GQD present in intracellular vesicle (arrow); magnification 18000x, scale bar 2 μm.

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