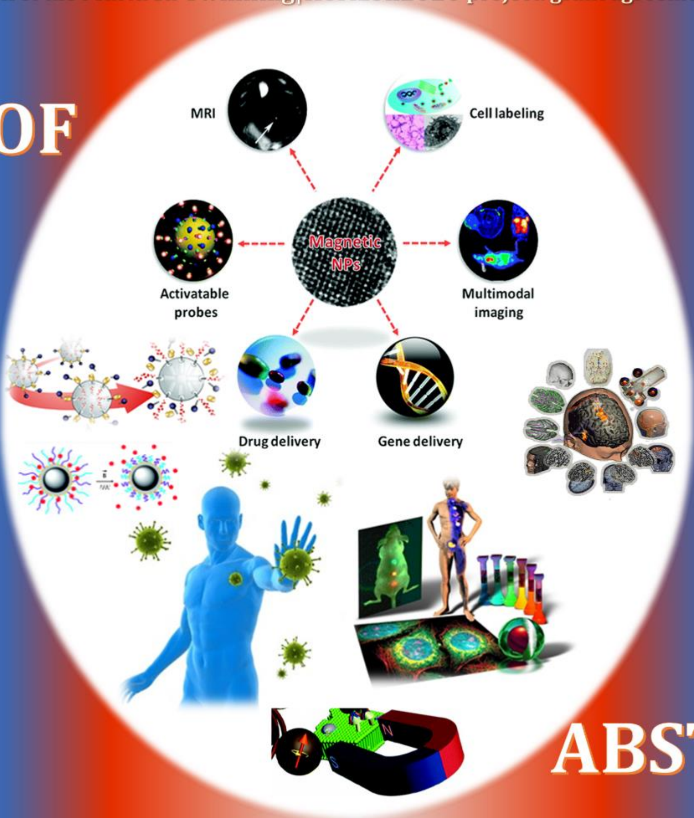
1st Training Workshop & Summer School

Magnetic Nanohybrids for Cancer Therapy

within the framework of the MaNaCa Twinning|Horizon2020 project: grant agreement No 857502 (2019-2022)

BOOK OF



ABSTRACTS

25-28 August 2020

Balkan Center-CIRI-AUTh, Thessaloniki-Greece

http://magnacharta.physics.auth.gr/manaca-workshop.htm

Magnetic Nanostructure Characterization: Magna Charta Technology & Applications

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Oral Presentations

Num	Title & Presenting Author	Session
O01	Magnetic Nanohybrids for Cancer Therapy ***M. Angelakeris, Greece***	
O02	Iron based “Core-Shell” Nanoparticles for Magnetic Hyperthermia of Cancer Cells ***A. Manukyan, Armenia***	**Materials & Structure**
O03	Scaling Up Magnetic Nanoparticles Production ***K. Simeonidis, Greece***	
O04	Characterization of nanomaterials using transmission electron microscopy ***M. Spasova, Germany***	
O05	Nano-Theranostics based on magnetic ferrite nanoparticles ***C. Dendrinou, Greece***	
O06	*Application of X-ray absorption fine structure spectroscopies for the study of Fe3-xMnxO4 nanoparticles* ***M. Katsikini, Greece***	**Magnetism & Properties**
O07	Tuning structure and Magnetic Properties of Nanoparticles for Enhanced Heating Performance ***P. Trohidou, Greece***	
O08	Basics of Magnetometry and How to Apply on Nanoparticles ***U.Wiedwald, Germany***	
O09	Introduction to X-Ray Magnetic Circular Dichroism ***T. Feggeler, Germany***	
O10	Core-Shell and Bi-phasic MNPs for cancer therapy: Structure and properties ***A. S. Kamzin, Russia***	
O11	Ferromagnetic Resonance: Theory and Applications for Magnetic Nanoparticles ***A.Semisalova, Germany***	
O12	*Magnetic liposomes as versatile clinical carriers* ***G.Litsardakis, Greece***	**Biomedical Constraints**
O13	Magnetite-Gold nanohybrids as ideal platforms for theranostics ***M. Efremova, Germany***	
O14	The Blood-Brain-Barrier as target for magnetic nanoparticle imaging and opening ***U. Hofmann, Germany***	
O15	Cancer nanomedicine: considerations for the in vitro experimental design ***C. Spiridopoulou, Greece***	
O16	How cells respond to magnetic field? Magnetic hyperthermia for Cancer Treatment ***R. Tzoneva, Bulgaria***	
O17	Enhancing cancer immunotherapy through Nanotechnology ***C. Chlichlia, Greece***	**Cancer Specific Aspects**
O18	Magnetic nanoparticles for cancer therapy and diagnostics: effects of morphology and coating ***M. Abakumov, Russia***	
O19	Cell membrane-coated magnetic nanocubes for the treatment of glioblastoma ***C. Tapeinos, Italy***	
O20	The Radiobiological Basis of Radiation Therapy and Hyperthermia ***S. Spirou, Greece***	
O21	Magnetic Particle Imaging Applications in Cancer Inflammation, Theranostics, and Cell Tracking ***N. Carvou, UK***	
O22	Combinatory, Magnetic or Non-magnetic cancer modalities? ***T. Samaras, Greece***	

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Magnetite-Gold nanohybrids as ideal platforms for theranostics

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In this work, we present the first size-dependent study of hybrid Fe_3O_4-Au NPs with diameters of 6-44 nm Fe_3O_4 and 3-11 nm Au for theranostics combining the contrast enhancement in magnetic resonance imaging (MRI), the heating potential in magnetic particle hyperthermia (MPH) and dual chemical functionality for the payload delivery.

High-quality Fe_3O_4 nanocrystals with bulk-like magnetic behaviour were obtained as confirmed by the presence of the Verwey transition. The 25 nm-sized octahedral Fe_3O_4–Au hybrids showed the best characteristics for MRI and MPH. We obtained an extraordinarily high r_2-relaxivity of 495 $mM^{-1}\cdot s^{-1}$ along with a specific loss power of 617 $W\cdot g_{Fe}^{-1}$. The functional *in vitro* hyperthermia test for the 4T1 mouse breast cancer cell line demonstrated 80% and 100% cell death for immediate exposure and after precultivation of the cells for 6 h with 25 nm Fe_3O_4–Au hybrid nanomaterials, respectively [1].

As a next step, Fe_3O_4-Au hybrids were conjugated with two fluorescent dyes or the combination of drug and dye allowing the simultaneous tracking of the nanoparticle vehicle and the drug cargo *in vitro* and *in vivo*. The delivery to tumors and payload release were demonstrated in real time by intravital microscopy [2]. Replacing the dyes by cell-specific molecules and drugs makes the Fe_3O_4-Au hybrids a unique all-in-one platform for theranostics.

References

[1] M. V. Efremova et al., Beilstein J. Nanotechnol, 2018, 9 (1), 2684–2699.
[2] M. V. Efremova et al., Sci. Rep., 2018, 8 (1), 11295.

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