

World Cancer Day in the Laboratory of Metallomics and Nanotechnologies at Mendel University in Brno

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Laboratory of metallomics and nanotechnologies attended the important event of traditional World cancer day (WCD) which was held on 4. February 2015. On this occasion were prepared a series of lectures aimed for introduction of nanotechnology research as an improvement for cancer diagnosis in early stages, treatment and progressive ways of healing the oncologic patients by gene therapy or rapid cancer diagnosis.

Keywords: World cancer day ; cancer; Laboratory of metallomics

1. Introduction

Program of WCD 2015 was dedicated to ten researchers from the Laboratory of metallomics and nanotechnologies and their lectures (Fig. 1). The whole series of lectures were introduced by information of the League against cancer Prague activities and regular actions also organized under its auspices on the Laboratory of metallomics and nanotechnology ground. For interest was introduced the cooperation of both subjects which has been continued on the project level since 2006.

The connection of some viruses and tumor diseases has been not fully understood yet, so the various relations between malignant progression and presence of SV40 (simian vacuolating virus 40) viral DNA, distributed between 1955 and 1963 in poliomyelitis vaccine as a contamination, were discussed. The ability of virus interference with the function of tumor suppressor p53 was described in laboratory animal tests; however the connections in human have not been clearly described yet.

The main part of lectures was given to nanomaterials and their application in diagnosis and treatment of oncology diseases. Technologies for earlier identification of malignant changes of carcinoma are rapidly developing field of re-

search and for that reason is annually discussed on lecture summarized the actual knowledge. In particular, combination of analytical protocols and nanomaterials for in vivo imaging or magnetic separation of target molecules – biomarkers which increases or decreases in dependence on the condition of the organism, shows the wide range of application scale. The most discussed possibilities of employing the nanotechnologies are drug delivery together with the decrease of non-target toxicity. Some of nanotransporters have been employed in clinical practice (Myocet, Abraxan) with excellent therapeutic results, which promise a great potential of this field of research. For increase the specificity against tumor tissue could be nanotransporters modified by a “controller” enabled the specific recognition of cancer cells based on their typical properties (e.g. the presence of receptors). Smart nanoconstructs are able to drug release in one particular place and eliminate the toxicity and side effects of cytostatics used in the treatment. In the case of gene therapy based on replacing the defective genes or eliminating its ability to encode a target protein, are employed similar nanotechnologies. Although, the idea of gene therapy is due to the ethical issues complicating acceleration to the

clinical applications, the Gendicin (gene which encoded wt-p53 in recombinant adenoviral vector) have been already used successfully for the treatment of malignant cancer squamous cell carcinoma of head and neck in China. Another obstacle that complicates practical application of gene therapy is the need to use viral vectors for gene integration into genome. Although, viruses are recombinantly attenuated, the undesirable massive immune response threatens in some cases. Separate category of nanomaterials, the carbon nanotubes and their modification by drugs or targeting ligands, show a huge application potential. In this case, the nanotoxicologic studies confirm the biocompatibility and bioavailability of carbon materials. In vivo and in vitro experiments demonstrate the carbon based carriers improve the passive intake of drugs by cancer cells, while the modification by targeting ligand rapidly increase the elimination of development of different tumor types. The unique properties of nanomaterials could be used not only for drug delivery, but for earlier diagnostic by targeted tumor imaging, both of fluorescence measurement or magnetic resonance where the nanomaterials are employed as contrast agents. In the field of fluorescence are highly discussed semiconductor crystals – quantum dots (QDs) due its higher quantum yield and the possibility of their modification. The main disadvantage of QDs is potential toxicity depending on the forming material, however it has been experimentally demonstrated the toxicity of QDs is negligible in comparison with the presence of the free metal ions. Moreover, the carbon quantum dots especially developed with less toxicity due to toxic metal elimination.

Further lectures discussed especially early diagnosis of cancer with the use of biomarkers. Although, the body fluids are the complex matrixes and most of known biomarkers are present in concentrations of the order of less than other matrix compounds, it is necessary to perform a separation step before analysis. The modern analytical methods for biomarkers analysis

allow huge possibilities of high resolution and sensitive detection. One of the interesting biomarker is metal-binding protein; metallothionein (MT), its alterations have been identified in a wide range of malignancies. Several studies have been proven the connection of MT into a number of physiological processes such as metal homeostasis and protecting the body against oxidative stress. The main role of MT is the storage and zinc transport thereby contributing to the genes involved to apoptosis, cell proliferation and cellular division. It is therefore not surprising; the level of MT could be used as a supporting tool in diagnostics, prognostics of state of health during and after oncologic treatment.

The word cancer day 2015, held on the ground of Laboratory of metallomics and nanotechnologies, provided scientific and educational program coupled with fruitful discussions with all interested researchers. The conference fulfilled the mission to share the information about cancer treatment and early diagnostics using modern analytical methods and interesting biomolecules.



Figure 1: Series of lectures given by Laboratory of metallomics and nanotechnologies researchers within WCD 2015

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Conflicts of Interest

The authors declare they have no potential conflicts of interests concerning drugs, products, services or another research outputs in this study. The Editorial Board declares that the manuscript met the ICMJE „uniform requirements“ for biomedical papers



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