

## Laboratory of Metallomics and Nanotechnologies – an initiator of the Metallomics Scientific Network formation

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The researchers from Laboratory of Metallomics and Nanotechnologies at Department of Chemistry and Biochemistry of Mendel University in Brno were, in connection to their research priorities, interested in the idea to create a cooperating partner network joining the excellent central European laboratories focused on the metallomic research. The effort in this area was supported by the project Metallomic Scientific Network of The International Visegrad Fund, which is devoted to both creation and support of the close collaboration between citizens and institutions in the Visegrad Group countries as well as the cooperation of these countries with other states and regions.

**Keywords:** metallomics; networking; International Visegrad Fund

### 1. Introduction

The main goal of the project Metallomic Scientific Network was to create the metallomic network joining the partners, which will collaborate on the common projects in the long-term horizon. Laboratory of Metallomics and Nanotechnologies sees the perspective area of its research in metallomics – the progressive scientific field focused on rapid and noninvasive methods of determination, localization and treatment of cancer. The newly formed network enables the Laboratory of Metallomics and Nanotechnologies and the project partners to utilize the scientific potential, diversify the research tasks and contribute to their solution. The obtained results are available to all partners, which contribute to the project. The viability of the Network is confirmed by the former successful collaboration between Laboratory of Metallomics and Nanotechnologies and the Faculty of Pharmacy of the Wroclaw Medical University on the metallothionein research. The results of this research focused on determina-

tion of human and rabbit metallothionein by Brdicka reaction and mass spectrometry were published in FEBS Journal. Furthermore, the cooperation on the investigation of the metallothionein's influence on the zinc bioavailability could have the essential impact on the understanding of mechanisms regulating the life processes at the molecular level.

### 2. The main outcomes of the project

The organization necessities connected to the formation of the Metallomic Scientific Network were discussed at several video-discussion at which each partner introduced himself, his scientific stuff as well as the results obtained in his laboratory. Even though Laboratory of Metallomics and Nanotechnologies cooperated with all partners individually in the past, the video-discussion was the first contact between each other. The following video-discussions were focused not only on the scientific topics but also on the arrangement on two personal

meetings of the partners at Metallomics and Technology Conference in Brno and Workshop in Debrecen.

### 2.1 Conference of Metallomics Technology

Metallomics Technology Conference was held from 14th to 18th June 2015 at the premises of Mendel University in Brno. The conference dealt with the latest trends and strategies in the metallomic research.

The conference was organized under patronage of rector of Mendel University Prof. RNDr. Ladislav Havel, PhD. During the first day of the conference, the invited lectures by Prof. Hajo Haase from the Technical University of Berlin on the effect of zinc on the immunity cell functions and by Prof. Juan Hidalgo from the Autonomous University of Barcelona on the effects of metallothionein in neuroinfection were presented. In the second lecture session, scientists from Masaryk University and from Laboratory Metallomics and Nanotechnologies from Mendel University in Brno presented their lectures devoted to metallothionein. The first day of the conference was finished with a guided tour of the premises of the hosting laboratory



**Figure 1:** Lecture by Associate Professor Vojtech Adam of Mendel University in Brno on the role of metallothionein in cancer [1].

During the second day, the project partners presented the results connected to the project topic achieved by their departments, and discussed the possibilities for future cooperation in research projects. During the third day of the conference, the participants visited the

Department of Pathophysiology, Masaryk University, where, among other things, they were acquainted with the results of the joint research of prostate cancer obtained through the ongoing collaboration of Masaryk University and Mendel University in Brno. The fourth day of the conference was, within the framework of so-called Round table, was devoted to the determination of major joint research interests in relation to the creation of the metallomics scientific network. This aims to not only at close cooperation between the scientific institutions of the Visegrad Group but also at the transfer of expertise and exchange of information related to monitored metallomics issues.



**Figure 2:** „Round table“ of principal investigator and project partners of Metallomic Scientific Network [1].

### 2.2 Workshop in Debrecen

Workshop was organized by Dermatology Department of the Medical Faculty Debrecen University was devoted to the possibilities of metallomics application in skin cancer therapy and was held from 1<sup>st</sup> to 3<sup>rd</sup> July 2015.

Among the most important outcomes belong, besides the existence of the mentioned network, three-day workshop as a bridge the gaps between the specialists and fields of science as diverse as inorganic chemists, biochemists and clinicians. The seminars were focused on Metallothionein and skin cancer presented by Vojtech Adam, Electrophoresis and electrochemistry of metallomics presented by Marta Kepinska and Jan Labuda. The project ideas of

Clinical characteristic and treatment of skin cancers were introduced by Gabriela Emri followed by contributions about Photodynamic therapy in the management of skin cancers and Photodynamic therapy in the management of skin cancers. During the workshop the visit of histopathology laboratory was done. Here could the participants see various histopathological samples connected to skin cancer. The last day was the round table organized and the visitors could discuss about metallomics and cancer.



**Figure 3:** Workshop Metallomics and Skin Cancer at University of Debrecen – prof. René Kizek, PhD (LMaN) and Dr. Gabriella Emri (UD) [2].

### 2.3 Videoconference of Metallomics and Analytical Methods

In August 25<sup>th</sup> and 26<sup>th</sup> a videoconference entitled The Metallomics and Analytical Methods was realized. This videoconference was focused on advances in metallomics as well as progress in the field of analytical techniques in connection to this rapidly developing scientific field and its application in cancer therapy. This two-day session was hosted by associate professor Vojtech Adam PhD, the head of the Department of Chemistry and Biochemistry, vice-rector of Mendel University in Brno and the main researcher of the whole project Metallomic Scientific Network.



**Figure 4:** Lecture by Associate Professor Kledi Xhaxhiu of University of Tirana, Albania [3]

### 3. Other outcomes of Metallomic Scientific Network

Under the project of Metallomic Scientific Network were arranged other outcomes of the project include five webseminars [3-7], one seminar [8], three videoconferences [9-11] and one workshop [2]. All these actions were focused on metallomics in connection with cancer and metallothionein imaging. Here, we are reported the summarization of past events in a comprehensive table (Tab. 1). The overview of the combined work of researchers of Visegrad group is given the book of abstracts of Metallomics Technology Conference 2015: Recent Advances and Strategies [12-33], or in the book of abstracts of Metallomics Technology Conference 2015: Metallomics and analytical method [32,34-43]. The electronic version of these books of abstracts is downloadable from websites of the project

[http://web2.mendelu.cz/af\\_239\\_nanotech/V4dp.php?ip=138](http://web2.mendelu.cz/af_239_nanotech/V4dp.php?ip=138).

**Videseminars**

Date	Authors	Title	Venue
24.4.2015	Adam V, Kizek R	<b>Metallomics - What is it? (Part I)</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic
15.5.2015	Adam V, Kizek R	<b>Metallomics - What is it? (Part II)</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic
5.6.2015	Guran R, Zitka O, Adam V	<b>MALDI Imaging of MT in tissue slices of tumors</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic
14.8.2015	Guran R, Zitka O, Adam V	<b>MALDI Imaging of MT in tissue slices of chicken embryos</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic
21.8.2015	Xhaxhiu K, Adam V	<b>Particle size distribution analyses</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic

**Seminar**

Date	Authors	Title	Venue
31.7.2015	Adam V, Kizek R	<b>Metallomics and skin cancer –DEBRECEN meeting summary</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic

**Videoconferences**

Date	Authors	Title	Venue
19.8.2015	Adam V, Moulick A, Kominkova M, Emri G	<b>Metallomic and melanoma cancer</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic
10.4.2015	Adam V, Richtera L, Hynek D, Labuda J	<b>Metallomic and cancer</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic
25.-26.8.2015	-	<b>Metallomics Technology Conference 2015: Metallomics and analytical methods</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic

**Conference**

Date	Title	Venue
14.-18.6.2015	<b>Metallomics Technology Conference 2015: Recent Advances and Strategies</b>	Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic

**Workshop**

Date	Title	Venue
1.-3.7.2015	<b>Metallomics and skin cancer</b>	. University of Debrecen, Egyetem tér 1, 4032 Debrecen, Hungary

**Articles**

Date	Authors	Title	ISSN
30.9.2015	Emri, G	<b>Immunohistochemical detection of metallothionein</b>	2336-3940
30.9.2015	Guran, R	<b>Maldi-tof msi and electrochemical detection of metallothionein in chicken liver after cadmium exposure</b>	2336-3940
1.10.2015	Kepinska, M	<b>Capillary electrophoresis of metallothionein</b>	2336-3940
	Sochor, V	<b>Laboratory of metallomics and nanotechnologies –an initiator of the metallomics scientific network formation</b>	2336-3940
30.9.2015	Xhaxhiu, K	<b>Synthetic birnessites and busenites as heavy metal cation traps and environmental remedies</b>	2336-3940

**Proceedings**

Authors	Title
Adam, V., Kizek, R.	<b>Metallomics Technology Conference 2015: Metallomics and analytical methods,</b>
Adam, V., Kizek, R.	<b>Metallomics Technology Conference 2015: Recent Advances and Strategies</b>

**Table 1:** Summarization of other outcomes of Metallomic Scientific Network.

It is obvious, the role of metallothionein is discussed in all presented contributions as an important metal-binding protein in the field of metallomics. In recent decade, the role of metallothionein was clarified in the connection with higher oxidative stress and cancer. Many studies have reported higher expression of MT-I and its mRNA in various human cancers; such as breast, kidney, lung, nasopharynx, ovary, prostate, salivary gland, testes, urinary bladder, cervical, endometrial, skin carcinoma, melanoma, acute lymphoblastic leukemia (ALL), and pancreatic cancers. Or the increased expression of MT I and II could be correlated to higher tumor grade/stage, chemotherapy/radiation resistance, and poor prognosis [44]. Due to metallothionein importance, various methods for studying this metalloprotein have been developed. We can mention electrochemical detection by Brdicka's reaction, PCR, capillary electrophoresis and last but not least MALDI imaging, which seems to be a novel, perspective method to studying the metallothionein levels in tumor tissues.

### 3.1 Published papers

For the above mentioned topic follows articles which are focused on the problematic of metallothionein and cancer, were published in the Journal of Metallomics and Nanotechnologies to give a comprehensive view on all this problematics: Immunohistochemical detection of metallothionein by Emri et al [45], MALDI-TOF MSI and electrochemical detection of metallothionein in chicken liver after cadmium exposure by Guran et al [46], Capillary electrophoresis of metallothionein by Kepinska et al [47], Synthetic birnessites and busserites as heavy metal cation traps and environmental remedies by Xhaxhiu et al [48]. All the articles are published in this volume of the journal.

## 3. Conclusion

The finalization of the Metallomic Scientific Network project on August 31<sup>st</sup> 2015 is a symbolic start of a new period of collaboration within the metallomic research of V4 countries on only in terms of ongoing exchange of the experiences but also in in terms of preparation

of new projects, which will be based of the newly developed collaboration.

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## Conflicts of Interest

The authors declare no conflict 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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3. Xhaxhiu, K.; Adam, V. Particle size distribution analyses; Mendel University in Brno, LMaN, Zemedelska 1, 613 00 Brno, Czech Republic, 21-08-2015.
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