

## **Nanotechnology to Aid Chemical and Biological Defence**

The NATO Science for Peace and Security Program has identified Defense against CBRN Agents and Environmental Security as key priority areas. Nanomaterials and nanotechnology can play a vital role in the detection and decontamination of chemical and biological threat agents. They also can be used in protective technologies. The ability to control matter on an atomic and/or molecular scale provides new opportunities to use materials. The area of sensing is a particularly relevant example in which nanotechnology can be useful, by exploiting the unique properties and phenomena exerted by matter at the nano-scale. Rather than just thinking in terms of miniaturization of sensors and devices, it is possible to imagine entirely new technologies that are developed to exploit novel nano-scale phenomena. Combining nanotechnology with biomolecular systems, we have the power of nanobiotechnology to achieve improved detection, decontamination and protection against chemical and bio-agents.

The purpose of this ARW will be to bring together a diverse group of international civilian researchers focused on nanoscience and nanotechnology problems that are relevant to chemical and biological defense needs, in order to share the state-of-the-art in the field, identify accomplishments, and to discuss the challenges and opportunities present in the field. The work discussed here will form a blueprint for researchers in the area of nanotechnology for chemical and biological defense, especially for future research in detection, decontamination and protection.

### **Co-Directors**

#### **Prof. Terri Camesano**

Worcester Polytechnic Institute  
Worcester, MA, USA  
E-mail: terric@wpi.edu

#### **Prof. Giorgi Kvesitadze**

Georgian Academy of Sciences  
Tbilisi, Georgia  
E-mail: giorgi@kvesitadze@science.org.ge

### **Scientific Program**

#### **Monday, September 22, 2014**

2:00-6:00 pm Arrival and Registration

6:00-9:00 pm Reception

**Tuesday, September 23, 2014**

**AM Session**

**Chair: Prof. Terri Camesano**

9:00-9:20      Introductory Remarks – Prof. Terri Camesano and Prof. Giorgi Kvesitadze

9.20-10:00    Dr. Robert Botto, Physical S&T Division, Chemical & Biological Technologies,  
Defense Threat Reduction Agency, USA

*“DTRA Perspective on Chemical and Biological Defense”*

10:00-10:40   Prof. Nina Chanishvili, The Eliava Institute of Bacteriophage, Microbiology and  
Virology, Tbilisi, Georgia

*“Bacteriophage-based Techniques for Identification of Biological Pathogens”*

10:40-11:00   Break

11:00-11:40   Dr. Audrey Beaussart, Université catholique de Louvain, Institute of Life Sciences  
Louvain-la-Neuve, Belgium

*“Molecular Tools to Characterize the Physicochemical and Mechanical Properties  
of Spores and other Biological Agents”*

11:40-12:20   Dr. Alexandra Ter Halle, Laboratoire des IMRCP, Equipe SMODD, Université Paul  
Sabatier, Toulouse, France

*“Microemulsions Research in Chemical Defense”*

**PM Session**

**Chair: Prof. Nina Chanishvili**

2:00-2:40      Prof. M. Jerome Duval, Laboratoire Interdisciplinaire des Environnements  
Continentaux, CNRS-Université de Lorraine, Vandoeuvre-les-Nancy, France

*“Reactive transfer of metals at microbial interphases : physico-chemical dynamic  
aspects, implications for bioavailability and toxicity evaluations”*

2:40-3:20      Dr. Irena Ciglenecki Jusic, Laboratory for physical chemistry of aquatic systems,  
Ruđer Bošković Institute, Zagreb, Croatia

*“Nanotechnology to Characterize Marine Surfaces and the Environment”*

3:20-3:40      Break

3:40-5:00      Poster Session I (includes student contributions)

**Wednesday, September 24, 2014**

**AM Session**

**Chair: Dr. Robert Botto**

9:00-9:40 Prof. Terri Camesano, Department of Chemical Engineering and Life Sciences Institute, Worcester Polytechnic Institute, Worcester, MA, USA

*"Detecting Microbial Pathogens using Antimicrobial Peptides"*

9:40-10:20 Prof. Raj Mutharasan, Department of Chemical Engineering, Drexel University, Philadelphia, PA, USA

*"Canilever-Based Sensors to Detect Pathogens"*

10:20-10:40 Break

10:40-11:20 Prof. Mladen Franko, Laboratory for Environmental Research, University of Nova Gorica, Slovenia

*"Fast Screening Techniques to Detect Neurotoxic Pesticides and Other Toxic Compounds"*

11:20-12:00 Prof. Perena Gouma, Materials Science and Engineering Department, Stony Brook University, Stony Brook, NY, USA

*"Selective Chemical Detectors, Biosensors, and Hybrid Nanoprobosc"*

**PM Session**

**Chair: Prof. Mladen Franko**

2:00-2:40 Prof. Giorgi Kvesitadze, Georgian National Academy of Sciences, Tbilisi, Georgia

*"Investigation of microorganisms' and plants' abilities to assimilate and metabolize organic ecotoxicants and heavy metals"*

2:40-3:20 Prof. Monique Van Hoek, National Center for Biodefense and Infectious Diseases George Mason University, Manassas, VA, USA

*"Drug delivery and treatment for Francisella tularensis"*

3:20-3:40 Open Discussion/Break

3:40-4:20 Prof. Tinatin Sadunishvili, Durmishidze Institute of Biochemistry and Biotechnology, Tbilisi, Georgia

*"Plant-Pathogen-Bacteriophage Interactions"*

4:20-5:30 Poster Session II (includes student contributions)

**Thursday, September 25, 2014**

**AM Session**

**Chair: Prof. David Wright**

9:00-9:40 Prof. Michele Penza, ENEA, Technical Unit Brindisi Technologies for Materials, Brindisi, Italy

*“European Research in Chemical Sensor Technologies for Environmental Protection and Safety”*

9:40-10:20 Prof. Mario Böhme, Department of Materials Science, Darmstadt University of Technology, Darmstadt, Germany

*“Developing Sensors based on TiO<sub>2</sub> Nanotubes to Detect Explosives”*

10:20-10:40 Break

10:40-11:20 Prof. Giorgio Sberveglieri, University of Brescia, Department of Information Engineering, Brescia, Italy

*“Surface Ionization and Gas Sensors for Detection of Low Concentrations of Toxic and Explosive Agents”*

11:20-12:00 Prof. Levent Kenar, Chief of Medical CBRN Department, Gulhane Military Medical Academy, Ankara, Turkey

*“Current methods used for the detection of chemical and biological agents”*

**PM Session**

**Chair: Prof. Giorgi Kvesitadze**

2:00-2:40 Prof. Polonca Trebše, Laboratory for Environmental Research, University of Nova Gorica, Slovenia

*“Application of Biological Tools for Monitoring of Chemical Poisoning”*

2:40-3:20 Prof. Aykutlu Dâna, UNAM-Institute of Materials Science and Nanotechnology Bilkent University, Bilkent, Ankara, Turkey

*“SPR-based Sensors”*

3:20-3:40 Break

3:40-4:20 Dr. Ario deMarco, University of Nova Gorica, Center for Biomedical Sciences and Engineering, Vipava, Slovenia and Institut Curie – TAb-IP, Paris, France

*“Pathogen Detection by Antibody-based Targeting of Cell Surface Epitopes”*

**Friday, September 26, 2014**

**AM Session**

**Chair: Prof. Raj Mutharasan**

9:00-9:40 Prof. David Wright, Department of Chemistry, Vanderbilt University, Nashville, TN, USA,

*“Sensors for the Developing World”*

9:40-10:20 Prof. Ahmet Özgür Yazaydın, Department of Chemical Engineering, University College London, London, United Kingdom

*“Applied Nanostructured Materials for Chemical Sensing”*

10:20-10:40 Break

10:40-11:40 Open Discussion – Research opportunities for collaboration

11:40-12:00 Concluding Remarks – Prof. Terri Camesano and Prof. Giorgi Kvesitadze

**Workshop End, Lunch and Departure**

## **Hotel Information**

**Rixos Downtown Hotel, Antalya, Turkey**

Address: Meltem Mh., Sakıp Sabancı Blv No:18, 07050 Antalya, Turkey

Phone:+90 242 249 4949

Web: <http://www.rixos.com/en/rixos-downtown-antalya>

## **NATO ARW Publication**

An edited book with workshop proceedings will be published in

**NATO Science for Peace and Security Series by IOS Press.**

Instructions for Authors will be sent.

## Poster Authors and Titles

Azamat Tynybekov, International Science Center, Bishkek, Kyrgyz Republic Radiological Risk Assessment in Kyrgyzstan

Christopher Gulka, Vanderbilt University, Electrochemical Detection of 2,4,6-Trinitrotoluene at Gold Nanoparticle Film Assemblies

Oleksiy Kharlamov, National Academy of Science of Ukraine, Fullerenes and quasi-fullerenes as perspective objects for hydrogen storage and energetics

Ganna Kharlamova, Kiev National Taras Shevchenko University, Analyses of Nanoobjects and GMP as Main Biological Threats of XXIst Century

Trahel Vardanian, Yerevan State University, Pollution of the Rivers Flowing in to the Lake Sevan by the Heavy Metals

Christina Hakopian, Yerevan State University, Biotechnologies and Environmental Security

Vahram Vardanyan, Yerevan State University, The influence of natural and anthropogenic radioactive sources on the environment pollution (case study: Republic of Armenia)