

Bucharest, 16-18 November, 2011

**Exploratory Workshop:
Emerging Analytical Tools to Quantify the Plant-Insect-Environment Interaction.
New Science for the Next Generation Integrated Bio/Sensors and Probes.**

Abstract

Through host-pest (e.g., plants-insects) interactions, plant-feeding insect vectors are spreading pathogens, while real-time system integrated analytical tools seem to be lacking. Our goals are to:

- investigate emerging bio/sensing methods best able to measure host-pest analytes of significance
- create host-pest monitoring bio/sensors based on micro-interfaced nano-receptors bio/chemistry;
- integrate host-pest monitoring bio/sensors into smart learning data mining systems (SLDMs);
- establish SLDMs roadmaps, such as to prevent/control insect-vectored plant or human diseases.
- prepare collaborative funding proposals within EU Network, sustain EU funded joint projects.

Background and Rationale

The host-pest interaction is structured by an extensive communication, from molecular to ecosystem levels. Signals and receptors are integrated in complex networks. Often, signals (such as ROS) also become weapons used by one of the partners to win Battle ground. In others cases, pathogens

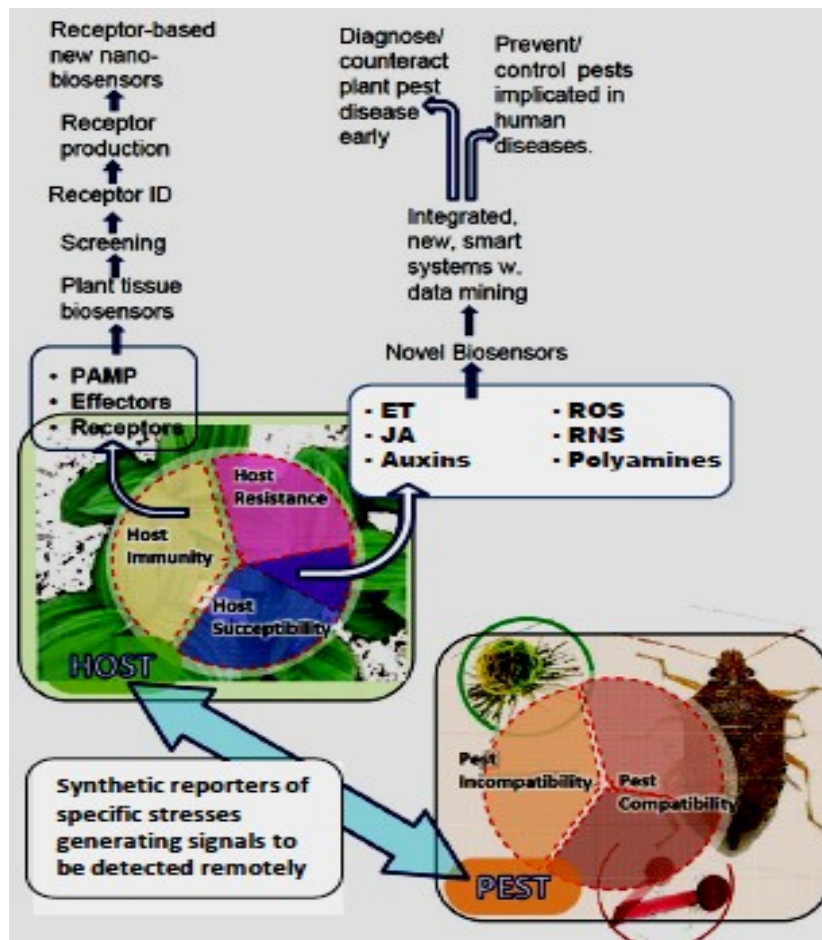


Figure 1. Analytes of interest, generated, consumed or exchanged in typical host-pest interaction. Abbreviations are: ID, identify; pathogen-associated molecular patterns, PAMP; ethylene, ET; jasmonic acid, JA; reactive oxygen species, ROS; reactive nitrogen species, RNS.

use these signal molecules to trigger changes in gene expression resulting in new phenotypes that increase individual fitness (1, 2).

Phenotypic changes are especially important for pathogens with complex life histories, including vector-born pathogens. These pathogens survive in multiple environments under different habitat-dependent stresses. Many pathogens have phenotypic plasticity that permits the exploration of multiple environments, which is likely regulated by signals or cues provided by their habitat (2, 3, 4). Pathogen infection also has profound effects on hormonal pathways involved in plant growth and development. As a virulence strategy, many pathogens have evolved mechanisms to tap into these hormonal signaling networks to interfere with host defense.

Plants do not have specialized cells to carry out immune functions. Therefore, when challenged by a pathogen or an insect, plant cells undergo reprogramming to prioritize defense over their normal cellular functions. The plants appropriate defense response is activated according to the pathogen type. For example, the salicylic acid (SA)-mediated resistance is effective against *biotrophs*, whereas the jasmonic acid (JA)-mediated response or the ethylene (ET)-mediated response are predominantly against *necrotrophs* and herbivorous insects (5).

Novelty of the Approach

The **host-pest** (e.g., plant-insect) **interaction** naturally gives rise to extensive communication, from *molecular* to *ecosystem* levels, as illustrated in figure 1. Some signals, such as ROS are established at the host level. However, few of this complex communication is fully understood and even fewer can be monitored and quantified. Likewise, biosensor technologies and intelligent systems sciences have progressed apace, but the former remain relatively narrowly focused in areas such as glucose detection in diabetes, water quality monitoring, and the latter are just breaking out from engineering applications, towards sensing and instrumentation for food quality and safety.

It is time for the potential of these cutting edge techniques to be harnessed and integrated to tackle the challenges of complex host-pest (plant-insect) signals. The environmental data: the light, humidity, atmosphere ions, temperature, water composition, affect both (i) the host-pest interactions and (ii) the performance of biosensors, once outside of controlled environment.

The fusion of intelligent systems analysis with biosensor technologies and molecular biology expertise will allow not only the derivation of risk-reduced selection strategies for the network, but also the ability to abstract instructive data from complex and variable data sets. These permutations will allow data feeds into an Integrated "Smart" System able to apply expert knowledge, learning abilities and data mining to establish, for example, pre-symptomatic detection of ill-health.

References

1. Camilli A, Bassler BL (2006). *Science* 311: 1113–1116.
2. Schild S et al. (2007). *Cell Host Microbe* 2: 264–277.
3. LoGiudice K, et al (2003). *Proc. Natl. Acad. Sci. USA* 100:567–71.
4. Nelson EJ, et al (2009). *Rev. Microbiol* 7: 693–702.
5. Glazebrook, JR (2005). *J. Annual Rev. Phytopathol.* 43: 205–227

Preliminary Program

16 NOIEMBRIE 2011 – ICECHIM, Bucharest	
09⁰⁰ - 09¹⁵	Registration of the Participants
09¹⁵ – 09³⁵	<i>Opening</i> Florin Oancea, Scientific Director ICECHIM (National Institute for Research & Development in Chemistry and Petrochemistry), ROMANIA
Chairs: Prof. Geza Nagy and Dr. Florin Oancea	
09³⁵ - 10³⁵	<i>“Sensory and behavioral responses by Plant-feeding insects to host metabolites”</i> , Patrick Guerin, University of Neuchatel, SWITZERLAND
10³⁵ - 10⁴⁵	Coffee / Tea Break
10⁴⁵-11³⁵	<i>„Application of Scanning Electrochemical Microscopy (SECM) in biological media”</i> , Geza Nagy, University of Pecs, HUNGARY
11³⁵ -11⁴⁵	Coffee / Tea Break
11⁴⁵ - 12¹⁵	<i>„Advanced systems based on porphyrins and/or phthalocyanines as components of photonics devices”</i> , Rodica-Mariana Ion, ICECHIM, ROMANIA
12¹⁵ – 14¹⁵	Lunch
14¹⁵ - 15¹⁵	Visit several departments of ICECHIM Bucharest
Chairs: Prof. Patrick Guerin and Prof. Rodica – Mariana Ion	
15¹⁵-15³⁵	<i>“Electrochemical sensor development for H₂O₂ and H₂S for biochemical application”</i> , Livia Nagy, University of Pecs, HUNGARY
15³⁵ - 15⁵⁵	<i>„(Bio)Sensors for on-field determination of mercury (II) and nitrites in water”</i> , Mihaela (Badea) Doni, ICECHIM, ROMANIA
15⁵⁵-16²⁵	<i>“Possible applications of molecularly imprinted polymers in biosensors for water pollutants monitoring”</i> , Andrei Sârbu, ICECHIM, ROMANIA
16²⁵-16³⁵	Coffee / Tea Break
Chairs : Prof. Wolfgang Knoll and Dr. Andrei Sarbu	
16³⁵ - 16⁵⁵	<i>“Low dimensional structures with tailored light emitting properties”</i> , Monica Enculescu, INCDFM (National Institute of Research & Development for Materials Physics), ROMANIA
16⁵⁵ – 17¹⁵	<i>„Specific detection of ligand-receptor type interactions by functionalised nanostructured layers”</i> , Alexandrina Nuta*, Ana Alexandra Sorescu*, Corneliu Nicolae Zaharia**, Stefan Frunza***

	*ICECHIM; ** Institute of Virology Stefan S. Nicolau "; *** INCDFM, ROMANIA
17 ¹⁵ -17 ³⁵	" <i>Complex nanowire devices for sensing applications</i> ", Ionut Enculescu, Elena Matei, Camelia Florica, INCDFM, ROMANIA
19 ⁰⁰ -21 ⁰⁰	Dinner
17 NOIEMBRIE 2011 – INFIM, Magurele	
Chairs: Prof. Jakub Dostalek and Dr. Lucian Pintilie	
09 ⁰⁰ -10 ⁰⁰	" <i>Bio-Functional Supramolecular Interfacial Architectures</i> ", Wolfgang Knoll, AIT Austrian Institute of Technology, Vienna, AUSTRIA
10 ⁰⁰ – 10 ¹⁰	Coffee / Tea Break
10 ¹⁰ – 11 ¹⁰	" <i>Nitric oxide functions in plant-pathogen interactions</i> ", Massimo Delledonne, Università degli Studi di Verona, ITALY
11 ¹⁰ -11 ²⁰	Coffee / Tea Break
11 ²⁰ -11 ⁵⁰	" <i>Combining Electrochemistry with time resolved Infrared spectroscopy for biosensing</i> ", Christoph Nowak, AIT Austrian Institute of Technology, Vienna, AUSTRIA
11 ⁵⁰ -13 ⁰⁰	Lunch
13 ⁰⁰ -14 ³⁰	Visit several departments of INFIM Magurele
Chairs: Prof. Massimo Delledonne and Dr. Ionut Enculescu	
14 ³⁰ – 15 ²⁰	" <i>Optical affinity biosensors utilizing surface plasmon-enhanced fluorescence spectroscopy</i> ", Jakub Dostalek, AIT Austrian Institute of Technology, Vienna, AUSTRIA
15 ²⁰ -15 ⁵⁰	" <i>Electrochemical sensors for pharmaceutical and environmental analysis</i> ", Robert Sandulescu, UMF ("Iuliu Hațieganu" University of Medicine & Pharmacy), Cluj, ROMANIA
15 ⁵⁰ -16 ¹⁰	" <i>Metal Oxide gas Sensors from basics to applications: Domestic Environmental Quality</i> " Adelina Stanoiu, Cristian Eugen Simion, INCDFM, ROMANIA
16 ¹⁰ -16 ³⁰	" <i>Polyamines in beneficial plant –microbe interactions</i> ", Florin Oancea, ICECHIM, ROMANIA
16 ³⁰ – 16 ⁴⁰	Coffee / Tea Break
Chairs : Prof. Christoph Nowak and Prof. Robert Sandulescu	
16 ⁴⁰ -17 ⁰⁰	" <i>Sensors based on modified porous graphite felt</i> ", Cecilia Cristea, UMF, Cluj, ROMANIA

17 ⁰⁰ -17 ²⁰	<p><i>„Peroxynitrite electrochemical detection using metalloporphyrin-conductive polymer ONO₂⁻ - sensitive hybrid film ”,</i></p> <p>Serban Peteu, ICECHIM, ROMANIA</p>
17 ²⁰ -17 ⁴⁰	<p><i>"Synthesis of semiconductor nanostructures with controlled morphological properties",</i></p> <p>Nicoleta Preda, INCDFM, ROMANIA</p>
<p>18 NOIEMBRIE 2011 – ICECHIM, Bucharest</p>	
09 ⁰⁰ - 11 ¹⁵	<ul style="list-style-type: none"> • Collaboration Options: Areas of interest, time horizons • Near future, available, bilateral, multi-lateral and EC available proposals TBA <p>Chairs: Dr. Florin Oancea and Prof. Massimo Delledonne</p>
11 ¹⁵ - 11 ⁴⁵	Coffee / Tea Break
11 ⁴⁵ -13 ⁰⁰	<ul style="list-style-type: none"> • Analysis: Possible collaborations, probable collaborations • Forming possible teams, tentative time frames <p>Chairs: Dr. Nicoleta Preda and Prof. Jakub Dostalek</p>
13 ⁰⁰ -15 ⁰⁰	Coffee / Tea Break
15 ⁰⁰ -18 ⁰⁰	<ul style="list-style-type: none"> • Specify possible scenarios • Multi-disciplinary international teams, coalescing around themes of interest • Planning the near future, in closing the exploratory workshop <p>Chairs: Dr. Serban Peteu and Prof. Patrick Guerin</p>