

## Who are LCAOS Partners?

*The LCaos Consortium is formed by eight partners from one Associate country and five Member States of the European Union: Israel, Germany, United Kingdom, Spain, The Netherlands, and Austria.*

**Technion – The Israel Institute of Technology (Coordinator); Haifa - Israel**

[www.technion.ac.il](http://www.technion.ac.il)

Leader: Prof. Hossam Haick

**Max-Planck Institute for the Science of Light; Erlangen - Germany**

[www.mpl.mpg.de](http://www.mpl.mpg.de)

Leader: Dr. Silke Christiansen

**University of Liverpool; Liverpool - United Kingdom**

[www.liv.ac.uk](http://www.liv.ac.uk)

Leader: Prof. John K. Field

**Tel Aviv University; Tel Aviv - Israel**

[www.tau.ac.il](http://www.tau.ac.il)

Leader: Dr. Nir Peled

**Complutense University of Madrid; Madrid - Spain**

[www.ucm.es](http://www.ucm.es)

Leader: Dr. Jose S. Torrecilla

**Micronit Microfluidics BV; Enschede - The Netherlands**

[www.micronit.com](http://www.micronit.com)

Leader: Dr. Eng. Marko Blom

**JLM Innovation; Tübingen - Germany**

[www.jlm-innovation.de](http://www.jlm-innovation.de)

Leader: Dr. Jan Mitrovics

**IONIMED Analytik GmbH; Innsbruck - Austria**

[www.ionimed.com](http://www.ionimed.com)

Leader: Dr. Jens Herbig

## LCAos Coordinator's Contact Details

*The LCaos project Coordinator is the Technion – Israel Institute of Technology (Haifa, Israel). The coordinating team is composed of:*

### Prof. Hossam Haick – LCAos Coordinator

*Department of Chemical Engineering and Russell Berrie Nanotechnology Institute  
Technion – Israel Institute of Technology,  
Haifa 32000, Israel*

*Tel: +972-4-8293087; Fax: +972-77-8871880*

*Email: [hbossam@technion.ac.il](mailto:hbossam@technion.ac.il)*

*Website: <http://lnbd.technion.ac.il/>*

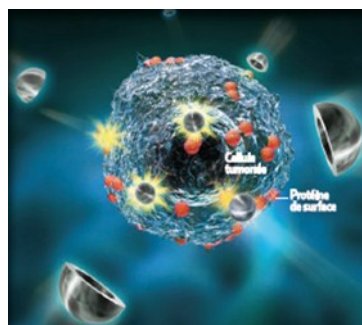
### Dr. Silvia Birsan – LCAos Administrative Manager

*Department of Chemical Engineering and Russell Berrie Nanotechnology Institute  
Technion – Israel Institute of Technology  
Haifa 32000, Israel*

*Tel: +972-4-8293560; Fax: +972-77-8871880*

*Email: [Silviabi@tx.technion.ac.il](mailto:Silviabi@tx.technion.ac.il)*

*Website: <http://lnbd.technion.ac.il/>*



## A Nanoscale Artificial Nose to Easily Detect Volatile Biomarkers at Early Stages of Lung Cancer and Related Genetic Mutations

Collaborative Project: Medium-Scale  
Focused Research Project (STREP)



HEALTH.2010.1.2-1 Tools for the  
Identification and the Detection of  
Biomarkers in Clinical Samples

## What is the Problem?

Lung Cancer is nowadays the most lethal cancer, accounting for 28% of cancer deaths globally. The average lifetime cost in Europe for the lung cancer treatment is €46,000 – €61,000 per patient and the survival rate is not spectacular. By detecting lung cancer in its early stages, experts expect to increase the 5-year-survival rate by 3-4 times.

Unfortunately, lung cancer diagnostic tests currently available [e.g., bronchoscope biopsy, pulmonary puncture and computer tomography (CT)] often *identify tumors at an intolerably late stage of disease*, occasionally *miss tumors* and sometimes *provide high rates or false positives*, a fact that leads to over-utilization of the medical system and to unnecessary medical procedures. *These methods are not suited for wide-spread screening, as they are not efficient* in terms of time and costs, and more importantly, *they are unpleasant for the patients and not free of complications*.

## What is LCaos Project Final Goal?

LCaos project aims to overcome these problems by using an approach based on volatile biomarkers emitted from membranes of the cancer cells. It has already been established that these volatile biomarkers can be detected either directly from the headspace of the cancer cells or via exhaled breath.

Through a multidisciplinary effort, incorporating nanotechnology, biomedical engineering, medical oncology, and computation strategies, *we are developing a new device*, a highly-sensitive inexpensive fast-response non-invasive nanometric artificial nose (*known as, NA-NOSE*), building on the coordinator's earlier success in this area.

This NA-NOSE will be able to detect pre-neoplastic volatile biomarkers that indicate an increased genetic risk of lung cancer as well as the presence of the disease.

## What are LCaos Objectives?

The main objectives of LCaos project are to:



- ◇ develop arrays of chemically-sensitive field effect transistors (FETs) of molecule-terminated silicon nanowires (Si NWs);
- ◇ *test the ability of these devices to sense volatile lung cancer biomarkers from in-vitro tissue, and from exhaled human breath;*
- ◇ study the signal transduction mechanism of the volatile biomarkers, using pattern recognition;
- ◇ *improve systems to enable the NA-NOSE to distinguish the targeted biomarkers from environmental clutter, using methylation expression profiling and genome-wide sequencing; and to*
- ◇ perform clinical-related studies to assess LC conditions in actual patients and tissues, and in the presence of real-world confounding signals.

Validation will be carried out by clinicians, professional mathematicians and computer scientists of our LCaos partners' teams.

## LCaos Project Overview

The LCaos project is an EU collaborative project funded under the 7th Framework Program.

Its central aim is to enable the earliest possible detection of lung cancer using volatile biomarkers present in exhaled breath and/or headspace of lung cancer tissues/cells by applying a novel, non-invasive and easy-to-use device.

This device is based on an "artificial electronic nose", which makes use of *cross-selective* and *sensitive sensor arrays* "trained" in their ensemble to detect LC biomarkers.

In LCaos project we uniquely modify the "artificial nose" concept by using a 3D silicon nanowire based (Si NW) field effect transistors (FETs) that show increased sensitivity to lung cancer biomarkers.

A true breakthrough in early detection of lung cancer will only be achieved by establishing *non-invasive screening* using biomarker detection in the human breath or headspace of lung cancer tissue using LCaos's reliable and easy-to-use NaNose concept.

This four-year initiative started on 1 April 2011 and is implemented by *eight world-renowned wide-range expert groups* ranging from engineering to medical centers .