



# ULTRAPLACAD Newsletter n°1

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<b>PROJECT TITLE</b>	Ultrasensitive plasmonic devices for early cancer diagnosis
<b>Grant Agreement N°:</b>	633937
<b>Starting Date:</b>	1st May 2015
<b>End Date:</b>	31st October 2018
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<b>PROJECT MANAGER:</b>	Elena Turco AMIRES (Czech Republic) <a href="mailto:turco@amires.eu">turco@amires.eu</a>

### General project overview (G. Spoto)

ULTRAPLACAD is a project funded by the European Union’s Horizon 2020 research and innovation programme, dealing with the development of a compact plasmonic-based device, with integrated microfluidics and functionalized nanostructures, for the detection of DNA, microRNA and tumor autoantibodies cancer biomarkers. ULTRAPLACAD project represents a radical change in detection of colorectal cancer by biomarkers circulating in blood (liquid biopsy). This diagnostic platform will improve early diagnostic testing and also enable more specific selection of patients for therapy, as well as enables therapy monitoring from liquid biopsies, thus reducing invasive procedures and improving patient management.



The project team includes partners holding cross-disciplinary competencies, including two of the first five plasmon resonance groups in the world, the inventor of surface plasmon microscopy – also known as surface plasmon resonance imaging - and plasmon-enhanced fluorescence spectroscopy, and full European value chain including disposable chip and readout platforms design, development and manufacturing.



## Inputs from the External Advisory Board (Elena Turco – AMIRES)

The ULTRAPLACAD External Advisory Board (EAB) was established with the objectives to receive support during the technical specification phase of the project, validation of results; confirm the continuity of high quality objectives before mid-term and support for flawless result exploitation and shift towards potentially new innovative products at the end of the project.

The list of experts, members of the ULTRAPLACAD External Advisory Board, is following:

- **Mrs. Jola Gore-Booth**, Founder and Chief Executive Officer at EuropaColon
- **Dr. Patrice M. Milos**, Former CEO and President, Claritas Genomics in Cambridge, Massachusetts (USA)
- **Prof Maurizio Ferrari**, President of the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC)
- **Prof. Markus Paulmichl**, MD, head of the Institute of Pharmacology and Toxicology at Paracelsus Medical University in Salzburg
- **Prof. Dr. David N. Reinhoudt**, responsible for the Radboud Nanomedicine Alliance at Radboud University Nijmegen
- **Dr. Santiago Valor**, Group Chief Medical Officer and Vice-President Medical at Labco, Madrid

The 1<sup>st</sup> ULTRAPLACAD External Advisory Board meeting was held on 8<sup>th</sup> May 2015 in Catania (Italy).

Since the beginning of the project, the EAB members contributed actively in the definition of the device requirements and specifications, also giving suggestions and recommendations for the project management and dissemination.

In order to gather the requirements from end users and EAB members and establish the technical specifications of the future ULTRAPLACAD instrument and consumables, **a survey in electronic format ([https://fr.surveymonkey.com/r/HJY Ultraplacad project](https://fr.surveymonkey.com/r/HJY_Ultraplacad_project)) was developed by Horiba**. The panel of the users contacted is around 32 persons, including the EAB members, and the result of the survey shows the need to develop the ULTRAPLACAD instrument as a laboratory automated machine. The end users requirements were already validated by the ULTRAPLACAD technical partners and technical feasibility was assessed.

## Optical biosensors for the ultrasensitive detection of nucleic acids at INBB (R. Corradini, M. Minunni, G. Spoto)

The sensitive and specific detection of nucleic acids released by tumor cells and freely circulating in blood may afford the opportunity to diagnose malignant tumors, monitor recurrence, and evaluate response to therapy solely through a non-invasive blood draw. INBB is heavily committed to this task by developing specific assays based on optical biosensors and providing enhanced performances thanks to the use of specifically designed metallic nanoparticles and highly performing probes.



INBB serves as the coordinator of ULTRAPLACAD project and contributes to project activities with three operative units located within the premises of Chemistry Departments at University of Catania, University of Parma and University of Florence in Italy.

Catania and Florence INBB units share previous experience in the development of plasmonic biosensor assays for the ultrasensitive detection of nucleic acids while Parma INBB unit holds experience in designing and



synthesizing peptide nucleic acids probes with enhanced performances for the targeting of nucleic acid sequences.

The Catania INBB unit, using PNA probes produced by Parma INBB unit, has developed an ultrasensitive method, based on surface plasmon resonance imaging, using gold nanoparticles for signal enhancement. This work led to the development of procedures for the detection of unamplified genomic DNA. During the activities of the project, these results will be fully implemented, with the aid of expertise by Florence INBB unit, by the planned improvement in probe performances, surface fabrication and assay development. In particular, efforts will be focused on development of specific, ultrasensitive, and robust methods for the detection of important nucleic acid biomarkers for colorectal cancer.

All the INBB teams participated to the International Congress on Biophotonics (ICOB 2015) held in Florence (May 2015), where the activities foreseen in the ULTRAPLACAD project were illustrated, during two invited lectures, to a wide international audience of experts in the field of photonics and biosensing. INBB contribution to ULTRAPLACAD has been also presented in two invited lectures at the European Winter School on Physical Organic Chemistry (e-WISPOC) (February 2016) and at the "Bioelectrochemistry and more...2016" conference held in Wiener Neustadt (June 2016), respectively.

### **Biomarker discovery and Biosensor Technology at AIT (A. Weinhäusel and J. Dostalek)**

The immune system of cancer patients is known to react to proteins which are aberrantly expressed in the tumor. These proteins are referred to as tumor-associated antigens (TAAs) and are targeted by tumor autoantibodies ( $\alpha$ -TAAs), which can be used as biomarkers for early diagnosis of cancer. The business unit Molecular Diagnostics (Department Health and Environment) at AIT-Austrian Institute of Technology GmbH has established different immunome-wide discovery technologies for the identification of novel  $\alpha$ -TAA-based biomarkers. AIT has used these platforms for identification of differentially reactive antigens, capable of discrimination between cancer-free controls and cancer patients.

The biomarker discovery activities are complemented by a Biosensor Technologies group at AIT. This unit pursues development of new optical methods for rapid and sensitive analysis of biomarkers. In particular, plasmonic biosensor technologies that utilize direct as well as optical spectroscopy-based readout are of interest. In the project ULTRAPLACAD, these two elements meet in order to deliver novel instrument that allows for early non-invasive diagnosis of colon cancer based on liquid biopsy.

In March 2016, four AIT co-workers presented their first results of the project ULTRAPLACAD at the conference Europtrode XIII which was held in Graz. The conference attracts around 300 participants and focuses on all aspects related to the research, development and applications of optical chemical sensors and biosensors.





Project partners:



Where to find us (ULTRAPLACAD publications and events)

What	Where	When
TV report at TG La Sesta	<a href="https://www.youtube.com/watch?v=1egg4kp94es&amp;feature=youtu.be&amp;t=9m30s">https://www.youtube.com/watch?v=1egg4kp94es&amp;feature=youtu.be&amp;t=9m30s</a>	6/05/2015
<b>Paper:</b> Targeting oncomiRNAs and mimicking tumorsuppressor miRNAs: new trends in the development of miRNA therapeutic strategies in oncology	International Journal of Oncology (DOI: 10.3892/ijo.2016.3503)	29/04/2016
<b>Paper:</b> Plasmonically amplified bioassay – total internal reflection fluorescence vs. epifluorescence geometry	Elsevier Talanta Journal (DOI: 10.1016/j.talanta.2016.05.023)	11/05/2016
<b>Posters</b> at European-Winter School on Physical Organic Chemistry	Brixen (Italy)	31/01-5/02/2016
<b>Posters and invited lecture</b> at Eurotrode 2016 Conference	Graz (Austria)	20-23/03/2016
<b>Invited lecture</b> at EuropaColon first advocacy masterclass	Warsaw (Poland)	6-8/11/2015
<b>Lecture</b> at eHealth Week	Amsterdam	8-10/06/2016
<b>Abstract and Lecture</b> at 21th World Congress on Advances in Oncology	Athens (Greece)	6-8/10/2016
<b>Lecture</b> at International Conference for Micro & Nanotechnologies for the Biosciences	Montreux (Switzerland)	7-9/11/2016

**ULTRAPLACAD project has a duration of 42 months, please, stay updated about the upcoming project results! – Visit [www.ultraplacad.eu](http://www.ultraplacad.eu)**

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