



# Ultrasensitive plasmonic devices for early cancer diagnosis: socio-economic impact, market overview and benchmarking analysis

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# AMIRES who we are



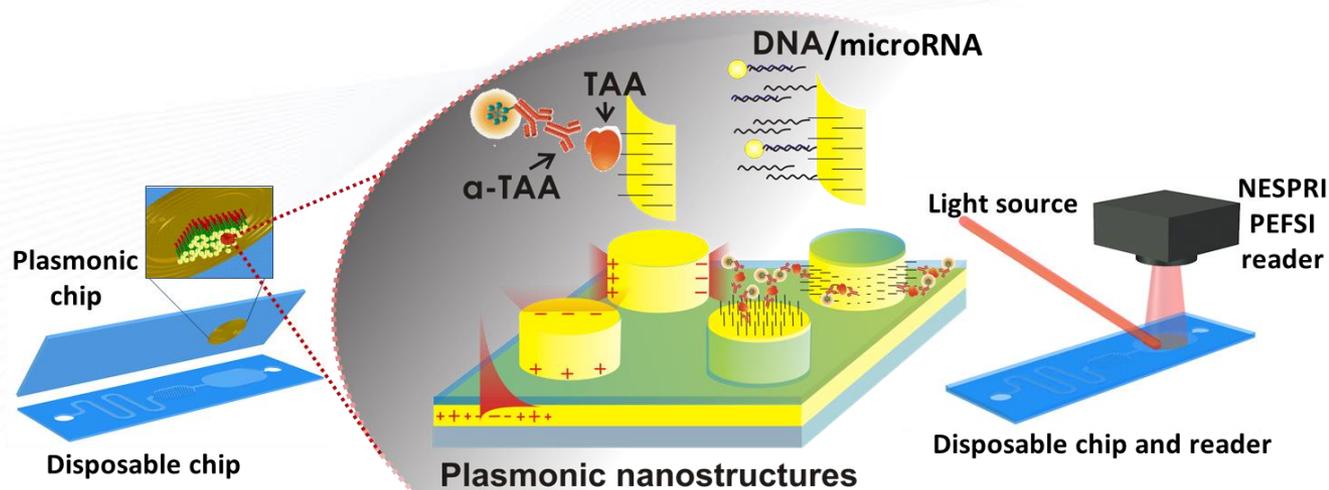
- Strategic partner(s) search
- Project initiation, planning, drafting, proof-reading and negotiation
- Project management
- Innovation opportunity analysis
- Technology assessment
- EU Lobbying
- Training

**“Experienced professionals provide support in strategically oriented innovations for business impact”**



# ULTRAPLACAD overview

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 autoantibodies to tumor-associated antigens ( $\alpha$ -TAAs) cancer biomarkers.





# ULTRAPLACAD first results

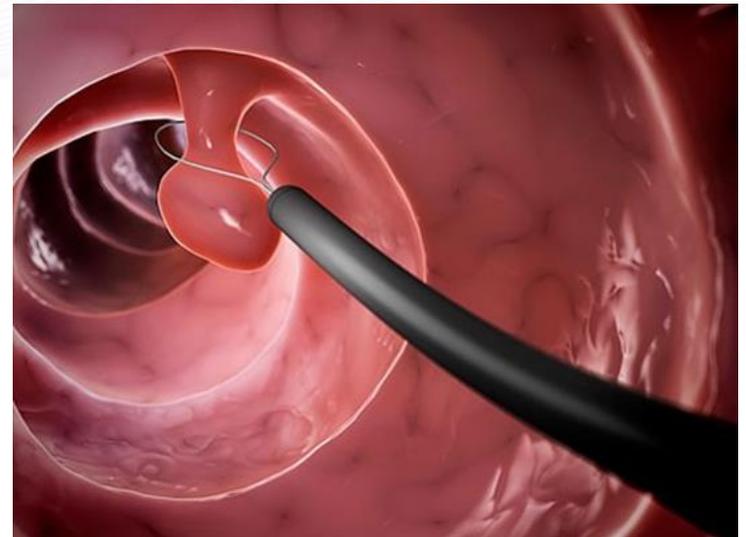
- Nanostructure geometries for the novel surface plasmon resonance imaging and plasmon-enhanced fluorescence sensing technologies were identified.
- Attomolar detection of all-RAS mutations and femtomolar detection of microRNAs has been already demonstrated.
- ULTRAPLACAD will develop a bimodal industrial prototype and the first version of plasmonic reader laboratory prototypes has been completed.
- Automated fabrication processes suitable for low cost mass production will be developed in the project and high-volume fabrication of nanostructured disposable chips has been also demonstrated.



# Colorectal cancer

Colorectal cancer is a lethal disease responsible for more than 200,000 deaths per year in Europe. *An early detection of cancer through screening has been shown to reduce the mortality from colorectal cancer.*

*Standard clinical protocols for colorectal cancer detection are based on tissue biopsy.* It is a costly procedure and, most importantly, due to their logistic and biological complexity, reach only a fraction of the population (limited throughput, personal barriers like fear and embarrassment).





# Social impact

Cancer biomarkers circulating in body fluids can be used for cancer diagnosis, prognosis and choice for therapeutic interventions.

*Biomarker detection is a key aspect to new minimally-invasive diagnostic approaches.*



**ULTRAPLACAD project represents a radical change in detection of colorectal cancer by biomarkers circulating in blood (liquid biopsy).**



# Economic impact

Today's screening methods for the early detection of cancer in average-risk asymptomatic people are based on invasive methods. **These screening methods have still high costs: between €2,000-3,000/test.**

The ULTRAPLACAD diagnostic platform will improve early diagnostic testing and **enables 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 development of **ULTRAPLACAD** platform allows a broad range of **clinical applications** and is a step to saving thousands of lives and, at the same time, avoiding additional strain on the healthcare systems in developed countries (**average cost of detection and annual cost for therapy represent approx. 7,2 billion € in Europe only**).

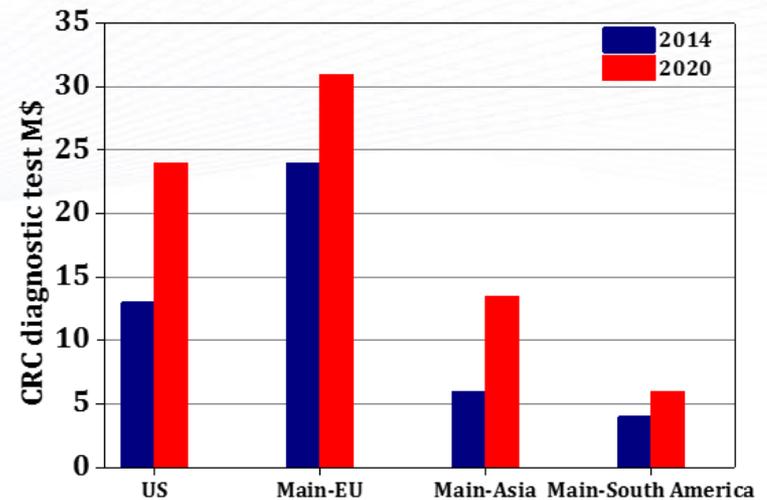


# Market overview

The global liquid biopsy market, valued at \$1.6 billion in 2015, will approach \$4.5 billion by 2020. **The cancer liquid biopsy market, the fastest growing segment, is predicted to reach \$1.9 billion by 2020**

[Dewan, Shalini. 2016. "Blood Testing: Technology And Global Markets - HLC184A". Bccresearch.Com]

In 2012 the European IVD market generated revenues of €10.7 billion account for 0.8% of the total healthcare expenditure in Europe. **The market of Colorectal Cancer diagnostics (CRC) represents nowadays approximately 47M\$ and should reach 74M\$ in 2020.**



**The ULTRAPLACAD project is expecting to enter an IVD segment of Cancer Molecular diagnostics (MDx), which has the highest expected growth potential of all IVD segments**



# Market trends

**ULTRAPLACAD project is continuously interacting with international experts and several inputs were collected:**

- The health systems and protocols for patient management in Europe is highly fragmented. France seems to be one of the most organized and advanced country in the public health management.
- The market of diagnostics is moving quickly offering innovative not invasive techniques for early diagnosis like blood tests and the use of big data stratification. This will have big impact on the pharmacogenomics, too.
- The market is currently requiring systems able to provide a “decision making” solution independently from the used technique.
- At Istituto Regina Elena the current golden standard is represented by the Digital PCR on-chip.



# Benchmarking

ULTRAPLACAD performances vs current methods for nucleic acids and protein detection							
Parameters	Today					ULTRAPLACAD	
L=low; M=Medium H=High	ddPCR miR	RT qPCR miR	qPCR DNA	DNA sequencing	Multiplexed protein	NESPRI	PEFSI
Analytical sensitivity (LOD)	~10 aM 1copy/ $\mu$ L	fM 100copies/ $\mu$ L	aM	fM ng/ $\mu$ L	pM/fM	aM DNA fM miR	aM
Selectivity	M	M	M	M	M/H	H	M/H
Robustness	M	M	M	L/M	M	M/H	M
Risk contamination	M/H	M/H	M/H	M/H	M	L	M
PCR amplification	Yes	Yes	Yes	Yes/No	-	No	-
Reader sales price (kEuro)	30-50	30-40	20-40	80-700	30-150	<100 (whole instrument)	
Time of analysis	2-4 h	1.5 h	1-2 h	2 h-days	3-5 h	< 1 h	< 1 h



# ULTRAPLACAD added value

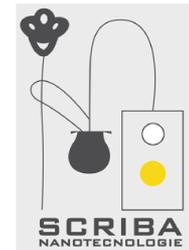
**Detection of DNA, microRNA and autoantibodies to tumor-associated antigens (a-TAAs) cancer biomarkers in one compact device with enhanced sensitivity and selectivity.**

From regularly updated IPR analysis it was observed that in the USA market there are companies making tests with DNA, RNA and proteins. **Anyway any commercially available system is currently able to provide all the features that ULTRAPLACAD is developing.**

Besides other important added values for ULTRAPLACAD are the fact that **it will be not required the PCR validation, and other diseases could be diagnosed**, including mutations, with an estimation time for adjustments of around 6 months.



# Project partners



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# Thank you for your attention!



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