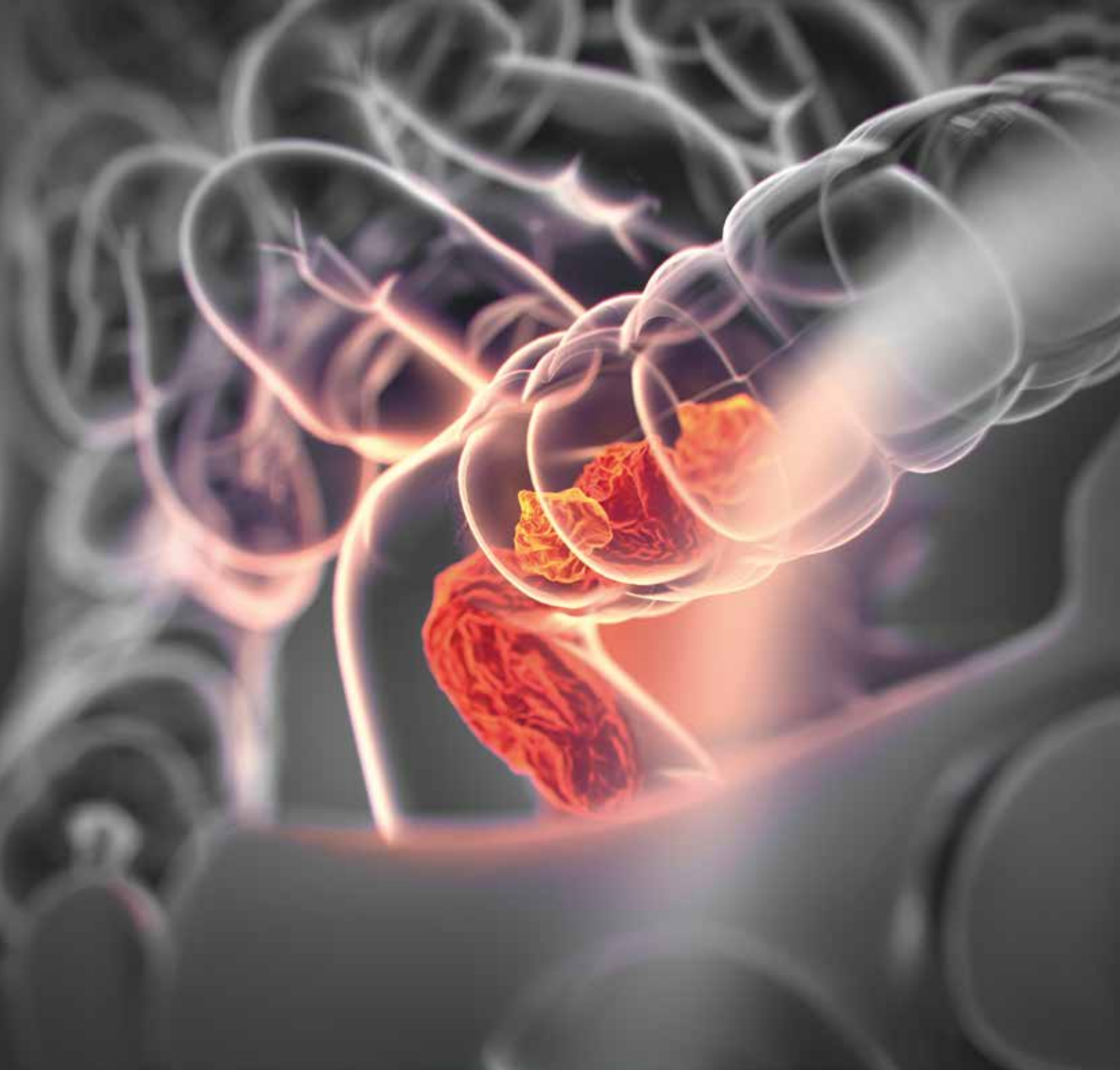


FASTER AND EASIER COLON CANCER DETECTION



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Efficient testing for improved patient outcomes

In the struggle against one of Europe's major cancers, LIQBIOSENS has developed a prototype machine that could prevent colorectal cancer deaths with effective and simple patient testing. The team of researchers hope to expand their product for widespread use

Colorectal cancer, referring to cancer beginning in either the colon or the rectum, is one of the deadliest cancers in the EU, according to the World Health Organisation. While it is possible to prevent cancer with certain lifestyle changes, a significant amount of cancer deaths can be reduced by simply detecting and treating it at its earlier stages. However, especially in terms of colorectal cancer, popular detection techniques can be invasive, painful or inefficient. A project co-funded by the EU's Horizon 2020 programme called LIQBIOSENS aims to provide a solution to this issue, bringing a revolutionary new method to the fight against cancer.

Project Coordinator Professor Antonio Arnau, founder of AWSensors, explains that tissue biopsy is currently viewed as an ideal cancer identification technique. Tissue biopsies can be both painful and invasive for the patient, and only represent a snapshot in time. He says that even when cancerous tissue is first discovered - when felt or seen through imaging, that the tumour may already have advanced significantly, reducing treatment options and life expectancy. 'LIQBIOSENS, on the other hand, attempts to detect cancer through a liquid biopsy and focuses on tackling colorectal cancer detection earlier.'

Recently, there has been significant progress in accurate and sensitive DNA analysis, allowing the project to monitor changes in a colorectal tumour's somatic cells through evaluation of the circulating tumour DNA (ctDNA). In order to obtain ctDNA, liquid biomarkers are acquired from body fluids such as blood, saliva or urine. 'Attaining these kinds of biomarkers makes for a more comfortable and less invasive

patient experience than obtaining tissue samples,' notes Arnau. Most importantly, liquid biopsies permit tracking of tumour dynamics in real time, crucial for early cancer detection.

A COLLABORATIVE EFFORT

LIQBIOSENS combines two technologies delivered by AWSensors and DestiNA Genomics. AWSensors provides the sensing technology and engineered platform needed to assess liquid biopsies. The LIQBIOSENS platform is constructed from AWSensors high-frequency, highly sensitive acoustic wave sensor, along with their microfluidic circuitry to move the clinical samples over the sensor. DestiNA Genomics provides LIQBIOSENS with the chemical reagents necessary to detect ctDNA mutations. 'DestiNA's chemistry needs a platform, so the LIQBIOSENS project has brought together the "printer and the ink" so to speak, enabling the building and testing of the combined technology,' explains Hugh Ilyine, CEO of DestiNA Genomics. 'This integration technology can provide a simple, low cost and real time-based test, enabling error-free detection of cancer mutations in blood samples, and can be an important player in the future market of liquid biopsy,' states Arnau.

INNOVATIVE ANALYSIS

So far, their multidisciplinary efforts have been successful. The liquid biopsy analysis has proven reliable, cost-effective, quick and user-friendly. By identifying correct sequences of nucleic acids that make up DNA and RNA, LIQBIOSENS is able to uncover cancerous colorectal. In addition, the price of a tissue biopsy is far more cost effective than the current 40 to 50 per

analysis price of a liquid biopsy. Testing for colorectal cancer through tissue biopsy involves a colonoscopy, which would cost thousands of euros in and of itself.

LIQBIOSENS analysis is expected to deliver a lower cost per test, and an equally small sample size, with only two to five millilitres of blood needed to detect the appropriate biomarkers. The test is anticipated to only take an hour or so, providing rapid feedback to both clinicians and their patients. After this, used cartridges with sensors can be disposed of in an environmentally safe way. It is apparent that LIQBIOSENS technology can be the future of cancer screening and diagnostic testing; the next step will be to validate the technical performance of the prototypes with patient samples, and then to introduce this novel diagnostic system commercially across Europe and on to the rest of the world, working closely with public and private health providers.

SHARING MEDICAL ADVANCEMENTS

The LIQBIOSENS project has made significant progress in its research and innovation and has now set goals to achieve the commercialisation of their liquid biopsy product. Firstly, the project team is working towards evaluating their product according to the perspective of end-users, being the medical professionals. Through this evaluation, new features are being selected and included in the platform and product to improve its commercial potential, with both software and hardware modifications to the system underway.

In the journey towards commercialisation, LIQBIOSENS has reached some critical checkpoints. So far, production price of AWSensors cartridges has been lowered

A first version of a fully integrated platform has been installed in the Genyo Centre. This important milestone makes it possible to proceed with the validation phase of the technology in a more real-world environment

while their performance improved, and the production of the chemical reagents has been optimised. Additionally, progress towards experimental use of the product by professionals is on track with both patients and medical professionals of varying backgrounds. LIQBIOSENS through its communication to the public is even now becoming better known. 'Now, a first version of a fully integrated platform has been installed in the Genyo Institute, Granada Spain, working closely with the Andalusian Government Health Service. This important installation milestone makes it possible to now proceed towards the validation phase of the technology in a more real-world environment,' explains Arnau.



LiqBioSens Platform Prototype

Ilyine also stresses the importance of distributing their technology more widely. 'Success with the technology development and commercialising of the LIQBIOSENS colon cancer assay and platform will quickly lead to further market interest to develop additional assays for a range of cancers, enabling economic growth, and the chance to become global leaders in cancer detection,' he says. With more extensive use of liquid biopsies targeting colon cancer, it is possible that unnecessary cancer deaths that plague countries year after year will begin to be reduced.

A BRIGHTER FUTURE

Not only does LIQBIOSENS detect and monitor colorectal cancer quicker, more precisely and more cost-effectively than other systems on the market, it has the potential to accelerate development of a European based cancer diagnostic industry. With cancer as one of the leading causes of death in Europe, it has become imperative to develop more efficient ways to identify it faster, paving the way for improved quality of life and life expectancy. The LIQBIOSENS project took on this challenge and has so far been successful. The next step is to complete its platform validation, and communicate the assay opportunities of this unique project to the medical profession, patient groups and funders, so as to realise a commercial and medical success story for European researchers and biotechnology companies. ▶

Project Insights

FUNDING

EC Horizon 2020 – Industrial Leadership – Leadership in enabling and industrial technologies – Information and Communication Technologies (ICT)
Project ID: 687785

PARTNERS

- Advance Wave Sensors S.L. (Spain)
- DestiNA Genomics (UK)
- Foundation for Research and Technology-Hellas (Greece)
- Andalusian Health Service (Spain)
- Sistemas Genómicos (Spain)
- Université Catholique de Louvain (Belgium)

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BIOS

Professor Antonio Arnau is a Professor at Polytechnic University of Valencia (UPV). He has participated in the last 10 years in 38 projects both at National and International level in public competition calls. Arnau has been the principal coordinator and IP in nine National Research Projects and two European Projects, and partner coordinator in five more projects of the European Commission including different Programmes such as ALFA, ERASMUS-IPUC, TEMPUS, and SOCRATES Thematic Network.

Hugh Ilyine is CEO of DestiNA Genomics, co-founding the company in 2010 as a spin-out from the University of Edinburgh. Ilyine is a member of the Canadian National Centres of Excellence Standing Selection Committee, and acts as a mentor to students and post-docs at various universities.



Impact Objectives

- A novel diagnostic platform for detection of KRAS and BRAF mutations in colorectal cancer using blood liquid biopsy

Faster and easier colon cancer detection

Professor Antonio Arnau and Hugh Ilyine discuss their work on LIQBIOSENS, a project developing an innovative way to identify colon cancer earlier through integrating sound waves, microelectronics, microfluidics, nano-materials and genomics



Professor Antonio Arnau



Hugh Ilyine

Could you share some information about LIQBIOSENS?

AA: The overall aim of the LIQBIOSENS project is the further development and validation in real settings of a novel diagnostic platform for the early and fast detection of circulating tumour DNA (ctDNA) and their KRAS and BRAF mutations associated to colorectal cancer through blood samples. The main features of LIQBIOSENS are: reliability (detection rates vary from 95–100 per cent); low-cost (40-50 euros per sample analysis); sensitivity (in the zM range); multiplexing capabilities (analysis of 27 KRAS and BRAF mutations simultaneously); short analysis time (30-60 minutes); user-friendly interface; and flexibility.

The LIQBIOSENS platform is based on the integration of two novel complementary technologies. On the one hand, the revolutionary DGL© technology of DestiNA Genomics Ltd, capable of delivering faster, more error-free detection of nucleic acids and their mutations than current enzyme-based detection systems, making “false

positive” results a thing of the past. On the other hand, the novel high-resolution acoustic wave microsensor technology property of AWSensors, that allows an accurate, inexpensive, label-free, direct and real time transduction method to quantitatively evaluate the results of the application of the above mentioned DGL© technique.

What is the importance of this work?

HI: Each year in the European Union over 300,000 colon cancer cases are reported, more than 140,000 in the US and over 2 million worldwide. Colon cancer is the second most prevalent female cancer and the third most prevalent for men. By combining novel sound wave sensing and unique ‘SMART Nucleobase’ chemistry intellectual property, the LIQBIOSENS project investment has enabled the engineering of a detection platform prototype and to demonstrate its technical performance through to patient sample testing.

Ultimately, who will benefit from the learnings?

HI: The big winners in the development of an improved test for colon cancer will be patients. The potential exists for the LIQBIOSENS assay when commercialised to be used for both confirmatory diagnosis as well as for prospective population screening.

It represents a unique opportunity to enter a globally significant market and develop a market leading role.

Though screening for colorectal cancer has the potential for earlier disease detection and much improved chances for patients to live better and longer, the poor sensitivity of faecal blood tests and high cost of new DNA mutation tests, which are seldom used in the EU, hinder market growth. What is clearly needed for the national health services of Europe and improved patient care is to have a test such as the LIQBIOSENS assay, which combines sensitivity and accuracy with a far lower cost per test.

How important has the contribution of the partners been on this project?

AA: All the partners play an important role in the project due to the different knowledge and knowhow necessary to be combined in only one device. As an innovative project with a goal focused on the commercialisation of a final instrument, additional expertise in the different competitive technologies already existing in the market is necessary, as well as the validation of the final device in a real environment. For this reason, a balanced contribution of all the partners is a key aspect and the project team was devised with this objective. ●