NEWSLETTER01
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SENSITIVE

Dear reader

Cancer is the second leading cause of death in EU-28 (26% of all deaths).

Approximately 1 in 6 cancer deaths is due to gastrointestinal (GI) tract tumors which include the esophagus, the stomach, the small and the large intestine.

The majority of GI tract tumors remain asymptomatic even until advanced stages when they are already invasive and often metastatic, and thus life-threatening.

Dr. Apostolos Klinakis

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Early diagnosis is the most important step towards treatment. With a few exceptions, early disease cannot only be assessed by histological evaluation of tissue biopsies. Due to the invasive nature of this procedure, it cannot be used as routine examination even in individuals at high risk. The same procedure is used to retrospectively assess complete removal of cancerous tissue in patients undergoing surgery. Thus, a robust imaging method that detects early onset disease and at the same time allows visualization of residual disease and cancerous tissue in patients with advanced disease is urgently needed.

We propose to build for the first time an imaging modality that will rely on visualizing subtle molecular and structural changes within tissues and thus allow visualization of early stage or residual disease in a label-free, minimally invasive manner. This way disease management will rely on intervention before tumors reach an advanced life-threatening stage.

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Interview

Dr. Dimitris Gorpas

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German Research Center for Environmental Health

1. What is your main field of research in HMGU?

The Institute of Biological and Medical Imaging (IBMI) at the Helmholtz Zentrum München in Munich, Germany, is a multi-disciplinary academic research structure, strongly integrated with the Chair of Biological Imaging at the Technical University of Munich. IBMI research focuses on innovative optical and optoacoustic methods that enable novel visualization of living biological tissue.

The Institute has 11 laboratories, with specialties ranging from engineering to biological and medical research. It is home to researchers from more than 25 nationalities and promotes independent career development and diversity. With a broad international presence and many prestigious awards, IBMI leads imaging and sensing technologies, advances biomedical discovery and translates novel sensing technologies to clinical applications.

2. How HMGU contributes in SENSITIVE project?

HMGU is leading the science-to-technology efforts of SENSITIVE, both at the hardware and data analytics levels. Through synergistic efforts with the two other engineering and physics partners, UC3M and RiverD, HMGU will develop a novel Scattering/Raman microscope to sense field cancerization at an organ level. This will be combined with an already existing device at HMGU -a unique hybrid second- and third-harmonic generation (SHG/THG) and optoacoustics microscope- in an attempt to systematically investigate any possible molecular and/or structural microalteration between the different stages of cancerization.

Moreover, HMGU will develop advanced signal processing and machine learning algorithms to provide insight into the composition of the target tissues and quantified information regarding changes to field cancerization biomarkers. During the later stages of the project, HMGU will transfer the knowledge acquired during the ex vivo studies within SENSITIVE into a never-before-seen hybrid endoscope, which will for the first time enable the investigation of field cancerization by means of detecting both structural and molecular microalterations in human patients.

3. What are your expectations from your work in SENSITIVE?

HMGU anticipates that SENSITIVE will showcase, for the first time, that detection of field cancerization is feasible through the combination of structural and molecular information. If successful, this will further spur the evolution of personalized medicine, and enable early detection while a disease is still curable.

The carefully designed working strategy of SENSITIVE and its highly acknowledged partners increases our confidence that this high-risk/high-gain project will successfully conclude with the detection of field cancerization biomarkers in human patients.

4. Could the results of SENSITIVE be used in other diseases?

As the main focus of SENSITIVE is the identification of structural and molecular biomarkers for the detection of field cancerization, by definition the direct results of SENSITIVE are related to cancer. However, the technological developments within the project could also be employed for the early detection of other diseases; these include, but are not limited to, inflammatory bowel disease, cardiovascular disease, and diabetes.

The hybrid Scattering/Raman microscope may prove to be a powerful tool for investigating and understanding the structural and molecular tissue microenvironment, and its changes at different stages of various diseases.

5. Are there any challenges in your work in SENSITIVE? How do you overcome them?

As in every high-risk/high-gain project, SENSITIVE does, and will continue to, face challenges. The development and validation of unprecedented technical inventions and the successful integration of stand-alone imaging modalities to obtain a synergistic imaging performance, in particular, might always come with some difficulties. However, the SENSITIVE partners have designed a thorough and efficient mitigation plan that would allow us to overcome any possible pitfall while still achieving all of the main priorities within SENSITIVE.

On top of this plan, HMGU is actively seeking the close interaction between the different partners involved in specific tasks of the project. For instance, during the design of the Raman and Scattering modules, a technology skype meeting was regularly scheduled between HMGU, UC3M, and RiverD to ensure not only the successful development of the two modalities, but also their straightforward and efficient integration into a hybrid microscope.