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Titre Thèse	An approach based on the combination of prognostic biomarkers and physiological µ-vibration concept to treatment decisions in breast cancer		
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Abstract :

Cancer pathology is a heterogeneous disease where several genes and cellular pathways have an impact on aggressive tumor behavior. Cancer treatment regimens are frequently tailored according to the genetic alterations or protein expression levels in individual genes using readily available archive specimens. Thus, a more specific tumor classification may be attained by identifying a set of criteria threshold with prognostic and predictive values. Therefore, statistical models will be developed that can identify candidate biomarkers which affect tumor behavior and patient clinical outcome (disease-specific and overall survival). Here, this will be done by integrating the results from genome-wide transcriptional, SNP, DNA methylation, RNA-seq correlated with physiological measurements by functionalized bio-sensor and clinicopathological features for the patient cohort.

Purpose and aims

This project is part of a prevention context. It complements the work initiated in 2014 at the IEMN on the design of an intelligent ultrasonic bra dedicated to the diagnosis of breast pathophysiology (Doi: 10.26502 / jcsct.5079039; IRASET-IEEE-2020). This work aims to design a system of both prevention and non-wired diagnosis capable of evaluating, through the properties of vibrational resonances, the pathophysiological potential of a given state thus leading to effective management of therapeutic interventions. It will meet a need long sought after by the operator for a non-invasive technique which, in the medium term will be a complementarity or an alternative to harmful techniques practiced today such as MRI or X-ray.

Because cancer pathology is a heterogeneous disease where several genes and cellular pathways have aggressive behavior on the organism, we then hypothesize that The pathophysiological evolution, the aberrant genetic and epigenetic modifications can guide the selection of therapeutic targets and refine the evaluation of the prognosis, which could in turn have a decisive impact on the results of future treatments against the cancer. It is therefore important to determine, early, the biophysical events involved in the process, thus promoting the switch to a potentially cancerous state. The treatment layout will then be adapted according to the genetic alterations detected or the expression levels of the proteins in the individual genes.

Today, to satisfy such layout, professionals are trying to identify cellular pathways that are disrupted in a genetically defined subgroup of patients. This action requires both the mobilization of human resources and a significant amount of time (two weeks). It can be summarized by the following two points:

1. Identify new genetic and epigenetic biomarkers associated with specific breast cancer survival
2. Assess the tumorigenic and therapeutic potential of candidate markers in breast cancer cell lines and xenografts derived from patients,

A major drawback is that this practice requires surgical intervention on the patient in order to take the samples necessary for microbiological analysis. This approach is essential but often undesirable for fear of activating the dynamic characteristics of the master cells that trigger metastasis.

In this context, this project aims to develop and implement a micrometric device (Lab-on-Chip) in order to avoid this surgical practice. It aims to quantify in a real time the effects of the presence of biomarkers on the measured vibrational properties of functionalized µ-beams activated in a narrow volume of physiological fluid extracted from the body without a surgical act.

Subsequently, these bio-physics parallelism may be useful as targets for early detection, drug development, patient stratification, and improved therapy.