Transcriptomic and phenotypic profiling of the white blood cells in breast cancer

A study to develop a screening test for early detection of breast cancer and relapses

Lay summary of the research plan

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Despite considerable improvements in breast cancer management, approximately one in four patients still die due to metastases. In order to decrease this mortality, the disease needs to be diagnosed as early as possible, and metastases must be prevented or treated effectively. Studies we have conducted show that the presence of breast cancer alters quantifiable phenotypic and transcriptomic characteristics of white blood cells (leucocytes) circulating in the blood. **These results suggest that it may be possible to exploit these changes in the leucocytes circulating in the blood to reveal the presence of primary breast cancer (screening) or a relapse (monitoring).**

The aim of our project is to generate additional data supporting these observations. To this end, we will use novel approaches and technologies (single cell RNA sequencing and multi-parameter analysis of the cell surface). We plan to compare first-diagnosis female patients with healthy women, and patients at the time of the first relapse after therapy with patients not having suffered a relapse. We will investigate the three biological subtypes of breast cancer (ER$^+$, HER2$^+$, triple negative). This multicentric study, conducted in the Lake of Geneva area, will be coordinated at the CHUV in Lausanne.

A 20 ml blood sample will be taken for the following lab tests: i) leucocyte phenotyping by flow cytometry; ii) transcriptomic analysis and phenotyping by single cell RNA sequencing, followed by bioinformatic analyses. The lab tests will be conducted at the University of Fribourg, the sequencing at the Genomic Technologies Facility of the University of Lausanne (LGTF) and the bioinformatic analyses at the Swiss Institute of Bioinformatics (SIB).

We hope that these analyses will help us validate our preliminary observations more precisely and that we will be able to identify candidate biomarkers (cells, phenotypes, gene expression) and combinations associated with primary breast cancer or the first relapse.
This study is part of a long-term goal to develop a cancer **screening blood test** and a **monitoring blood test** for early detection of relapses. The practical implications of these tests are potentially significant: the tests could contribute to changing the way women are screened and patients monitored, thereby **greatly improving** the quality of life of women in general (screening) and of breast cancer patients (monitoring). From a clinical point of view, the monitoring test would be a valuable new tool that could help support **therapeutic choices** in the treatment of breast cancer.