XEMPERIA®

bio-inspired diagnostics

Revolutionary Nanotechnology for Simple and Accurate Nucleic Acid and Mutation Detection

Cutting-edge technology empowers physicians with innovative solutions that transform healthcare and elevate patient care

Cancer, a disease like no others

Cancer remains a leading cause of suffering and death worldwide. Despite significant advancements in technology, nearly one in two affected individuals still succumb to the disease.

Founded in 2023 as a spin-off of the **University of Fribourg, XEMPERIA** is built on over 15 years of scientific research supported by over **CHF 12 million** in public and private funds.

Our mission is to improve **patients' quality of life** through science-driven, and technology enabled solutions.

XEMPERIA developed new nanotechnologies for rapid, accurate and cost-effective detection of **miRNA** and **cancer-associated single nucleotide mutations** in blood samples. miRNA and genetic mutations have important therapeutic implications for cancer patients.

These technologies are designed for both **laboratory research applications** and **clinical use**.

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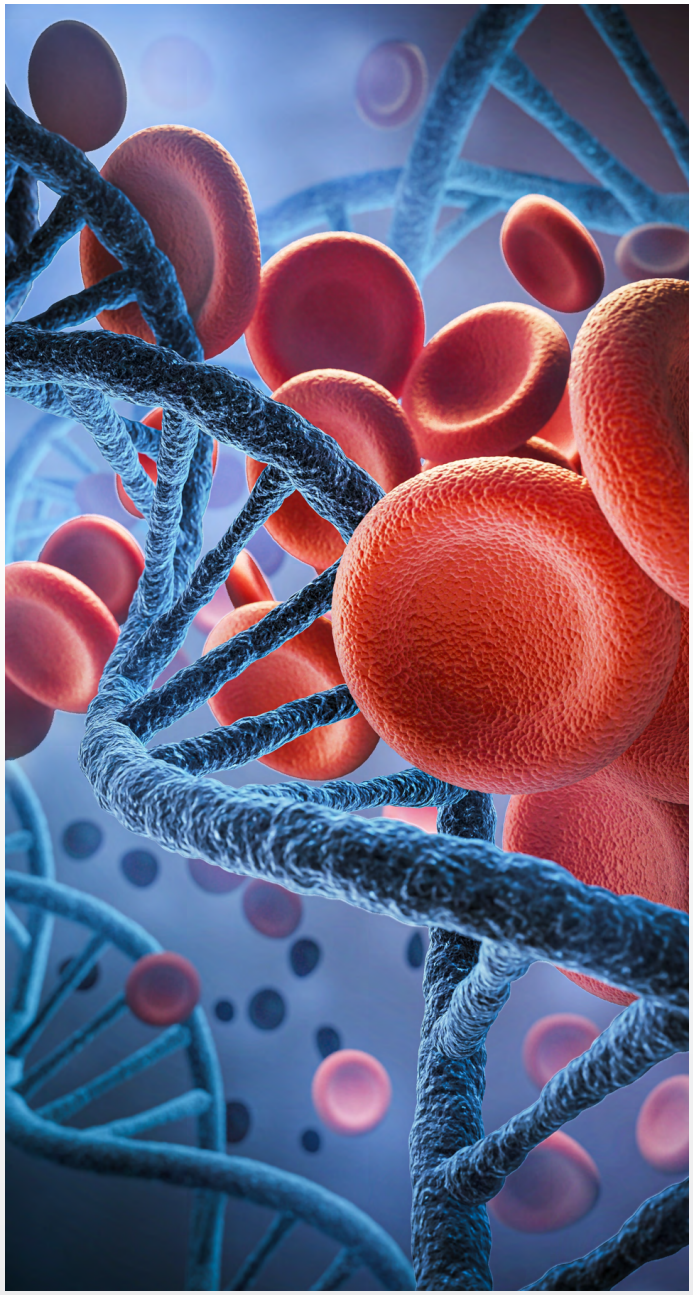
Nucleic acid detection by our revolutionary Nanosensors

Circulating cell free DNA and RNA are promising, clinically relevant cancer biomarkers [1].

They can provide important information for early cancer detection, treatment selection, monitoring response to therapy, disease progression and minimal residual disease (MRD).

Accurate measuring of DNA and RNA in patients' blood is challenging.

Current technologies (next generation sequencing, hybridization and PCR) are costly, time consuming and require specialized laboratories.



There is growing demand for innovative, rapid, precise, and user-friendly detection methods for circulating RNA and DNA in order to be able to enhance and personalize cancer patient management.

Our cutting-edge nano sensors **detect nucleic acids** in plasma and provide a streamlined alternative to conventional technologies. They are:

- **Simple to use in research and routine medical laboratories**
- **Accurate and affordable with fast turnaround time**

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DNA origami Nanosensor for miRNA detection

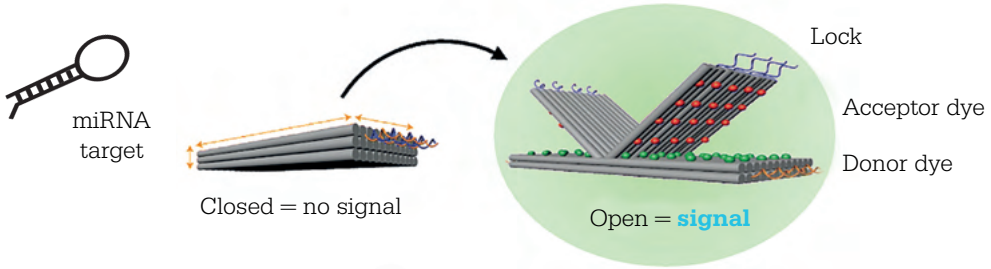
MicroRNAs (miRNAs)
are small non-coding RNAs (22–24 nucleotides) with regulatory activities for many cellular functions. In oncology, they are considered valuable blood biomarkers for cancer detection and monitoring. Their biological and medical relevance was recognized with the 2024 Nobel Prize in Medicine or Physiology.

Detection of miRNA by PCR, RNA-sequencing, and microarray hybridization is expensive, time consuming and requires specialized laboratories, faces significant limitations, restricting their use in clinical medicine and laboratory research.

We have developed innovative, sustainable, cost-effective **DNA origami nanosensor technology** enabling rapid, highly sensitive and specific miRNA detection in serum and plasma with little preanalytical processing a limit of detection(LOD) in the low picomolar range.

The detection of the target miRNA is revealed by a fluorescence signal.

miRNA detection by DNA origami nanosensor



Domljanovic I, Loretan M, Kempter S, Acuna GP, Kocabey S, Ruegg C.

Nanoscale. 2022 Oct 27; 14(41): 15432–15441. IP protected

Domljanovic I, Kocabey S, P Acuna G, Ruegg C. Small. 2025 Nov 14:e12100. doi: 10.1002/smll.202512100.

Our DNA-Origami technology allows easy, fast, sensitive and specific detection of miRNA

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DNA origami Nanosensor development strategy

Phase I (2019–2024): DNA origami-based nanosensor development for miRNA detection, feasibility studies at University of Fribourg, and securing patent.

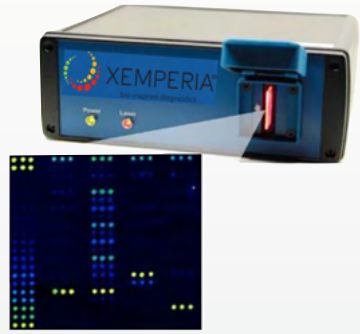
Phase II (2025–2026): Advanced multiplexed miRNA detection in plasma, optimized assays. Secured CHF 150k in funding.

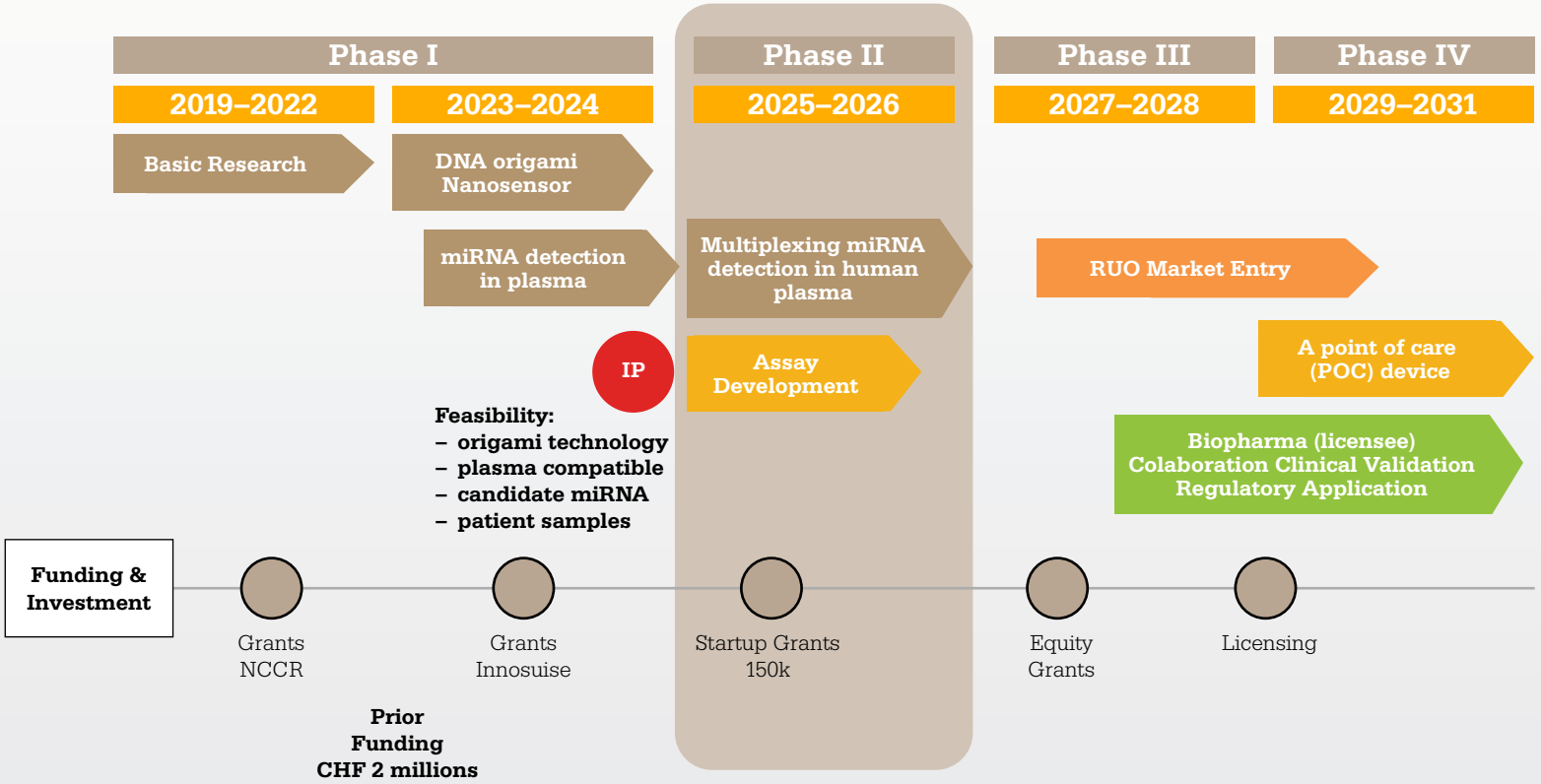
Phase III (2027–2028): Market entry for research applications, secured revenue by selling as Research Use Only (RUO). Licensing to medical laboratories partners for distribution as Laboratory developed test (LDT).

Phase IV (2029–2031): Licensing and Partnership for Clinical validation, secure regulatory approval, and develop a point-of-care device for real-time miRNA detection.

The product: A kit with all reagents for the detection of specific miRNA though florescent readout. Detection by microplate reader.

The technology can be further developed for multiplexed detection of specific miRNA on a microchip using a portable optical reader.





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Mutation detection by DNA-based signal amplification

Mutations are DNA alterations that can promote cancer and are key hallmarks of cancer. Several cancers have mutations with important clinical implications. *KRAS, P53, PIK3CA, BRAF, EGFR, BRCA1/ESR1, ALK* are some of the genes that carry mutations relevant to the choice of therapy, disease monitoring and patient management.

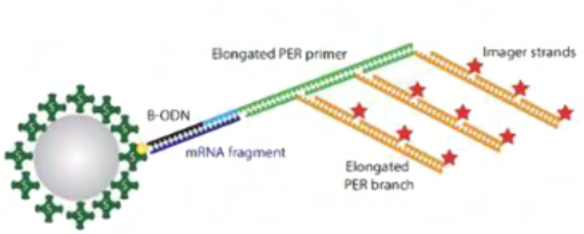
Next-Generation Sequencing (NGS) and **Polymerase Chain Reaction (PCR)** are widely used for mutation detection **in both preclinical and clinical research.** These technologies require specialized equipment and trained personnel, making them time-consuming and costly. As a result, mutation analysis remains largely confined to specialized laboratories, limiting broader accessibility.

An **innovative approach** with higher accuracy, more accessible and cost-effective is needed to enable precise gene mutation detection beyond specialized laboratories.

We have developed a **novel technology** to address this need. It is based on **capturing target RNA fragments** on beads, followed by a **primer exchange reaction (PER)** and **branched hybridization** to amplify the fluorescence signal, which is then detected by **flow cytometry**.

Our technology allows detection of specific mutations in genes from plasma of cancer patients with a limit of detection (LoD) at low fM = 27 fM and single base specificity.

The technology is adaptable for detection of multiple mutations (multiplexing) in one test. By concomitant detection of the normal and mutated gene it also determines the frequency of the mutated gene.



Flow-cytometry based mutation detection by PER-based signal amplification on microbeads

Kocabey S, Cattin S, Gray I, Rüegg C. Biosens Bioelectron. 2025 Jan 1;267:116839. IP Protected

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Multiplexed Mutation detection development strategy

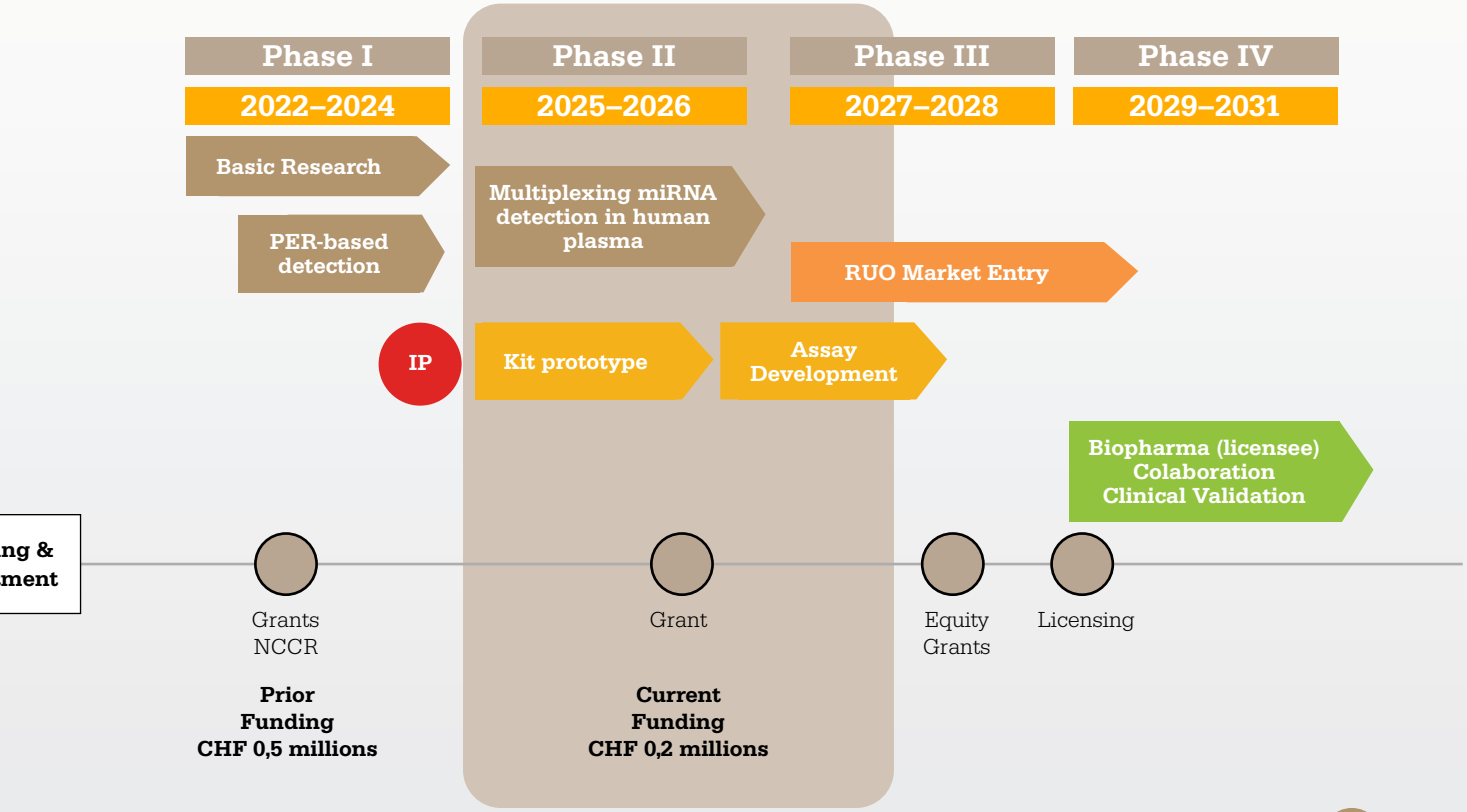
Phase I (2022–2024): Development of the technology, feasibility studies at University of Fribourg, and securing a patent.

Phase II (2025–2026): Advanced multiplexed mutation detection in plasma, optimized assays, Kit prototype for RUO.

Phase III (2027–2028): Market entry for research applications (RUO – Research Use Only). Licensing to medical laboratories partners for distribution as Laboratory developed test (LDT). Secure further funding and initial revenues. Setting the stage for clinical validation.

Phase IV (2029–2030): Clinical validation study with a partner, secure regulatory approval, and develop a certified protocol.

The product: A kit will all reagents for multiplex detection of cancer relevant wild type and mutated genes. Fluorescent signals are detected by flow cytometry and data processed to identify mutated genes.



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Market and business strategy

The **global liquid biopsy** market, which encompasses circulating DNA/RNA detection, was valued at approximately USD 10.85 billion in 2023. It is projected to reach USD 32.54 billion by 2033, growing at a compound annual growth rate (CAGR) of 11.61% from 2024 to 2033.

XEMPERA aims to commercialize its innovative tests through RUO as a **rapid market entry strategy (2027)**, paving the way for broader adoption and future regulatory approvals. The next phase of our strategy focuses on **licensing** and establishing biopharma partnerships **(2028)** to advance clinical applications and drive broader adoption of our technology.

Unique and competitive technology that is simple, accurate, and cost-effective. Our solution addresses the growing demand for nucleic acid and mutation detection outside specialized centers—bringing testing closer to patients (POC devices) and making it accessible in regions with less developed healthcare systems.

Scientifique sources

1. Itani, M. M. et al. A Signature of Four Circulating microRNAs as Potential Biomarkers for Diagnosing Early-Stage Breast Cancer. Int J Mol Sci 22, 6121 (2021).
2. Madhavan, D. et al. Circulating miRNAs with prognostic value in metastatic breast cancer and for early detection of metastasis. Carcinogenesis 37, 461–470 (2016).
3. Hamam, R. et al. Circulating microRNAs in breast cancer: novel diagnostic and prognostic biomarkers. Cell Death Dis 8, e3045–e3045 (2017).
4. Ozawa, P. M. M. et al. Liquid biopsy for breast cancer using extracellular vesicles and cell-freemicroRNAsas biomarkers. Translational Research 223, 40–60 (2020).
5. Breast Cancer Liquid Biopsy Market Size, Share & Trends Analysis Report By Circulating Biomarkers Forecasts, 2025–2030.

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Our story

Our foundation

XEMPERIA was established in 2023 as a Spin-off of the University of Fribourg in Switzerland, on a profound commitment to transforming breast cancer care through the power of early detection. Our foundation lies in over 25 years of pioneering translational cancer research and biomarker discovery with a passionate drive to make a meaningful impact on global health.

Prof. Curzio Rüegg

Founder and CEO/CSO

Curzio is a MD, recognized leading figure in cancer research, trained in Basel, Zurich Bellinzona, and San Francisco. He pursued his academic career at the University of Lausanne/CHUV and the University of Fribourg, Switzerland. He has published over 180 scientific articles and previously co-founded two MedTech Start-ups.

Dr. Sarah Cattin

Founder and CTO

Sarah holds a PhD in Medical Biology with a focus on immunology and cancer from the University of Lausanne. She is the Head of the Cell Analytic Facility at the University of Fribourg where her expertise in cancer biology and immunology plays a key role in advancing cell analysis techniques and applications in academic and biotech research.

Dr. Tuto Rossi

Founder and CLO

Tuto is a legal expert with a PhD from the University of Fribourg, specializes in commercial and banking law, as well as private international law. He is the founder of «Tuto Rossi Law & Notary Office» and has been instrumental in founding numerous Start-ups. He teaches at the universities of Fribourg and Urbino and is an active member of the parliament in Ticino.

Our vision

Our vision is to establish ourselves as leaders in blood tests for detecting and monitoring breast cancer and assisting doctors in making therapeutic decisions.

Our mission

Our mission is to reduce cancer mortality and enhance patients' quality of life by identifying and addressing cancer at its earliest and most treatable stages.

Our solution

XEMPERIA develops accurate, user-friendly, and cost-effective tests for breast cancer early detection and monitoring, Leveraging an unparalleled approach. XEMPERIA's technology represents a unique innovation, that can be easily adapted to other cancers and inflammatory diseases.

Our financial potential

Thanks to its distinctive features, our technology holds tremendous market and financial potential. In 2024, the market size for breast cancer diagnostic is projected to reach a valuation of USD 4.7 Billion. By 2033, the valuation is anticipated to reach USD 11.3 Billion.

December 2025

Our revolutionary nano technology makes nucleic acid and mutation detection easy, accurate and affordable: let's work together to save more lives.

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