

# Wearable device for detection and elimination of cancer cells at inception: birth of a new era

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## Abstract

Despite major advances in molecular oncology and cancer therapeutics, early detection remains a critical limitation for many malignancies. Current screening approaches rely largely on anatomical or morphological changes, highlighting a persistent gap between modern biological understanding of cancer and its clinical application. This article examines the evolution of cancer biology and explores why these advances have not yet translated into effective early detection strategies.

I propose a wearable device-based framework that integrates peripheral blood DNA methylation profiling of tumor suppressor genes and oncogenes with physical detection of early malignant cells. Technologies such as superconducting quantum interference devices (SQUID), metamaterial sensors, and microwave imaging are discussed as platforms for three-dimensional localization of nascent cancer cells. In parallel, “elimination” wearable devices capable of delivering localized energy—via radiofrequency or microwave ablation, nanoparticles, or programmable nanomachines—are proposed to eradicate malignant cells at inception.

This integrative model bridges molecular oncology, applied physics, and digital health, introducing a new paradigm for early cancer detection and prevention.

**Keywords:** Cancer screening, SQUID, Nano-machines, Meta material sensor, Electromagnetic field, Microwave imaging, Radio frequency ablation, Digital oncology

## Introduction

In the last 83 years, since the birth of nitrogen mustard [1] which opened the new chapter of cancer therapeutics, we have also been dealing with the dilemma of early detection of cancer [2]. As of this writing, some 83 years later, we still lack a reliable and valid cancer screening test for a good number of neoplastic disorders.

Some notable examples include ovarian cancer [3], pancreatobiliary carcinoma [4], hepatocellular carcinoma [5], brain tumors [6], lymphoma [7], and leukemias [8].

Mammogram [9], colonoscopy [10], and the controversial PSA screening for prostate cancer [11] are among the few and perhaps only success stories.

As we have advanced enormously in the development of new generation of cancer therapeutics, we have also developed a significantly deeper understanding of molecular and genetic mechanisms that underlie the neoplastic transformations [12].

This development and evolution in our understanding has not as yet been optimally employed in the development of new cancer screening and treatment in real world, while we have moved from nitrogen mustard and multi-agent chemotherapy protocols to targeted therapy [13] and new generation of immunotherapy [14], as well as tumor vaccines [15].

We still rely on calcification pattern in mammogram and visual appreciation of tumor mass or polyp, for breast and colon cancer screening, respectively.

This represents a major breakdown between our understanding of the underlying mechanisms of neoplastic transformation, and their application towards development of new cancer screening methodology.

A similar breakdown is witnessed between such understanding and development of new generations of cancer therapeutics. Even though we have jumped from nitrogen mustard to targeted therapy and new generation of immunotherapy in the last 83 years, there is still a big gap between our understanding of neoplastic transformation [16] and its application in development of new generation of cancer therapeutics. Wearable devices are a revolution in cancer diagnosis and treatment. It takes advantage of DNA methylation profiling of tumor suppressor genes and elimination of cancer at its inception.

This article proposes a novel conceptual framework for cancer detection and prevention using wearable devices that integrate blood-based DNA methylation profiling with physical detection of early malignant cells. By exploiting increased signaling network entropy and associated nano-scale electromagnetic perturbations in newly transformed cells, such devices could enable real-time localization and targeted elimination of cancer at its inception. This approach introduces a potential shift toward preemptive oncology, with implications for earlier diagnosis, reduced morbidity, and improved cancer outcomes.

**Evolution in definition of cancer**

For the most part, in 20<sup>th</sup> century, cancer used to be defined as proliferation of cells in a disorderly fashion [17]. As knowledge about differentiation pathways including the steroid-retinoid family of receptors evolved [18], cancer definition also evolved into uncontrolled proliferation of de-differentiated cells.

As we became more knowledgeable and aware of the associated molecular and genetic aberrancies of different cancers, we started to incorporate them in our pathology reports. We also started to teach cancer as a disorder of genome in medical schools and medical texts. Next generation sequencing [19] and comprehensive immuno-staining [20] have become an essential part of modern pathology reports.

Meanwhile, we have gone through whole genome profiling [21], exomics [22], epigenomics [23], microRNA network development [24], proteomics [25], polyomics [26], and spatial polyomics [27].

This rapidly expanding body of molecular insight into tumor biology has reshaped how cancer is classified, studied, and conceptualized.

**Discussion**

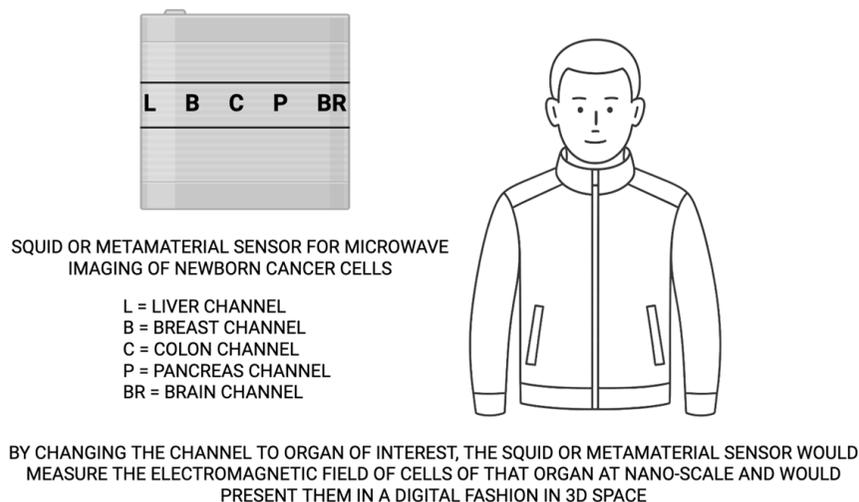
The big question is, why these massive advancements in our understanding of neoplastic transformation have not yet been translated into, not only screening tests, but also identification of cancer cells at much earlier stages. Recently, methylation profiling of tumor suppressor genes and oncogenes in peripheral blood [28] has opened the way for achievement of this goal. Through this methodology we become able to recognize preneoplastic changes and potential future neoplastic transformation of different organs. One major barrier so far has been that such advances in understanding of neoplastic transformation have not lent themselves to physical measurement of the earliest events [29].

To overcome this barrier, I have proposed measurement of perturbations in master regulator complex network entropy of normal cells [30] in different stages down the path of neoplastic transformation. It has been well shown, described and published that master regulator complex network entropy of cancer cells are significantly higher as compared to their normal counterparts [31]. Introduction of methylation profiling of tumor suppressor genes and oncogenes in peripheral blood, discussed in AACR 2025, would enable us to identify earlier neoplastic transformation events of different organs. This, in and of itself, would not enable us to pinpoint and identify a small fraction of cells undergoing neoplastic transformation in each organ. We could, however, take advantage of the increase in master regulator complex network entropy of that fraction of cells in organ of interest towards their identification in 3D space [32].

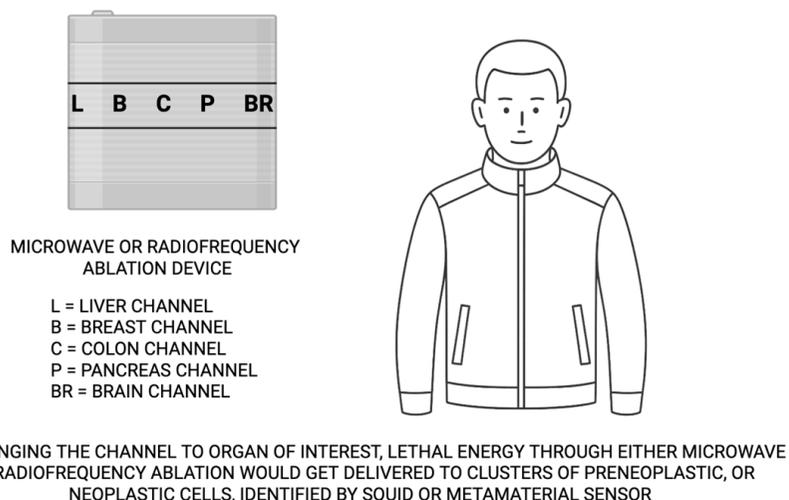
Squid [33] and microwave [34] imaging are two of practical applications of physical parameter, such as magnetic field of cancer cells at a nano-scale [35].

Nano-scale variation of magnetic field of cancer cells with elevated master regulator complex network entropy [36], might be a better and more distinctive measurement in this regard.

As such, my proposed wearable device should be loaded either with squid [37] or metamaterial sensor for microwave imaging of recently born cancer cells.



**Figure 1.** Wearable device D [Detection].



**Figure 2.** Wearable device E [Elimination].

Such wearable device should also be designed with multiple channels: each channel focusing on one organ of interest, based on information given to us by methylation profiling of specific tumor suppressor genes and oncogenes related to the organ of interest. Hereby, I would coin “D” for detection wearable devices and “E” for cancer cell elimination wearable device. The “E” wearable device should be able to deliver lethal high energy particles at nano-scale level to the newborn malignant cells [38].

Radiofrequency [39] and microwave ablation [40] are among the two major modalities that could be employed for annihilation of new population of cancer cells. Of course, we could employ other methodologies for annihilation of the newborn cancer cells, such as nano-particles [41] and nano-machines [42] that could get programmed to eliminate cancer cells of interest by delivering lethal energy of different types, including vibration [43], heat or cold [44].

### Conclusion

The design and manufacture of above-mentioned wearable devices and the application of nano-particles, and nano-machines would take us into the new era of cancer cell detection at the time of inception and its elimination, or abortion, before it could acquire the capability of causing the demise of the host. As such, we would take a quantum leap into the new field of cancer detection and cure.

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