Catching Cardiotoxicity Early: Monitoring Cardiovascular Health with Wearables

AI-enabled Optoacoustic Sensing of Microvascular Morphology

Suhanyaa Nitkunanantharajah, Mohamed Elsharawy, Ivy S. Curren, Vasilis Ntziachristos

FACTS & FIGURES

Start date:	01.03.2026
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IHI funding:	~ 28 Mio € (Innovative Health Initiative JU Call 9)
Industry funding:	~ 24 Mio €
Total Cost:	~ 52 Mio €
Project website:	compass-care.eu
Social media:	linkedin.com/company/compass-ihi-project/

CHALLENGE - Cardiotoxicity Detection

Cancer therapies can cause **lasting cardiac damage**, compromising long-term survival and quality of life. However, cardiotoxicity is typically detected only after cardiac function has already begun to decline, when damage may already be irreversible. Earlier detection would enable timely therapy adaptation and cardio-protection intervention while the heart can still recover.

Current cancer care methods offer **limited predictive capabilities for cardiotoxicity**, **late-stage detection**, and **no practical means for frequent monitoring**.

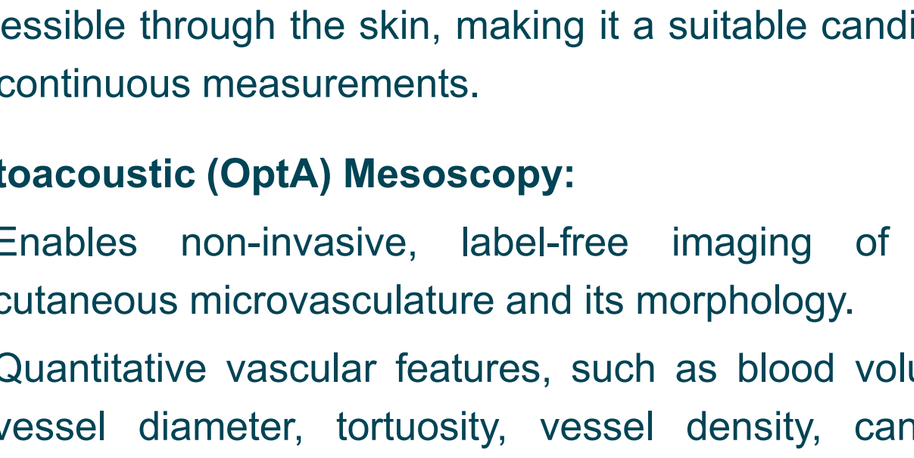
IDEA – Leveraging the Skin as an Accessible Window into Systemic Health with Optoacoustic Mesoscopy

Microvascular and endothelial injury precedes myocardial dysfunction. The cutaneous microvasculature is directly accessible through the skin, making it a suitable candidate for continuous measurements.

Optoacoustic (OptA) Mesoscopy:

- Enables non-invasive, label-free imaging of fine cutaneous microvasculature and its morphology.
- Quantitative vascular features, such as blood volume, vessel diameter, tortuosity, vessel density, can be extracted from OptA images.
- OptA has been shown to capture differences in vessel structure and endothelial function between between healthy individuals and patients with cardiovascular disease[1,2].

Therefore, it is a promising tool to assess cardiac-related vascular biology.



OptA cross-sectional image of skin microvasculature

1 Karlas, Angelos, et al. "Multiscale optoacoustic assessment of skin microvascular reactivity in carotid artery disease." *Photoacoustics* (2024)
2 He, Hailong, et al. "Single-capillary endothelial dysfunction resolved by optoacoustic mesoscopy." *Light: Science & Applications* (2026)

Compass

Biomarkers	Monitoring	Clinical Decision Support
Identification and validation of early cardiotoxicity marker	Continuous, non-invasive tracking of cardiac health, enabling timely intervention	AI-enabled tools integrating imaging, biomarkers and wearable data to personalize care

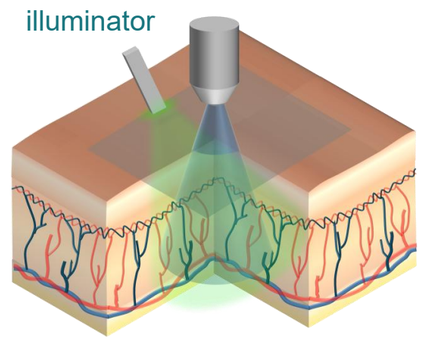
Clinical expertise + multimodal data + AI

APPROACH – From Imaging to Sensing, Making Optoacoustics Wearable

Goal

A wearable OptA sensor for non-invasive, continuous and longitudinal microvascular monitoring

→ Smaller size, lower cost, real-time capabilities



Challenges

- Miniaturization of the system into a wearable sensor
- **Extracting morphological features and functional information of the vasculature from 1D sensing data**

Can vascular features be extracted from OptA sensing data alone?

PRELIMINARY RESULTS

AI-enabled inference of vascular features from OptA sensing

	Qualitative [AUROC]	Quantitative [R^2]
Median vessel radius	0.87 ± 0.04	0.69
Branch length ratio	0.86 ± 0.05	0.65
Total blood volume	0.79 ± 0.05	0.39
Tortuosity	0.59 ± 0.04	0.00

→ Certain vascular features can be estimated from OptA sensing data

Next steps:

- Assessment of endothelial function with OptA sensing
- Integration of OptA sensing with complementary wearable technologies

VALUE OF IHI COLLABORATION

- Industry-academic partnership – expertise in developing an innovative and market-ready product
- Facilitated translation into clinical practice
- Large-scale project spanning multiple aspects of a problem

CAREER IMPACT

- Networking opportunity
- International, multi-disciplinary environment
- Opportunity to collaborate with industry partners

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