

A System For All Day Biosampling: Microdialysis and Wearables Collide

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Summary:

Recent developments in wearable sensor technology have increased the ability to perform research in real-world settings. However, a challenge has been to link wearable signals with biological measures. In this paper, examples of ambulatory hormone profiling combined with wearable devices are used to illustrate the potential value for future studies in health and disease.

Keywords: microdialysis; hormones; wearables; chronomedicine

Background, Motivation and Objective

Human physiology is organized across the 24-hour day by timing systems that shape endocrine secretion, sleep, activity, temperature, metabolism, and responses to the external environment. Until relatively recently, it has only been possible to capture dynamic changes in biological systems in contrived laboratory settings. As a result, key features of these important systems have been difficult if not impossible to observe in everyday life. At the same time, multiple kinds of wearable devices have emerged and have been applied for use as indirect proxies of environmental and physiological signals. A key gap has been the ability to anchor proxy signals with real biological markers in ambulatory, real life situation.

Ambulatory microdialysis and wearables: Narrowing the gap between biological and passive monitoring

Portable microdialysis coupled to automated fraction collection can generate high resolution profiles of hormones over 24-hours or more in home based-setting, including during sleep [1,2]. These initial studies established proof-of-principle feasibility and signposted the value of dense endocrine sampling. The aim of these methods is to improve diagnosis and treatment of health conditions by providing critical insights into dynamics and the links between wearable-measured signals and underlying biology.

Dynamics in everyday life

We used ambulatory microdialysis to quantify 24hr patterns of adrenal hormones in 214 healthy people [3] defining normal healthy variation and establishing reference for comparisons with disease [4].

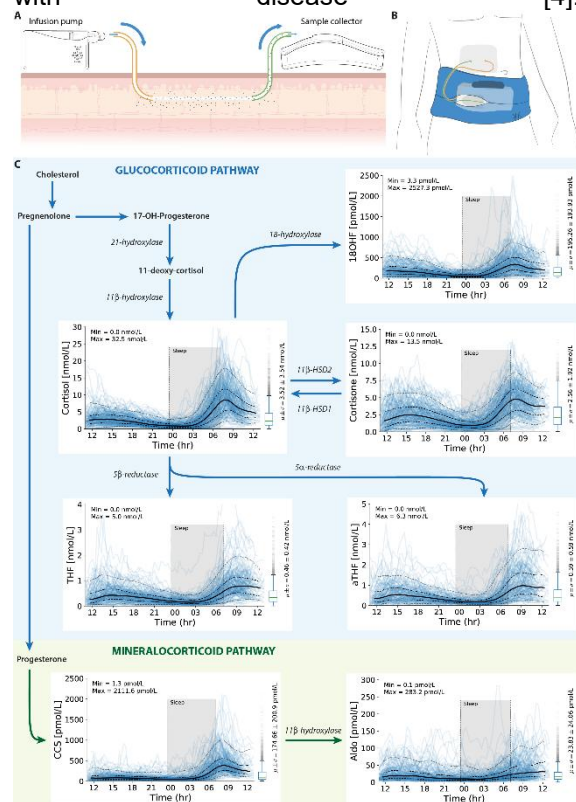


Fig. 1. Patterns of 7 adrenal steroids in n=214

healthy volunteers collected during normal daily life [3].

Broadening the horizon

A series of pilot studies have demonstrated the feasibility of integrating wearable devices into ambulatory microdialysis protocols.

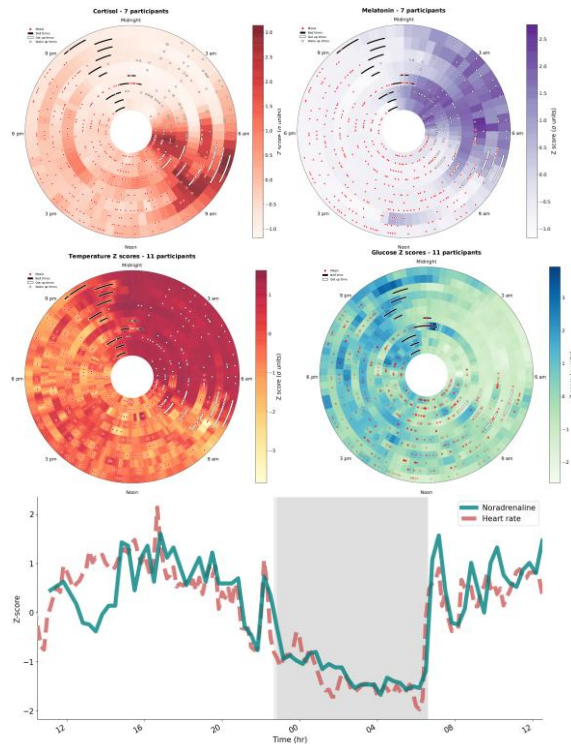


Fig. 2. 24hr heatmaps illustrate 24hr variation in hormones, skin temperature and glucose. Bottom: Free noradrenaline tracking with heart rate in a healthy volunteer (Author's unpublished data)

Advanced analysis methods now permit quantification of a wider variety of hormones and metabolites in interstitial fluid, including melatonin and free catecholamines (Fig 2).

The future of digital endocrinology and health

The combination of ambulatory biosampling and digital wearables opens doors for a potential revolution in the understanding of health and disease. The upcoming Endotrain DTP (10.3030/101227148) will train doctoral candidates across eight countries in this exciting new era where research innovation, digital solutions, and clinical care intersect.

References

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