Continuous Skin and Body Temperature Monitoring in Medical Applications: Literature review

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Text of abstract

Keywords: keyword 1; keyword 2; keyword 3

Highlights: These are the highlights.

# 1 Introduction

A new method of core body temperature monitoring is introduced and compared to currently used methods ([Lilly et. al., 1980](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1097_00003246-198012000-00010)).](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1097_00003246-198012000-00010>)).)

([Mellergård, 1995](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1016_0090-3019%2895%2980049-m))](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1016_0090-3019%2895%2980049-m>))) find no clear evidence for a correlation between consciousness level and brain temperature.

In 1971, Fox and Solman [9,10] invented a noninvasive deep temperature thermometer using a zero-heat-flow method ([Yamakage et. al., 2003](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1007_s005400300026)).](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1007_s005400300026>)).)

([Larina et. al., 2005](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1088_0022-3727%2f38%2f15%2f015))](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1088_0022-3727%2f38%2f15%2f015>))) induced temperature gradients in tissue and tissue-like samples and monitored the temperature distribution using the optoacoustic technique.

([Chen et. al., 2010](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1145_2221924.2221960))](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1145_2221924.2221960>))) demonstrate a design of non-invasive neonatal temperature monitoring with wearable sensors.

The objective of ([Raab et. al., 2011](%5Bhttps://www.paperdigest.org/paper/?%5D(https://www.paperdigest.org/paper/?paper_id=doi.org_10.1108_00070701111177683)))

## 1.1 Wearable sensors

([Oh et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-29400434))](<https://www.paperdigest.org/paper/?paper_id=pubmed-29400434>))) demonstrate the fabrication of a highly sensitive flexible temperature sensor with a bioinspired octopus-mimicking adhesive.

## 1.2 Temperature variability in the day

([Mills et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-30022159))](<https://www.paperdigest.org/paper/?paper_id=pubmed-30022159>))) identify an independent metabolic pathway that controls acute activation of adipose tissue thermogenesis in vivo. The AMP-activated protein kinase (AMPK) is a cellular energy sensor that has recently been demonstrated to be important in potentially regulating the metabolic activity of brown and beige adipose tissue.

The contribution of ([Desjardins et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-30120579))](<https://www.paperdigest.org/paper/?paper_id=pubmed-30120579>))) is to summarize recent work describing the role of AMPK in brown and beige adipose tissue, focusing on its role in adipogenesis and non-shivering thermogenesis.

([Li et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-30449620))](<https://www.paperdigest.org/paper/?paper_id=pubmed-30449620>))) identify the gut hormone secretin as a non-sympathetic BAT activator mediating prandial thermogenesis, which consequentially induces satiation, thereby establishing a gut-secretin-BAT-brain axis in mammals with a physiological role of prandial thermogenesis in the control of satiation.

([Chouchani et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-30503034))](<https://www.paperdigest.org/paper/?paper_id=pubmed-30503034>))) review the evidence for regulators of heat production in thermogenic adipocytes in the context of the thermodynamic and kinetic principles that govern their therapeutic utility.

([Baker, 2019](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-31608304))](<https://www.paperdigest.org/paper/?paper_id=pubmed-31608304>))) discuss the state of evidence for potential non-thermoregulatory roles of sweat in the maintenance and/or perturbation of human health.

## 1.3 Temperature monitoring in wounds

([Salvo et. al., 2017](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-29257113))](<https://www.paperdigest.org/paper/?paper_id=pubmed-29257113>))) describe the advances in sensors and biosensors for monitoring the concentration of C-reactive protein (CRP), temperature and pH in wounds.

([Touret et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1016_j.ymssp.2017.07.044))](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1016_j.ymssp.2017.07.044>))) focus on condition monitoring studies which use this thermal approach.

([Youn et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-30489065))](<https://www.paperdigest.org/paper/?paper_id=pubmed-30489065>))) propose flexible temperature sensors using silver nanowires (NWs) and a flexible colorless polyimide (CPI) film integrated with a wireless data transmission circuit.

([Rahman et. al., 2020](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.11591_eei.v9i1.1557))](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.11591_eei.v9i1.1557>))) explore the use of Internet of Things (IoT) in monitoring the temperature and humidity of a data centre in real-time using a simple monitoring system to determine the relationship and difference between temperature and humidity with respect to the different locations of measurements.

([Lori et. al., 2022](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-35225350))](<https://www.paperdigest.org/paper/?paper_id=pubmed-35225350>))) include 31 neonates (16 males, 15 females; mean [SD] gestational age 39 weeks [1.67]) who received therapeutic hypothermia for HIE. Other influential work includes ([Zakaria et. al., 2018](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1109_icbaps.2018.8527408)).](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1109_icbaps.2018.8527408>)).)

## 1.4 Systems approach for temp monitoring

([Mehmood et. al., 2015](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-25884377))](<https://www.paperdigest.org/paper/?paper_id=pubmed-25884377>))) present a low-power portable telemetric system for wound condition sensing and monitoring.

([Salvo et. al., 2017](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-29257113))](<https://www.paperdigest.org/paper/?paper_id=pubmed-29257113>))) describe the advances in sensors and biosensors for monitoring the concentration of C-reactive protein (CRP), temperature and pH in wounds.

([Sattar et. al., 2019](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1155_2019%2f8059629))](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1155_2019%2f8059629>))) provide a wound care solution based on a biosensor-based sensing system to measure basic biomarkers, considered as major wound characteristics, i.e., body temperature and body oxygenation, and design a fuzzy inference system to predict their effect on wound hydration, which ultimately recommends necessary actions to boost healing.

The aim of ([Lavery et. al., 2019](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-31423317))](<https://www.paperdigest.org/paper/?paper_id=pubmed-31423317>))) was to assess the sensitivity, specificity, and lead time associated with unilateral diabetic foot temperature monitoring.

([Gordon et. al., 2020](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-32109516))](<https://www.paperdigest.org/paper/?paper_id=pubmed-32109516>))) report the prediction specificity, lead time, and annualized alert frequency in each cohort at maximum sensitivity.

By integrating the emerging bioelectronics and software ([Lou et. al., 2020](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-32392156))](<https://www.paperdigest.org/paper/?paper_id=pubmed-32392156>))) create a flexible wound healing system.

([Lu et. al., 2021](%5Bhttps://www.paperdigest.org/paper/?paper_id=doi.org_10.1109_isscc42613.2021.9365992))](<https://www.paperdigest.org/paper/?paper_id=doi.org_10.1109_isscc42613.2021.9365992>))) present a CMOS multimodality system-on-a-chip (SoC) integrated with electrochemical sensors (ECH), a temperature sensor (TS), and a current stimulator (CS).

This study was performed to evaluate the feasibility of a mobile health (mHealth)-based thermometer for foot temperature monitoring in patients with chronic foot ulcer before and after endovascular therapy and to determine the association between temperature change and wound healing time ([Lin et. al., 2021](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-33960955)).](<https://www.paperdigest.org/paper/?paper_id=pubmed-33960955>)).)

To progress in the latter, the purpose of ([Miskovic et. al., 2022](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-35646874))](<https://www.paperdigest.org/paper/?paper_id=pubmed-35646874>))) is twofold. Other influential work includes ([Tang et. al., 2021](%5Bhttps://www.paperdigest.org/paper/?paper_id=pubmed-33919752)).](<https://www.paperdigest.org/paper/?paper_id=pubmed-33919752>)).)

## 1.5 casy dla stałego monitorowania temp

## 1.6 jak dobrze mierzyć temp i unikać błędów

## 1.7 trendy temperatury

## 1.8 temp traq - przykłady publikacji

<https://pantabletka.pl/drgawki-goraczkowe-u-dziecka/>

# 2 Discussion

# 3 Conclusion

# 4 Acknowledgements

# 5 References