

Circadian rhythms: a proposal to monitor environmental stressor variations and COVID-19 impacts

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Abstract— The circadian rhythm regulation is essential to perform a healthy lifestyle, and it is influenced by several events triggered by environmental interactional factors. Circadian clocks regulate the pharmacokinetics and efficacy of many therapeutics, as several drug targets and the proteins involved in drug transport and metabolism exhibit daily rhythmic expression in our bodies. The work presents a proposal of remote circadian monitoring for COVID-19 patients.

Clinical Relevance— A critical aspect of COVID-19 management is to understand the dosing-time dependency of drugs and vaccines that elicit any clinical improvement in the infected patients.

I. INTRODUCTION

The circadian rhythm regulation is essential to perform a healthy lifestyle, and it is influenced by several events triggered by environmental interactional factors such as light, night and day duration, seasons, diet etc [1]. Alterations of such factors can have negative impacts on the incidence of several mental and metabolic diseases such sleep disturbance, depression like cancers, cardiovascular non communicable diseases and diabetes. Furthermore the circadian clock regulates the cell cycle[2]. Several studies has concluded to find a relationship to circadian rhythms changes and tumorigenesis in some cancers and adenocarcinoma [2]. COVID-19 symptoms can exacerbate in different mode circadian dysfunctions: circadian clocks also regulate the pharmacokinetics and efficacy of many therapeutics, as several drug targets and the proteins involved in drug transport and metabolism exhibit daily rhythmic expression in our bodies[8]. Monitoring the circadian cycle is key for better COVID-19 care management.

II. CIRCADIAN RHYTHMS

.Circadian rhythms are 24-h rhythms in physiology and behaviour generated by molecular clocks, which serve to coordinate internal time with the external world. The circadian system is a master regulator of nearly all physiology and its disruption has major consequences on health and factors such as temperature and light has a major influence[2]. Circadian rhythms also affects gene expressions. Significantly, circadian and clock-controlled gene mutations have recently been identified in the aetiology of sleep, mental health and metabolic disorders. The mechanisms underlying circadian regulation are cell autonomous transcription-translation feedback loops (TTFLs)[2]. Most cells in the body possess a molecular clock maintained in synchrony by a master

pacemaker located in the suprachiasmatic nuclei (SCN) of the hypothalamus [1].The molecular clock feedbacks to signals that provide temporal cues called zeitbergers[2]. Zeitgebers are environmental cues that help your body sync with Earth’s light cycle (Figure 1)

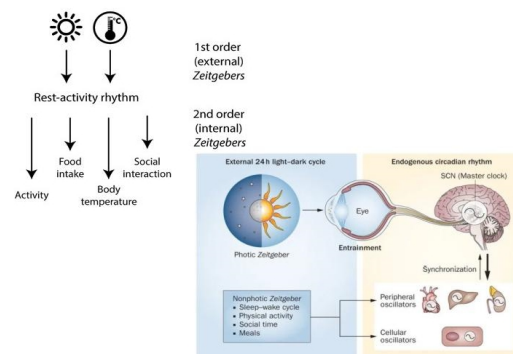


Figure 1: Examples of Zeitgebers and classification[1]

III. CIRCADIAN RHYTHMS IN COVID-19 PATIENTS

Disruption of our circadian clock favors rapid virus replication and dissemination, thus severe form of infection. COVID-19 severity indeed depends on when in the day–night cycle SARS-CoV-2 infection occurs, as the battle between virus replication and its neutralization by the host immune system depends on the circadian phase of the host[3]. Monitor circadian rhythms can support a better management and treatment of COVID-19 treatment. Novel telemedicine devices use wearable sensors can provide remote multi-parametric measurement of different biological signals and environmental circadian triggers, assumed as zeitgebers. The work proposes a setup to monitor biosignals and circadian zeitgebers to support the remote management of quarantine COVID-19 patients.

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