

CIRCADIAN RHYTHM ON DAY LIFE AND WORK – THE TUNING OF OUR BIOLOGICAL CLOCK IN PRACTICE

Panagiotis V. Tsaklis^{1,2,3 a}

¹ Department of Physical Education and Sport Science, ErgoMech-Lab, University of Thessaly, Trikala, Hellas

² Department MMK Karolinska Institute, Solna, Sweden

³ Center of Orthopaedics and Regenerative Medicine (C.O.RE.) / (C.I.R.I.) - Aristotle University Thessaloniki, Hellas

^atsaklis@uth.gr

SHORT COMMUNICATION

Abstract The circadian rhythm or as usually referred to, the ‘biological clock’, represents the daily physiological and biochemical changes in our body, that occur from internal and external stimuli and help it to adapt to the variety of activities and changes of the day. Physical activity and social interactions are important exogenous factors that are in line with the proper functioning of our circadian rhythm.

It was only 2017 when Jeffrey C. Hall, Michael Rosbash and Micheal W. Young were honored with the Nobel Prize in Medicine and Physiology for their research on molecular mechanisms that control the Circadian Rhythm of living beings. It has been millions of years that from the first simple bacteria to the more complicated organisms, the cells individually but also collectively, developed their routine in their environment and time, in a vital planet, wisely located around its bright star. The circadian rhythm or as usually referred to, the ‘biological clock’, represents the daily physiological and biochemical changes in our body, that occur from internal and external stimuli and help it to adapt to the variety of activities and changes of the day. Every external stimulus that affects our rhythm is called Zeitgeber (timer) and fires an according body reaction. The main timer of the circadian rhythm for most organisms is light and its alternation with darkness. If someone tries to ‘break’ his circadian rhythm by ignoring sleep for a few days, psychological issues will occur. The human body can learn to function in cycles between 18 and 28 hours, so any change of smaller or larger scale than that, usually forces the body to revert back into a 24-hour cycle. Even in areas with constant daylight such as in the north and south poles, the body has already determined its cycles of sleep and insomnia when it is first regulated.

THE INTERACTION BETWEEN LIFESTYLE AND OUR CIRCADIAN RHYTHM

«Our way of life is determined by a set of actions, goals, plans, values, behaviors, reactions and beliefs, which we follow and act on an individual, family and wider social level, combined with the culture of the community to which each of us belongs. Our psychological, social and spiritual well-being is directly intertwined with our good and balanced Health »

Our sleep and vigilance are quantitatively and qualitatively, direct regulators of our good physical and mental health. Studies in the U.S. have shown that a simple delay in the start of classes, such as 8:30 a.m. (1hour extra sleep), can lead to a financial gain of \$83 billion in the economy in a decade, due to the improved public health for children and adolescents. The most important circadian rhythm disorders are those of sleep and depression, which are usually caused by changes in working hours. Similar results can occur from an alternating work shift, morning/night. Systematic exposure to artificial light, even for small periods of time during the night, creates changes in the rhythm, with overstimulation, anxiety, depressed behavior and reduced ability to learn and memorize. Even though everyone reacts and adapts differently under such conditions, almost all are deregulated and this affects every one of their daily activities and, ultimately, their quality of life. Spatial-temporal changes, such as changing the time zone and / or hemisphere (season) for several days, deregulates our rhythm (jet lag) and will require time and organization of our routine in the new area or then on our return, for reintegration. According to studies, circadian rhythm interruptions can cause significant pathologies such as seasonal affective disorder (SAD), delayed sleep syndrome, metabolic syndrome, diabetes, cardiovascular disease, cancer, and changes in consciousness.

MAKING THE CHANGE

Physical activity and social interactions are important exogenous factors that are in line with the proper functioning of our circadian rhythm, as they both cause positive physiological and biochemical changes. In addition, a proper and balanced diet plays a special role and supports the rhythm pattern. Today's technology has disconnected social and labor activities from the effects of light and darkness on the external environment. The proper construction of a building and its space layout could prove to be an important contributing factor for the adequate exposure to natural light for many people. We should seek, during the day, to have a bright environment at home or at work, with natural light and if we supplement with artificial light, it should make a difference (more intense) in relation to the lighting of the space at night. Thus, our body will distinguish between day / night and the rhythm will remain unaffected.

The circadian rhythm works best when we have regular sleep habits, such as regular bedtime and waking up in the morning, including on weekends. If we have the ability to control our work schedule we can adjust the rhythm more easily. At night shifts, the same hours of sleep and awakening should be maintained daily, even on days off work.

In a circular work shift, the changes must be made with a "clockwise" movement, for better adjustment. We should change from day to night shifts, and not the opposite, or even worse, irregularly. In order to prepare for a new shift, sleep and awakening habits should be adjusted gradually. Sleep should be adjusted 3 days before the shift change occurs. If we move "clockwise", we should delay our sleep schedule by 1-2 hours every night. The time of day in which we eat, could speed up or delay our internal clock. If we move breakfast, meals and dinner later in the day, it can delay the desire to sleep and affect our rhythm.

Another variable is the planning of our exercise. Many people choose to exercise at night and as a result the circadian rhythm changes, as the secretion of melatonin is affected due to its competition with exercise hormones (e.g. adrenaline). Thus, depending on the exercise goal, we prefer specific times of the day (Figure 1).

Our lives and daily routines, however complex and time-pressured they may be, do not stop being regulated by the mechanisms that nature has generously given us through time, evolving us into a well-tuned machine that simply needs proper and periodic maintenance. This is how we fight the corrosion that automatically and inevitably began to spread in our bodies, from the first day of our earthly role.

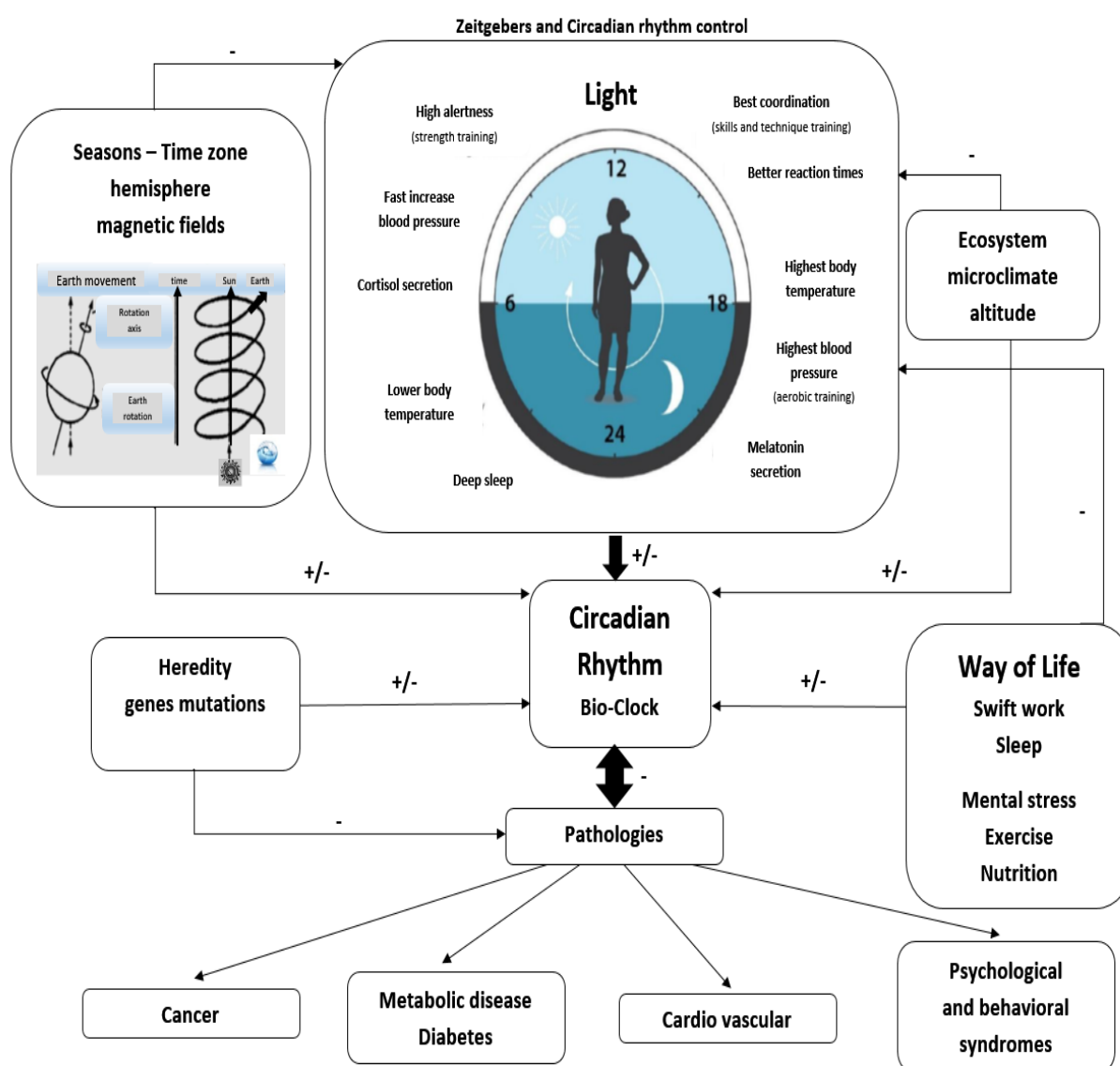


Figure 1. Exogenous factors that affect the Circadian Rhythm and the resulted pathologies, a) (+) means positive effect of the factor on the Rhythm and b) (-) the opposite.