SCIENCE OF ENDOBIOGENY

Source: Traditional Ink Brush Painting by Mokwon, Subsoo Lim

A BRIEF REVIEW OF CIRCADIAN AND SEASONAL ADAPTATION

> "A certain degree of cyclicity is nearly as characteristic of life as adaptability itself, and the lack of periodicity, or rigidity, is almost equivalent to death. The female sexual cycle, the pulse, the sleep rhythm with all the concomitant diurnal variations, the interchange between activity and rest, between work and play, the periodic renewal of cells in various organs are all indispensable for the maintenance of normal life. Stressors tend to disrupt this periodicity in many ways. It would be interesting to examine the possible relations between the diseases of adaptation due to stress and what might be called the "diseases of periodicity."—Hans Selye, 1950[1]

By Kamyar M. Hedayat, MD

Introduction

Humans move through time and space on a tilted planet. This planet, Earth, rotates around its axis and revolves around its sun, Sol. The circadian and seasonal fluctuations of light create the demand for adaptation of periodicity. For most people these transitions feel effortless: waking from sleep, passing from winter to spring, etc. Those in whom the transition is impaired suffer from all sorts of disorders: insomnia, brain fog, spasmophilia, cystitis, seasonal depression, schizophrenia, seasonal allergies, and metastasis of cancer, to name a few.[2] Thus, understanding the teleology and means of periodic adaptation are key to treating the disorders related to their rhythmic disruption.

Adaptation demands vary in origin, frequency and duration. Consider two types of internal demands.

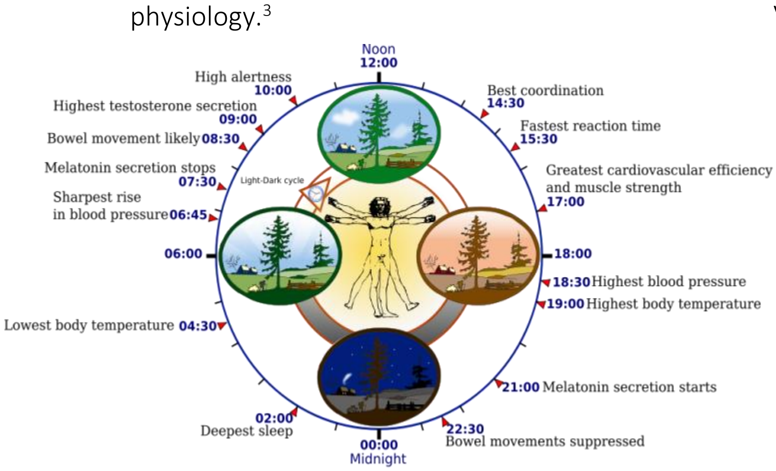
Regulation of vital functions, e.g., heart rate, blood pressure and blood sugar are constant in frequency of adaptation, but irregular in duration.

The duration of adaptation during sleep is different than during exercise. In contrast, the genetic unfolding in the great phases of life (e.g., puberty, gonadopause) are long in duration, lasting years, but short in frequency—they only occur once. The same is true for external demands. The weather, for example, is constantly fluctuating. However, time-based adaptations are regular in frequency and duration. We refer here to circadian and seasonal changes, focusing on two key neurohormones: serotonin and melatonin. We conclude with a review of the activity of the adrenal and thyroid glands throughout the year in relationships to geomagnetic activity.

https://neovitruvian.wordpress.com/category/nikola-tesla/

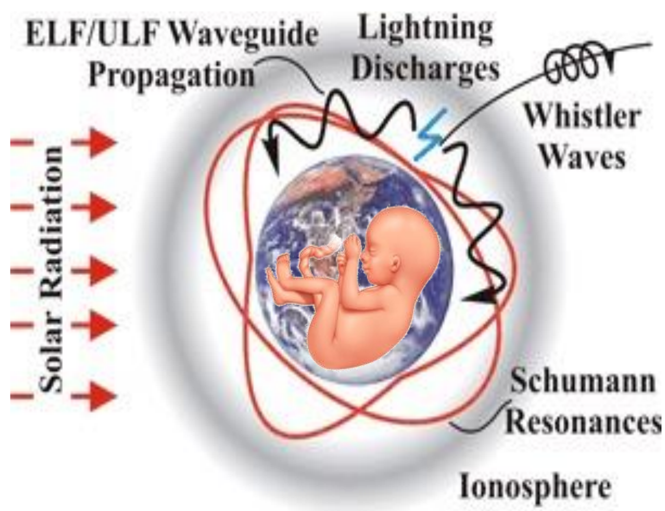
CHRONOBIOLOGY AND COSMOBIOLOGY

Chronobiology is the study of the variations of biologic function over time (figure 1). Scientists have long understood that plants and animals engage in different types of activity according to the time of day. By the 1950's physicians were reporting circadian variations in human physiology.[3]



Source: https://commons.wikimedia.org/wiki/File:Biological_clock_human.svg

Chronobiology is largely the result of cosmologic factors which are not often recognized by physicians. However, chrono- and cosmobiology should not be separated from each other. Here, we define cosmobiology as evaluating the effects of variations frequencies emitted from the sun and reflected by the moon: light, electromagnetism, gamma rays, ultraviolet rays, etc., as well as phenomenon around and within the earth arising from this activity: Whistler waves, Schumann resonance, and geomagnetism (figure 2).



http://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/fetal-development/art-20046151?pg=2

Public health researchers have shown perhaps the greatest interest in cosmobiology. For example, various conditions and events at personal, societal and geopolitical levels have been related to cosmobiologic events:

- **Reproduction:** menstrual phase locking, fertility and rates of parturition,[4-9]
- **Health:** cardiovascular events,[10-13] gastric bleeding,[14] death from cancer[13]
- **Intraspecies aggression:** War,[15] homicide,[16-18] suicidal tendencies,[19] motor vehicle accidents[13,20]
- **Interspecies aggression:** Incidence of animals biting humans[21]

In summary, chronobiology is largely driven by cosmobiology. Though, there are periodic variations in human physiology that occur even when biological systems are maintained completely in the dark (c.f. our discussion with Professor Hogenasch).

TELEOLOGY

The reasons for circadian and seasonal adaptation are different, and thus, their mechanisms vary, but not the elements that participate. In humans, circadian adaptation serves to create delineated periods of vigilance, movement, catabolism and consumption vs. sedation, stillness, anabolism, and restoration. It is thanks to our being situated on the floor of an aerial ocean that us terrestrial mammals alternate between stillness and activity, and attendant, distinct phases of physiology. In contrast, aquatic mammals such as dolphins, never come to complete rest. They engage in uni-hemispheric sleep. One half of their brain remains active while the other half sleeps.[22]

METABOLISM

Only 1-2% of total serotonin is produced in the brain, within the raphe nuclei of the medulla oblongata. Approximately 95% is produced in enterochromaffin cells of the intestines, with a small percentage produced in the skin and lungs.[23] Despite this, central (brain) serotonin plays an outsized role in periodic adaptation. It is derived from tryptophan, thus its chemical name, 5-hydroxytryptophan (5-HT) (figure 3).

Vitamin B6 is an essential co-factor in 5-HT's production. Serotonin is itself the precursor to melatonin, produced in the pineal gland. Melatonin's chemical name is N-acetyl-5-methoxy-tryptamine. Methylation (addition of a -CH_3 group) is the rate limiting step. Thus consumption of leafy green vegetables or use of S-adenosyl methionine (SAMe) is important to support proper melatonin production [Figure 3].[24] (C.f. Lizzie Johnson's article for a discussion of food sources of serotonin and melatonin).

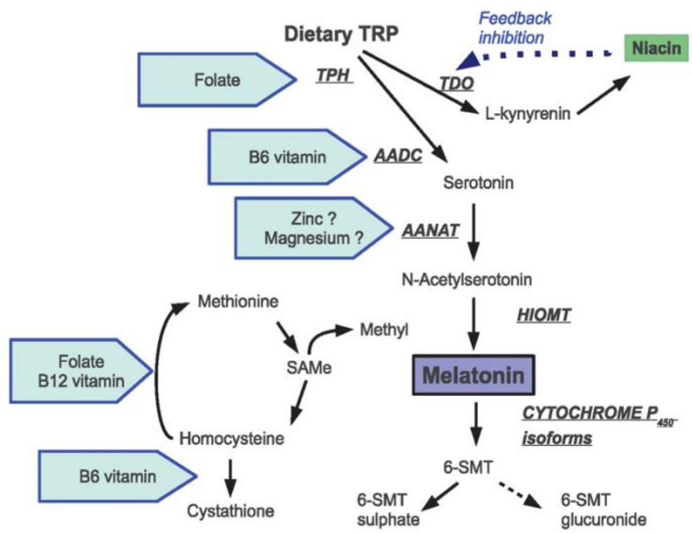


Fig. 1. The synthetic pathway and metabolism of melatonin and possible sites for some nutrients to influence on the synthesis. Enzymes are in underlined capital letters in italics. TRP, tryptophan; TPH, tryptophan hydroxylase; TDO, tryptophan dioxygenase; AADC, aromatic aminoacid decarboxylase; AANAT, arylalkylamone-N-acetyltransferase; HIOMT, hydroxyindole-O-methyltransferase; 6-SMT, 6-sulphatoxymelatonin; SAMe, S-adenosylmethionine.

PHYSIOLOGY OF PERIODIC ADAPTATION

Nocturnal functions of Serotonin

Serotonin and melatonin are neurohormones. They function as neurotransmitters, neurohormones and hormones. Both play key roles in adaptation syndromes of periodicity. In circadian adaptation, they work concordantly and sequentially. At night they ensure optimal sleep *by suppressing diurnal physiology*.[25] This is important for neurologic reorganization and repair, as well as systemic drainage and detoxification. Serotonin inhibits cortisol rise by blocking CRH, and, according to the theory of endobiogeny, high cortisol is associated with one phenotype of depression along with reduced serotonin activity in the brain. This explains why there is a bi-directional causative relationship between insomnia and depression, and a strong association of co-morbidity.[26]

Nocturnal functions of Melatonin

Melatonin engages many mechanisms to ensure sleep.[27] From an endobiogenic perspective, its relationship with POMC (pro-opiomelanocortin) is key, namely melanocyte stimulating hormone (MSH) derivatives αMSH and βMSH, as well as endorphins (figure 4).[28]

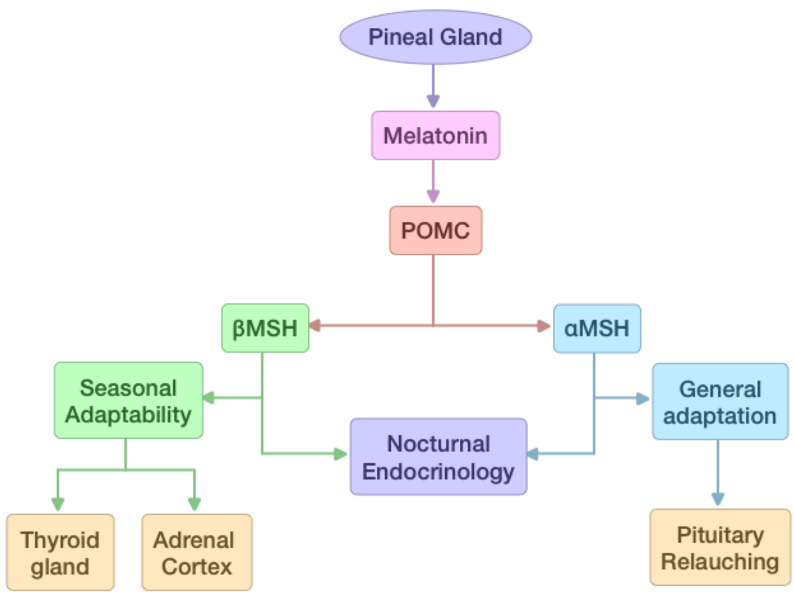


Figure 2: Overview of melatonin activity. The direct mechanism of pineal regulation of diurnal, seasonal and general adaptability is through pro-opiomelanocortin (POMC) hormone. POMC is split into beta and alpha melanocyte stimulating hormones (MSH), which then influence these three types of adaptation responses. See chapter 6: The Corticotropic Axis for a full discussion. © 2015 Systems Biology Research Group.

In the first half of the night, melatonin favors αMSH. Thanks in part to the nocturnal suppressive activity of Serotonin, nocturnal αMSH dissociates pituitary and peripheral endocrine coupling. In the second half of the night, melatonin favors βMSH. βMSH stimulates direct release of cortisol and makes the adrenal cortex more sensitive to ACTH.

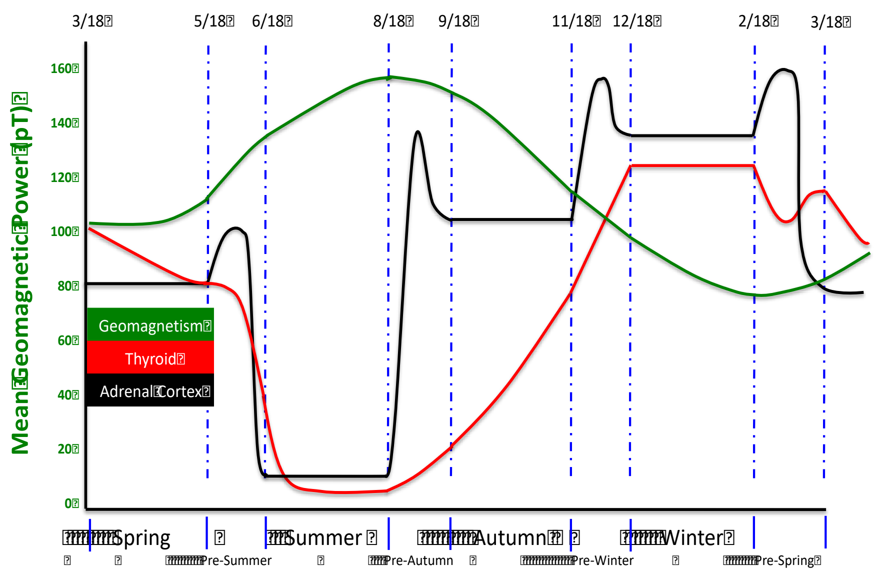
As melatonin declines and βMSH rises, the suppressive effects of serotonin are escaped, relaunching cortisol for emergence from sleep for matinal clarity. Melatonin also stimulates production of endorphins, which play a role in pain management and sleep quality. This in turn aids in the quality of drainage of critical organs during sleep.[29] Thus, in restorative light sleep, organs and tissues are detoxified and repaired. During restorative deep sleep, the brain itself is drained and detoxified.[30]

Diurnal functions of Serotonin and Melatonin

During the day, both these neurohormones enhance awareness. Serotonin increases sensory (and food) intake by augmenting the amount of information the conscious mind is aware of.[31] Serotonin and Melatonin *increase diurnal physiology* through stimulation of ACTH and vasopressin, either directly or through POMC and melanocyte stimulating hormone, thus ensuring adequate permissive cortisol activity.[28]

Seasonal functions of Serotonin and Melatonin

With respect to seasonal adaptation, serotonin plays a key role in the autumn and winter. Its levels rise to increase diurnal cortisol production by stimulation of ACTH, similar to its diurnal activity. However, the action progressively increases from August 18th through September 20th (in the Northern Hemisphere), according to the theory of Endobiogeny. It is assisted by oxytocin-induced stimulation of vasopressin, which also stimulates ACTH. Thus, it is clear how seasonal depression can arise when both serotonin and cortisol levels fail to rise in the darker seasons of the year. In the spring, Melatonin stimulates melanin and POMC to prepare the organism to tolerate more sun. βMSH once again plays in the start of spring adaptation. Around February 18th it relaunches the adrenal cortex (figure 5, far right, black line). Then, it relaunches thyroid function between March 1st to



March 18th for a "spring cleanse" of winter accumulated waste products and adipose tissue (figure 5, far right, red line).[29]

Figure 3: Seasonal chronobiologic adaptation syndrome according to Dr. Duraffourd, with geomagnetic data provided by and used with permission of Professor Alfonsas Vainoras, MD, Habil. Dr., Lithuania State Medical University Institute of Cardiology, mean magnetometer readings from Lithuania, January-December, 2015. Endocrine function is show in relative levels of fluctuation. Geomagnetic data is show in absolute value, in pico Teslas (pT). Dates are show in the US system where the month precedes the day of the month. Dates apply for the Northern hemisphere. From the left, geomagnetic activity is the highest line, followed by peripheral thyroid. The lowest line is the adrenal cortex. *From The theory of Endobiogeny,* vol 1, Academic Press, © 2019.

THE CIRCANNUAL RELATIONSHIP OF THE ENDOCRINE SYSTEM WITH THE EARTH

Thus, so far our discussion has focused on chronobiology arising from cosmobiology: the alternations of light from the earth's rotation and revolution around the sun. However, there is another aspect of periodicity which is telluric in nature: geomagnetism. The earth, with its liquid iron core is a generator of a vast electromagnetic field and the magnetosphere which protects the earth from rays harmful to biologic life on earth. The sun emits various regular and irregular waves of electromagnetism. The regular waves are based on the distance of the earth from the sun throughout the year. The irregular ones are based on solar flares. The earth receives these waves and responds in kind.

Returning to figure 3, one notes a distinct inverse relationship between thyroid activity (red line) with geomagnetic activity (green line). In the summertime, geomagnetism is at its peak and thyroid activity at its nadir, and the opposite is true in the winter. The adrenal cortex (black line), acts as a "high beta / gamma wave" force that allows the body to adapt to every seasonal change with its short periods of intense peaks of activity before settling into a steady state. The steady state varies throughout the year. Returning to our earlier discussion, it is thanks to serotonin and melatonin, oxytocin and βMSH that these endocrine changes come about.

Conclusion

Periodicity adaptation syndromes come about because of the changes in light and darkness on the earth. Living systems must adapt their level of metabolic activity according to the cues offered by light, which indicate periods of relative quiescence and activity. The neurohormones serotonin and melatonin play key roles in circadian and seasonal adaptation. They are assisted by oxytocin and βMSH for seasonal adaptation. They affect fluctuating levels of multiple hormones and levels of organ activity. There are numerous disorders of periodicity, such as insomnia, PMS, and spring allergies, which can be better managed with an understanding of chronobiology and cosmobiology. ❊

About the Author

Kamyar M. Hedayat is co-founder of Systems Biology Research Group, a private research company dedicated to promoting research, education, publication, product formulation and development of commercial clinical tools based on the theory of Endobiogeny. He was trained by the co-developer of the Endobiogenic teachings, Dr. Jean Claude Lapraz, and is a leading international proponent of integrative physiology and Endobiogeny. He is the author of the definitive four-volume series *The Theory of Endobiogeny.*

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