

HOW NATURE'S RHYTHMS AFFECT OUR STATE OF HEALTH

Dr. Iva Lloyd, RPP, ND

"Health is a condition that enables individual life and living systems to maximize potential... [L]ife in living systems is busy self-organizing toward increasing complexity and diversity. It is this directionality that provides humans with a normative principle that is of great relevance to the way that human economy can connect with and live within nature's economy."

- Glenn A. Albrecht, 2001

The idea that humans are "in charge" and that nature is a servant to human desires and industrial living is an irrational belief that allows individuals to ignore, disobey and attempt to manipulate or overcome the natural rhythms that exist. Over the years there has been increasing research that shows that many symptoms and diseases are caused by or aggravated by individuals attempting to live a life that is not aligned to the natural rhythms of life. "The basic scientific consensus about rhythms is that they are quite complex, not understood, and that they seem to affect everything imaginable."¹

The scientific study of biological clocks, their associated rhythms and how living organisms adapt to these rhythms is known as chronobiology. The central nervous system, cardio-vascular and respiratory rhythms, as well as eating, sleeping and activity functions vary widely within the same individual and are known to respond to the changes in the main biological rhythms which include:

- Circadian which relates to the revolution of the earth and follows a 24 hour cycle;
- Circatidal which relates to the ebb and rise of tides and follows a 12.4 hour cycle;
- Circalunar which relates to the phases of the moon and follows a 29.5 day cycle;
- Circannual which relates to the seasons of the year and follows a 365.25 day cycle;
- Ultradian rhythms are cycles that are shorter than 24 hours such as feeding patterns, the 90-minute REM cycle, the 4-hour nasal cycle, or the 3-hour cycle of growth

hormone production. These rhythms are a reflection of the "beating" or pulsing of individual cells.

Collectively these rhythms regulate much of the temporal biology of life on Earth. The increasing isolation of humans from these geophysical cycles, as a result of improved living conditions, industrial living, easy access to food and 24/7 working practices, have led many to believe that humans function independently of them.² The rest of this article explores a few of these rhythms in more detail.

Circadian

The circadian rhythm is endogenous and cycles roughly every 24 hours in the biochemical, physiological and behavioural processes of all living entities. Circadian rhythms are generated and entrained by external cues, called zeitgebers, the primary one being daylight. Other environmental cues include noise, food, and social interaction.³ The genetic basis for the mammalian circadian rhythm was discovered in 1994⁴ and is known to control sleep/wake, blood pressure, reaction time, levels of alertness, digestive secretions as well as thirst and appetite. There are also clear patterns of core body temperature, brain wave activity, endocrine rhythms, immunity, glucose regulation, cell regeneration and other biological activities that are affected.⁵ The circadian rhythm is often referred to as the pacemaker due to its large control on physiological and behavior functions.³

Although there are peripheral oscillators found in the esophagus, lung, liver, pancreas, spleen, thymus and skin⁶, the primary circadian "clock" is a cluster of approximately ten thousand nerve cells located in the suprachiasmatic nucleus (SCN) of the hypothalamus. The SCN receives information about illumination through the photoresponsive retinal ganglion cells. These cells contain the photo pigment melatonin which follows the retinohypothalamic tract to the SCN. Light is able to either suppress or synchronize melatonin production according

to the light schedule.⁵ In addition to light intensity, wavelength (or colour) of light is a factor in the entrainment of the body clock. Melanopsin is most efficiently excited by blue light, 420-440 nm.⁷ The SCN takes the information on the lengths of the day and night from the retinal ganglion cells, interprets it, and passes it on to the pineal gland. In response the pineal secretes melatonin which normally peaks around 9 p.m. and is absent from the system or undetectably low during daytime. The level of melatonin secretion can be measured in the plasma or saliva or by measuring urine sulfatoxymelatonin, its main hepatic metabolite.^{8,5} Melatonin not only conveys information concerning the day cycle of light and darkness to body physiology, it also responds to seasonal rhythms. It has also been proposed that melatonin has an antipyretic property⁹ and that decreased melatonin levels correlate with an increased risk of cancer.¹⁰

There are many factors known to disrupt the circadian clock including caffeine intake, travel, shift-work, irregular sleeping patterns and lack of exposure to sunlight.^{3,1} Insomnia, hypersomnia, headache, intestinal symptoms, jet lag and shift-work disorders are common circadian-disrupted complaints.¹¹ Patients affected by chronic immune/inflammatory conditions, for example, rheumatoid arthritis, exhibit circadian and circannual rhythms¹² as do cluster headache attacks¹³ and some cardiovascular diseases.¹⁴ In order to prevent disruptions in the circadian sleep cycle it is important to maintain a regular sleep schedule, which includes retiring and waking approximately the same time each day, and sleeping a consistent number of hours each night.

As a naturopathic doctor talks to their patient and inquires about their habits, lifestyle regimen, and their symptoms it will often reveal a pattern that is out-of-sync with a normal circadian rhythm. Prescribing Vitamin D or melatonin is often helpful in addressing circadian disruptions, but educating a patient on the importance of establishing a regimen that is more in line with the circadian rhythm and avoiding disrupting factors is more in line with the naturopathic philosophy of 'treat the cause'.

Circalunar

Circalunar hormone cycles have been observed not only in women, but also in men.^{15,16} The menstrual cycle being the one most commonly associated with the lunar cycle. Other physiological functions that have been associated with lunar rhythms include sleep duration with women being more affected

than men^{17, 18}, the occurrence of seizures^{19,20} and the admission to the acute stroke unit with a diagnosis of medically unexplained stroke symptoms.²¹

Historically and from an astrological point of view the new moon is associated with introducing new patterns and the full moon is associated with getting rid of old patterns. It is common for naturopathic practitioners to utilize the rhythm of the lunar cycle when treating conditions such as amenorrhea or the detoxification of heavy metals. Having a patient track their symptoms and then mapping them to the lunar cycle will reveal whether or not there is a pattern. Often awareness in itself is comforting to patients and allows them to modify their eating, sleeping or behavioural patterns during times of aggravation.

Circannual

"Live in each season as it passes; breathe the air, drink the drink, taste the fruit, and resign yourself to the influences of each. Let them be your only diet, drink, and botanical medicine."

- Henry David Thoreau - 1906

Seasonality is a well-known phenomenon in life and health sciences. Since Hippocrates, observers worldwide have noted and documented marked fluctuations in the incidence of many diseases. There are also more deaths in the winter than in the summer.²² Temperature, humidity, and precipitation – the defining factors of the seasons – are important determinants of the survival of pathogens resulting in many viral and bacterial infections showing seasonal variability^{22,23} with the fall and winter months being the most common period for upper respiratory infections, especially in infants.²⁴

It has been found that short photoperiods lower the set point for body temperature regulation in humans²⁵ and hence body temperature naturally changes and adjusts with the seasons; for example, exposure to a decrease in sunlight during fall was accompanied by an improvement of cold tolerance and exposure to an increase in sunlight in the spring and summer improves heat tolerance.²⁶ Even the secretion of melatonin lasts longer during the longer winter nights.²⁷

Seasonal variation in heart failure is well known for having winter-spring predominance. Males and very old patients were the subgroups with the highest seasonal variation.²⁸ An increase in myocardial infarctions and strokes also is known to follow a circalunar and circannual rhythm.^{21,29}

Circadian and seasonal variability affects basal

cortisol levels and mood,³⁰ with seasonal affective disorder (SAD) being the most common mood disorder known to be affected by the total amount of light available in the environment.^{3,31} Manic behavior, depression and other psychiatric disorders are also known to have a seasonal pattern.

In many situations, our biology and our society appear to be in serious opposition and the damaging consequences to our health under these circumstances are increasingly recognized.² As naturopathic doctors it is valuable to educate patients on the value of changing sleeping patterns, food choices and activity levels by season. For example, having patients choose warmer, cooked foods (such as soups and stews) in the winter versus cold, raw foods (like salads) can decrease those symptoms that are aggravated in the winter. Determining the degree to which nature's rhythms are a factor with patients is a valuable part of the naturopathic assessment. Nature offers many guides and insights on how to achieve and maintain health. As society moves back to recognizing nature and environment as an integral aspect of life and living, the wisdom of nature will become clearer.

About the Author

Dr. Iva Lloyd is a naturopathic doctor, registered polarity practitioner and reiki master. In 2002 she founded Naturopathic Foundations, an integrated clinic with naturopathic doctors and other alternative health care providers that blend the naturopathic and energetic aspects of health care.

Dr. Lloyd teaches part-time at the Canadian College of Naturopathic Medicine. She is the author of four books: *Building a Successful Naturopathic Practice*, *Messages from the Body, a guide to the Energetics of health*, *The Energetics of Health, a naturopathic assessment and History of Naturopathic Medicine, A Canadian perspective*. Dr. Lloyd writes for various journals and magazines and gives seminars on naturopathic assessment, the integration of the mind and body, and the building blocks to health. She is current editor of the *Vital Link* and is Past-Chair of the board of the Canadian Association of Naturopathic Doctors.

References

- Lanier JL 1999 Terms of Circadian Rhythm. http://www.colostate.edu/Depts/Entomology/courses/en507/papers_1999/lanier.html
- Foster RG; Roenneberg T 2008 Human responses to the geophysical daily, annual and lunar cycles. *Current Biology* Sep 18 (17): R784-R794
- Marino Patrick C. 2005 Biological Rhythms as a Basis for Mood Disorders. Rochester Institute of Technology
- Vitaterna MH, King DP, Chang AM, Kornhauser JM, Lowrey PL et al 1994 Mutagenesis and mapping of a mouse gene clock, essential for circadian behavior. *Science* 264:719-725
- Claustrat B; Brun J; Chazot G 2005 The basic physiology and pathophysiology of melatonin. *Sleep Medicine Reviews* Feb; 9 (1):11-24

- Zanello S et al. 2000 Expression of the circadian clock genes clock and period1 in human skin. *Inv Dermatol*, Vol115
- Newman LA, Walker MT, Brown RL, Cronin TW, Robinson PR 2003 Melanopsin forms a functional short-wavelength photopigment. *Biochemistry* 42(44):12734-12738
- Benloucif, Guico MJ, Reid KJ et al 2005. Stability of melatonin and temperature as circadian phase markers and their relation to sleep times in humans. *Journal Biological Rhythms*. 20(2): 178-188
- Cagnacci A, Elliott JA and Yen SSC 1992 Melatonin: a major regulator of the circadian rhythm of core temperature in humans. *Journal Clinical Endocrinology. Metabolism* 75:447-452
- Jung-Hynes B and Ahmad N 2009 SIRT1 controls circadian clock circuitry and promotes cell survival: a connection with age-related neoplasms. *The FASEB Journal* 23(9):2803-2809
- Tagaya H 2009 Circadian rhythm sleep disorders. *Japanese Journal of Clinical Medicine* 67(8):1501-1506
- Cutolo M and Straub RH 2008 Circadian rhythms in arthritis: hormonal effects on the immune/inflammatory reaction. *Autoimmunity Review*. 7(3):223-228
- Holland RP and Goadsby PJ 2009 Cluster headache, hypothalamus and orexin. *Current Pain and Headache Reports* 13(2):147-154
- Butcher JN, Mineka S, Hooley JM 2004. *Abnormal Psychology* (12th ed.) New York, Allyn & Bacon.
- Celec P, Ostadnikova D, Putz Z, Hodossy J, Bursky P, Starka L, Hampl R and Kudela M. 2003 Circatrigintan cycle of salivary testosterone in human male. *Biological Rhythm Research*. 34:305-315
- Rensing L, Meyer-Grable U, Ruoff P. 2001 Biological timing and the clock metaphor: oscillatory and hourglass mechanisms. *Chronobiology International* 18:329-369
- Ebling F.L.P. and Barrett P. 2008 The Regulation of Seasonal Changes in Food Intake and Body Weight. *Journal of Neuroendocrinology* 20, 827-833
- Röösli M, Jüni P, Braun-Fahländer C, et al 2006 Sleepless night, the moon is bright: longitudinal study of lunar phase and sleep. *Journal Sleep Research* 15:149-153
- Baxendale S; Fisher J 2008 Moonstruck? The effect of the lunar cycle on seizures. *Epilepsy & Behavior* Oct; 13 (3):549-550
- Quigg M, Fowler KM, Herzog AG 2008 Circalunar and ultralunar periodicities in women with partial seizures. *Epilepsia* 49(6):1081-1085
- Ahmad F; Quinn TJ; Dawson J; Walters M 2008 A link between lunar phase and medically unexplained stroke symptoms: an unearthly influence? *Journal Of Psychosomatic Research* Aug; 65 (2):131-133
- Naumova Elena N 2006 Mystery of Seasonality: Getting the Rhythm of Nature. *Journal of Public Health Policy*
- Kusumaningrum HD, Riboldi G, Hazeleger WC, Beumer RR. 2003 Survival of the foodborne pathogens on stainless steel surfaces and cross-contamination to foods. *Internal Journal Food Microbiology*. 85(3):227-236
- Alonso A, Andres JM, et al 2007 Bronchiolitis due to respiratory syncytial virus in hospitalized children: a study of seasonal rhythm. *Acta Paediatrica* 96(5):731-735
- Heldmaier G, Steinlechner S, Ruf T, Wiesingner H and Klingpor M 1989. Photoperiod and thermoregulation in vertebrates: body temperature rhythms and thermogenic acclimation. *Journal of Biological Rhythms* 4: 251-265
- Yumiko Teramoto, Ikuko Ioki, Danuta Rutkowska and Hiromi Tokura 1997 The Daily Rhythms in the Core Temperature during Spring and Autumn Under Natural Conditions in Young Women. *Biological Rhythm Research*, 1997, 28(2), 161-165
- Hedge A. 2009 *Biological Rhythms*. Cornell University
- Hermida RC, Clavo C et al 2003 Seasonal variation of fibrinogen in dipper and nondipper hypertensive patients. *Circulation* 108(9):1101-1106
- Díaz A, Ferrate D et al 2007 Seasonal variation and trends in heart failure morbidity and mortality in a South American community hospital. *Congestive Heart Failure* 13(5):263-266
- Peterson CK; Harmon-Jones E 2009 Circadian and seasonal variability of resting frontal EEG asymmetry. *Biological Psychology* Mar; 80 (3):315-320
- Ennis E and McConville C 2004 Personality traits associated with seasonal disturbances in mood and behavior. *Current Psychology* 22:326-338

Other References

Laberge, Lesperance P, Tremblay R, Lambert C, Montplaisir J 1997 Phase delay of 6-sulphatoxymelatonin in normal adolescents. *Sleep Research* 26:727

Paul MJ; Galang J; Schwartz WJ; Prendergast BJ 2009 Intermediate-duration day lengths unmask reproductive responses to nonphotic environmental cues. *American Journal of Physiology*. May; 296 (5):613-619

Revelle W, Humphreys MS, Simon L and Gilliland K 1980. The interactive effect of personality, time of day, and caffeine: A test of the arousal model. *Journal of Experimental Psychology: General* 109:1-31

Teramoto Y, Tokura H, Ohkura K, Ohmasa Y, Suho S, Inoshiri R and Masuda M 1996 Effects of different light intensities during the forenoon on the afternoon thermal sensation in mild cold. *Journal Thermal Biology* 21:339-343

Tokura H, Yutani M, Morita Tand Murakami M 1994 Effects of bright and dim light intensities during daytime upon circadian rhythm of core temperature in man. In *Temperature Regulation*, Milton A.S. ed. Birkhauser Basel, 285-289