

BIOLOGICAL RHYTHM

Authored by
mohammad looti

October 18, 2025

RECOMMENDED CITATION

mohammad looti (2025). *BIOLOGICAL RHYTHM*. PSYCHOLOGICAL SCALES. Retrieved from <https://scales.arabpsychology.com/?p=48872>

BIOLOGICAL RHYTHM

Primary Disciplinary Field(s): Biology, Chronobiology, Physiology, Psychology

1. Core Definition

A **biological rhythm**, frequently referred to interchangeably as a **biorhythm** or **internal rhythm**, is an intrinsic, recurrent fluctuation in the physiological or behavioral processes of an organism. These fluctuations are highly organized, cyclical changes that occur in response to periodic shifts in the internal environment, although their timing is often synchronized (or entrained) by external temporal cues known as *zeitgebers* (such as light-dark cycles, temperature, or social interaction). These rhythmic patterns are essential for regulating and maintaining internal stability (homeostasis) and enabling the organism to anticipate and adapt effectively to the predictable changes in its external world.

The study of these temporal structures in living systems constitutes the scientific field of Chronobiology. A key distinction in this field is the concept of **endogenous rhythm**--meaning the cycle is generated internally by a biological clock, such as the suprachiasmatic nucleus (SCN) in mammals, and persists even when the organism is isolated from all external time cues, demonstrating its inherent nature.

2. Etymology and Historical Development

The recognition that life processes are fundamentally temporal dates back centuries. Early observations noted the daily opening and closing of flowers and the sleep-wake cycles of humans, suggesting a predictable pattern of behavior tied to solar time. However, the first rigorous scientific demonstration of an internal, or endogenous, rhythm was performed in 1729 by French astronomer Jean-Jacques d'Ortous de Mairan. He demonstrated that the daily leaf movements of the sensitive plant (*Mimosa pudica*) continued even when the plant was sealed in darkness, confirming that the cycle was driven by an internal mechanism, not just the sun.

In the 20th century, research progressed significantly with the identification of specific biological pacemakers. The concept of the **circadian rhythm** was formalized by Franz Halberg in the 1950s. Subsequent discoveries led to the localization of the principal biological clock in the mammalian brain--the Suprachiasmatic Nucleus (SCN)--which acts as the master regulator of most bodily rhythms. Further molecular studies in fruit flies and mice led to the discovery of specific **clock genes** (e.g., *Period* and *Cryptochrome*), which encode proteins that cycle in concentration over a 24-hour period, thus providing the molecular basis for timing throughout the organism.

3. Key Characteristics (Types of Rhythms)

Biological rhythms are primarily classified according to the length of their periodicity. These categories allow researchers to distinguish between rapid fluctuations and those that span weeks or seasons.

Circadian Rhythms: These are cycles that operate with a period of approximately 24 hours (from the Latin *circa diem*, meaning "about a day"). They are the most common and influential rhythms, controlling fundamental processes such as the sleep-wake cycle, core body temperature fluctuations, metabolic rate, and the timing of various hormone secretions. These rhythms are typically reset daily by the light-dark cycle to maintain synchronization with astronomical time.

Ultradian Rhythms: These are cycles that are shorter than a 24-hour period, meaning they occur multiple times per day. Examples of ultradian rhythms include the stages of non-REM and **REM sleep**, which cycle every 90 to 120 minutes during a sleep period, as well as hormone pulses, breathing rate, heart rate, and fluctuations in alertness and appetite throughout the waking day.

Infradian Rhythms: These cycles have a period longer than 24 hours, often extending to weeks, months, or even a year. The most prominent human example is the female **menstrual cycle**, which lasts approximately 28 days and involves complex, coordinated hormonal changes that regulate reproduction. Other infradian rhythms include seasonal changes in weight, hibernation cycles in animals, and the seasonal variation in mood observed in Seasonal Affective Disorder (SAD).

4. Physiological and Psychological Manifestations

The periodic changes driven by biological rhythms manifest across both the physiological and psychological domains, dictating optimal timing for function and rest. The source content explicitly notes variations in **energy level**, **hormonal level**, and **sexual desire**.

Energy and Performance Levels: Circadian rhythms directly govern periods of peak energy and vigilance. Cognitive performance, reaction time, and physical strength typically peak during the mid-to-late afternoon hours, corresponding to a high point in the body's core temperature cycle. Conversely, performance dips are common during the early morning hours and the mid-afternoon, reflecting the body's natural propensity for rest.

Hormonal Regulation: Nearly every major endocrine gland is regulated by a biological rhythm. Melatonin, the sleep-inducing hormone, is secreted exclusively at night, while the stress hormone **cortisol** typically exhibits a strong diurnal cycle, peaking upon waking to promote alertness and declining throughout the day. Disruptions to this delicate hormonal timing can significantly impact immune function and metabolic health.

Psychological State and Mood: Mood, alertness, and various cognitive functions are subject to rhythmic changes. Individuals often experience predictable variations in emotional stability and susceptibility to stress throughout the day. Furthermore, the infradian menstrual cycle affects mood and energy levels due to cyclical shifts in estrogen and progesterone.

Reproductive Function: Sexual desire and reproductive capability are strongly tied to rhythms. In humans, testosterone levels often peak in the morning (a circadian effect), while the female menstrual cycle (an infradian effect) is the principal driver of fertility and associated psychological and physical changes.

5. Significance and Impact

The significance of biological rhythms transcends mere timing; they are integral to the optimization and survival of the organism. By providing an internal schedule, these rhythms allow the body to anticipate upcoming needs--such as preparing the digestive system for the expected ingestion of food or initiating cellular repair processes during sleep. This anticipation saves energy and enhances the efficiency of physiological systems.

In modern clinical practice, understanding these rhythms is critical. The field of **chronotherapy** or chronopharmacology utilizes knowledge of biological timing to optimize medical treatments. For instance, drugs for asthma, which often worsens during the night due to rhythmic changes in lung capacity, are sometimes formulated for delayed release to peak when the symptoms are anticipated. Similarly, chemotherapy agents are often administered when cancer cells are most vulnerable, following their own rhythmic cycles of division.

6. Debates and Criticisms

While the fundamental existence and mechanism of scientifically verified rhythms (circadian, ultradian, infradian) are robustly supported by molecular and physiological evidence, two primary areas of discussion persist. First, the term **biorhythm** often carries connotations of the discredited pseudoscientific theory popularized in the 20th century. This theory proposed that human life follows deterministic 23-, 28-, and 33-day cycles (physical, emotional, and intellectual) starting precisely at birth, which has been repeatedly debunked by empirical studies for lacking predictive power or a plausible biological mechanism.

Second, scientific debate continues regarding the exact mechanisms of **entrainment** and the resilience of endogenous clocks. Research explores the precise hierarchy among different biological clocks (peripheral vs. central) and how reliably these internal systems can maintain accurate timing when environmental inputs are variable or contradictory. This understanding is particularly critical when addressing the public health challenge posed by **chronodisruption**--the misalignment between internal biological timing and external schedules, commonly seen in shift

work, which is linked to increased risks of cardiovascular disease, diabetes, and mood disorders.

7. Further Reading

[Chronobiology \(Wikipedia\)](#)

[Suprachiasmatic Nucleus \(Wikipedia\)](#)

[Jean-Jacques d'Ortous de Mairan \(Wikipedia\)](#)

ARABPSYCHOLOGY.COM