
James W. Schreier, Ph.D., SPHR

Chronobiology, the study of biological rhythms and internal clocks, is a field that reveals the profound impact of temporal patterns on human health, behavior, and well-being. Every living organism, from the smallest bacteria to humans, operates on a series of biological rhythms that govern everything from sleep cycles to feeding patterns. The implications of these rhythms extend far beyond the mere understanding of "jet lag" or sleep disorders; they touch upon every aspect of human life, influencing when we are most alert, how we metabolize medications, and even how we respond to treatments for severe illnesses like cancer.

As society progresses, the integration of chronobiological insights into daily activities and professional settings has become more pronounced. One such application is "**chronoworking**," an approach where work schedules are tailored to align with individual biological clocks, potentially enhancing productivity and overall job satisfaction. This alignment suggests a shift from a one-size-fits-all scheduling model to a more personalized approach, acknowledging that peak performance times can vary dramatically from one individual to another.

Beyond the workplace, chronobiology is also making significant inroads in medicine and education, where timing can be critical. In medical settings, treatments can be precisely timed to the body's rhythms to maximize efficacy and minimize side effects. This practice, known as chronotherapy, instills confidence in its precision and effectiveness. Similarly, educational institutions are considering later start times for classes, especially for adolescents, to coincide with natural sleep patterns and optimize learning and attention.

This series explores the intersection of biological rhythms, delving into the applications of chronobiology in working environments, medical treatments, and educational settings.

## Intuitive Insights

I became aware of the chronobiological factors of my life at an early age. I was a “morning person,” an early riser during my teenage years. I suspect it was influenced by 1) my father, who arose and left for work at 4 a.m., 2) my newspaper delivery route (ages 12 – 16) with 2 a.m. Sunday morning work at the station, and 3) genetics.

This was verified in college when I discovered a rare preference for 8 a.m. classes. During that time, I found the bimodal nature of chronobiology for me. The “morning person” was strong, but there was also a “night person” driven by multiple shifts each week, working “5 – 9 p.m.” at a department store for six years. During high school, I discovered that a mid-day or later afternoon nap supported this split schedule for my energy and focus. Professionally, I arrived early at work for decades, often before 5 a.m., and then taught classes in that same 5-9 p.m. time frame. My curiosity about genetics was piqued.

## A Genetic Factor

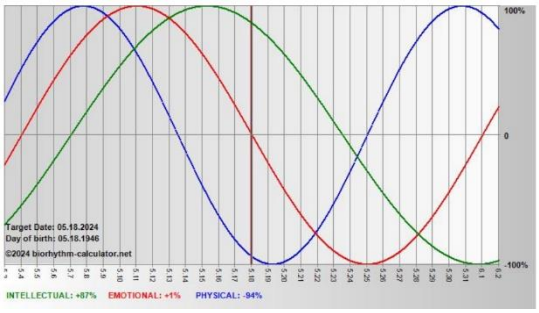
Considerable evidence supports a genetic component in chronobiology, particularly in regulating circadian rhythms. Circadian rhythms, 24-hour cycles in the physiological processes of living organisms, are influenced by a set of "clock genes" that interact in feedback loops to control and maintain timing processes within the body.

1. **Clock Genes**: Specific genes, known as clock genes, play critical roles in maintaining the circadian clock. Examples include PER (Period), CRY (Cryptochrome), CLOCK, and BMAL1. Mutations or variations in these genes can affect an individual's circadian rhythms and are linked to various disorders.
2. **Genetic Regulation**: The circadian system is genetically regulated through feedback loops where clock proteins produced by clock genes regulate their synthesis by inhibiting the activity of genes, creating a 24-hour cycle.
3. **Heritability of Chronotypes**: Studies suggest that chronotypes (whether someone is a "morning person" or an "evening person") are partly heritable, with genetics explaining a significant portion of the variance in people’s sleep timing and duration.

This information supports the influence I believe my father had on my chronobiology. That is further supported by the fact that most of my relatives on my father’s side were (and still are) Iowa farmers. Farming defines early morning work!

## Chronobiology versus Biorhythms

Biorhythms became popular in the 1970s. The theory proposes that knowing one's biorhythm can help anticipate periods of high or low performance based on **physical**, **emotional**, and **intellectual** states. According to the theory, these cycles start at birth and influence us throughout our lives. Aware of the impact of time on my life, I found the topic interesting, mainly when early computer programs supported "tracking" one's biorhythms. Several online and "app" Biorhythm calculators continue to be available.




Today, however, biorhythms are considered a more pseudoscientific concept that claims human life is influenced by rhythmic biological cycles. The concept of biorhythms as predictive tools lacks scientific validation.

The continued popularity of biorhythms, despite lacking scientific validation, is attributed to several factors:

1. **Appeal to Intuition**: Biorhythms offer an appealing and straightforward explanation for the fluctuations in physical, emotional, and intellectual states people experience daily. The idea that these can be predicted and charted resonates with the human tendency to seek patterns and explanations for complex behaviors.
2. **Personalization**: Biorhythm calculations provide personalized insight uniquely tailored to an individual's birth date. This personalization can make the concept more enticing.
3. **Psychological Comfort**: The belief in biorhythms can offer comfort to some people, similar to how people find comfort in astrology. It provides a framework that might help individuals make sense of their experiences and decisions.

## *"What's Jet Lag?"*

There is one more question for this introduction, a connection to my earlier "Intuitive Insights." For decades, particularly in the 1990s-2010s, I traveled extensively. This included a 30-day "around the world+" trip to several former Soviet Union countries, multiple trips to Europe, and trips to China and South Africa. While I understand the concept of "jet lag" because I have colleagues who struggle with severe cases, I frequently ask, "What's Jet Lag?" because I never experienced it.

Connecting this to chronobiology sparks the search for an explanation. It provides insights into why some individuals might not experience jet lag or experience it less severely than others. Jet lag occurs when there is a mismatch between the internal body clock (circadian rhythm) and the external environment, typically triggered by rapid travel across time zones. Here's how chronobiology relates to individuals who seem immune or less susceptible to jet lag:

1. **Adaptability of Circadian Rhythms**: Some people have circadian systems that are more adaptable to changes in light-dark cycles, which can help them adjust more quickly to new time zones. Both genetic factors and lifestyle habits, such as regular exposure to natural light, can influence this adaptability.
2. **Chronotype Flexibility**: Chronotypes, or individual preferences for morning or evening activity, can also affect susceptibility to jet lag. People with more flexible chronotypes, who can comfortably alter their sleep and wake times, may experience less disruption when their external environment changes.
3. **Pre-Travel Preparation**: Some individuals may be more proactive or knowledgeable about strategies to minimize jet lag, such as adjusting their sleep schedule in the days leading up to a trip, staying hydrated, and strategically timing light exposure to reset their internal clock more rapidly upon arrival.
4. **Genetic Factors**: Genetic predispositions play a significant role in determining how our bodies respond to disruptions in circadian rhythms.
5. **Lifestyle and Health**: Individuals who maintain a healthy lifestyle, including regular exercise, a balanced diet, and good sleep hygiene, may have more robust circadian rhythms.

Reflecting on these factors, I see that chronotype flexibility and genetic factors stand out.

## The Chronobiology Chronicles