



# WHAT IS THE CIRCADIAN RHYTHM?

## DEFINITION

The circadian rhythm is the body's internal biological clock, averaging just over 24 hours, that regulates physical, mental, and behavioral changes in response to light and darkness. A master clock in the brain's suprachiasmatic nucleus (SCN) coordinates these rhythms, while "peripheral clocks" in organs such as the liver, heart, and gut regulate processes like metabolism, hormone production, and digestion. Together, these systems keep the body aligned with the 24-hour day, influencing sleep-wake cycles, body temperature, mood, and overall health.

The term circadian comes from Latin: circa ("about") and dies ("day"), meaning "about a day."

**Fact:** The circadian rhythm is not exactly a 24-hour clock. In humans, it averages about 24.2 hours. The light-dark cycle is what "entrains" it to an exact 24 hours.



## HOW IT WORKS

At the center of this biological clock is the suprachiasmatic nucleus (SCN) in the hypothalamus. The SCN receives light information from the eyes and uses it to keep the body's processes aligned with the environment.

- **Nighttime:** The SCN signals the pineal gland to release melatonin, a hormone that cues the body that it is time to prepare for sleep, although it does not directly cause sleep.

**Fact:** Melatonin signals night but does not force sleep. Many people can remain awake even when melatonin levels are high.

- **Daytime:** When light enters the eyes, it suppresses melatonin production and contributes to a rise in cortisol. Cortisol helps promote alertness and readiness for daytime activities.

**Fact:** Cortisol peaks in the morning, but its rhythm is regulated by the hypothalamic-pituitary-adrenal (HPA) axis, not only the SCN.

Together, melatonin and cortisol help signal the timing of your internal day and night.



## WHY CIRCADIAN RHYTHM MATTERS

A healthy circadian rhythm supports nearly every system in the body:



### Restful Sleep

Easier sleep onset and more consistent rest.



### Mood & Mental Clarity:

Supports focus, memory, and emotional balance.



### Digestion & Metabolism:

Helps regulate appetite, energy use, and weight stability.



### Hormone balance:

Coordinates signals that affect stress, fertility, and growth.



### Immune health:

Strengthens the body's ability to fight illness and recover.

When the circadian rhythm is disrupted by shift work, jet lag, late-night screen use, or irregular schedules, it can affect sleep, mood, energy, and long-term health.

# HEALTH RISKS OF CIRCADIAN DISRUPTION



## Sleep Disorders

- Difficulty falling or staying asleep
- Daytime sleepiness and fatigue
- Conditions such as shift work disorder or delayed sleep phase syndrome



## Accidents and Errors

- Reduced alertness increases risk of car accidents and workplace injuries
- Higher error rates in healthcare and other safety-sensitive fields



## Metabolism and Digestion

- Increased risk of obesity, insulin resistance, and type 2 diabetes
- Irregular appetite and weight gain



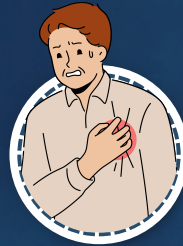
## Hormones and Reproduction

- Fertility challenges and menstrual irregularities, especially among shift workers
- Suppressed melatonin may play a role in reproductive difficulties
- Fact: Most data linking melatonin and reproduction come from animal studies. More research is needed in humans.



## Immune Function

- May increase vulnerability to infections
- May slow recovery or wound healing
- May increase inflammatory markers



## Cardiovascular Health

- **Hypertension:** Circadian misalignment can interfere with the body's normal nighttime "dipping" of blood pressure, contributing to sustained hypertension
- **Atherosclerosis:** Chronic disruption may contribute to inflammation and other processes linked with plaque build-up.
- **Arrhythmias:** Higher risk of irregular heartbeat and sudden cardiac events
- Stroke and heart disease: Elevated long-term risk with chronic disruption



## Mental Health

- Disruptions are strongly associated with mood disorders such as depression, bipolar disorder, and seasonal affective disorder (SAD)
- Misalignment can worsen symptoms in conditions such as ADHD and schizophrenia, where sleep disturbances are common
- Poor sleep further increases mood instability and cognitive difficulties



## Brain Health

- Research suggests a bidirectional relationship: circadian rhythm disruption may increase vulnerability to neurodegenerative conditions such as Alzheimer's and Parkinson's disease, while these conditions can further disturb circadian function
- Associated with poorer memory, concentration, and decision-making

## OCCUPATIONS AT HIGH RISK

Some jobs require working when the body's natural clock would prefer sleep. This can increase risk for insomnia, fatigue, metabolic problems, cardiovascular disease, mood symptoms, and possibly some cancers.

Fact: In 2019, the International Agency for Research on Cancer (IARC) classified night-shift work as "probably carcinogenic to humans (Group 2A)."

High-risk occupations include:



**Healthcare Providers:**  
Doctors, nurses, pharmacists, lab technicians, and hospital staff with overnight or rotating shifts



**Protective Services:**  
Police officers, firefighters, paramedics, and correctional officers



**Manufacturing & Industrial Workers:**  
Factory workers, energy production staff, and 24-hour operations



**Military Personnel:**  
Active-duty members with deployments, missions, and duty rotations



**Hospitality & Retail:**  
Hotel staff, food service, and retail employees working nights or early mornings



**Media, Communications and IT:**  
News reporters, broadcast staff, emergency dispatchers, and IT professionals supporting around-the-clock systems



**Transportation Workers:**  
Pilots, airline crew, truck drivers, train conductors, and public transit operators

## HOW TO PROTECT YOUR CIRCADIAN RHYTHM



Seek natural light during the morning and daytime to anchor your body clock



Avoid caffeine, heavy meals, and vigorous exercise late in the evening



Try to keep a consistent schedule for sleeping and waking, even on weekends



Honor your chronotype. Some people naturally wake earlier (morning larks) while others wake later (night owls)



Limit light at night, especially from phones, tablets, and TVs

# DAILY RHYTHM CHECKLIST

## MORNING



Get 15–30 minutes of natural light soon after waking, when possible.



Eat a balanced breakfast



Move your body with light exercise to reinforce alertness

## AFTERNOON



Take breaks outdoors if possible



Avoid caffeine after mid-afternoon



Schedule demanding tasks during your usual peak alertness time, when possible.

## EVENING



Dim indoor lights after sunset



Avoid heavy meals and vigorous workouts within 2–3 hours of bedtime



Set aside screens or use blue-light filters in the last hour before sleep

## BEDTIME



Go to bed around the same time each night



Create a relaxing wind-down routine such as reading, stretching, or listening to calming music



Keep your bedroom cool, quiet, and dark



## KEY TAKEAWAY

The circadian rhythm is more than just a sleep timer. It is a master regulator for the brain, heart, hormones, metabolism, and immune system. Protecting it through light exposure, regular routines, and healthy daily habits supports sleep, mood, and long-term health.