

Circadian Rhythm

Biohacker Report

REPORT CATEGORY —



Sample Client

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DISCLAIMER

This report does not diagnose this or any other health conditions. Please talk to a healthcare professional if this condition runs in your family, you think you might have this condition, or you have any concerns about your results.

Personal information

NAME

Sample Client

SEX AT BIRTH

Male

HEIGHT

5ft 5" 165cm

WEIGHT

137lb 62kg



How this works

Our Wellness Reports analyze how your DNA influences your health.
We then use this analysis to give you personalized risk estimates and recommendations.



Similarly, our Trait Reports look at how your DNA influences your traits.



Your DNA is like an instruction manual — it contains a lot of information.
You can think of it as a blueprint for your body.

Genetic variants are parts of DNA that differ from person to person. Some can make you more vulnerable to certain health issues, while others may influence traits such as eye color.



We use artificial intelligence and machine learning to analyze all this information.
We then summarize your results as a risk score or display it on a gauge.

In total, we analyze up to 83 million genetic variants.

When we give a risk score, the risk icon tells you if you are at a higher or lower risk compared to other people:



Genotype color info:

AA

You don't have any risk alleles

AA

You have 1 risk allele

AA

You have 2 risk alleles

Your risk is also displayed as a percentile. This will tell you how your risks compare to our sample population. The lower your percentile number, the lower your risk. The "50th percentile" would be an average risk.

Similarly, the gauge tells you your relative risk score compared to our sample population, or it indicates a specific trait or haplotype you are more likely to have based on your genetic variants.

When applicable, we also list top evidence-based recommendations that may help lower your risk. The focus is on recommendations that may be of benefit to you, based on your genetics.

Our recommendations come in four categories: lifestyle, diet, supplements and drugs.
The following icons tell you which category a recommendation falls into:



Our team of scientists also ranks each recommendation.
We rank based on impact and the strength of evidence in the medical literature.

Impact shows how strongly a recommendation will affect your health in a certain area.
Evidence is how much scientific support there is for the recommendation. Rankings are from 1 to 5 (low to high):



Impact

Impact scores range from 1-5. These scores reflect how much of an effect each recommendation can have. An impact score of 5 predicts the biggest effect.

When a recommendation affects something we can measure, we use those measurements to assign the impact score. For example, a recommendation that decreases cholesterol by 20% will have a higher impact score than one that decreases it by 5%.

Some recommendations affect things that we cannot directly measure, like stress or mood. For these, the impact score is based on how well they work relative to other recommendations and standard treatments. The best ones get the highest scores.

If there is a lot of research that shows a recommendation works especially well for your genotype, the impact score gets increased.

Recommendation Evidence

5 / 5

Recommendations that are considered effective and generally recommended by experts and medical bodies.

4 / 5

Recommendations that are considered likely effective and that have multiple independent meta-analyses and a great many studies supporting them.

3 / 5

Recommendations that are considered possibly effective and have many studies supporting them

2 / 5

Recommendations that have insufficient evidence, with two or several clinical trials supporting them, or many studies but with ambiguous results.

1 / 5

Recommendations that have insufficient evidence, with a single clinical trial, or with many studies most of which didn't find support for the recommendation.

0 / 5

No evidence in humans.

Genotype-specific Evidence

High-quality

Direct evidence that a recommendation helps more in people with your gene variant (many clinical trials, a few large clinical trials, or a meta-analysis).

Medium-quality

Direct evidence that a recommendation helps more in people with your gene variant (a few clinical trials or one large clinical trial).

Low-quality

Direct evidence that a recommendation helps more in people with your gene variant (a single clinical trial or more trials with inconsistent results).

Indirect

A recommendation may help more in people with your gene variant because it targets a specific gene or protein affected by your variant (e.g., MTHFR, dopamine).

In theory

A recommendation may help more in people with your gene variant because it targets a specific mechanism affected by your variant (e.g., inflammation, oxidative stress).

Some things to keep in mind:

- Genetics doesn’t play a considerable role in a condition or a trait.
- There is not enough research available to estimate a genetic predisposition.
- There are technical limitations to estimating or presenting a genetic predisposition.
- The topic is sensitive, and a genetic predisposition should only be estimated and presented by a healthcare professional.

Introduction

The circadian rhythm is our body’s internal clock. One of its main jobs is to maintain the sleep/wake cycle [\[R\]](#), [\[R\]](#), [\[R\]](#).

Other key biological processes controlled by the circadian rhythm include:

- **Hormone secretion:** The production of melatonin (which promotes sleep) increases in the evening and peaks at night, while cortisol (associated with alertness) is highest in the morning [\[R\]](#), [\[R\]](#).
- **Body temperature:** Core body temperature typically drops during sleep and rises during the day to promote alertness and physical activity [\[R\]](#).
- **Metabolism:** The timing of eating and digestion is also influenced by circadian rhythms, affecting how the body processes food and stores energy [\[R\]](#), [\[R\]](#).

Disruptions to the circadian rhythm due to shift work, jet lag, light exposure at night, or chronic sleep deprivation can have significant negative effects on health. They have been linked to health problems such as [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#):

- **Sleep disorders:** individuals with circadian rhythm disturbances often experience insomnia, poor-quality sleep, or excessive sleepiness during the day.
- **Mood disorders:** disruptions in the circadian rhythm have been associated with an increased risk of depression, anxiety, and other mood disorders. This may be due to the impact of circadian misalignment on neurotransmitter systems that regulate mood.
- **Metabolic disorders:** circadian misalignment is linked to an increased risk of obesity, insulin resistance, and metabolic syndrome. The timing of food intake and energy expenditure plays a crucial role in maintaining metabolic health.
- **Cardiovascular health issues:** chronic circadian rhythm disturbances, particularly those seen in shift workers, have been linked to an increased risk of heart disease and stroke.
- **Cognitive decline and neurodegenerative disorders:** disruptions to the circadian rhythm, particularly in older adults, can contribute to cognitive decline, dementia, and Parkinson’s disease.
- **Cancer:** circadian rhythm disruption may increase the risk of some cancer types, especially breast, prostate, and colorectal cancer [\[R\]](#).

Tips to rebalance your circadian rhythm include [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#):

- Getting more sunlight during the day
- Limiting screen time at night
- Sticking to a regular sleep schedule
- Maintaining a sleep area that’s cool, dark, and quiet
- Avoiding hunger or large meals before bed

Genetics of the Circadian Rhythm

Morning or evening preference is impacted by genetics and environment. A number of genetic variants may impact your internal clock. Gender and age may also play a role [\[R, R\]](#).

The [CLOCK](#) (‘Circadian Locomotor Output Cycles Kaput’) gene is a core component of the biological clock. The [rs1801260](#) polymorphism is the most studied SNP in the *CLOCK* gene. Its minor 'G' allele increases CLOCK activity and has been associated with abnormal and less stable circadian rhythms [\[R, R, R\]](#).

[NPAS2](#) (neuronal PAS domain protein 2) is one of the core genes responsible for coordinating our circadian rhythms. The ‘G’ allele of [rs11123857](#) and the ‘A’ allele of [rs2305160](#), have been associated with circadian disruptions [\[R, R, R\]](#).

[Melatonin](#) is a hormone responsible for your **sleep-wake cycle (circadian rhythm)**. It is made in the pineal gland in response to the absence of light. The [MTNR1A](#) and [MTNR1B](#) genes encode two melatonin receptors. The [rs12506228](#)-A variant of *MNTR1A* has been associated with job-related exhaustion in shift workers. In turn, the [rs10830963](#)-G and [rs1387153](#)-T variants of *MTNR1B* have been linked to shift work-related breast cancer, prostate cancer, and type 2 diabetes [\[R, R, R, R, R, R, R, R\]](#).

[ADORA2A](#) encodes the [adenosine](#) A2A receptor. These receptors are mainly located in the brain area where [dopamine](#) is produced. **Adenosine accumulates in the evening and promotes calmness and sleepiness.** In contrast, less adenosine means more wakefulness. Two variants in this gene, [rs5751876](#)-T and [rs2298383](#)-C, have been linked to anxiety, sleep disturbances, and worse cognitive performance after sleep deprivation [\[R, R, R, R\]](#).

The [ADA](#) gene encodes the adenosine deaminase enzyme, one of the two enzymes that break down adenosine. The ‘T’ allele of [rs73598374](#) encodes an



Typical likelihood of circadian rhythm imbalances based on 12 genetic variants we looked at

Your top variants that most likely impact your genetic predisposition:

GENE	SNP	GENOTYPE
CLOCK	rs1801260	AG
MTNR1B	rs1387153	TT
MTNR1B	rs10830963	CG
ADORA2A	rs5751876	CT
ADORA2A	rs2298383	TC
ADA	rs73598374	TC
BDNF	rs6265	TC
COMT	rs4680	AG
MTNR1A	rs12506228	CC
NPAS2	rs2305160	GG
TNF	rs1800629	GG
NPAS2	rs11123857	AA

The number of "risk" variants in this table doesn't necessarily reflect your overall result.

underactive protein and has been linked to increased drowsiness and reduced attention in the morning [\[R, R, R\]](#).

[BDNF](#) (brain-derived neurotrophic factor) is a component produced mainly in brain cells. It plays many key roles that support your brain’s ability to grow and learn. The ‘T’ allele of [rs6265](#), also known as “[Val66Met](#)”, decreases BDNF levels and has been associated with social jetlag and disrupted sleeping patterns in adolescents [\[R, R, R\]](#).

The [TNF](#) gene encodes a cytokine that plays a central role in the immune response and [inflammation](#). The [rs1800629](#) polymorphism (also known as *TNF*-308) is one of the most researched SNPs in the *TNF* gene. **The ‘A’ allele is associated with 6-7 times higher levels of TNF-alpha.** This allele has been linked to sensitivity to sleep deprivation, sleep disturbances and morning fatigue [\[R, R, R, R\]](#).

The [COMT](#) gene helps make an enzyme that helps break down neurotransmitters such as [dopamine](#), [norepinephrine](#), and [epinephrine](#). People with two copies of the “G” allele at [rs4680](#) may have higher COMT enzyme activity and have been nicknamed the “worriers” because they break down stress-related chemical messengers more quickly. People with this genotype may be more susceptible to the negative effects of sleep deprivation on cognition [\[R, R, R, R\]](#).

Your Recommendations

Your recommendations are prioritized according to the likelihood of it having an impact for you based on your genetics, along with the amount of scientific evidence supporting the recommendation.

You'll likely find common healthy recommendations at the top of the list because they are often the most impactful and most researched.

DOSAGE		DOSAGE	
1	Reduce Mobile Phone Use	2 hours	2 Behavioral Sleep Extension
3	Sleep for 7+ Hours		4 Maintain a Regular Meal Schedule
5	Morning Bright Light Therapy	20 minutes	6 Limit Caffeine Intake
7	Avoid Large Meals		8 Reduce Artificial Light at Night
9	Melatonin	500 mcg	10 Regular Sleep Schedule
11	Circadian Rhythm Alignment		

1



Reduce Mobile Phone Use

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Limit your mobile phone use to less than 2 hours per day for non-work-related activities. Avoid using your phone during meal times and at least 1 hour before bedtime to improve sleep quality and reduce eye strain.

TYPICAL STARTING DOSE

2 hours

Description

Reducing mobile phone use involves limiting the time spent on smartphones and other electronic devices, which can help alleviate digital eye strain, improve sleep quality, and reduce the potential for distraction-related accidents.

Mobile devices like smartphones and tablets have become indispensable for:

- Communication
- Information searching
- Video gaming
- Social media participation

However, their excessive use may increase the risk of health conditions, such as [\[R\]](#), [\[R\]](#):

- Neck problems
- Carpal tunnel syndrome
- Sleep problems
- Mood disorders

How it helps

Reducing mobile phone use limits exposure to blue light, which can disrupt melatonin production and hinder sleep quality. By fostering better sleep patterns, this approach supports the natural circadian rhythm, ultimately promoting overall health.

2



Behavioral Sleep Extension

IMPACT1 / 5

EVIDENCE1 / 5

How to implement

To implement behavioral sleep extension, aim to increase your total sleep time by going to bed 15 to 30 minutes earlier than your usual bedtime, or by allowing yourself to sleep later in the morning. Gradually increase this time as needed to reach a target of 7 to 9 hours of sleep per night, consistently, including on weekends. Adjust your daily schedule to accommodate this change, making sleep a priority.

Description

Behavioral sleep extension involves adopting healthier sleep habits to extend the duration and improve the quality of sleep. It can lead to improved cognitive function, mood, and overall well-being by addressing sleep deficiency.

How it helps

Behavioral sleep extension improves sleep duration and quality, which are essential for restoring normal circadian rhythms. By enhancing sleep hygiene and consistency, this approach not only alleviates sleep deficiency but also fosters better cognitive function and overall well-being.

3



Sleep for 7+ Hours

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Ensure you allocate enough time in your schedule to achieve a minimum of 7 hours of sleep each night. This might involve going to bed earlier or adjusting your evening routine to promote relaxation and make it easier to fall asleep.

Description

Optimizing sleep involves adopting healthy sleep habits and creating a sleep-conducive environment to ensure restorative and sufficient sleep duration. It supports cognitive function, mood stability, and overall physical health. Most experts recommend getting **at least 7 hours of good-quality sleep each night**.

[Sleep](#) supports your body and mind [\[R, R\]](#). More precisely, sleep helps:

- Support brain health [\[R, R\]](#)
- Maintain a healthy weight and appetite [\[R, R, R\]](#)
- Regulate blood pressure [\[R, R\]](#)
- Balance blood sugar [\[R, R\]](#)

Ways to sleep better include [\[R\]](#):

- Reducing your bright light exposure (screen time) in the evenings
- Sticking to a regular sleep schedule
- Avoiding hunger or large meals before bed
- Avoiding nicotine, caffeine, and alcohol before bed
- Maintaining a sleep area that’s cool, dark, and quiet

How it helps

Getting 7+ hours of sleep aids in regulating the body's internal clock, promoting a robust circadian rhythm. Sufficient sleep enhances hormonal balance and neurotransmitter function, which are crucial for maintaining consistent sleep-wake cycles.

4



Maintain a Regular Meal Schedule

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Eat your meals at the same times each day, for instance, breakfast at 7 AM, lunch at 12 PM, and dinner at 6 PM. Stick to this schedule every day, including weekends, to help regulate your body's internal clock and improve digestion.

Description

Maintaining a regular meal schedule helps regulate blood sugar levels, supports digestion, and promotes a healthy metabolism. Consistency in meal timing can contribute to overall energy balance and long-term weight management.

Blood sugar ([glucose](#)) is the body’s main source of energy. It increases after a meal. Skipping meals may reduce this energy supply and lead to [R](#), [R](#):

- Poor cognitive performance
- Headaches

A regular meal schedule means eating the same number of meals at about the same times every day. Doing so may help [R](#), [R](#):

- Balance the internal clock
- Maintain a healthy body weight
- Support healthy cholesterol levels
- Prevent migraines

How it helps

Adhering to a regular meal schedule reinforces the body’s internal clock, promoting synchronized hormonal release and metabolic processes that align with circadian rhythms. This consistency not only aids digestion but also stabilizes blood sugar levels, enhancing overall energy regulation.

5



Morning Bright Light Therapy

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Expose yourself to a light therapy box, which mimics natural sunlight, for about 20-30 minutes each morning within the first hour of waking up. It's important to do this daily, especially during months with less natural sunlight, to help manage symptoms of Seasonal Affective Disorder (SAD) or other conditions influenced by light exposure.

TYPICAL STARTING DOSE

20 minutes

Description

Bright light therapy, often used to treat conditions like seasonal affective disorder (SAD) and certain sleep disorders, involves exposure to specific wavelengths of light. It can help regulate sleep patterns, improve mood, and alleviate symptoms associated with mood disorders.

[Bright light therapy](#) involves exposing people to artificial indoor light via a “light box.” This box is often placed nearby for 30 minutes each morning. A light therapy box should [\[R\]](#), [\[R\]](#), [\[R\]](#):

- Provide 10,000 lux of light
- Filter out UV light

Light therapy may improve mood and help with certain mental health conditions [\[R\]](#), [\[R\]](#).

How it helps

Morning bright light therapy aids in the regulation of circadian rhythms by enhancing melatonin suppression and promoting alertness during the day. This exposure helps improve sleep quality and stabilize mood, mitigating symptoms associated with circadian rhythm disruptions.

6



Limit Caffeine Intake

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Limit your caffeine consumption to less than 200 milligrams per day, equivalent to about two 6-ounce cups of coffee. Aim to avoid caffeine-containing foods and beverages such as tea, chocolate, and some soft drinks, especially in the late afternoon and evening to minimize sleep disturbances.

Description

Although caffeine is the world's most popular stimulant, some people choose to limit or avoid it due to potential adverse effects on their sleep, mood, or blood pressure.

How it helps

Limiting caffeine intake aids in enhancing sleep quality by reducing the stimulating effects that can interfere with the body's natural circadian rhythm. This adjustment promotes more consistent sleep patterns and overall better physiological functioning.

7



Avoid Large Meals

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Divide your daily food intake into smaller portions spread out over five to six times a day instead of having three large meals. Ensure that each portion is balanced and includes a variety of nutrients. This means having breakfast, a mid-morning snack, lunch, an afternoon snack, dinner, and possibly a light evening snack, depending on your caloric needs.

Description

Eating smaller, more frequent meals may help prevent overeating. This involves eating the same number of meals at about the same times every day. Doing so may help with issues like blood pressure, body weight, cholesterol levels, and migraines.

Eating smaller, more frequent meals may help prevent overeating. One way to do this is to keep a regular meal schedule. This involves eating the same number of meals at about the same times every day. Doing so may help [\[R\]](#), [\[R\]](#), [\[R\]](#):

- Manage blood pressure
- Balance the internal clock
- Maintain a healthy body weight
- Support healthy cholesterol levels
- Prevent migraines

How it helps

By avoiding large meals, the digestive system can function more efficiently, minimizing disruptions to the circadian rhythm and promoting better sleep quality. This practice also helps regulate metabolic processes that are crucial for maintaining overall health.

8



Reduce Artificial Light at Night

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Starting at least two hours before your usual bedtime, avoid using electronic devices such as smartphones, tablets, and computers. Also, consider using dim red lights for night lights, as red light has the least power to shift circadian rhythm and suppress melatonin. Try to make your sleeping environment as dark as possible by using blackout curtains or a sleep mask.

Description

Reducing artificial light exposure at night involves minimizing exposure to artificial lighting sources, which can disrupt circadian rhythms and sleep patterns. Doing so supports better sleep quality and overall well-being.

[Sunlight](#) or bright light during the day can benefit your body and mind. It may improve your mood, performance, and sleep quality [\[R, R, R\]](#).

However, **exposure to artificial light at night**, for example through the use of phones, tablets, and computers may be harmful [\[R, R, R\]](#).

It may reduce [melatonin](#) production and throw off your [circadian rhythm](#). People with high exposure to artificial light at night like night-shift workers may have an increased risk of [\[R, R, R\]](#):

- Mood disorders (e.g., depression)
- Sleep problems
- Obesity
- Diabetes
- Cancer

How it helps

Reducing artificial light at night helps synchronize circadian rhythms by promoting the natural production of melatonin, the sleep hormone. This alignment improves sleep quality and supports overall health, reducing the risk of sleep disorders and associated health issues.

9



Melatonin

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Take 500 mcg of melatonin orally, about 30 minutes before bedtime, to help with sleep. It can be taken daily as needed.

TYPICAL STARTING DOSE

500 mcg

Description

Melatonin is a natural hormone produced by the pineal gland in the brain that helps regulate the sleep-wake cycle. It plays a crucial role in promoting sleep onset and maintaining a consistent sleep pattern, making it a commonly used supplement for managing sleep disorders and jet lag.

[Melatonin](#) is an important sleep hormone. Bright light at night may prevent your body from making enough melatonin [\[R, R, R\]](#).

Your body makes melatonin on its own. However, some people take melatonin supplements to help them sleep. It may help with jet lag in particular [\[R, R, R\]](#).

How it helps

Melatonin supplementation aids in reestablishing a normal sleep-wake cycle by enhancing the body's natural hormonal signals for sleep initiation, particularly beneficial for individuals with disrupted circadian rhythms.

10



Regular Sleep Schedule

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Go to bed and wake up at the same time every day, even on weekends and holidays. This helps regulate your body's internal clock, leading to better sleep quality. Aim for 7-9 hours of sleep per night.

Description

Maintaining a regular sleep schedule involves going to bed and waking up at consistent times each day. This practice helps regulate the body's internal clock and promotes better sleep quality, mood, and cognitive function.

How it helps

Adhering to a regular sleep schedule strengthens the circadian rhythm by synchronizing the body's internal clock, which enhances the overall quality of sleep and supports optimal physical and mental functioning.

11



Circadian Rhythm Alignment

IMPACT

1 / 5

EVIDENCE

1 / 5

Description

Circadian rhythm alignment is the process of adjusting your sleep-wake cycle to match the natural 24-hour cycle of the Earth's rotation. Circadian rhythm alignment has been linked to a number of health benefits, including improved sleep quality, better mood, and reduced risk of obesity, heart disease, and diabetes.

How it helps

Aligning the circadian rhythm through targeted therapy enhances sleep quality and regulates hormonal fluctuations, leading to improved sleep patterns and overall well-being. This synchronization aids in mitigating symptoms associated with sleep disorders.