

# Researchers call for new studies to learn how our brains change when we're awake after midnight

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If you've ever stayed up late angrily commenting on Twitter posts, eating a whole pint of ice cream out of the container, finishing another bottle of wine, or just feeling miserable, you might identify with the Mind After Midnight hypothesis.

The hypothesis, which was detailed in a recent paper in *Frontiers in Network Psychology*, suggests that when humans are awake during the biological circadian night—after midnight for most people—there are neurophysiological changes in the brain that alter the way we interact with the world, especially actions related to reward processing, [impulse control](#) and [information processing](#).

These changes can make you more likely to view the world negatively, engage in harmful behaviors, and make [impulsive decisions](#) (including those associated with addictive behaviors such as gambling and [substance abuse](#)) without fully thinking through the consequences.

"The basic idea is that from a high level, global, evolutionary standpoint, your internal biological circadian clock is tuned towards processes that promote sleep, not wakefulness, after midnight," says Elizabeth B. Klerman, MD, Ph.D., an investigator in the Department of Neurology at Massachusetts General Hospital, Professor of Neurology at Harvard Medical School and the senior author of the paper.

Klerman describes the hypothesis as a call for researchers to conduct new studies to better understand how these circadian differences affect behavior, decision making and job performance at night—and identify strategies that can help people cope.

The findings could have wide-ranging effects on individuals who are required to be awake at night for work, including pilots, health care workers, police officers and military personnel. Research could also lead to new strategies to reduce violent crime, substance use disorders, suicides and other [harmful behaviors](#).

"There are millions of people who are awake in the middle of the night, and there's fairly good evidence that their brain is not functioning as well as it does during the day," Klerman says. "My plea is for more research to look at that, because their health and safety, as well as that of others, is affected."

## Bad things happen after dark

Previous research has shown that people are more at risk for engaging in harmful behavior such as suicide, violent crime and substance use at night.

For example, Michael L. Perlis, Ph.D., an Associate Professor of Psychology at UPenn's Perelman School of Medicine and a co-author of the Mind

After Midnight hypothesis, found that if you adjust for the number of people who are awake at any given time, [suicides are statistically more likely to occur during the nighttime hours](#).

Homicides and [violent crime](#) are also more common at night, as are the risks of the illicit or inappropriate use of substances such as cannabis, alcohol and opioids.

Our nighttime food choices at night also tend to be unhealthy, as we pursue more carbohydrates, lipids and processed foods and often consume more calories than we need.

So why is it that all these bad behaviors come out at night?

There are a few obvious answers—it's much easier to commit a crime under the cover of darkness, for one, and there are less people around and awake at night to help us keep our behavior in check. But it's likely there's a biological basis as well.

Klerman explains that the circadian influence on the neural activity in our brains changes over the course of 24 hours, leading to differences in the way we process and respond to the world.

For example, positive affect—the tendency to view information in a positive light—is at its highest point during the morning, when circadian influences are tuned to wakefulness, and at its lowest point during the night, when circadian influences are tuned to sleep.

In parallel, [negative affect](#)—the tendency to view information in a negative or threatening light is highest at night.

Your body also naturally produces more [dopamine](#) at night, which can alter your reward and motivation system and increase the likelihood of engaging in risky behavior.

This biased interpretation of information is then sent along to the parts of the brain responsible for decision-making, which normally work to control negative emotional distractions and focus on goal-oriented behavior.

But these parts of the brain are also subject to circadian-influenced changes that can impair decision making, functioning and prioritization.

Suddenly, your worldview narrows and becomes more negative, you start to make poor decisions, and the mental map you create of the world around you may no longer match up with reality.

The result? You might end up drinking too much, missing a crucial diagnosis on a patient, crashing an oil tanker into some rocks, or worse.

Klerman experienced some of these feelings firsthand when she struggled to fall asleep after experiencing severe jet lag during a trip to Japan.

"While part of my brain knew that eventually I would fall asleep, while I was lying there and watching the clock go tick tick tick—I was beside myself," she recalls.

"Then I thought, 'What if I was a drug addict? I would be out trying to get drugs right now.' Later I realized that this may be relevant also if it's suicide tendencies, or substance abuse or other impulse disorders, gambling, other addictive behaviors. How can I prove that?"

### Putting the hypothesis to the test

The need for proof is key here. It's important to note that Mind After Midnight is still a hypothesis—one that will require validation through carefully constructed research studies.

In an ironic twist, the best way to gather this data without the confounding effects of [sleep loss](#) will require researchers and study staff themselves to be awake and working after midnight, for example by taking fMRI images of study participants whose sleep cycles have been carefully adjusted for nighttime wakefulness or conducting other protocols.

"Most researchers don't want to be paged in the middle of the night. Most research assistants and technicians don't want to be awake in the middle of the night," Klerman concedes.

"But we have millions of people who have to be awake at night or are awake at night involuntarily. Some of us will have to be inconvenienced so we can better prepare them, treat them, or do whatever we can to help."

**More information:** Andrew S. Tubbs et al, The Mind After Midnight: Nocturnal Wakefulness, Behavioral Dysregulation, and Psychopathology, *Frontiers in Network Physiology* (2022). DOI: [10.3389/fnetp.2021.830338](https://doi.org/10.3389/fnetp.2021.830338)

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