

Refresh

The science of sleep for optimal performance and well being



Unit 2: Tick Tock Goes the Circadian Clock: The challenge of Monday Morning Classes

Your body is constantly striving for a state of homeostasis which means it's just trying to keep everything at a regular, normal level so you can function in the best possible way. In order to do this, it needs to tell you when to sleep. Here is a little information about how your body regulates your need for shut-eye:

During the day:

1. A biological substance called adenosine increases homeostatic drive for sleep. The longer you are awake, the higher the level of this homeostatic drive becomes.
2. Your internal circadian clock pushes back, resisting the homeostatic drive for sleep by stimulating neural pathways in the brain that promote alertness.

Note: The brain's internal circadian clock is the suprachiasmatic nucleus of the hypothalamus. The hypothalamus is a specialized region of the brain in charge of helping maintain homeostasis by regulating variables such as temperature, blood pressure, appetite, electrolyte balance, and of course... sleep/wake cycles.

At bedtime:

1. As your usual bedtime approaches, your internal circadian clock "runs out of steam", decreasing the strength of its alerting signals.
2. You are flooded with adenosine, and you start to feel pretty sleepy.
3. You begin your first sleep cycle.

Lots of people override their sleepiness with a little substance called caffeine, which temporarily interferes with sleep by blocking adenosine receptors in the brain.

You can also consciously override the circadian cycle to prolong wakefulness in order to stay out with friends on weekends or to stay up late studying for a test. However, the drive to sleep becomes more difficult to override as the number of sleepless hours increases.

During the night:

1. Adenosine levels decrease.
2. Alerting signals from your circadian clock are also decreased; so overall the balance remains in favor of sleep promotion and you are able to stay asleep.

In the morning:

1. Your internal circadian clock starts to increase the alerting drive.
2. Your adenosine well is dry.
3. The balance is tipped towards wakefulness and you wake-up for the day.

Fun Fact: Melatonin doesn't just make you tan, it is also involved in the regulation of sleep and wakefulness. During the daytime, light from the sun—and other sources of bright light—suppress melatonin secretion in the brain, which increases circadian alerting signals and keeps you going through your day.

Check-out this website for a graphic video explanation of the sleep wake cycle: <http://www.scienceofsleep.net/sleep.aspx>.

Monday is universally dreaded among students, but not only because it signals the start of a school week. It turns out that your body may be trained to hate Mondays because of your sleeping habits.

Many college students get out of sync with their weekday internal circadian clock by sleeping in late on weekends. This can cause Monday morning brain fog while you're sitting in Music Theory, dreaming of your fluffy feather pillow. This scenario can extend to Tuesday and Wednesday morning brain fog as your circadian clock tries to re-adjust to your weekday schedule. If your weekend and weekday sleep schedules are extremely different, your performance could suffer all week. The simple mismatch between your weekend circadian clock demanding sleep and your weekday school schedule demanding attention to class can leave you miserable. This also is the reason for "jet lag" after an overseas flight. In essence, many students feel "jet lagged" every Monday, although it probably won't get you an extension on your research paper.

Some students may easily recognize something is wrong with their sleep clock (when they wake up in a puddle of drool at the end of their history lecture). Most students will have less pronounced weekday/weekend schedule mismatch and won't know whether it is affecting their mood or performance. More subtle symptoms of circadian clock mismatch include: decreased creativity, decreased memory, and increased irritability.

Aiming to have the same basic sleep schedule for weekdays and weekends, particularly the same rise time, can reduce symptoms of circadian clock vs. weekday schedule mismatch. You might not guess that waking up at 8:00 AM on Saturdays would **decrease** your irritability, but you might be surprised.

The benefits of getting up at the same time every morning:

Authors of one study of a random sample of students living in an on-campus residence hall found that each hour earlier students reported getting out of bed on weekends predicted a 0.11 higher end of semester GPA (Trochel et al., 2000). If you are one of those people who feel best at night and would

rather not see daylight before noon, picking a strict morning wake up time is likely to be more difficult but also much more beneficial for you than for your morning-loving friends.

Of course, if you get up earlier on weekends, you'll have to get to bed earlier in order to get enough sleep. Going to bed earlier on weekends during college may seem completely impossible, but notice we didn't say "early" but "earlier". If you now fall asleep at 4:00 AM on Friday nights, crashing at 1:00 AM instead might still allow you to enjoy nightlife and at the same time lead to some serious results. The same is true for waking up in the morning. If you currently get up for classes every weekday at 8:00 AM but sleep in until noon on weekends, setting a goal to get up at 10:00 AM on weekends is likely to improve your performance in and out of class. We recommend getting up at approximately the same time every day on weekdays and getting up no more than one hour later on weekends. Once you get used to living in sync with your circadian clock you will notice improvement in your sleep and your overall sense of well being.

Make mornings something you look forward to:

Having something you enjoy doing scheduled as your first morning activity will help you keep a constant wake time because you will be looking forward to getting out of bed. This is particularly important on weekends, when you might not otherwise have much incentive for getting out of bed until lunch time. You could exercise with a friend, plan an early morning trip to the beach, paint, read a good book in the early morning sun, watch one of those daytime TV movies that are so quality...the possibilities are endless.

Early morning sunshine:

Exposure to light first thing in the morning is a good idea, especially if you are not really a morning person. Early AM exposure to bright light can suppress sleep inducing melatonin levels and provides a cost-free alternative to fake tanning (but avoid mid-day sun exposure because skin cancer isn't fun and you derive no circadian clock benefit from mid-day sun exposure). If you prefer to avoid sun-exposure as much as possible, simply sitting in the shade looking out at brightly sun-lit areas is enough to reduce brain levels of melatonin and help re-set your circadian clock for earlier wake-up times.

Naps:

There's nothing better than a short, mid-afternoon nap on a Sunday. However, napping for longer than one hour or napping late in the evening can disrupt circadian clock timing. If you like to nap, try to do it for an hour or less and get it in the afternoon before 5:00 PM.

Practice suggestions:

1. Determine an ideal fixed daily wake-up time. We recommend picking a weekend wake-up time that is no more than one hour later than your weekday wake-up time. However, any change to make daily wake-up times more consistent is a good move.
2. Limit naps to less than one hour and avoid naps after 5:00 PM. The best time to nap is 7 to 9 hours after your morning wake-up time.
3. Continue to use the 30 second sleep diary. Save your sleep logs so you can see how your sleep patterns change over time.

Thirty Second Sleep Diary:

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Time you went to bed last night:							
Time you got out of bed this morning:							
Number of minutes you estimate it took you to fall asleep last night:							
Number of times you remember waking up in the middle of the night:							
Total number of minutes you estimate you were awake in during the night:							
Total amount of sleep you had last night:							
Number (none = 0) alcoholic beverages you consumed before going to bed last night:							
Did you take any sleeping medication last night (record "yes" or "no")? If yes specify.							
How much did you enjoy sleeping last night? 0 1 2 3 Not at all Very much							
How refreshed do you feel this morning? 0 1 2 3 Not at all Very much							

Adapted from Morin, C.M., and Espie, C.A., *Insomnia: A Clinical Guide to Assessment and Treatment*, Springer 2004.