The power of sleep

A guide to unlocking your best rest

muse®

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Chapter one:

Sleep in the modern world

From experiencing deep, restorative sleep to feeling energized and focused the next day, a good night's sleep can seem pretty miraculous. And it is. Yet many of us know very little about how to make the most of the sleep we can get (if any!).

In this eBook, we'll dive into everything you need to know about sleep—from why we need it and common sleep issues, to tips for your best sleep and the magic of lucid dreams.

NOTE: Remember, this book is meant to be educational and should never be seen as a substitute for working with a licenced healthcare practitioner.

Why do we need sleep & what is a circadian rhythm?

Sleep is essential for our bodies and minds to stay healthy and function properly. To help us meet our slumber needs, we all have an internal body clock that regulates our sleep. It's basically our sleep/wake monitor that controls when we feel tired and in need of rest and when we feel energized and ready to start the day. This clock operates on a 24-hour cycle known as your "**circadian rhythm** (1)."

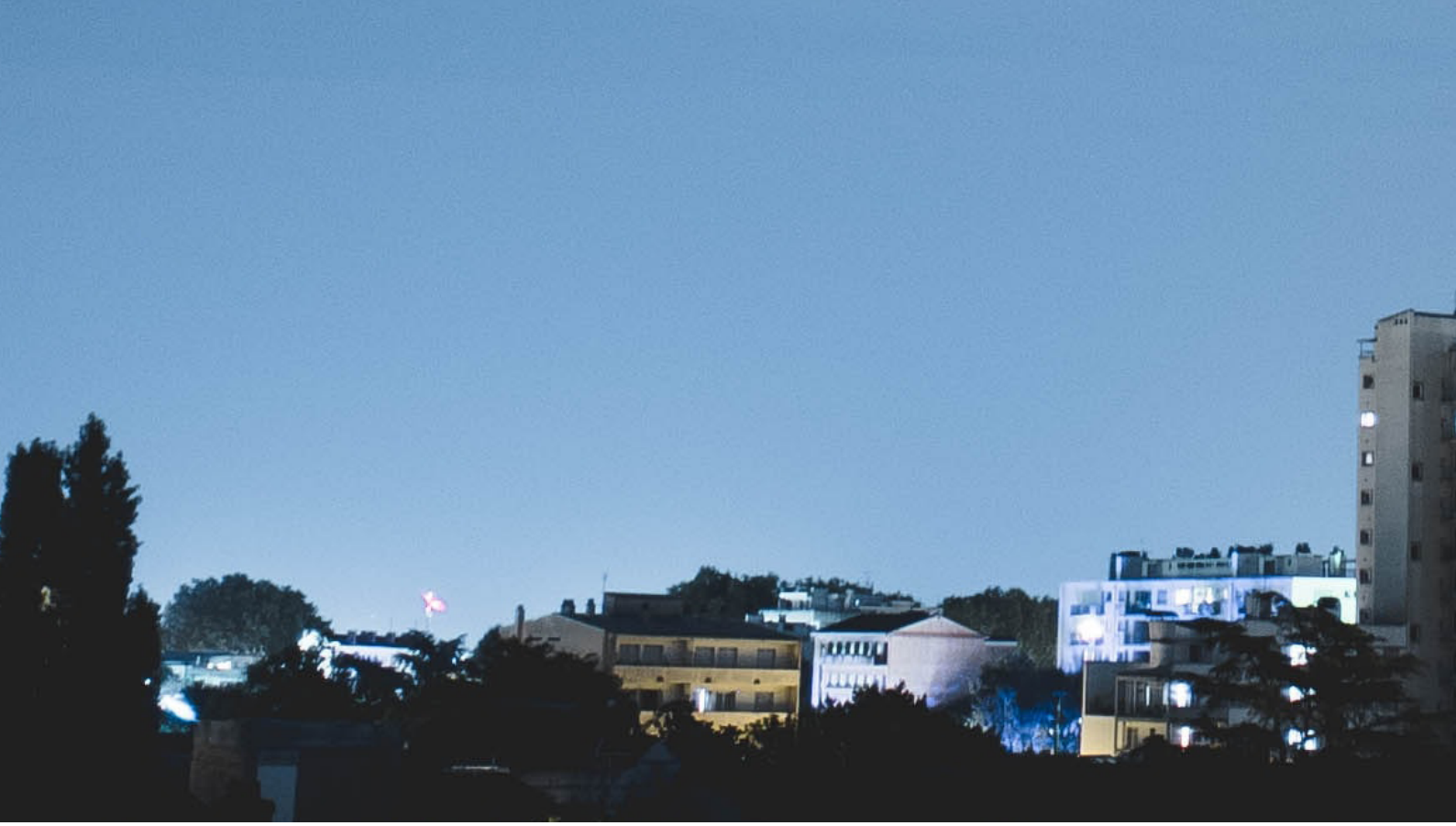
Your circadian rhythm works along with melatonin, an essential sleep hormone, to keep you on track. Melatonin is produced and released in your body depending on the time of day. **When it's dark out, more melatonin is released, helping you sleep. And when it's light, less is released, helping you feel more energized** (2).

So why, more specifically, is sticking to your circadian rhythm and getting enough sleep so important? A few key reasons are (1):

- It allows your mind and body to recharge so that you feel refreshed when you wake up.
- It helps your body stay healthy so that it can fight off disease.
- It keeps your brain healthy, boosting your ability to concentrate, think clearly, and process memories (4).

Takeaway

Your circadian rhythm helps ensure you get enough sleep. Sleep is key for your body for many reasons including the ability to fight off disease and for your mind to think, concentrate, and remember.



What happens when we don’t get enough sleep?

Because sleep is so essential to our daily functioning, when we don’t get enough the negative effects can be serious. Early symptoms like drowsiness can show up right away after one night of poor sleep, while other symptoms, like a weakened immune system, can result after longer periods of sleep shortage. And though the timing and extent to which we each experience these symptoms will vary, they can generally be broken down into short-term and long-term negative effects. (3).

Short-term effects of sleep deprivation (3):

- Increased anxiety
- Excessive daytime sleepiness—and everything that comes along with daytime drowsiness, from decreased work performance to a higher risk of getting in a car accident.*
- Relationship stress
- Lower cognition—brain functions like memory, decision-making, reasoning, problem-solving, reaction time, and alertness all worsen (4)
- Lower quality of life
- Forgetfulness—research is revealing that sleep has an impact on learning and memory. It's shown to be critical for locking in the new information we learn and committing it to our memory (4).

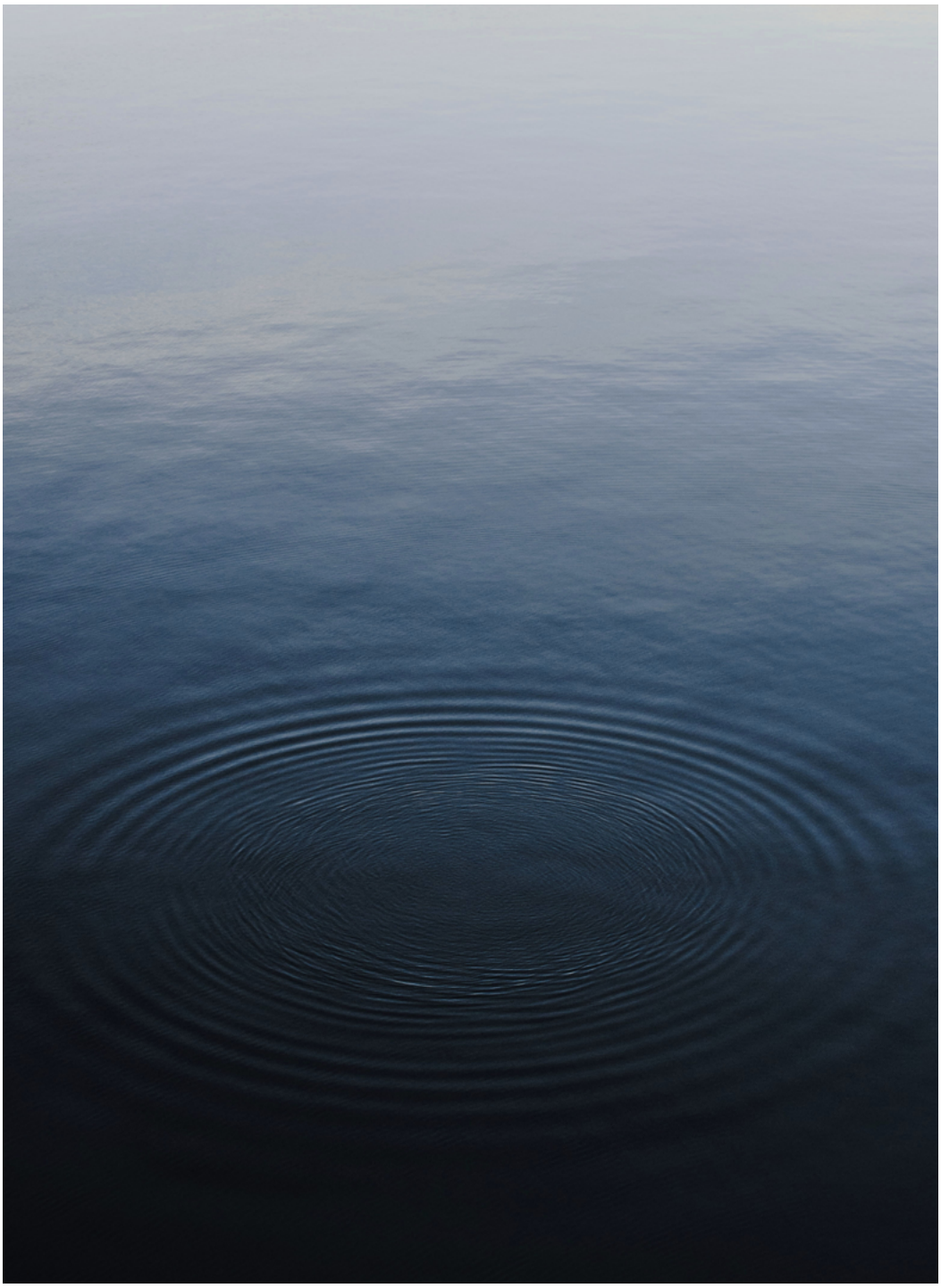
Long-term effects of sleep deprivation (3):

- Obesity
- Severe health issues—such as high blood pressure, diabetes, heart attack, cancers (breast cancer, colorectal, and prostate) heart failure, or stroke
- Depression
- Decreased immunity—and increased sickness because your body can't fight off illness
- Lower sex drive
- Increased stress hormone (cortisol)—which can break down collagen, the protein necessary for keeping skin healthy
- Skin issues—more fine lines, wrinkles, and uneven skin color

*A National Sleep Foundation study found that you're three times as likely to get in a car accident if you've had less than 6 hours of sleep each night (5).

Takeaway

Lack of sleep can have significant short and long-term consequences, from increased anxiety and relationship stress to a weaker immune system and cardiovascular issues.



Chapter two:

Common sleep issues

While we know skimping on sleep isn't good for us, millions of us still don't seem to log enough hours each night. In fact, surveys conducted by the National Sleep Foundation found that at least **40 million Americans suffer from over 70 different sleep disorders** (6).

What's more, the survey found that 60% of adults report having sleep issues at least a few nights a week. The result? At least a few times every month, more than 40% of adults experience daytime drowsiness severe enough to disrupt their daily activities. And it's not just among adults. The same study found that 69% of children experience sleep issues at least a few nights a week (6). So what's going on here?

Why can't I fall asleep?

Are you someone who needs to read in bed for an hour to wind down or are you out like a light as soon as you lie down? **Sleep latency is the amount of time it takes you to fall asleep.** If it takes 20 minutes or more to doze off, you might want to look into your pre-bed habits. On the other hand, if you fall asleep quickly (a fast sleep latency), that could be an issue as well (7). Sleep experts D. Thomas and W.M. Anderson of the Encyclopedia of Sleep have a term for this—pathologic sleepiness (8). It means you fall asleep in less than five minutes, which has been associated with impaired overall performance (8).

Sleep and dream psychologist, Rubin Naiman, Ph.D., says it's important to debunk the myth that we should all be falling asleep instantly or there's something wrong with us.

> In our high-velocity world, many people believe good sleepers fall asleep in a flash. This attitude can trigger anxiety when sleep onset isn't rapid, further delaying falling asleep (9).

Naiman says it's "perfectly normal" to lie in bed for 10 or 20 minutes before you drift off. But if you find it's taking a lot longer, here are some common reasons why that might be (10):

1. **You have a sleep disorder.** Sleep apnea and insomnia are the most common.
2. **You're stressed or worried.** When we are stressed, our body's stress response system, which involves the release of stress hormones like cortisol, can lead to a state of hyperarousal. This heightened state of physiological and psychological alertness can make it difficult to relax and fall asleep.
3. **You drank caffeine too late in the day.** This is a big one. Caffeine (from coffee, tea, sodas, etc.) blocks a brain chemical called adenosine that helps you sleep.
4. **You ate within a few hours of bedtime.** Lying down with a full stomach can promote heartburn, making it harder to fall asleep.
5. **Your room is not dark enough.** Or other environmental factors are affecting your sleep, like noisy surroundings, disruptive partners/kids/roommates, or an uncomfortable bed.
6. **You were on your phone late.** Staring at the blue light from your smartphone can suppress the secretion of melatonin (sleep hormone) shifting your circadian rhythm. Your body interprets the light as daytime and keeps you from getting sleepy (11).
7. **You exercised too close to bedtime.** Studies show it may be best to finish your exercise at least 90 minutes before you hit the sack. Intense to moderate exercise will also affect you more than lighter exercise, like gentle

Takeaway

Things many of us do every day—from drinking coffee too late in the day to scrolling our phone before bed—can affect our sleep.

Why can’t I stay asleep?

All of the above reasons that keep you from falling asleep can be many of the same culprits that wake you up in the middle of the night. There are, however, a few other distinct factors—from your hormones to your medications—that might keep you from staying asleep throughout the night (14).

You had a few drinks. Drinking alcohol within a few hours of sleep may not affect your ability to doze off, but it could wake you up in the middle of the night. Why? As the alcohol metabolizes and the effects wear off, it can result in restlessness and prevent deep sleep (10).

You have underlying conditions. Some of the most common are anxiety, neuropathy (tingling or numbness in the hands and feet), sleep apnea (which causes brief pauses in breathing at night), and chronic pain.

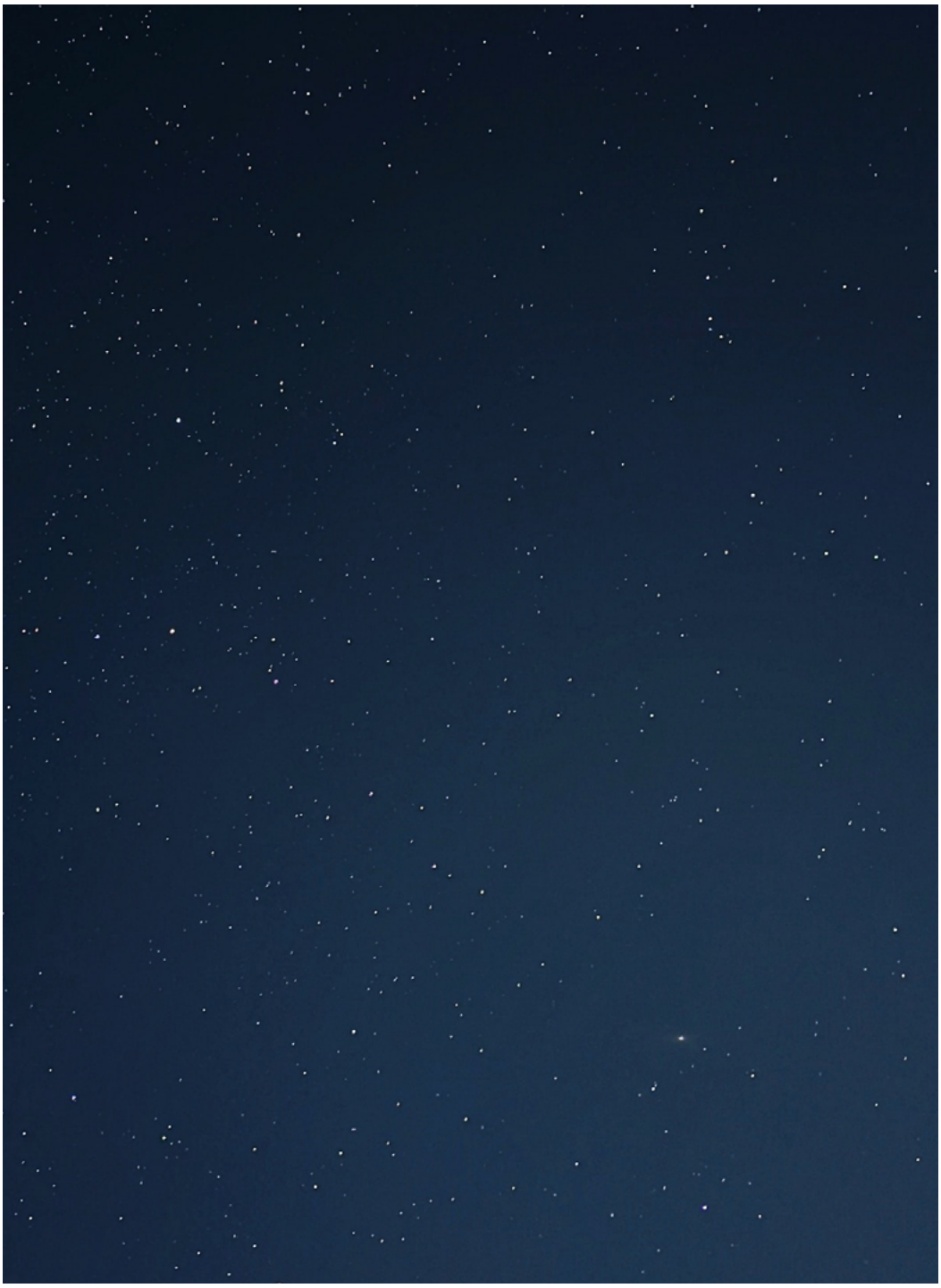
You're taking certain medications. Some antidepressants, beta blockers to treat high blood pressure, cold remedies containing alcohol, and corticosteroids to treat inflammation or asthma can affect sleep.

Your age. According to Harvard Medical School, interrupted sleep is more common in older adults. Your circadian rhythm can shift when you're older causing you to get sleepy earlier. An 8:00 pm bedtime, for example, might lead to a much earlier wake time.

Your hormones are out of balance. Since your hormones play a role in sleep function (melatonin), if there is an imbalance, that can disrupt your nightly zzzs. A woman's menstrual cycle, perimenopause, and menopause can all cause hormonal shifts that disrupt sleep. For example, decreased estrogen can lead to hot flashes that could wake you up at 2:00 a.m. (10).

Takeaway

Everything from your age and prescription medications, to hormones and health conditions, are factors to consider when it comes to assessing the quality of your sleep and why you're waking up during the night.



EVEN WHEN I GET ENOUGH SLEEP, I STILL FEEL TIRED.

Do you find that no matter how many hours you sleep, you still feel groggy in the morning? This could point to issues with the quality of your sleep. The most common reason for feeling unrested in the morning is not getting enough deep sleep, or waking during the deepest parts of your sleep cycle (7).

It could also have to do with your **neurobiology.** In the few hours right before you wake up, you've spent most of your time in REM sleep, dreaming. In this state your brain is very active and uses a lot of ATP, the energy molecule. Adenosine is part of that molecule and is produced and released as you sleep in this stage. Increasing amounts of it have been shown to make you more drowsy. Why? **Adenosine is a neurotransmitter that blocks the neurons that help you feel awake and alert.** You could wake up feeling sluggish because adenosine piled up while you were dreaming (15).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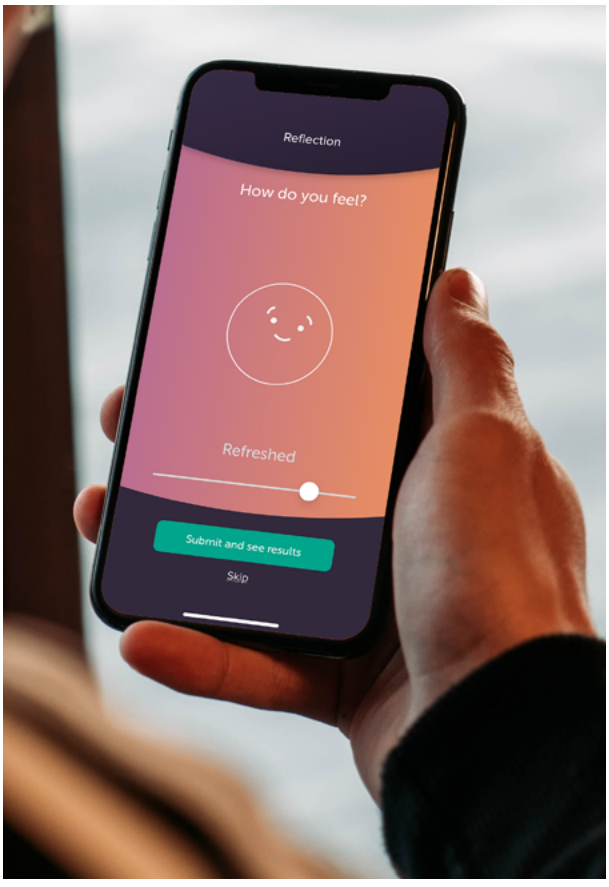
Reflection
How do you feel?
Refreshed
Submit and see results
Skip

Takeaway

Not getting enough deep sleep is the most common reason you might feel groggy after a full night of rest.


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Chapter three:

Hack your sleep

So how do we go about improving our sleep? A basic understanding of your sleep stages (and what's happening in your body in each) is a good place to start. It can help you see where you're missing the mark and help you make the shifts you need to start sleeping more soundly.

There are two types of sleep: REM and non-REM. Within non-REM sleep, there are three stages you pass through en route to the fourth stage, REM. **Every night we cycle through these four stages several times for different lengths of time.** In general, non-REM cycles are longer toward the beginning of your sleep, while REM cycles are longer toward the end (7).

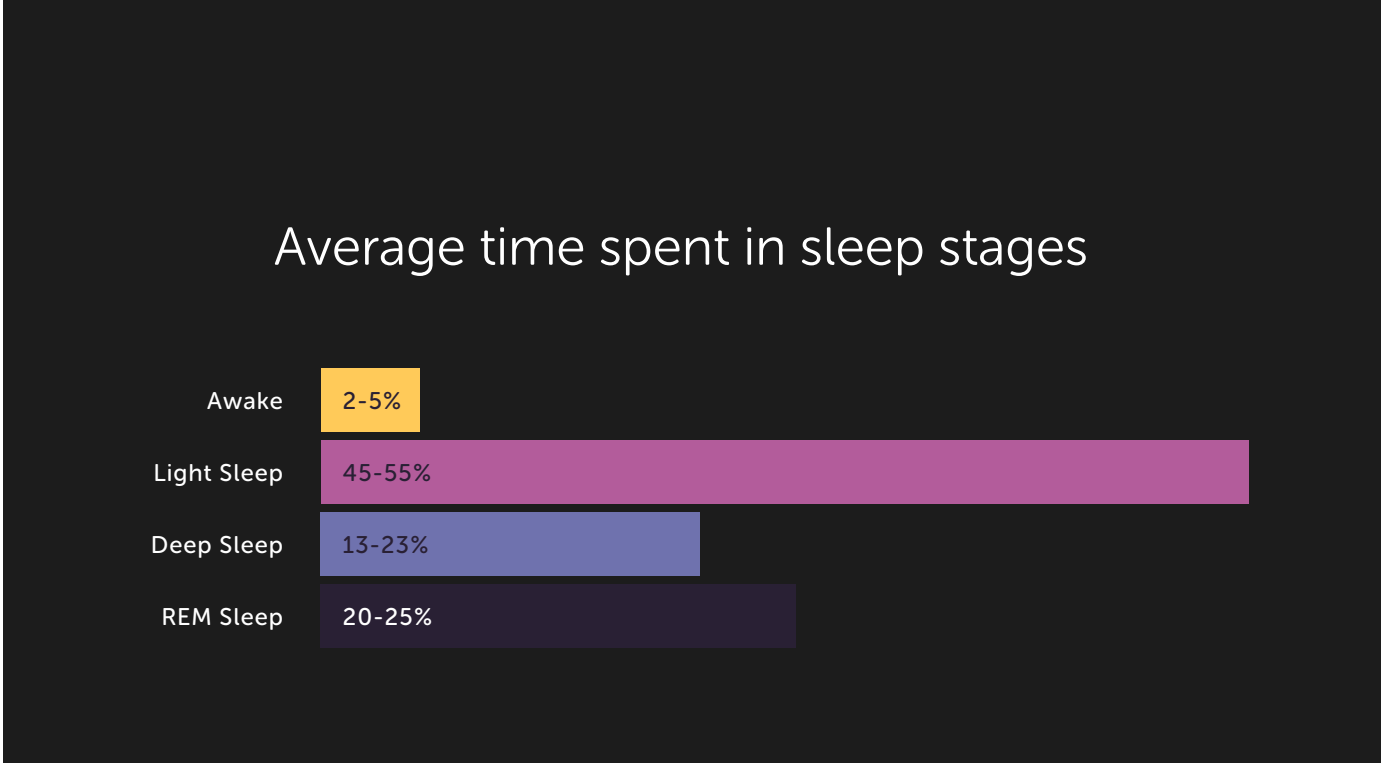
Gamma Waves / 31-120cps/Hz
Hyper brain activity and alertness, aha moments, sometimes anxiety, super clarity, above average integration of sensory information, euphoria.

Beta Waves / 13-30cps/Hz
Waking alert conscious thinking, external focus, cognition, concentration, five physical senses. Computing, arranging, organizing, making sense of external world. Prolongation of beta can lead to exhaustion, anxiety and tension.

Alpha Waves / 8-12cps/Hz
Alert and lucid but relaxed thought, daydreaming, light meditation, internal focus, receptive state, visualization, creativity, accelerated or super-learning, increased serotonin levels.

Theta Waves / 4-7.5cps/Hz
High states of creativity, subconscious creativity, deep relaxation, deep meditation, intuition, long-term memory, vivid visual
imagery, creative inspiration, free flow of ideas, REM dream and deep sleep.

Delta Waves / 1-4cps/Hz
Intuition and insight, transcendental meditation, physical rejuvenation and healing, explansive awareness. Most often found in deep dreamless sleep and unconscious states.



Stage 1: non-REM (Light): When you start drifting off, your brain waves slow and you move into alpha and theta brainwave zones. This is a light stage of sleep where you can still awake easily. In your body, your muscles begin to relax while your heart rate, breathing, and eye movements all slow down. This stage lasts for only a few minutes and prepares you for deeper slumber.

Stage 2: non-REM (Light): The majority of your sleep time is spent in this stage. Here your muscles relax further, your body temperature drops, your brain slows, and your eye movements stop. And though your mind is calm, your brain will experience sleep spindles—short, quick bursts of electrical activity that last about two seconds. These are believed to play a key role in organizing your memory.

Stage 3: non-REM (Deep): This is where deep sleep happens. Your brain starts operating more in slower delta waves. At this point, your heart rate and breathing are at their lowest points and your muscles are fully relaxed. This stage is also where a lot of key processes happen such as tissue repair, growth hormone production, and immune system optimizing. In this stage, you're conked out so you might not hear your alarm clock or your snoring spouse.

Stage 4: Rapid eye movement (REM): This is your dream state. The first happens about 90 minutes after you fall asleep. In this stage, your brain is very active and most resembles your awake state. In your body, your heart rate increases, your breathing speeds up, and your eyes, though closed, start moving more quickly (hence the name "rapid eye movement" sleep). Like non-REM, REM sleep is also important for memory and learning and seems to affect mood. The amount of REM sleep we get appears to be highest when we're infants and then declines in adulthood. If you sleep eight hours, you'll enter REM sleep about five times (every 90 minutes).

Takeaway

You pass through 3 non-REM sleep stages where your movements and mind become progressively more relaxed before entering REM sleep, where you dream. In one night's sleep, you'll cycle through all of these stages multiple times.


88
Sleep Session
Oct 11, 2020
Go-to-Sleep Soundscape
Underwater
00:22
Start Time
08:42
End Time
8h 19m
Time in bed
Sleep Stages
7hr 5m
Time Asleep
01 02 03 04 05 06 07 08
Awake REM Light Deep
Deep Sleep Intensity
152
Deep Sleep Points
01 02 03 04 05 06 07 08

Debunking some common sleep myths

Before we dive into some tips for improving our sleep, there are some common sleep stories that have been floating around for years that you may have heard. Are they true or are they false? Let's take a look (7).

1. **Everyone needs 8 hours of sleep every night.**

FALSE. The current recommendation of how many hours of sleep you need depends mostly on your age. Infants and children need a lot more sleep than adults because of the rapid pace they're growing and developing. Newborns require the most (14-17 hours a day) while older adults generally require the least amount of sleep (7-8 hours).

2. **Sleeping in on weekends will make up for the sleep you lost during the week.**

FALSE. One of the best things you can do for your sleep is to go to bed and wake up at the same time every day—yes, including on weekends. Because of our circadian rhythm, our bodies love routine and run more efficiently when they can predict our patterns.

Now that you know that we cycle through four sleep stages each night (and that we only have a few nightly opportunities for deep sleep), you can see how it's hard to make up for a deep sleep deficit during one or two mornings of sleeping in.

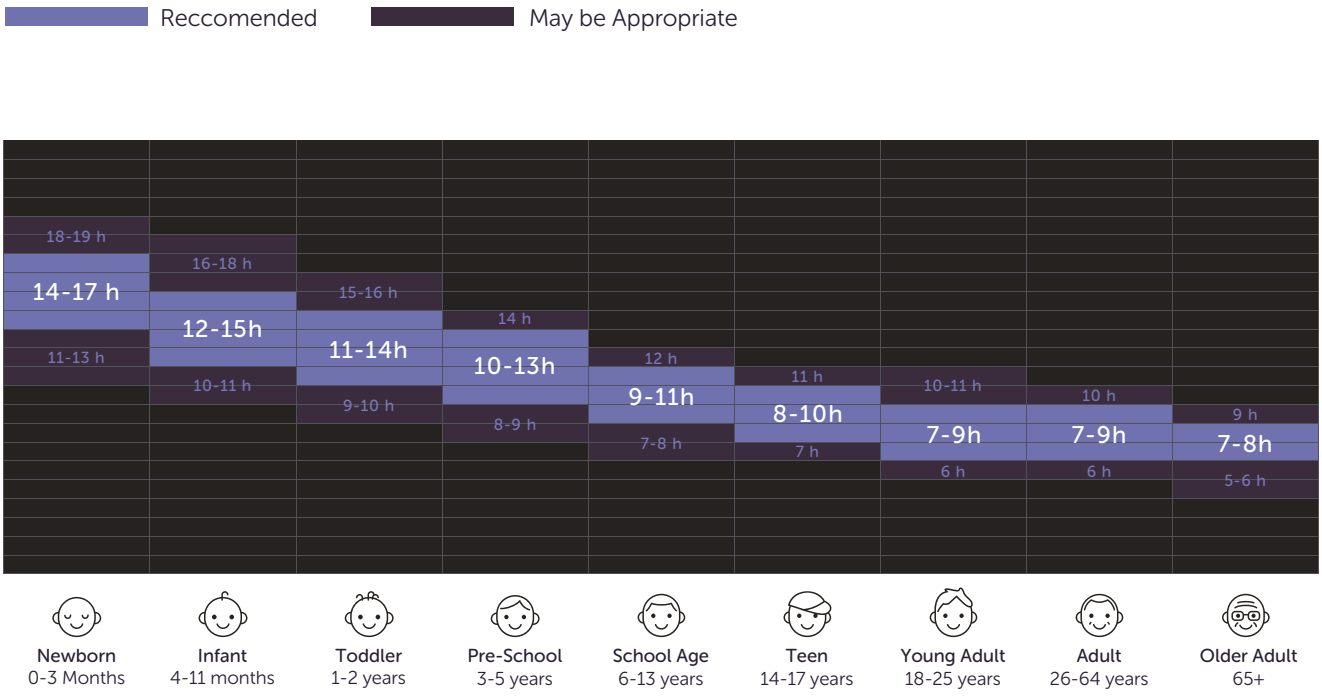
3. **Napping during the day makes up for lost sleep at night.**

FALSE. While taking a 10-20 minute "power nap" can be helpful for boosting your mid-day energy, napping for longer than 20-30 minutes at a time can be harmful to your nighttime sleep. In general, naps—especially longer ones—could keep you from sinking into the deepest stages of your sleep cycle later at night.

Takeaway

Three common sleep stories have proven to be false: that everyone needs eight hours of sleep every night, that sleeping in on weekends can make up for a sleepless week, and that napping during the day can help make up for your sleep deficit.

Reccomended sleep durations



So how much sleep do you need?

In general, **the amount of sleep you need will depend on your age and can vary even within your age group depending on your lifestyle and personal needs** (7). For example, high-performance athletes or pregnant women may require a bit more shut-eye than others. According to a national study by the Sleep Foundation, you'll generally need the most as an infant (up to 17 hours) and the least as an older adult (as little as 7) (16). And while the study provides general recommendations, it can be helpful to keep in mind that everyone's needs will vary and the wider "may be appropriate" range (indicated by the green area of the chart below) may be where you find your best rest (7).

The key first step to assessing your sleep is to observe what your sleep patterns are. With a sleep tracker, you can track the duration, quality, and phases of your sleep, along with other factors. Once you have a baseline, you have a measurement for improvement and can track your progress from there (21).

Tips for hacking your sleep

Knowing the benefits of each stage of our sleep, we can see that non-REM and REM sleep are both essential to the quality of our slumber and thus our overall health. Though there are many factors that influence our sleep including our genes, age, the stress in our lives, and medications, studies widely agree on a few best practices to help you doze off (and stay asleep) (17).

Turn off all screens at least 1 hour before bed.

Exercise daily and ideally at least 2-3 hours before bedtime.

Wake up at the same time every day.

Take a warm shower/bath or have a cup of herbal tea.

Avoid caffeine after lunch. Caffeine has a 3-5 hour half-life, which means it takes that long for your body to get rid of half the caffeine it consumed. For that reason, it can be a good idea to avoid any afternoon pick-me-ups at least 6 hours out from your bedtime (13)

Meditate daily. Science shows meditation can help reduce feelings of stress and anxiety and boost feelings of focus (24).

Tips for hacking your sleep

It's equally important to set up your sleeping environment so that you're less likely to be disturbed in the middle of the night (17).

- Make sure your room is dark enough or use a sleep mask over your eyes.
- Minimize having disruptive pets, children, partners sleep with you when possible.
- Set your room to a comfortably cool temperature.
- Reserve your sleeping space for sleep and intimacy only. Try to avoid eating, doing work, and watching TV in bed.

There's also an increasing interest in the use of binaural beats to increase focus & relaxation. A binaural beat is when you listen to two different tones (one in each ear) and your brain processes, and relaxes into, a beat at the difference of those frequencies. While more research is still needed, there has been initial studies showing that listening to binaural beats may increase relaxation, with lower frequencies (1-4 Hz) associated with deeper sleep (22).

Takeaway

For your best sleep, practices like avoiding caffeine after lunch, waking up at the same time every day, and maximizing the comfort of your bedroom, can make all the difference.

How does meditation help sleep?

Research shows that meditation, in combination with other healthy lifestyle habits, has the ability to help improve your overall sleep quality by helping you fall asleep sooner (faster sleep latency) and reducing the number of times you wake up in the night. Certain forms of meditation also appear to enhance REM sleep. **Meditation and healthy lifestyle habits can also help improve symptoms of high stress and persistent feelings of anxiousness—both of which have been shown to affect sleep quality (17).**

Like sleep, meditation activates the parasympathetic ("rest and digest") nervous system. During which breathing and heart rate decrease, and blood pressure drops, helping us feel relaxed. During meditation, we experience alpha and theta brainwave states—the same as when we're in the earlier stages of our sleep cycle. Meditation, however, is not a direct replacement for sleep, as it hasn't been shown to activate our delta brainwaves that are necessary for deep sleep. You can view **meditation as a useful tool for helping you relax, unwind, and improve the quality of nearly all stages of sleep (17).**

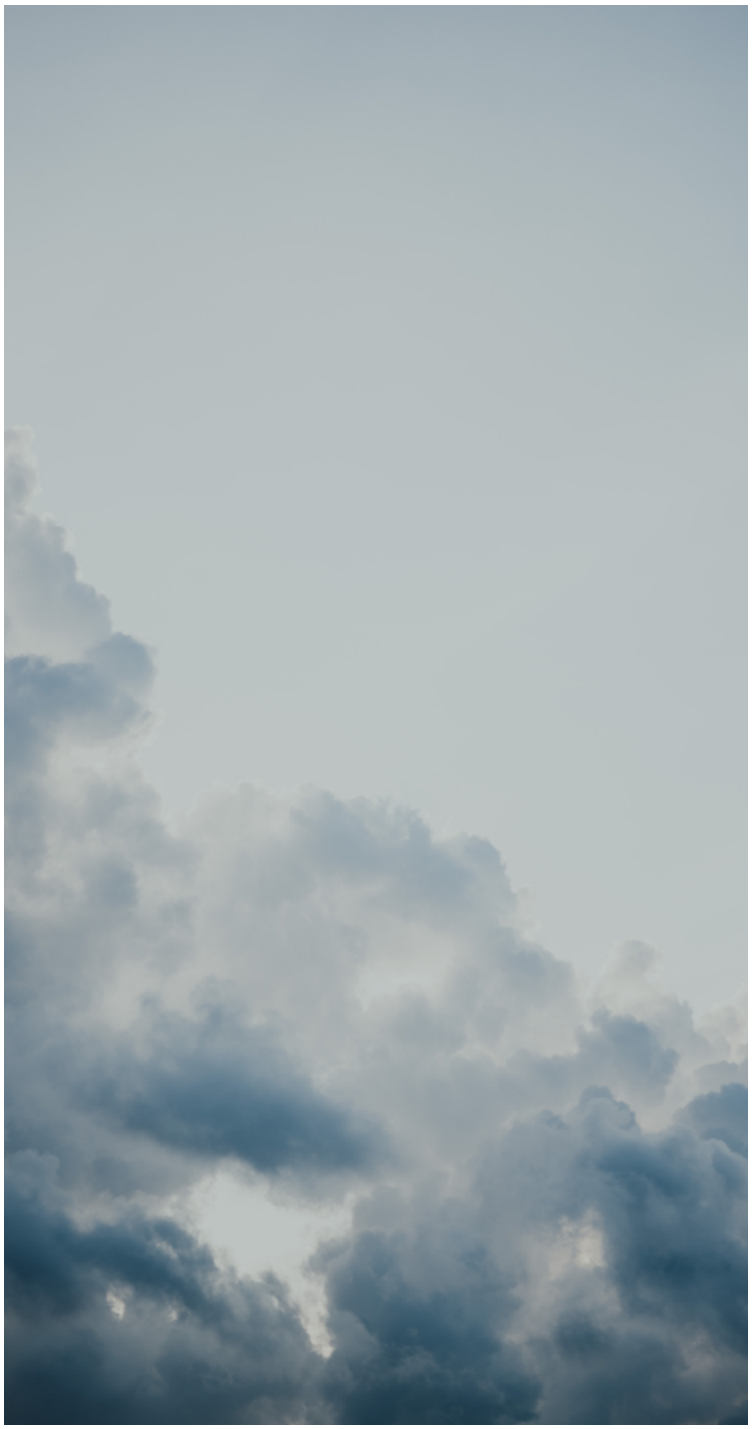
Takeaway

Meditation in combination with healthy lifestyle factors can help us sleep better by reducing feelings of stress and anxiety that keep us awake, as well as help improve nearly all stages of sleep through activating our ‘rest and digest’ nervous system.

Chapter four:

Hack your dreams

> Our dreams are reminders that we too were (and still are) protoconscious. We are always ourselves in our dreams; we sense, we act and we feel vividly in an entirely fictive world of the brain's devising.
>
> - J. Allan Hobson



What happens in our brains when we dream?

From floating through the ether to meeting fantastical creatures, we've all experienced the wild and magical worlds that appear when we dream. Some of us scour dream books to deduce their meaning, while others of us write them off as meaningless fiction. Some theorists even say they help us consolidate memories, process emotions, and simulate threatening situations (so that we can be more prepared when they happen) (23). While further research into these theories needs to be conducted, what we do know is what happens in our brains while we sleep.

Dreaming primarily happens during REM. In this stage, our minds get a lot more active. You experience REM every 90 minutes while sleeping and each subsequent REM cycle is a bit longer than the one before. Your first REM cycle might last around ten minutes and your last might be closer to an hour. This is why many people experience most of their dreaming in their last REM cycle just before waking (7).

When dreaming, we experience alternate realities that often don't happen in our normal, waking life. We see things that don't exist, often become confused about time and place, and we can have wildly fluctuating emotions. Then, the next morning, we seem to quickly forget most of it. And despite their ephemeral nature, dreams seem to be both a normal and useful biological and psychological process (18).

Takeaway

When we dream, we are in our most active sleep stage, REM, which we cycle through multiple times every night. In dreams, we can experience alternate realities that don't happen in our waking life.

What are the benefits of dreaming?

There is a lot more research needed to uncover all of the reasons why we dream, however, there are a few benefits we think dreaming offers. It appears that dreaming is not just an adventure of the mind, but can offer some brain boost as well. Two of the main benefits are (18):

Creativity

When dreaming, the brain begins to synthesize the information we learned that day with the deep library of knowledge we already have stored. It starts connecting related pieces of information and creates a sort of web of associations that can help us apply new insights to problems we've been stumped on. This can be why we're often recommended to "sleep on it" when we have a big decision to make.

Overnight therapy

Dream sleep can help take the painful sting out of tough moments from our day. In a sense, sleep helps dissolve bitter feelings we have from an experience, helping us wake up the next morning feeling better.

What is lucid dreaming?

Have you ever woken up in your sleep only to realize that you were actually still asleep and dreaming? Lucid dreaming is when your subconscious is dreaming and your conscious self wakes up so you become aware of your dream while it's still happening (19).

Though the term was first coined by Dutch psychiatrist Frederik Van Eeden back in 1913, researchers were still skeptical of lucid dreaming's validity until the 1970s and 1980s when studies began to surface saying that lucid dreamers were, in fact, lucid. Today, we know that up to 55% of people have experienced a lucid dream at some point in their lifetime, while 23% experience lucid dreams at least once a month.

In lucid dreamers, there also appear to be some different physiological effects in the body. When lucid, many experience increased respiration and heart rate, different brainwave features as shown on an EEG, and a noticeable hybrid sleep state where the dreamer experiences some REM features and some wake features in certain parts of the brain.

Takeaway

Lucid dreaming is when your subconscious is dreaming and your conscious self wakes up so you become aware of your dream while it's still happening.

Are there benefits of lucid dreaming?

You've probably heard of many people trying to lucid dream. But why would you want to? It turns out there are a number of potential benefits of the conscious dream state that have been studied over the years, including (19):

1. **Fewer Nightmares:** Lucid dreaming appears to decrease the frequency and intensity of nightmares.

2. **Increased Performance**: From studying athletes, there is some evidence that lucid dreaming can help improve motor skills. They can allow athletes to further explore certain physical skills with minimal injury as well as help them acquire new skills.

3. **Enhanced Creativity**: Similar to a normal dream state, it's been hypothesized that lucid dreams boost creativity and problem-solving abilities as well, wherein one can ask a character in their dreams for advice.

How can you ack your dreams? Lucid dreaming 101

Dream recall is the ability to remember what happens in your dreams. But, for most of us, this is hard to do. Usually upon waking, all those colors, details and feelings from your dreams seem to quickly evaporate. In fact, according to Scientific American, the average person forgets about 50% of their dream upon waking and just ten minutes later, that number can be as high as 90%. And shortly thereafter, the dream seems to disappear almost like it never happened (20).

Because of the many benefits of lucid dreaming, researchers have looked into whether it can be induced or taught. It turns out there are ways we can, in fact, induce more of the lucid state as well as bring more of our dream world into our waking life (19).

> Nighttime can seem longer than the day when you dream big dreams. Daytime lasts longer for people who make their dreams come true

1. **Record your dreams.** Keep a pen and pad (or journal) at your bedside so that upon waking you can quickly jot down anything you remember about your dreams. Since dreams disappear so quickly, it's helpful to be ready to record right when you wake up. This can also help build awareness of your dreams in general.
2. **Practice good sleep hygiene.** Since lucid dreaming mostly occurs during REM cycles and usually not until the later part of the night, improving your sleep quality is key. This starts with your pre-bed routine. Try to start winding down an hour before bed by turning off all your screens, quieting your mind with reading or the like, and letting your body relax.
3. **Try the MILD technique.** Mnemonic Induction of Lucid Dreaming (MILD), coined by researcher Stephen LaBerge, refers to setting an intention to remember to do something. Start by remembering a past dream (ideally one that you have just awakened from). Then see if you can identify a "dreamsign," or something in your dream that helps you realize it was a dream. Next, visualize returning to the dream, recognizing this dream sign, and mentally saying: "The next time I'm dreaming I want to remember to recognize what I'm dreaming." This is easier said than done, but gets easier with practice.
4. **Meditate.** Research shows that those who meditate experience more lucid dreams than those who don't. In a 2018 study, 48.6% of non-meditators reported never having a lucid dream compared to only 23.6% of long-term meditators. Additionally, about 13%

From sleep to dreaming, there's a lot that happens when we close our eyes for the night that's key to our overall health and wellbeing. And with 40 million Americans suffering from over 70 different sleep disorders, we know there's a lot of room to improve the quality and quantity of our slumber.

While sleep trackers alone are not a silver bullet to solving all of your sleep problems, using an accurate sleep tracker to gain deeper insight on the quality of sleep you are actually getting can be a key first step to helping you feel more energized, refreshed, and focused. The in-depth overnight tracking data Muse S provides can show you where you can improve and tweak your bedtime routine to start shifting toward deeper, more restorative sleep. With lab-grade precision and brain-powered insights, our new sleep features can help you find your best rest from the comfort of home.

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Resources

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