

## SLEEP-WAKE CYCLES FOR TEENAGE ONLINE GAMERS

**Joshua Maudsley, Christina Driver\* and Daniel Jamieson**

*Thompson Institute, University of the Sunshine Coast, Birtinya, QLD, Australia*

### YOUNG REVIEWERS:



**HARRISON**

AGE: 10



**OLI**

AGE: 10

Did you know that sleep is one of the most important parts of your day? Sleep helps your body to recover from your busy day and leaves you energized and ready for the next. While sleep is critical for people of all ages, it is perhaps the most important for teenagers. Teenagers who get enough sleep are helping their brains become stronger and better connected. This helps them to get better grades at school, to make helpful decisions at home and school, to continue to grow bigger and stronger, and to feel happier. Unfortunately, online gaming before bedtime is making it hard for some teens to get the sleep they need to enjoy all of sleep's benefits. So, put away those consoles before bed, to give your brain the best chance of making you smarter, stronger, faster, and happier!

On average, you will spend about one-third of your life asleep. If you are 15 years old, that means you have spent about 5 years of your life sleeping. While scientists are still discovering the exact purpose of sleep, there is no denying that it is an incredibly important part of life. Sleep helps your body recover from your daily activities and gives your

### NON-RAPID EYE MOVEMENT SLEEP (NREM)

Includes three stages of sleep in which we gradually become less responsive.

### RAPID EYE MOVEMENT SLEEP (REM)

A stage of sleep following NREM where our eyes move rapidly. During this stage of sleep our bodies and brains are able to recharge and develop.

### HIPPOCAMPUS

A seahorse shaped part of our brain which is involved primarily in short- and long-term memory.

### CORTEX

Outer layer of the brain.

### Figure 1

The hippocampus (blue) acts as the short-term memory storage for the experiences of the day (like a USB). During NREM sleep, the day's data is transferred into long-term memory storage in the cortex of the brain, allowing the brain to learn new things again the following day (Created with BioRender.com).

brain a chance to rest and prepare for the next day [1]. We have all experienced how important sleep is for the ability to function, and we are all aware of the effects of not having enough sleep!

As our lives become more connected through the internet, online gaming is becoming more common and is very popular, particularly with teenagers. Part of the attraction of online gaming is that it can be done at any time or place. While it is great to be able to access these games and communities whenever we like, online gaming late at night can have some disastrous effects on sleep and even the development of the brain [2].

## WHAT IS SLEEP AND WHY DO WE NEED IT?

Sleep is an incredibly important part of our lives. While we might not realize it, each night we go through several different sleep stages, which help our bodies to rest and recover. There are two main parts of the human sleep cycle. These are known as **non-rapid eye movement sleep (NREM)** and **rapid eye movement sleep (REM)**. NREM sleep includes three sub-stages of sleep, which get deeper and deeper, meaning brain activity becomes slower, and it becomes harder to wake the person up. NREM sleep helps the body to recover from the day and allows memories from the day to be moved from a short-term memory-storage area called the **hippocampus** (like a USB flash drive with a small storage capacity) (Figure 1), to a long-term hard-drive-type storage area located throughout the **cortex** (the gray-colored outer layer of the brain), with limitless storage capacity. If we don't transfer the memories from the brain's short-term USB each night, we won't have the space to create new memories effectively the next day. This would make it harder to learn new things [3].

During REM sleep, the eyes start to move around quickly (hence the name "rapid eye movement"). REM sleep is the stage of sleep when

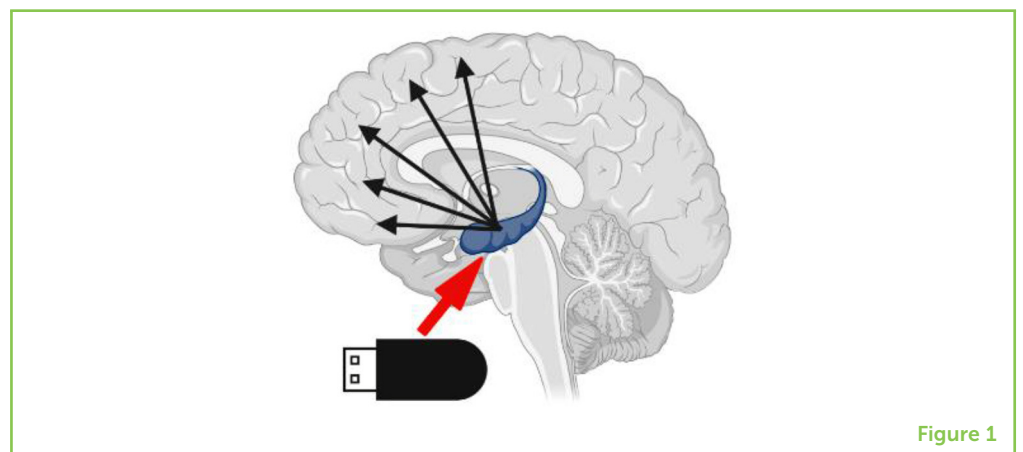


Figure 1

most dreaming occurs. Have you ever experienced the feeling of trying to run away from something in a dream, but you can't get your legs to move fast enough? This is because our bodies enter a sort of paralysis when we are in REM sleep, which means our bodies do not want to move. This paralysis stops us from acting out our dreams, which could be dangerous! Because the amount of time spent in the REM stage of each sleep cycle increases toward the end of the night, the longer you are asleep each night, the more REM sleep you will get (Figure 2) [4].

### Figure 2

Sleep cycles take around 90 min. REM sleep occurs at the end of each cycle. The amount of time spent in REM sleep gets longer each cycle, meaning that the last two REM stages account for around 60% of a person's REM sleep each night! The first REM stage may only last for about 5–10 min. The last REM stage lasts about 1 h. If people only get 6 h of sleep, they miss out on around 60% of their REM sleep. Getting a full night's sleep is very important (Created with BioRender.com)!

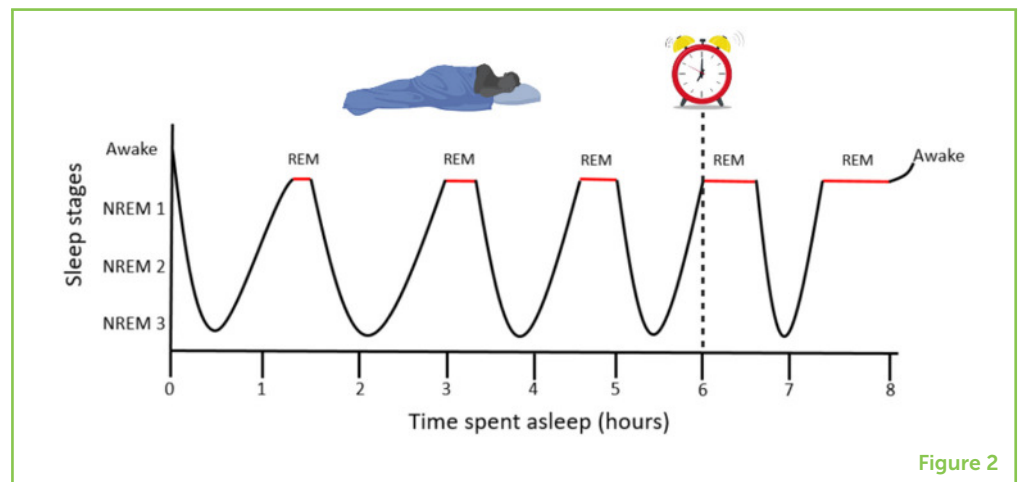


Figure 2

REM sleep has been shown to be very important for creativity. When people (or animals like mice) are presented with a problem that they can't quite figure out, studies show that after getting good REM sleep that night, they are far more likely to wake up the next morning with the ability to solve the problem [3]!

## HOW DOES THE BODY KNOW WHEN TO SLEEP?

Most of us will agree that sleep typically happens at night. This preference is programmed into our behavior, with our brains telling our bodies when to go to sleep. A special part of the brain called the **suprachiasmatic nucleus (SCN)** (Figure 3) is in charge of starting the sleep cycle each night. This sleep cycle is called the **circadian rhythm** and it repeats roughly every 24 h [4]. While children and adults tend to fall asleep easily, teenagers may lie in bed for a long time, trying to fall asleep. This is because the teenage circadian rhythm is delayed, causing teenagers to become tired later in the evening and to want to sleep later in the morning. This shift in circadian rhythm happens because of the delayed release of a hormone called melatonin [5]. Hormones are chemical messengers that are released into the bloodstream to send messages throughout the body.

Melatonin is released into the blood stream by a part of the brain called the **pineal gland** (Figure 3) and this hormone's job is to get the brain

### SUPRACHIASMATIC NUCLEUS (SCN)

A brain structure involved in the regulation of circadian rhythms.

### CIRCADIAN RHYTHM

A biological rhythm which occurs once every 24 h.

### PINEAL GLAND

A part of the brain responsible for releasing the hormone, melatonin.

### Figure 3

Sunlight (or artificial light from a gaming device) enters the eye and travels along the optic nerve to the built-in clock in the brain called the suprachiasmatic nucleus (SCN). The amount of light detected by the SCN tells the pineal gland when it is time to release melatonin and get the body and brain ready for sleep (Created with BioRender.com).

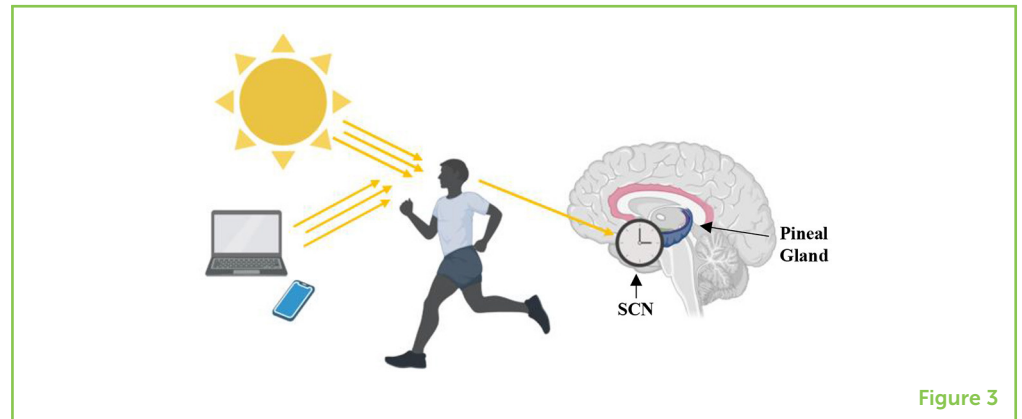


Figure 3

and body ready to go to sleep. While melatonin in the brains of adults is released at around 10 PM, for teenagers it may not be released until 1 AM! This can make it really hard for teenagers to fall asleep at the same time as their parents. It's no wonder that teenagers have so much trouble getting up early for school!

The teenage brain is an incredible piece of hardware that undergoes important development during the teenage years. During adolescence, the teenage brain can change and adapt to different experiences. One way this happens is through a process called **myelination**. Thanks to myelination, the cells of the brain, called neurons, communicate with each other at an increased rate. If you think of neurons like a slip'n'slide, myelination is like putting lots of soap and water on the slip'n'slide, helping the messages that are sent around the brain to travel much faster. Increased myelination also helps people to think more deeply, to problem solve, and to plan for the future—all things that teenagers can definitely have some problems with! REM sleep plays a key role in helping this brain development to occur [6].

Because of all these benefits of sleep, it is no wonder teenagers are always being encouraged to get enough sleep. Scientists have determined how much sleep people of various ages need to be healthy and happy (Table 1). The data indicate that teenagers should be getting 8–10 h of sleep each night. Unfortunately, many teenagers today are not getting the recommended amount of sleep, and there are many things that can distract teenagers from getting enough sleep. One of these is online gaming.

## HOW DOES ONLINE GAMING EFFECT TEENAGERS' SLEEP?

Due to school and family schedules, many teenagers spend a lot of time online at night. While it is both normal and acceptable to play online games, it can become a problem when the gaming starts to affect your life. You might be playing games online so much that you

### MYELINATION

Insulation that wraps around the connections of the brain helping brain signals to move more quickly.

**Table 1**Recommended sleep durations<sup>a</sup>.

	Age range	Recommended sleep (hours)
Newborn	0–3 months	14–17 h
Infant	4–11 months	12–15 h
Toddler	1–2 years	11–14 h
Preschool	3–5 years	10–13 h
School-age	6–13 years	9–11 h
Teen	14–17 years	8–10 h
Young adult	18–25 years	7–9 h
Adult	26–64 years	7–9 h
Older adult	65+	7–8 h

<sup>a</sup><https://www.sleepfoundation.org/articles/how-much-sleep-do-we-really-need>.**Table 1**

are not getting enough sleep, are missing out on social events, or are finding yourself constantly thinking about gaming online instead of doing your schoolwork.

The overuse of internet gaming is a real problem in terms of teenagers' sleep quality. As well as reducing the amount of sleep teenagers get, playing online games at night also affects the brain in ways that carry on well after the console or device is turned off. Mobile phones, tablets, computer screens, and televisions all produce a special kind of light called blue light. Looking at blue light during the day keeps us alert and awake, but too much blue light at night can confuse the SCN into thinking that it is still daytime, which delays the release of melatonin. This delay in melatonin release can disrupt what is already a delayed circadian rhythm, leading to shorter sleep duration, and particularly to reduced REM sleep (Figure 2), which is vital for teenage brain development [7]. This is why a person may not feel tired right after leaving a screen. The excitement that comes with playing your favorite online games has also been shown to stimulate the brain and keep you awake when you should be asleep. This means that simply switching to 'night mode' is not very helpful, unfortunately. Scientists have also discovered that a lack of sleep in the teenage years puts people at higher risk of developing mental disorders and may even affect the way that their brains fully develop.

## SUMMARY

Late-night online gaming has clear and harmful effects on our sleep patterns. This is particularly problematic for teenagers, who already have a delayed sleep cycle. By overusing online gaming, particularly at night, gamers run the risk of delaying the production of melatonin, which can reduce the all-important REM sleep cycle. If teenagers continually do not get enough REM sleep, brain development can be affected, which can impact their adult lives. When gaming online, teenagers should think about the time during which they are gaming, and how close it is to bedtime. Teenage gamers should make sure that

they are giving their brains enough time to switch off before it's time to go to sleep.

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**SUBMITTED:** 14 February 2021; **ACCEPTED:** 28 April 2022;

**PUBLISHED ONLINE:** 24 May 2022.

**EDITOR:** Gideon Paul Caplovitz, University of Nevada, Reno, United States

**SCIENCE MENTOR:** Marian Berryhill

**CITATION:** Maudsley J, Driver C and Jamieson D (2022) Sleep-Wake Cycles For Teenage Online Gamers. *Front. Young Minds* 10:667856. doi: 10.3389/frym.2022.667856

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## YOUNG REVIEWERS

### HARRISON, AGE: 10

My name is Harrison and I am 10 years old.



### OLI, AGE: 10

My name is Oli and I am 10 years old.



## AUTHORS

### JOSHUA MAUDSLEY

Josh is a Secondary School Assistant Principal and Psychology teacher on the Sunshine Coast, Queensland. He has a background in Psychology and is currently engaging in post-graduate study in Mental Health & Neuroscience at the University of the Sunshine Coast, Thompson Institute. Josh is passionate about student wellbeing as well as the responsibility of educational institutions in providing mental health literacy and support for adolescence. \*joshua.maudsley@bne.catholic.edu.au



### CHRISTINA DRIVER

Chrissie Driver is a lecturer in Mental Health and Neuroscience on the beautiful Sunshine Coast, Queensland, Australia. Chrissie is passionate about youth mental health and understanding the developing adolescent brain and is part of the youth mental health research team at the Thompson Institute, USC. She also has her own two lively teenagers at home who share her passion for science and the developing brain! \*cdriver@usc.edu.au



### DANIEL JAMIESON

Daniel completed his Ph.D. at the University of the Sunshine Coast Thompson Institute. Daniel's research focuses on the impact of sleep on adolescent brain development and mental health. Daniel looks forward to continuing his research at the Thompson Institute focusing on circadian rhythms in young people.

