Sleep is a fundamental function of the human body and it is crucial for our well-being and health. Most people are not aware of the importance of sleep. Only few adopt good sleep habits and sleep enough hours. This can lead to several consequences, such as problems with attention and memory and the development of diseases. Each one of us has an internal rhythm that changes as we develop. Respecting the number of hours of sleep needed by our bodies is crucial. The practice of good sleep habits can help us have a good night’s sleep. However, some sleep problems can be more difficult to treat and a sleep specialist might be necessary to evaluate the situation and provide the appropriate treatment. Understanding
sleep and recognizing its importance will help you to sleep better and, ultimately, to have a healthy life.

Sleep is essential for our well-being and health. It is a natural and basic function important for all organisms, from microorganisms to plants to humans, independent of gender, ethnicity, age, or culture. Even many years ago, Greeks and Romans worshiped gods associated with sleep, like Hypnos and his Roman equivalent, Somnus. Poor sleep is for humans what Kryptonite is to Superman: it weakens us. It is not by chance that, on average, one third of our day is spent asleep.

HOW DO OUR BODIES KNOW WHEN TO SLEEP?

Sleep is a fundamental biological function, highly regulated by (1) circadian rhythms, which are 24 h cycles that regulate the internal processes of our bodies, and (2) sleep homeostasis, which is the “battery” that regulates our energy levels and tells us when to sleep and when to awaken.

Circadian rhythms are cycles of approximately 24 h (from the Latin *circa* — “about” — and *diem* — “a day”) that underlie all the biological and behavioral functions of our bodies. Each cell of the body acts as a biological clock, meaning that we all have multiple clocks inside our bodies, in all tissues and organs. These biological clocks organize the day into 24 h, assigning specific functions, such as sleeping, to specific times of the day [1]. The timing of these clocks is set by a master clock located in the brain. Biological clocks are also affected by the condition of the body, such as its energy level, and on factors in the external environment, such as the amount of light or oxygen that is present or the amount of physical activity that is being performed. One example of a function regulated by biological clocks is body temperature, which is highest between 4 and 6 p.m. and lowest around 4 a.m. Activity and sleep patterns are also regulated by biological clocks. During the day, we are usually more alert and active: eating, playing, working, moving, etc., while during the night, we are less active and more predisposed to sleep.

When the day starts, we are often full of energy, but this energy decreases as the day goes on and at night we feel more tired, because our bodies need to sleep. During sleep time, the body uses energy to perform maintenance and repair, recharging our batteries (Figure 1). Superman also needs to recharge his powers under the sun. So, we sleep when our biological clocks tell us to, and when our batteries are empty. We wake up when our batteries are fully charged. This cycle repeats every 24 h.
Day/night cycle of the body. During daytime, with sunlight, we are more likely to perform activities that require more energy from our batteries (orange represents high energy levels in the battery). Energy levels decrease throughout the day (yellow represents low energy in the battery), and at night, body temperature decreases and the brain produces a sleep signal called melatonin, telling us that we need to sleep to recharge our batteries.

**SLEEP IS IMPORTANT!**

Most people are not aware of the importance of having good sleep habits, and only a few sleep enough hours to recharge their batteries. Sleeping less than what your body needs, which is called sleep deprivation, has severe consequences. In the short term, sleep deprivation can cause irritability, poor memory, concentration problems, headaches, and decreased immune defenses. In the long term, sleep deprivation can lead to an increased likelihood of developing certain diseases, including heart disease, obesity, and brain disorders. This also happens to Superman—his powers diminish when he is not exposed to the sun for a long time. The necessary number of hours of sleep needed to fully recharge our batteries varies from person to person and from age group to age group. The National Sleep Foundation, an American organization created to improve health and well-being through sleep education, recommends a suitable number of hours for each age group (Figure 2) [2].

Respecting the number of hours of sleep that our bodies need is very important. However, it is equally important to understand when we should sleep. Each of us has our own internal rhythm, called a **chronotype**, defined by our internal clocks. Our chronotype determines when we like to sleep [3]. Two main chronotypes, called morningness (being most active and alert in the mornings) and eveningness (being most active and alert in the evenings), are the two extremes. However, chronotype also changes as we

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**CHRONOTYPE**

Inner time preferences, set by our internal clocks, that determine when we are alert and productive during the day, either in the early morning hours or later in the day.
get older. Preteens and many elderly people usually experience morningness, while adolescents commonly experience eveningness. Indeed, many teenagers feel excessively sleepy during the day because they have difficulty falling asleep at night and waking up early in the morning.

**WHAT IS SLEEP HYGIENE?**

Taking too long to fall asleep, sleep disturbances, and daytime sleepiness are the most obvious signs of poor sleep hygiene. Good sleep hygiene includes habits and practices that help you to have a good night of sleep [4] (Figure 3). For example, going to bed and waking up at regular times. Even in exceptional cases, it is important not to go beyond 2 h from our regular routines, as it may deregulate our internal clocks and lead to difficulties falling asleep or waking up at specific hours. Physical exercise is also important to improve sleep quality. However, exercise acts as a stimulant and should be avoided close to bedtime. Similarly, other stimulants, such as chocolate and caffeinated drinks, keep our brains awake and should also be avoided close to bedtime.

Sleeping conditions should also be considered, such as the bedroom’s temperature (16–18°C or 61–64°F), its comfort, and its lighting. Bright light from lamps, cell phones, and TV screens should be turned off and electronic devices should be left out of the bedroom. Even before going to bed, the excessive use of electronics and bright lights should be avoided. Why? At dusk, our brains start to prepare our bodies
Sleep hygiene. In order to have a good night’s sleep, it is important to adopt sleep hygiene habits shown here.

**MELATONIN**
Called the sleep hormone; a chemical signal produced by the brain in response to the absence of light that makes us feel sleepy.

**BE AWARE OF SLEEP DISORDERS**
Sleep disorders can cause difficulties with falling asleep or staying asleep, affecting the quantity and quality of our sleep. There are over 80 diagnosed sleep disorders [5] (Table 1). These can be caused by irregular sleep schedules, caffeine or alcohol, drugs, aging, a genetic predisposition, or the presence of other medical conditions, such as anxiety or brain disorders. We can imagine these disorders as Kryptonite, which weakens Superman and puts Metropolis city into serious danger.

If good sleep hygiene does not improve ongoing sleep difficulties, consulting a medical doctor or a sleep specialist should be the next step. First, the medical doctor will talk with the patient and evaluate his/her sleep habits, sleepiness during the day, presence of diseases,
Table 1

| Sleep Disorder Categories                        | Characteristics                                                                 |
|-------------------------------------------------|----------------------------------------------------------------------------------|
| Insomnia                                        | Most prevalent sleep disorder worldwide. It consists on the inability to fall or stay asleep and/or a poor-quality sleep. |
| Sleep-related breathing disorders                | Involve difficulties in breathing during sleep, promoting frequent awakenings. It includes Obstructive Sleep Apnea. |
| Central disorders of hypersomnolence             | Excessive sleepiness that is not caused by sleep problems or abnormal circadian rhythms. |
| Hypersomnia                                      | Patients fall asleep at inconvenient or even dangerous places, such as at work or while driving. |
| Circadian Rhythm Sleep-Wake Disorders            | The patient’s sleep pattern (chronotype) is very early or very late, as Delayed Sleep Phase Syndrome. |
| Parasomnias                                      | Unwanted movements, behaviours or dreams while falling asleep, sleeping or waking up. These include sleepwalking (somnambulism), a sleep disorder that is very common in kids. Sleepwalking means getting up and walking or carrying out activities while sleeping. Most kids have sleepwalking episodes occasionally and outgrow it by the teen years or when they reach adolescence. |
| Sleep Related Movement Disorders                 | Conditions that cause simple involuntary movements, as leg movements, that disturb sleep or its onset. |
| Other sleep disorders                            | Other disturbances that do not fit into any of the classification sections above but that impact on sleep, such as sleep disturbances associated with other medical conditions. |

and current medication. If bad sleeping habits are detected, the doctor will advise the patient to change those habits to promote better sleep hygiene. If bad sleeping habits are not the problem, the patient must be further evaluated. Sleep might be monitored at home or at a Sleep Unit, using electronic devices. If a sleep disorder is diagnosed, there are several treatments that might be followed depending on the diagnosis. For example, a medical doctor might prescribe medication containing melatonin, if indicated. The status of the patient will be monitored by the Sleep Unit throughout the treatment and, depending on how the patient does, medication can be adjusted or removed. Other treatments might involve wearing devices during sleep, such as masks that help breathing while sleeping, or a psychologist to help people to sleep better.

To finalize, we recommend you to see this video where you can review all about sleep!

Video—Animation on the importance of sleep, developed together with the Portuguese Sleep Association.
SLEEP WELL, SLEEP TIGHT

Now that you know how, when and why our bodies need to sleep, habits and practices that help to sleep better or that, on the contrary, disturb a good sleep night, existent sleep disorders and what to do in those contexts, there are no excuses to not have a good night of sleep! Do not let a bad sleep night be your kryptonite, superhero!

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YOUNG REVIEWERS

ALBA, AGE: 8
My name is Alba. I am 8 years old and I am from Córdoba, Spain. My hobbies are dancing, singing, cooking, and playing with my brother. When I am older, I want to be either a teacher or a singer, a dancer, or an actress.

MARTINA, AGE: 8
My name is Martina. I am 8 years old and I am from Spain. My hobbies are drawing, listening to pop music, and skating. When I am older, I want to be a teacher or a famous painter.

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Laetitia Gaspar received a Bachelor’s degree in Genetics and Biotechnology from the University of Trás-os-Montes e Alto Douro (2014) and a Master’s in Cellular and Molecular Biology from the University of Coimbra (2016), Portugal. Laetitia has since been working in the sleep field, on Obstructive Sleep Apnea (OSA), one of the most common but highly undiagnosed sleep disorders. For her Ph.D., Laetitia is exploring OSA’s impact on cells, while searching for new strategies to improve OSA diagnosis. She has also been actively involved in several initiatives to improve awareness of the importance of sleep.

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Ana Santos-Carvalho is a Ph.D. researcher and science communicator in Health Sciences. Ana studied the protective role of a brain signal in the retina (the back of our eye that senses light and sends information about it to the brain). After her Ph.D., she developed an interface between schools and research centers in Portugal’s Institute for Education and Citizenship. Later, she began working with a research team studying sleep disorders. Currently, Ana is coordinating science communication at Institute for Interdisciplinary Research at the University of Coimbra.

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