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# WHAT IS SLEEP?

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## AN INTRODUCTION TO SLEEP

This chapter will tell you everything you wanted to know about sleep but were too sleepy to ask.

### WHY DO WE SLEEP?

If I could tell you the answer to that question I would not be writing this book I would be sitting at home polishing my Nobel prize. The honest answer is that despite years of research we have yet to fully understand the functions of sleep in humans, or in any species for that matter. Numerous theories have been developed over the years as to why we need to sleep; from energy conservation to repair and recuperation, but none provide a comprehensive explanation. A recent study showed 952 genes to be involved in insomnia but their existence explains less than 10% of the overall chance that a person will have insomnia, showing just how little we actually know. Indeed, the more we find out about sleep, the more complex it becomes.

Essentially if it has got a brain it sleeps, if it is a mammal its sleep is recognisably similar to ours. Animals sleep after they have satisfied all their biological needs, essentially if they have had enough food and water to survive, are in a safe place and, when appropriate, have taken the opportunity to ensure the survival of the species, then they will sleep. This is perfectly illustrated by the three-toed sloth which was thought to need 16 hours sleep a day. However, when someone bothered to study them in the wild, rather than observing them in captivity, they were actually found to sleep less than 10 hours a day. The difference simply was that in captivity they had all their needs met, and so didn't have to spend time looking for food, water, and so on.

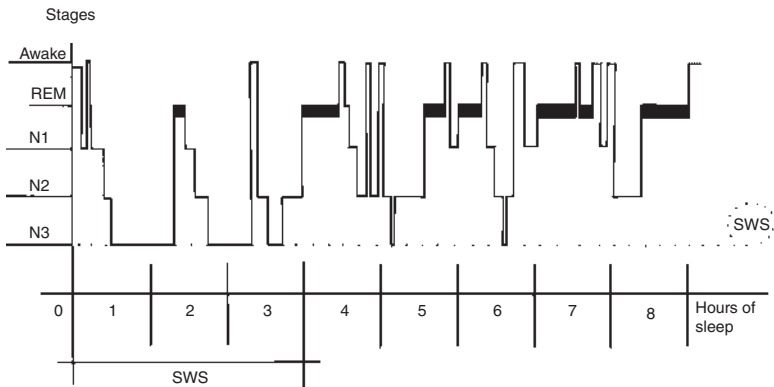
## WHAT IS SLEEP?

What is that thing that Shakespeare called

*The death of each day's life, sore labour's bath, Balm of hurt minds, great nature's second course, Chief nourisher in life's feast.*

**(Macbeth)**

Sleep is divided into two distinct states, Rapid Eye Movement (REM) sleep and non-REM sleep, with non-REM sleep being further divided into three stages; N1, N2, N3, each of increasing depth. During the night you pass through the four sleep stages: N1, N2, N3, and REM sleep in what are known as 'sleep cycles'. Sleep progresses cyclically from N1 through to REM, then begins again with stage N1. Each sleep cycle lasts approximately 90 to 110 minutes in adults. The first couple of sleep cycles have long periods of uninterrupted deep N3, or Slow Wave Sleep (SWS), with relatively short REM periods. Later in the night the REM periods lengthen and SWS



is mostly absent. Thus, the first third of the night is predominantly SWS sleep and the later part of the night is spent in the lighter stages, N1, N2, and REM sleep. On the previous page is stylised representation of a night's sleep for an adult showing the distribution of the various sleep stages across the night.

Stage N1 (3–7% of sleep) is the lightest stage of sleep and is the transition between wake and sleep. It is the type of sleep that you have at the start of the night when you feel you are drifting in and out of sleep. When you are in stage N1 sleep you can be woken easily, and indeed if you are awakened you will probably claim not to have been asleep. During the transition from wake to sleep, many people experience sudden muscle contractions or 'jerks'; a sensation of falling or a 'presence', benign or otherwise, in the room. Falling asleep is not like switching off a light bulb. There are a number of complex processes that need to occur, and these so-called hypnagogic events seem to be 'glitches' in the preparation for sleep. Although they may be perceived as worrying or scary they are in fact normal and harmless. N1 is also the sleep stage you are in when you are dipping in and out of when you wake in the middle of the night and feel you have been awake for hours.

Stage N2 accounts for 45–50% of sleep and, although it is the biggest single portion of sleep, it is the stage which we know least about. It is known to play a part in memory but as yet we do not completely understand why we spend half the night in this stage.

As sleep becomes deeper, slow brain waves (called delta waves) start to appear and we enter N3 or SWS (20–25% of sleep). N3 is the deepest stage of sleep and when someone is in SWS it can be very difficult to wake them. SWS is believed to be most closely linked with the restorative processes of sleep and is thus the part of sleep

that makes you feel like you have had a good sleep. It also plays a key role in making you feel well rested and energetic during the day. SWS is important for memory and learning and it is for this reason that children have proportionally more SWS than adults, as well as the fact that SWS is the only time that you physically grow. It is during SWS that some people, particularly children, experience behaviours (known as parasomnias) such as bedwetting, sleep talking, sleepwalking or night terrors. Both short and long sleepers essentially have the same amount of SWS thus it seems as though a minimum amount of N3 deep sleep is needed per night, no matter how long the total sleep time. Given the importance of SWS after partial or total sleep deprivation the brain attempts to make up all the missed SWS.

During Rapid Eye Movement (REM) sleep (20–25% of sleep) the eyes can be observed jerking rapidly back and forth under closed eye lids, hence its name. It is during REM sleep that most of our 'story-like' dreams occur (dream-like events can occur in any stage of sleep but they are generally thought to be shorter, more focused on a single emotion and lacking the narrative complexity of dreams in REM sleep). REM sleep is involved in processing emotional memories and ensuring our psychological health. During REM our brainwave activity can increase to levels experienced when a person is awake, breathing becomes more rapid, irregular and shallow, heart rate increases and blood pressure rises. In order that we do not act out our dreams we lose muscle tone during REM and thus we are effectively paralysed.

However, good sleep is both quantity *and* quality i.e. it is important to get the right proportion and distribution of the various sleep stages during the night. Additionally, your sleep should as far as possible be unbroken and of the correct duration for you.

## CIRCADIAN RHYTHMS

Our sleep is regulated by two body systems: sleep/wake homeostasis and our circadian rhythm (aka 'body clock'). Sleep/wake homeostasis essentially tells us how long we have been awake and, at the end of the day, tells us that it is time to go to sleep. Our circadian rhythm regulates our sleepiness and wakefulness over a 24-hour period. The circadian rhythm rises and falls across the day with our strongest drive to sleep generally occurring between 2–4 a.m.. We also have another much weaker desire for sleep during the afternoon between roughly 1–3 p.m., the so called 'post-lunch dip' which, because it is a function of our circadian rhythm, does not actually need food for it to occur. Our individual circadian rhythm dictates whether we are a 'morning person' or an 'evening person' as well as the exact timing of our individual peaks and troughs of alertness and sleepiness across the 24 hours.

The most important signal that it is time to go to sleep is darkness, in response to which the brain produces a hormone called melatonin. The release of melatonin is the signal that initiates a number of processes that lead us to fall asleep. Melatonin levels drop across the night and in the morning approximately 90 minutes prior to our wake-up time our body clock starts a series of changes (e.g. increase in body temperature, production of the hormone cortisol) that results in our awaking. This is why you have an 'uncanny' ability to wake up before your alarm goes off. If the body knows when you are going to wake, because you have set the alarm, or because (as recommended) you have a regular wake-up time, it can actually prepare to wake up naturally at that time (as long as you are not severely sleep deprived). However, if the body does not know when you intend to wake it cannot prepare and thus you are liable to feel groggy when you wake.

The major external stimulus that signals the fact that it is day is sunlight and it only takes a few minutes of daylight to tell our brain that it is time to be awake. Even through closed eyes sunlight can signal that it is time to wake up, hence why in summer we often wake early. Because of our dependency on light and dark to entrain our body clock our sleep need varies with the seasons. In summer we have a natural tendency to sleep less and in winter, when it is dark and cold, we tend to want to sleep more.

Humans, in common with most animals, have evolved to sleep at night and to be awake during the day. One of the main reasons for us to sleep at night is that our nocturnal vision is comparatively poor, compared to most other animals which means that we are unable to usefully do anything at night e.g. hunt, work, etc. We are also vulnerable to predation, by big furry things with large teeth and good nocturnal vision. This means that from a survival point of view it is best to find somewhere safe at night, and sleep. Hence, we can only sleep when we feel safe and secure (this is also the reason that at a very basic, primeval level we are all afraid of the dark).

## **HOW MUCH SLEEP DO I NEED?**

Individual sleep need is like height – we are all different and it is, to a large degree, genetically determined. Anywhere between four and eleven hours can be considered normal but getting just one hour less sleep a night than you require can have measurable effects on your physical and mental health.

Your personal sleep need is essentially the amount of sleep that allows you to feel awake, alert, and refreshed during the following day. Very simply, if you feel sleepy during the day then you are

probably not, for whatever reason, getting the sleep you need during the night. So, if you only need four hours sleep a night to feel at you best during the day attempting to get eight hours sleep means that you are trying to get something you don't need and can't get anyway. If you need eleven hours to be at your best, cutting your sleep down to eight hours, because this is what is 'recommended', just means you will be significantly sleep deprived. Because sleep need is analogous to height it should be clear that you cannot 'train' yourself to need less sleep any more than I, at 1.97m tall, can train myself to be 1.75m, however desirable it would be for when I fly economy class.

## THE EIGHT-HOUR MYTH

Given the ubiquity of this 'fact' it may come as a bit of a surprise to learn that eight hours is not the recommended length of sleep, and actually never has been. It is disingenuous to suggest that eight hours sleep is anything other than an average, it is not an ideal. In the past various writers commented on the number of hours sleep needed, for instance Bullein in 1576 states that

*'sixe or eight houres will suffice nature'*

Vaughan in his *Naturall and artificial directions for health* (1600) writes

*'How many houres may a man sleepe? Seaven houres sleepe is sufficient for sanguine & choleric men; and nine houres for fleagmaticke, and melancholick men.'*



And the book *Directions and Observations relative to Food, Exercise and Sleep* (1772) states

*'It is not possible to lay down any Rule as to the Length of Time necessary for Sleeping; for as this does in a great Measure depend upon Age, Habit and other Circumstances, it ought in different Persons to be different: But it seems to be agreed, that it ought not in the general to be less than six nor more than nine Hours in a Day.'*

This advice is confirmed by seventeenth to nineteenth century proverbs that variously say

*'The Student sleeps six Howres, the Traueller seven; the Worke-man eight, and all Laizie Bodies sleepe nine houres and more.'*

*'Nature requires five, Custom gives seven! Laziness takes nine, And Wickedness eleven.'*

*'Six hours for a man, seven for a woman, and eight for a fool.'*

These historical statements are no different than the current recommendations, the American Academy of Sleep Medicine recommendation for sleep duration in adults is simply over seven hours. The National Sleep Foundation consensus statement is often quoted seven to nine hours; however, the recommendations define times as either as 'recommended; may be appropriate for some individuals; or not recommended'. There is no clear explanation of 'some individuals', so it is perhaps clearer to quote the durations of sleep that are 'not recommended' which for adults (26–64 years) is less than six hours sleep or more than ten hours sleep.

These proverbs and historical advice strongly suggest that sleep durations in the past were pretty similar to those of today, providing further evidence that we are not in fact in the midst of a 'catastrophic' sleep-loss epidemic.

## **ARE YOU A LARK OR AN OWL?**

We all know people who are bright-eyed and bushy-tailed first thing in the morning and others who, shall we say, need a bit of time and a lot of coffee to become even remotely human. Although the timing of our sleep can be dictated by such external factors as our jobs, lifestyle, and so on, morningness (aka 'lark') and eveningness (aka 'owl') are to a large part genetically determined. In very approximate terms about a quarter of people are strongly morning people, a quarter strongly evening and the rest somewhere between the two.

How to determine whether you are a lark or an owl? Do you find yourself wanting to go to sleep relatively early and have no problem getting up early, and eager to start the day? If the answer is 'yes', you're probably a lark. If you answered 'no' then you may be an owl. Owls want to go to bed late and find it difficult to get up and out of bed first thing in the morning. (For a more scientifically valid way to measure whether you are a lark or an owl search for a copy of the Horne and Ostberg morningness and eveningness questionnaire.)

Because of the genetic predisposition it is not possible for you to 'train' yourself to become a lark or owl. All that you can really do is learn to how cope with the effects of being out of phase and to reduce the impact. For instance, owls would benefit from getting exposure to daylight as soon as possible after they wake up.

Larks may find that getting out in the daylight late afternoon/early evening helps them to stay awake longer. The impact of morningness/eveningness is most acutely observed in owls who because of societal pressures often need to wake up much earlier than their natural propensity to wake, this causes them to experience 'sleep inertia', that feeling of grogginess in the morning that can persist for between 15 minutes and 2 hours after waking.

## **SLEEPY OR TIRED?**

Although in common parlance 'sleepy' and 'tired' are used interchangeably there is actually an important difference between them. Sleepy means a propensity to go to sleep, tired implies physical and/or mental fatigue/exhaustion. Therefore, you can be tired without being sleepy e.g. you know sometimes that even though you are physically exhausted, you cannot fall asleep because your mind is racing. This is important from a sleep point of view because if you have a problem with your sleep at night you will have daytime consequences, i.e. you will be sleepy during the day. If you are tired during the day then this could be for a myriad of reasons e.g. a long commute, a boring job, a row with the other half, and so on. Therefore, being tired during the day is not necessarily a sign that you have a problem with your sleep, more a problem with your lifestyle. It is natural to feel a bit sleepy when you awake in the morning, and in the early afternoon when you have a natural reduction in alertness (the so called 'post-lunch dip'). However, if you really feel that you could easily fall asleep at 11 a.m. then there is probably a problem with your sleep.

A simple example to demonstrate the difference between sleepy and tired is to imagine you have to walk up three flights of stairs, when you get to the top do you need to sit down or sleep?

If you need to sit down then you are tired/fatigued/knackered/exhausted, if you need to sleep then you are sleepy and if you are sleepy during the day you have a problem with your sleep.

Signs of sleepiness include:

- not feeling refreshed after sleep
- difficulty keeping your eyes open and focussed
- greater tendency to fall asleep while at work
- more frequent naps during leisure hours
- lots of yawning
- extended sleep during days off
- increased errors and loss of concentration at work
- feeling irritable, restless and impatient

## **AN HOUR BEFORE MIDNIGHT**

We have all heard it a million times: 'One hour's sleep before midnight is worth two after'. (The earliest source, from 1640, gives the idea that one hour's sleep before midnight is worth three after; but from 1670 the proverb equates its worth to two hours). This proverb is simply explained by the fact that deep SWS is predominant in the first third of the night and so much of the restorative benefit of sleep is achieved in that period. Thus, given a bed time of 9 or 10 p.m. a person gets most deep restful sleep in the hours before midnight with lighter and less refreshing sleep in the hours after midnight. So, it has nothing to do with 'midnight' per se and more to do with the timing of deep restorative sleep being in the first third of the night, whenever this occurs. This proverb is now only used as a way of trying to persuade your teenage daughter to come home at a reasonable time.

## **IS DAYLIGHT SAVING TIME INCREDIBLY DISRUPTIVE?**

While research shows it can take up to three days for your internal body clock to 'reset' when the clocks change, it is not 'incredibly disruptive'. Think how disruptive travelling from Paris to London, or New York to Chicago, is for your sleep, the answer it is not at all. Try it yourself, now, change the position of the hands on you watch by going back one hour. . .done? OK, did you have a heart attack? Did you have a car accident? Changing the clocks is merely changing the time on clocks and watches, it does nothing to alter the solar or lunar cycle. We do not gain or lose any sleep unless we set an alarm, which is why the clock change happens at 2 a.m. on a Sunday morning so the vast majority of people do not have the get up at their regular time to go to work. If you sleep for eight hours a night and don't set an alarm it does not matter if the position of the hands on your watch changes in the night you will still get eight hours of sleep. Trying to prepare yourself, or your child, by changing their bedtime gradually by 15 minutes a night every few nights, is as pointless as it is unnecessary.

The best advice for helping your body deal with the time change is to make sure you change all your clocks to the new time before you go to sleep, meaning that you hit the ground running when you wake up.

Don't overthink 'losing' or 'gaining' an hour – if you normally wake up at 7 a.m., then get up at 7 a.m. rather than trying to overcompensate for the change in time. And most importantly don't hit snooze! Routine is key to good sleep.

It is claimed that evidence has shown an increase in incidences of workplace injuries, car accidents and heart attacks in the days after we spring forward, but although statistically significant they are very small increases.

The twice yearly 'panic' about the clock change is simply a case of the media hyping up a non-story.

## **DREAMS AND DREAMING**

A dream is a subconscious experience of a sequence of images, sounds, ideas, emotions, or other sensations occurring predominantly during REM sleep. Everyone dreams four or five times a night, but you can only remember a dream if you wake up during it or within a couple of minutes of it finishing. If you do not remember your dreams, it is probably that you are just a good sleeper, hence you are not waking up during your dreams. Conversely, if you feel you are always dreaming it probably means that your sleep is being frequently disturbed for one reason or another.

When we are dreaming, the dream is, for all intents and purposes, real to both our mind and body and so the body can have a physiological response to what occurs in the dream. We have all woken from a dream with our heart pounding, feeling out of breath, sweating, and feeling a sense of fear or anxiety. And we have all woken in the morning thinking 'I cannot possibly go to work today I have just spent all night fighting dinosaurs and frankly I am exhausted'. We are 'living the dream' in the most literal sense.

Now it would be a bit embarrassing, and potentially dangerous, if we were to run around the bedroom four or five times a night enacting our dreams, so in order to protect us and our bed-partners

from harm, when we dream we lose muscle tone. We are thus unable to act out our dreams. Essentially, we become floppy, except interestingly a part of the male anatomy that frequently does the exact opposite. However, this has nothing to do with the content of the dream and everything to do with simple fluid dynamics. Sexual dreams in fact only occur about 10% of the time although erections occur in approximately 80% of dreams.

The actual content of our dreams is limited in certain ways. When we are asleep we are at our most vulnerable and therefore we still need to remain vigilant to what is going on in the environment. However, as our dreams are essentially real experiencing certain sensations in our dreams would compromise our vigilance, which could have serious consequences. For instance, because the sleeper is unable to see or move when asleep, vision and movement do not play a role in providing accurate information about the external world and therefore they can exist in our dreams without compromising vigilance. This is why the overwhelming majority of our dreams are visual and we can experience motion, such as the common feeling of flying. However, because we have to rely on our other senses to provide information about what is going on, sensations such as touch, smell or certain sounds, that would compromise vigilance by interfering with signals coming from the external environment, rarely occur in our dreams.

Anxiety is the most common emotion experienced while dreaming. As in the waking state, it has been found that men generally have more aggressive feelings in their dreams than women, while children's dreams do not contain much aggression until they become teenagers.

Most of us have a reoccurring 'stress' dream – that is, usually, about a situation that we would find stressful in real life e.g. relating to

events at school, being chased, falling, arriving too late, failing an exam, and so on. My 'stress' dream is very simple. I am back at school, I am in the playground during break time, the bell rings, I am with my friends as they start to walk off to the next lesson, I suddenly realise that I don't know what lesson I am going to, I don't have my timetable, I don't know if I have the right exercise books, and I don't know if I have done the right homework. Every time I have this dream it is at this point that I wake up. Before this scene the dream could have gone on for a long time and have been completely unrelated but, somehow, I end up having this narrative. It can be helpful in dealing with stress if you learn to identify your particular recurrent stress dream.

The only difference between your dreams and waking reality is that your dreams are internally generated. The content of your dreams can be made up of pretty much anything you know or can imagine. Time is compressed or distorted in your dreams. Your dreams start out as a jumble of images etc. which your brain's tries very hard to make sense of. So, however weird and abstract your dreams seem, they are in fact the best interpretation your brain can make of what is going on in your mind. Your dreams only become the stories you think they are when you tell them to your partner/therapist.

It is interesting that people only ever seem to tell you about their 'interesting' dreams. You don't talk about the utterly mundane dreams that we all have because your partner has started thinking you're quite boring during the day and this would make it appear that you can't even be interesting in your nocturnal fantasy life. However if your dream was in any way exciting you still would not tell your partner about it as they never appeared in it.



## Dream Interpretation

Dreams are personal and can be about anything that you know or you can imagine, thus dream interpretation of whatever type, Freudian, Jungian, 1001 dreams interpreted, is from a scientific point of view absolute nonsense. However much you explain yourself to your therapist, they are never going to fully understand what goes on in your head or know all the experiences you have gone through, all the emotions you have felt; all that you have seen and done, all that you can imagine. They therefore cannot tell you what your dream means, to you.

If your dreams are so important and meaningful why do you have no memory of the vast majority of dreams that you have and only partial memory of those that you think you do remember? What are these 'forgotten' dreams telling you, and how do you know?

Dreams have as much or as little meaning as you would like to invest in them. Beethoven dreamed symphonies; I will never dream symphonies because I am completely non-musical. You don't need people or dream interpretation books to understand what your dreams mean. Essentially that is like asking someone to tell you what you think. Look for the meaning within yourself because your dreams are part of you. We are all different and if you put two people in front of a Hollywood movie you will most likely get two views of it, for instance some people view *Star Wars* as a deep, meaningful philosophical story, but others see it as a piece of meaningless trash that fills two hours. Your dreams are the same, and you should enjoy them in the same way. So, if you feel your dream is telling you something then fine, but if you feel that it's just a movie, then it's just a movie.

One way to illustrate the variety in dream interpretation is to consider the old, no doubt apocryphal, idea that according to Freudian analysis if you dream about a train entering a tunnel you are dreaming about sex (it was always about sex with Freud wasn't it?). However, it could be that the dreamer is a railway enthusiast, dreaming of 'Castle Class' No. 7029 *Clun Castle* in full steam, entering the Box tunnel, (ooh, er missus!), and they don't have sex!

Many people believe that they can 'see' the future in dreams. We have all heard them – 'I dreamed there was going to be a plane crash and six months later a plane crashed'. Well maybe you are indeed psychic or maybe you were actually dreaming about the plane crash that you saw on the news last week. Now if you did dream that BA001 to New York was going to crash next Tuesday and you phoned both British Airways and the Civilian Aviation Authority immediately you awoke to warn them of the impending disaster, then I would be impressed if this did actually happen. But then again, I would also ask: could you not dream the lottery result at least once in a while?

One last piece of nonsense to dismiss 'if you fall in a dream and hit the ground you will die' of course you won't, trust me.

## **Lucid Dreaming: It's a Gateway to Creativity, Man**

Proponents of lucid dreaming make outlandish claims as to their ability to explore new realms of consciousness and creativity while controlling their dreams. In a lucid dream the dreamer realises that they are simultaneously conscious and dreaming, therefore they are able to make decisions concerning their dream, or directing it in some way. The art of lucid dreaming is having the conscious

awareness that you are dreaming without, by doing this, causing yourself to wake up.

Lucid dreaming is a bit like anything, some people find it easy while others will wake up every time they try to do it. Given the fact that any dream can only be made up of things you know or have experienced, and given the fact that in order to lucid dream you are using your conscious mind, it cannot be a gateway to a new realm of consciousness. Imagine your dream is a car and your brain is a GPS of Great Britain, being able to direct the car means that it might be easier to get to London, but you won't be able to get to London, Ontario.

The only real difference between a dream and a lucid dream is that in a lucid dream events happen in real time.

## **Cheese and Dreams**

There is a commonly held belief that eating cheese causes dreams, but the simple fact is that there is nothing in cheese that could specifically cause dreams/nightmares that is not also found in numerous other foods such as turkey, milk, eggs, nuts, chicken, fish, soy, and tofu.

## **CHILDREN AND SLEEP**

You will perhaps have noticed that this book is not entitled, 'How to get your child to sleep better and not annoy the heck out of you'. So, it is hopefully not too much of a surprise or disappointment that I am not going to write too much about children's sleep.

However, I do think that it is important to touch on a few aspects of sleep in children

Sleep is crucial to the development of happy, healthy, intelligent, well-behaved children because it is essential for

- growth and physical development
- learning and memory
- mental and physical performance
- mood and emotions
- good health and prevention of disease

Sleep is vitally important to the physical, emotional, and mental development of children; and because all the important aspects of the development of a child occur during the night, if you mess up the night, you mess up the child.

A study has shown that even reducing sleep by as little as 45 minutes a night, compared to what is needed, is enough to have a measurable negative effect on children's mental performance.

Sleep problems can have a profound impact on children

- hyperactivity and inattention.
- poor concentration.
- poor impulse control
- disruptive behaviour/aggressiveness
- higher levels of depressed mood
- emotional problems
- poor academic performance
- inter-sibling fights
- family stress, physical and mental health
- parents' relationship with each other

It is true to say that on average children need much more sleep than adults but like adults, children can have very different sleep needs. There is no 'normal' or 'right' amount of sleep for a child, only broad recommendations. The National Sleep Foundation recommends the following sleep durations, per 24 hours:

New-borns	0–3 months	11–19 hours
Infants	4–11 month	10–18 hours
Toddlers	1–2 years	9–16 hours
Pre-schoolers	3–5 years	8–14 hours
School-aged children	6–13 years	7–12 hours

As you can see the ranges are relatively broad; so within these recommendations, regardless of how many hours your child sleeps, if they are happy, healthy, thriving, doing OK at school, and are well-behaved during the day, then they are almost certainly getting enough sleep for them as an individual, so don't worry.

Sleep in children is constantly changing as their brains develop.

## Sleep in New-borns

Sleep in new-borns is equally divided between day and night. Roughly a new-born will sleep in 3-4-hour periods followed by 1-2 hrs awake.

## Sleep in Infants

At around 2–3 months; the child starts to establish a diurnal cycle with sleep occurring mostly during the night. However, in order to get all the sleep it needs the child will still require one or two

sleep periods during the day. By approximately 9 months 70–80% of children will be sleeping through the night.

## **Sleep in Toddlers**

Around the age of 1 year most children, as they become more aware of 'self' may experience separation anxiety, night-time fears and a reluctance to go to sleep. Sleep problems are common (20–40%) in this age group.

## **Sleep in Pre-Schoolers**

By the age of 6 most children will no longer need a regular day-time nap and thus, finally, sleep is purely nocturnal with a degree of consistency night-to-night.

## **School Children**

Sleep duration continues to fall and sleep consolidates into a single period of mainly unbroken slumber. And then. . .

## **WHY DO TEENAGERS SLEEP SO MUCH?**

Teenagers are different, and teenagers are odd, ('teenagers' has a rather loose meaning in terms of sleep and can refer to people from 12–25years). They are different because they genuinely need more sleep than adults. This is because they are going through puberty and so there are major physical and emotional changes that are happening to them and they need sleep to help deal with them.

Teenagers are odd because they do genuinely need to go to sleep later than adults. There is an actual shift in their biological rhythm, we don't know why this shift has evolved, but it is definitely there. Importantly, though, this shift is at most only 2 hours. The recommended bedtime for a teenager is around 11–11:30 p.m. and they should be getting on average about 9–9½ hours' sleep, although the range of acceptable sleep according to NSF consensus statements are as follows.

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Teenagers 14–17 years	7–11 hours
Young Adults 18–25 years	6–11 hours

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This means that a teenager who says they cannot get out of bed at 9 a.m. may actually be telling you the truth, but a teenager who says that they cannot get out of bed till noon is merely lazy, there is no physiological need for them to sleep that long. Most teens do not get enough sleep, one study found that only 15% reported sleeping at least 8½ hours on school nights. Because of this most teenagers experience excessive daytime sleepiness on a regular basis and teenagers report twice as many sleep problems as the general population. Academic workload can be a contributory cause of sleep problems, but just as important are: social activities, after school activities; computer/phones/internet/TV/excessive caffeine use, alcohol, their delayed sleep phase and irregular sleep/wake schedules. Adolescents tend to have irregular sleep patterns; in particular, their weekend sleep schedules are much different to than their weekday schedules, to some extent as a direct consequence of weekday sleep loss.

When I was growing up no one would phone you after 9 p.m. – if the phone rang after that time it could only mean there had been a death in the family. This is no longer true and a study shows that use of mobile phones for text messaging is a factor in impairing

adolescents' sleep. The alert noise when a new message is received frequently wakes them and there is a significant association between being woken by noises from their mobile phones and how sleepy they feel during the day. One, no doubt in her mind well-meaning, parent I spoke to recently said that she could not deprive her daughter of her mobile overnight, although she knew it was disturbing her daughter's sleep, because she did not wish to be 'too hard' on her. I must admit that I find this a very strange way of thinking. However, the ubiquity of mobiles in the bedroom is becoming a problem in adults (see 'Fads' below)

You may blame their hormones for why your teenager is a miserable, moody, nightmare to live with but it is much more likely that they are just sleep deprived. High rates of sleeping difficulty are reported in adolescence, as one study found that 23% had difficulty falling asleep (a figure which increased with age), 11% woke in the night, and waking in the morning was a problem for 18% with only 3% waking too early. Excessive sleepiness can:

- Limit their ability to learn, listen, concentrate, and solve problems.
- Can contribute to acne and other skin problems.
- Lead to aggressive or inappropriate behaviour.
- Cause overeating or eating unhealthy foods.
- Contribute to illness.

## **Should Schools Start Later?**

Because of the shift in their biological rhythms, teenagers' natural sleep cycle can put them in conflict with school start times. Most high school students need an alarm clock or a parent to wake them on school days and they seem to find it inordinately difficult to drag themselves from their bed and actually 'get up and go'.



Because they are sleep deprived, they are sleepy all day, having difficulty paying attention in class and not performing academically, or athletically, at their best.

It may come as a surprise that there is no good reason why the school day starts when it does; the actual origin of the early start goes back to a time when a child's education was also combined with the need to be useful labour on the farm. Therefore, there is no good reason why school start times could not be moved later. There is good evidence from America that starting school later can improve grades, attendance and behaviour. Parents and teachers report that teens are more alert in the morning and in better moods; they are less likely to feel depressed.

Most of the American research says that it is start times before 8:30 a.m., as is common in the US, which are the problem. In the UK schools start around 9 a.m. and so it should be less of a problem; although this does not mean that we should not consider starting school later particularly for teenagers, (although there is no scientific reason to start lessons at 1:30 p.m. as one UK school is reported to have done). What is interesting is that in America, where this research has been discussed for 20 years or more and despite the proven benefits of later start times, there have been very few schools that have adopted a later start to the school day. Indeed, recently, some school boards have actually moved start time earlier. However, as mentioned above, there are no compelling reasons why schools cannot start later, it may be convenient for parents to drop off their children at school before work but that would seem a poor excuse to set our children up to fail. Opponents to moving school start times later claim that this would just mean that students went to bed even later, but research has shown that this is not the case, students do not go to bed later, but actually got one hour more of sleep per school night. (Another reason for

early school starts in the US and Canada is that it is convenient for running the school buses.)

So, if we really cared about our children's education and their health we should perhaps consider later school start times, and if for whatever reason this was not possible then at least schools should be encouraged to sensibly timetable 'academic' lessons and examinations later in the day.

## **SLEEP AS WE AGE**

One of the great myths about sleep is that people need less sleep as they grow older. Actually, while our sleep patterns may change over time, the need for sleep becomes fixed in early adulthood and does not greatly change across the life course. Essentially an 85-year-old needs the same amount of sleep they did when they were 25. What actually changes as we get older is the ability to get the sleep we need.

As we age we get progressively less of the deep, restorative, Slow Wave Sleep (SWS) and thus our sleep becomes less refreshing. We start to lose our SWS in our middle years; in men it generally starts from their mid-thirties to forties, while in women it starts in their 50s.

Children have a lot of deep sleep. It is vital for growth, memory and learning and thus children can sleep anywhere, through anything, and if they do wake there is a great deal of biological pressure for them to go back to sleep. Thus, if you lose this SWS as you age your sleep will become more easily disturbed and there will be less pressure on you to go back to sleep if awoken. Our sleep is further compromised as we get older because there are more things to

wake us and keep us awake e.g., pain, bladder problems, anxiety, and so on. Think about it, you get up in the middle of the night to go to the bathroom, you empty your bladder and get back into bed. Men can do this in less than 1½ minutes, woman take a bit longer (because they wash their hands!), so why are you awake for the next hour and a half? It is not the bladder – you have just emptied that – so is it pain, anxiety, a snoring partner?

In addition to the changes in sleep architecture there are changes to our circadian rhythms whereby older people tend to become sleepier in the early evening, go to bed earlier and wake earlier in the morning.

The lack of refreshment from sleep causes many older people to feel that they are suffering from sleeping problems, whereas much of what they feel could be accounted for by the natural changes in their sleep. The problem is compounded if the older person also naps during the day as this may use up some of their need for sleep and so they may sleep less at night, again causing them to perhaps believe that they have a sleep problem.

The fact that it is more difficult to get good sleep as we get older does not lessen the importance of trying to get the best sleep we can.

Why, I hear you ask, is there a gender difference in this loss of SWS? Well, my theory is very simple: from a biological point of view men are very simple. Men only have three roles: to hunt, to protect, and to play a small but crucial role in the continuance of the species. The problem is that when a man gets to his mid-thirties, early forties he starts to become less able to fulfil the first two of these roles, 'Oh! My knee and my back hurt, maybe I will watch TV today and hunt and protect tomorrow.' Essentially, at this point,

he has become biologically redundant and should probably crawl to the back of the cave and await death. This phenomenon can be seen in the animal kingdom in species that have a dominant, alpha male such as chimpanzees, gorillas, and lions. Once the alpha male becomes weak – either through age, disease, or injury – he is deposed by a younger, fitter, healthier member of the group. He is then cast out of the group and essentially awaits a sad and lonely death. Basically, nature pretty much gives up on middle-aged men as they really aren't of much use anymore from a biological perspective. (Because of this a woman's biological needs dictate that when your man becomes a bit useless you should get rid of him and take up with a younger, more virile man, who is much more able to hunt and to protect you and your offspring.) Women, on the other hand, have a much more important biological role in that they can have babies; so nature does its best to ensure that the woman is around to nurture and bring up her offspring, and so it protects her. This is why women on average live longer than men in all developed nations.

The loss of SWS seen in men is merely a recognition that by the time they are in their thirties men know everything, have nothing more to learn, and do not need to maintain their strength and virility. This is the reason that as men age their memories get worse and they experience, on average, poorer sleep than do women in later life. Essentially, it is the start of the long, slow journey to our final destination (it is not like that Simon Munnery joke, 'why do men die before their wives. . .because they want to').

## **WOMEN AND SLEEP**

Across a lifetime, a woman's sleep is affected in different ways due to the various biological influences at different stages of her life.

A woman's menstrual cycle may cause discomfort, and sleep changes as the hormones oestrogen and progesterone are known to influence sleep and circadian rhythms. Many women report 2–3 days of disrupted sleep during each cycle, with some women experiencing an increased number of awakenings and other sleep disturbances during their premenstrual period, while conversely other women report excessive sleepiness, fatigue, and longer sleeping hours.

Oral contraceptives, because they can affect body temperature regulation, can also have a negative effect on sleep.

Sleep is disrupted substantially during pregnancy and postpartum, with prevalence of insomnia ranging from 15–80%. After conception most women report daytime fatigue and the need for longer night-time sleep. Feelings of nausea and vomiting during the first trimester can lead to disturbed sleep. From the second trimester onwards, the time spent asleep begins to decrease and sleep quality becomes poor due to nocturnal awakenings, fatigue, leg cramps, difficulty sleeping in certain positions and shortness of breath. Pregnant women, especially during the final trimester, seem to have a heightened risk for both obstructive sleep apnoea and restless legs syndrome (RLS). Incidence of snoring also increases during pregnancy.

During menopause many women experience hot flushes that, when nocturnal, can disrupt sleep. Because the sleep disturbance is related to changes in body temperature it is important to have a cool temperature in your bedroom; to have light, cotton bed linen; and it is advisable to avoid anything that raises body temperature before bed. Hormone replacement therapy, if considered appropriate by your doctor, can help sleep by relieving severe hot flushes.

## WHY MEN FALL ASLEEP AFTER SEX

As we have seen previously, from an evolutionary point of view a man's role is essentially to hunt and to protect. Once he has provided food and ensured the safety of the family/group there is little else useful for him to do, therefore he sleeps. Now, for most animals, sleep and sex are not linked in any way because when you have sex you are vulnerable, your back is turned and your mind is on other things. For instance our closet cousins, chimps and gorillas, have sex very quickly. Therefore, if a man feels safe and secure enough to have nice, pleasurable sex then he is also safe and secure enough to go to sleep (and of course after a hard day hunting and protecting he needs his sleep). Now many people say that this desire to sleep is the result of a release of various hormones during sex. However, surely those hormones are released equally when you are making love in a bed or having a quick 'knee trembler' in a back alley, yet I am pretty sure no man has ever been overcome with sleepiness in the latter situation.

The same process is true with regards to eating: when you have your head stuck in a wildebeest carcass you are vulnerable, so if you are not 'king of the jungle' you either need take your food somewhere safe or you eat quickly. Thus, if you are in the position to be able to enjoy a nice pleasurable meal you are safe and secure enough to sleep. Similarly, if you are relaxed enough to be able to watch the game on TV, especially if your partner has given their tacit approval that you can do so, meaning there will be no 'has-sles', it is the ideal time for a snooze.

## NAPPING

While naps do not necessarily make up for inadequate or poor-quality night-time sleep, a short nap of 20–30 minutes (aka a 'power nap') can restore alertness, enhance performance, and

reduce mistakes and accidents. The increase in alertness following a nap may persist for a few hours.

The ultimate 'power nap' is to drink two cans of a functional energy drink, like Red Bull, just before the nap. The caffeine will take approximately 30 minutes to start working so you will get the benefit both of the nap coupled with the boost of the caffeine. (NB coffee is a bad 'drug delivery' system for caffeine because, dependent on how it is brewed, the level of caffeine can vary massively. So, although you think you are having a 'strong' black coffee it may actually contain, little, if any, caffeine. Functional energy drinks on the other hand contain a standard, known amount, although they also contain an awful lot of sugar and don't on the whole taste as nice!)

Napping can also have psychological benefits. A nap can be a pleasant luxury, a welcome break in a stressful day. While there are some benefits to napping there can also be negative effects. If the nap is too long or you are very sleepy you may suffer from sleep inertia upon awakening. Sleep inertia is the feeling of grogginess and disorientation that can come with awakening from a deep sleep and can last for approximately 15 minutes to 2 hours. Also, if you nap too long or too late in the day this may affect your night-time sleep. If you have trouble sleeping at night, a nap might amplify the problems. If you need to get 8 hours of sleep and you get 2 of them in the day you are likely not to need more than 6 hours sleep during the night, so you will either find it difficult to fall asleep or wake up early.

Old people may nap simply because they are bored. However, they commonly do not sleep well at night and thus feel the need to take a nap during the day, but this may contribute to them not sleeping at night and thus a vicious circle develops. It is often advised that old people should avoid napping in the hope that this will shift this sleep into the night. However, the problem with this advice is

that if you stop napping during the day there is no guarantee that this sleep will now occur during the night and thus you may actually be depriving yourself of sleep. Therefore, if you nap during the day and get, what is to you, an acceptable amount of sleep during the night and feel pretty OK during the day then don't worry about having your nap. However, if your nocturnal sleep is particularly poor then it may be worth trying to do without your nap for a couple of weeks and see if your sleep improves. If so, carry on; if not, go back to napping.

In order to be able to nap you have to be able to cognitively disengage from your surroundings and some people are much better at doing this than others, hence some people are able to pretty much nap anywhere at any time while others find it almost impossible to nap unless extremely sleepy when their napping is unintentional.

If you suffer from insomnia only occasionally, taking a short nap shouldn't be a problem, but if you suffer from chronic insomnia, it's probably best to avoid an afternoon snooze, in order to try and re-establish a regular nocturnal sleep pattern.

## **The Siesta**

The siesta is a traditional, common practice among many healthy people worldwide, although its prevalence is strongly associated with hot, tropical regions between 30°N and 30°S of the equator. In these regions there is actually some evidence of a genetic predisposition to taking a siesta.

The siesta would seem to be an evolutionary adaptation i.e. it is too hot during the heat of the midday sun to be able to act without the need of considerable effort to remain cool, therefore it



was easier to find a cool, safe place to sleep. This would allow us to conserve, what could be very limited resources (as Noel Coward remarked, in hot climates only 'mad dogs and Englishmen go out in the midday sun'). This propensity to sleep after midday in hot countries expresses itself as the siesta, and in colder climes as the evolutionary hangover – 'post-lunch dip' – a natural drop in cognitive performance (which as mentioned before does not actually need you to eat food for it to occur).

There is little evidence concerning the effects of taking a siesta on nocturnal sleep quality. However, it seems that the subjective perception of nocturnal sleep is undiminished in those who take a siesta. There is evidence that a siesta can increase daytime alertness and counteract the effects of sleep deprivation and thus can have a beneficial effect on daily work performance.

There are mixed findings about the medical benefits of the siesta, for instance there are a few studies that have linked siesta with an increased risk of myocardial infarction. While, on the other hand, there are other studies which showed a protective action of siesta against coronary artery disease. The difference may be explained by the fact that in some societies a siesta is part of a sedentary lifestyle which can also be associated with other risk factors e.g. obesity, diabetes, hypertension which are linked to an increased risk of heart disease, whereas in less sedentary societies the siesta may represent an important stress-coping mechanism that provides protection against coronary artery disease.

Therefore, if you live in a country that traditionally has a siesta then there is really no good reason to give it up. However attractive the idea of a mid-afternoon nap for a couple of hours, the introduction of the siesta to more northerly climes really would not work, particularly in winter time when it would be dark when you woke up.

In this instance a mid-afternoon 20 minute 'power nap' is probably more appropriate.

## Should we Adopt the Japanese Way of Napping?

The Japanese have a number of words for different types of naps including; *on'ne* i.e. falling asleep waiting for the dial-up modem to connect (only people of a certain age will understand this example) and *issui*, a nap whilst waiting for a pot of rice to boil. However, the most interesting concept is that of *inemuri*, 'asleep but present'. This is where you appear to be asleep in a situation where you are present for another reason e.g. during a lecture or meeting. The important thing about *inemuri* is that you have a posture as though you were listening and while you appear to be asleep you are in fact able to contribute to the situation when called upon. Therefore, *inemuri* is not a nap per se, more dozing or daydreaming with your eyes closed. *Inemuri* is acceptable because it shows that you must be sleepy from working so hard and for this reason it is not considered embarrassing, although snoring or dribbling are considered bad form. The Japanese believe that *inemuri* actually aids creativity, and again this leads to an acceptance of this behaviour. This is perhaps different from social mores in the UK/Europe/USA where such behaviour would probably be judged as being due to laziness or having been out all-night partying and would thus be considered unacceptable in the workplace. Is there a case for the adoption of *inemuri* in the UK/Europe/USA? Given the fact that we are all working long hours and rates of stress have gone up there is perhaps a need for the supposed benefits associated with *inemuri*. We have all been in situations where we are required to be 'there' but have no useful role to perform so why not be allowed to be present but 'asleep'?