

# *STUDENT'S SLEEP*

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## PREFACE

Most students entering college are unaware about the importance of sleep. They are ignorant about sleep deprivation and sleep disorders. Many students keep on suffering and some of them are dying, e.g. in accidents, without ever knowing the true cause of their problem. A complete instructional course about the consequences of good and bad habits of sleep should be included in the curriculum in our colleges. Students must learn that healthy sleep, along with physical fitness and good diet, is part of good health. We cannot be healthy unless our sleep is healthy.

Before writing this book, I always thought that I was *wasting* one-third of my lifetime in sleeping. But now I know that proper sleeping is an *investment* in the success and progress in life. A deep, sound sleep makes a person feel refreshed and vigorous, ready again for active work. Sleep is spoken of in the warmest of words—it is healthy, sound, calming, refreshing, restoring, sweet, and enchanting. Pavlov emphasizes the importance of sleep in health and points out that sleep might be used in therapeutic treatments of various disorders.

In 1757 Benjamin Franklin came up with the axiom, ‘Early to bed, early to rise, makes a man healthy, wealthy, and wise’. It would be more accurate to say according to James Maas, ‘consistently to bed and consistently to rise, makes a man healthy, wealthy, and wise’.

I have added glossary for your convenience. If you are stuck with some term, just check it in the glossary. And if you still need further explanation, look it up in an encyclopedia, may be from the computer’s CD Rom; or if you have access to the Internet, then just go to the *search* and see the details.

Our personality is made up of three dimensions—Body, Soul and Spirit. Body needs rest, nearly for 8 hours a day, but our soul works 24 hours. So during sleep you can continue your learning. For that this book will be helpful for you.

*So the Lord God caused the man to fall into a deep sleep.*

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# 1.1 What is Sleep

## Definitions

1. A natural periodic state of rest for the mind and body, in which the eyes usually close and consciousness is completely or partially lost, so that there is a decrease in bodily movement and responsiveness to external stimuli.
2. Resting state in which an individual becomes relatively motionless and relatively unaware of the environment.
3. Natural state of rest characterized by reduced body movement and decreased awareness of surroundings.

During sleep, which is in part a period of rest and relaxation, most physiological functions such as body temperature, blood pressure, rate of breathing and heartbeat decrease.

A sleeping person is unconscious to most things happening in the environment. The difference between someone who is asleep and someone who has fainted or gone into a coma is the fact that sleeping person can be aroused if the stimulus is strong enough. A normal sleep can end quickly, unlike someone who has been knocked out, is anesthetized or in a coma.

There must be a pretty good reason that God designed a mandatory 8 hours period of nearly total unconsciousness every day. We have known the biological reasons for eating and drinking, but we have been in the dark about the 'why' for the third biological need of sleep.

## Significance

A change in the rhythm is observed in all living things, not only in animals, but in plants, too. There is a difference in plant respiration in the daytime and at nighttime. At night there is more powerful ascent of the nutritive juices. It is also known that leaves of plants such as the mimosa and acacia fold and curl up for the night. Many birds go to sleep with their heads under their wings, while some animals seek for a secluded, quiet nook, where nothing can disturb them. However, it is only in the higher animals and in humans with their highly organized central nervous system and particularly well-developed cerebral hemispheres, that a clear difference is noted between the sleeping and waking states, a distinct periodic rotation of these states.

Deprivation of food is endured much easier than deprivation of sleep. Without sleep both man and animals succumb sooner than in conditions of complete starvation.

*I love to sleep. It really is the best of both worlds. You get to be alive and unconscious.*

## 1.2 Why We Sleep

No one knows for sure why we sleep, there are a number of theories. Sleep may have evolved to protect animals from their predators by reducing their activity during the times when they are most vulnerable. The exact purpose of sleep remains a mystery. However, the following are **two major theories** for why we sleep.

### **Adaptive Response**

It is so as to keep us from stumbling around in the dark. The sleep leaves us in a very vulnerable state. We see that those species that are commonly preyed upon sleep very little. They must be alert to avoid the perils of the night. An interesting adaptation that has occurred in such animals, is that sleep may consist of a series of very short naps. The Indus dolphin, for example will sleep nearly 7 hours, but take those 7 hours in a series of 4 to 60 seconds naps. Even more interesting is the bottle nosed dolphin, which sleeps only in one hemisphere of its brain, at any one time. Thus, it is always at least half conscious to alert itself to dangers. For us humans, sleep is a way for us to prevent stumbling around the dark, avoiding its hidden dangers. Someone suggested that sleep is a behaviour we encourage in when there is nothing else important to do. It would seem that we would have evolved such that every part of our day was in some way beneficial to our survival.

### **Restorative Process**

In some experiments we see that our muscles don't necessarily need sleep but, rather, our brain that controls our movements and thoughts need sleep to function normally.

Some studies show that if we go without sleep, there was not any physiological stress or inability to exercise in sleep deprived patients. However, it has been found that after a few days of deprivation, problems in perception develop. Some experiments show that when exercise takes place in warm, humid climates *slow wave sleep* [see section 1.5] is increased by 25 %. There seems to be a correlation between the temperature of the brain and the amount of slow wave sleep observed.

*The sleep watchers glimpse things that a thousand years of common sense never told us.*

## 1.3 Who & When

### Who Sleeps

Reptiles, birds and mammals all asleep. Some fish and amphibians reduce their awareness but do not become unconscious. Insects do not sleep, although they may become inactive in daytime or at night.

Reptiles do not dream. Birds dream a little. Mammals all dream. It is known from brainwaves study [see Section 1.5].

Some animals, like humans, sleep in a long session. Dogs and some other sleep in many short intervals. Some sleep at night and some, like owl, sleep during the day. Cows and horses can sleep while standing up. Whales and dolphins' half of the brain sleeps at a time, so that they breath consciously.

### **When sleeps**

1. Sleep gives the body a chance to repair muscles and other tissues, replace aging or dead cells.
2. During sleep, growth hormones in children are secreted and chemicals important to the immune system are secreted.
3. Sleep gives the brain a chance to organize and archive memories.
4. It lowers our energy consumption, so that to take 3 times a day instead 4 or 5 times.
5. It recharges the brain.

### Falling Asleep

When we are tired, we go to sleep. For sleep, usually we lie down on our bed, close the eyes and fall asleep.

How sleep is different from being awake. It is not an abrupt change from wakefulness. To become completely asleep you proceed through gradual steps. Each of these steps has some pattern.

The night's sleep start off by the thoughts of the person becoming hazy and reacting less to external occurrences. The muscles in the body become relaxed. Body temperature, heartbeat and blood pressure slowly drop.

As the person passes from wakefulness and enters the NREM sleep [see Section 1.5 ] the level of serotonin in the brain increases. It is how the body makes the transition from being awake to asleep.

*How wonderful is Death. Death and his brother Sleep. –Shelley*

## 1.4 Characteristics of Sleep

It is a known fact that one of the symptoms of approach of sleep is the relaxation of almost all the muscles. This relaxation begins with the muscles of the neck, when a person begins nodding, his head falling either forward or sideways. As sleep becomes deeper the other muscles of the body relax, except for certain muscles the tension of which is essential for the proper functioning of the body in sleep. An example of this is the round muscle of the eye: its contraction shuts the eye tightly, thus protecting it against light, contamination, and injury. Tension is also retained in the muscles of the urinary bladder. The activities of all the other organs and systems of the body also alter during sleep. The heartbeats are weaker and slower, pauses between them longer. Blood pressure falls by 20 to 25 mm of mercury. The bloodstream flows slower, particularly in such vital organs as the brain, liver, kidneys. The vessels in the skin dilate, the amount of blood in them increases, and the skin feels warmer, although the body temperature in general falls. Breathing becomes slower, deeper, and even. Sometimes it grows noisy owing to the loosening of the soft palate, the edge of which hangs freely and vibrates during inhalation and exhalation. Oxidation processes and metabolism decrease. During sleep the activity of a number of glands also decreases, particularly of the glands in the facial area. This explains the cause of the disappearance of the inflammation of thin tissues of the nose in the morning after a good night's sleep.

When someone sleeping, the following characteristics are seen.

1. The person's eyes are closed.
2. If possible the person will lie down to go to sleep.
3. If sitting, will be in a relaxed position.
4. The person's muscles are completely relaxed.
5. The person breathes in a slow pattern.
6. The person doesn't hear anything unless it is a loud noise.
7. The person occasionally rolls over or rearranges his or her body. It may be for regular circulation for each part of the body.
8. If you shake the person, yell loudly or flash a light, sleeping person will wake up in contrast of a faint position or in coma.

*Sleep faster, we need the pillows.*      –Yiddish proverb

## 1.5 Stages of Sleep

Sleep consists of several stages that cycle throughout the night. The types of brain waves based on amplitude and frequency determine the stages of sleep. One of the broad division is between NREM and REM. Sleep research shows that certain regions of the brain play critical roles in sleep. The brainstem, the portion of the brain just above the spinal cord, is critical in REM sleep control, while the forebrain is particularly important in NREM sleep control.

Stage	% spent during sleep	Frequency (cycles per second)	Characteristics
Awake		> 12	* awake * synchronized higher brain waves
Awake (relaxed)		8 – 12	* desynchronized less high brain waves * relaxed, drowsy, often with eyes closed
NREM1	5 %	4 – 8	* transition state between sleep and wakefulness * eyes begins to roll slightly * brief periods of <b><u>Slow Wave Sleep(SWS)</u></b> similar to those present while awake * lasts only for a few minutes
NREM2	45 %	8 –15	* peaks of brain waves become higher * lasts only for a few minutes * decreasing sensory awareness
NREM3	12 %	2 – 4	* also called deep sleep * very slow brain waves
NREM4	13 %	0.5 – 2	* deepest of the sleep * last of the sleep stages before REM sleep stages reverse and then REM sleep begins
REM	25 %	> 12	* frequent bursts of rapid eye movement along with occasional muscular twitches * brain waves have a high frequency and brain is quite active just while awake * heart may beat faster and breathing may become shallow and rapid * most vivid dreaming during this stage



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One complete sleep cycle lasts about 90-100 minutes. During the night a person will experience 4 to 5 complete sleep cycles. The sleep cycle begins with four stages of NREM. These stages then quickly reverse and followed by first REM period, roughly 90 minutes after falling asleep. This first REM period will last for about 10 minutes, as a new cycle begins about every 100 minutes. As the night proceeds the length of stages 3 & 4 of NREM begins to fade, and length of REM sleep increases, up to one full hour in length. So as the night goes on you dream for longer period of time.

This elementary fact of sleep stages was unknown until 8-year-old Armond went to bed one night in 1952. His father, Aserinsky, a University of Chicago graduate student, needed to test an EEG machine he had been repairing during the day. He placed electrodes near Armond's eyes to record the rolling eye movements believed to occur during sleep. Before long, the machine went wild, tracing deep zigzags on the graph paper. He thought the machine was still broken. But as the night proceeded, the activity periodically recurred. He finally realized, fast, jerky eye movements accompanied by energetic brain activity. When the boy awakened, he reported he was having a dream. Aserinsky had discovered what we now know as REM sleep.

To measure the voltage of the electrical impulses being given off by the brain's neurons, technicians can use an EEG machine. The type of brain wave, defined by amplitude and frequency, helps to determine the type of sleep that the sleeper is experiencing. The state of falling asleep is called the hypnagogic state.

## Awake

When the patient's eyes are open, their EEG waveform is rapid and fast. When the patient closes their eyes and is calm, slower brain waves appear.

## NREM Sleep

In Non-Rapid Eye Movement (NREM), most of the muscles relax, body systems take a rest, and the brain waves associated with wakefulness and alertness disappear and are replaced by increasingly slow, deep waves of inactivity. It may be mechanism designed to "cool" the brain periodically by suppressing behaviour and lowering metabolic rate. NREM is divided into four stages.

## Stage 1

The transition from wake to sleep occurs within minutes. You are less aware of their surroundings than just a few minutes ago. You may be woken by a whisper, or noise. You have dream-like sensations of falling, hearing voices, or seeing flashes of pictures. It takes 5 – 10 minutes to progress to Stage 2.

## Stage 2

It is the real stage of true sleep and accounts for about 50 % of total sleep. The person is less aware of his surroundings and is *light sleep* since individuals are easily aroused from this sleep state. When awakened, they will deny having been asleep.

## Stages 3 & 4

Both these two stages are considered as *deep sleep*. Characterized by slow brain waves. As the person is in a very relaxed state, they have a slow, regular heart beat and respiratory rate. It is very difficult to arouse a person in this state. If they are awakened, they are confused and slow to react. It is normally easy to go back to sleep.

During this time, the growth hormone is secreted. This hormone in children encourages growth. In adults it assists with healing of muscles. The body does its repair work.

## REM

In rapid eye movement (REM) stage, the person's eyes move in a rapid, flickering twitching motion, while their eyelids are closed. The most interesting symptom of REM sleep is the muscular paralysis that occurs. And they are temporarily paralyzed during this stage, which includes respiratory muscles, except for the diaphragm. It lets the mind explore the realms of its subconscious. The blood flow to the brain is increased. One experiences an increase in heart rate, respiration, blood pressure, muscle twitches, oxygen consumption, and gastric secretions. In children, this may help enable the brain to grow and in adults to repair itself. This stage results in increased genital activity. At this stage, the person is easily aroused by meaningful stimuli, if awakened, appears alert and attentive.

REM sleep is generated by a region in the brainstem, called the pons, and adjacent portions of the midbrain. Researchers have found that chemical stimulation of the pons will induce very long periods of REM sleep, while damage or injury to this brain region can greatly reduce or even prevent REM sleep.

There are two purposes of REM sleep. Firstly learning and secondly developmental. If we wake up from REM sleep, we have a good chance of recalling dreams. Rapid eye movements also stir the liquid behind the cornea; this delivers fresh oxygen to corneal cells, preventing their suffocation.

The amount of REM sleep during a sleep period is known as the *REM density*. If we sleep for a few hours, the REM periods usually get progressively longer.

They usually last 20-40 minutes, but can last up to an hour late in the sleeping session. This means that if we wake up from REM sleep, we have a good chance of recalling dreams. Scientists believe that REM sleep is closely related to wakefulness because brain wave activity during REM sleep is marked by short, rapid wave patterns similar to brain wave activity of the waking state.

For a baby that has just been born, REM sleep is about 50 % of their sleep. As the baby grows up, this level decreases, reaching 20-25 % by adulthood. The relationship between maturity at birth and REM sleep suggests that REM sleep plays a role in the development of the brain. One of the myths about sleep is that smarter animals spend longer periods in REM sleep. REM sleep amounts in humans—believed to be most intelligent members of the animal kingdom, are not remarkably high or low.

Mentally handicapped people with a low IQ, under 70, or who are retarded, experience less REM sleep. This means there could possibly be a connection between how smart a person is to how much they dream!

**Purpose** of REM sleep seems to be biological and a psychological need. It seems a psychological function of dreams in the symbolic dealing with or working out of an individual's conscious or unconscious problems. The purposes of REM sleep, from some of the theories, we conclude some of the following points.

- Restoration of brain chemicals and neuron proteins.
- Memory storage and organization.
- Dealing with stress or problems in dreams.
- Brain development.

You must have both REM and NREM sleep to get a good night's sleep. Most sleeping medicines change the quality of sleep and the REM component of it.

*Peoples rarely snore during dreams. When REM starts, snoring stops.*

## 2.1 Sleep Debt

Sleep debt is the amount of sleep you should have had, but didn't.

Those students who get less sleep than the body needs build a sleep debt. The debt accumulates over time and takes a toll on student's motor and intellectual functions. Even a little sleep debt can affect students. If there is a sleep debt of 10 hours or more, performance will be impaired.

For optimal functioning, it is best to get enough sleep every night. If that is not possible, experts say you should try to make up for sleep loss as soon as possible. Sleep loss effects of aging, it may increase the aging related diseases, such as obesity, diabetes and hypertension.

Many people can accumulate 30 or 40 hours of sleep debt, and still they think they were functioning normally during the day. But doctors can show that such a person is impaired. Their reactions are not as quick as they could be, their memory is not as good as it should be.

Every hour you put off going to sleep is like racking up another Rs. 50/- on your credit card. Sleep debt is like a monetary debt. It must be paid back sooner or later. The size of the sleep debt you have is directly related to the amount of lost sleep.

Whatever your ideal amount is, that is the amount of sleep that must be obtained each day, to avoid becoming sleep deprived. If the needed amount is not obtained, the lost sleep accumulates into a larger and large sleep debt. Throughout the day, you take out about 8 hours from this bank account, generating sleep debt. Over the course of the night, as you sleep, you replenish your account. If you sleep 6 hours, you still owe 2 hours. If you do this for 4 in a row, you have lost an entire night's sleep.

Not getting the proper amount of and the best quality sleep may have serious consequences. Many studies have shown that sleep deprivation adversely affects performance and alertness. Reducing sleep by as little as one and a half hours for just one night reduces daytime alertness by about one-third.

In all walks of life, it is likely that sleep deprivation has consequences—difficulty in studying, less productivity, more mistakes, and fatigue. For majority, the accumulation of large sleep debt appears to have happened so gradually that they wrongly blame their tiredness and fatigue, depression, stress, growing older, etc.

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Excessive daytime sleepiness impairs memory and the ability to think and process information, and contributes to a substantially increased risk of

sustaining an occupational injury. Sleep deprivation causes you to feel tired (not sleepy). Sleep debt has harmful impact on carbohydrate, metabolism and endocrine function. The effects are similar to those seen in normal aging.

The bottom line is that you should wake up feeling relatively refreshed and you should not feel sleepy during the day.

### **To know about sleep debt**

If you feel tired during the day, you probably have sleep debt. Sit down and relax in a chair on a warm afternoon, in the sun. If you start to feel tired, or drowsy, and can fall asleep, you have a sleep debt.

### **Wakefulness is sleep deprivation**

Ordinary waking day accumulates sleep debt. Once sleep debt is zero, the sleeper awakens and begins accumulating sleep debt again. You must have a certain amount of sleep debt in order to fall asleep again. How much sleep debt you have also usually determines how quickly or slow you fall asleep.

### **Sleep debt accumulation**

When you use alarm clock, you accumulate sleep debt. For regular feature, you are increasing your sleep debt. The brain keeps an accurate count of sleep debt for at least two weeks.

### **Sleep Surplus**

We cannot accumulate a sleep surplus. When your body does not need sleep any more, you will not be able to sleep. You feel tired after sleeping in late. It is probably due to an accumulated sleep debt. If you feel drowsiness after laying for a longer time, it might be your biological clock is less active.

*A large sleep debt makes you stupid.*      –William Dement

### **Drowsiness**

It is alarming. It is the last step before falling asleep. Drowsiness may mean you are seconds from a disaster. If you are aware of feeling drowsy, you can avoid catastrophe or accidents.

As the need for food is expressed by hunger and for water by thirst, so is the need for sleep expressed by a specific condition, drowsiness, when it is said, one's head becomes "heavy with sleep". Drowsiness resulting from a regular shortage of sleep cannot be looked upon as a morbid condition. This is but the normal reaction of a healthy body striving to satisfy its vital needs. Just as there are no other means of overcoming hunger or thirst than by satisfying them, so increased drowsiness of this type can only be eliminated by taking a good long sleep, and after that by sleeping as much as the body demands.

In many cases, a person may have slept an adequate number of hours, may even feel that he has had enough sleep, and yet be sleepy all the time, his working capacity becoming very low. Sometimes the condition appears at the start of the day, when there would seem to be no "lawful" reasons for it. Drowsiness is observed in college students during the early morning lectures. In some instances such a sudden craving for sleep may be explained by the fact that in certain individuals the transition from sleep to the waking state and activity occurs slowly, with delay; these people need a certain period of adaptation, of adjustment to work. In these cases drowsiness must be overcome by an effort of will and by regular physical exercises in the morning to disperse the remnants of sleep and stimulate the nervous system.

However, in some cases continuous drowsiness is observed as the result of exhaustion. This type of sleepiness is of a protective nature, as it blocks the fatiguing activity of the nervous system. It can be overcome by dealing with its basic cause, that is, with over fatigue. A temporary rest is needed, and a better regimen of work. It is also expedient to sleep longer hours, and to take a nap, if possible, in the daytime.

### **Dozing**

When a person starts yawning, stretching, the muscles become loose and flabby, it becomes difficult to concentrate on anything, to continue work. Gradually the person stops the sense and significance of words addressed to him. And his head falls to his chest, his thoughts become confused, chance images appear, and suddenly he is asleep. If this stage of falling asleep does not terminate in full sleep, then such a condition is called *dozing*.

*Do not love sleep or you will grow poor: stay awake and you will have food to spare.*

## **2.2 Sleepless Impact**

Missing one night of sleep is not fatal. A person will generally be irritable during the next day and will slow down or become tired easily. If a person misses two nights of sleep, it gets worse. Mistakes increase, concentration and attention are difficult. After three days, a person will start to hallucinate and clear thinking is impossible. With constant wakefulness a person can lose grasp of reality. A person who gets just a few hours of sleep per night can experience many of the same problems over time.

If you don't get enough sleep, you can become more prone to disease.

More people die each year from crashes related to sleepy, drowsy or fatigued drivers than from all the other causes. Sleeplessness can severely and irreversibly hamper the brain's ability to restore and retain information.

It may have more health harming consequences, including increased chances to ulcers, early death and impaired learning and memory. Sleep deprivation exerts a derogatory influence over metabolism and hormonal activity similar to that usually reserved for the aging process.

Sleep deprivation suppresses immune cells that fight off viral infections and cancer, which helps explain why people who sleep 8 hours a night tend to outlive those chronically sleep-deprived. When infections do set in, we typically sleep more, boosting our immune cells. Chronic sleep debt also alters metabolic and hormonal functioning in ways that mimic aging and are conducive to obesity, hypertension, and memory impairment. Other effects include impaired creativity and concentration, slight hand tremors, irritability, slowed performance, and occasional misperceptions on monotonous tasks.

People who chronically get inadequate sleep may be ill more often and seem to be at increased risk of obesity. It also appear extra-vulnerable to diabetes, cardiovascular disease, hypertension and depression. Especially among the young, it can create a profound learning and behaviour gap.

The attention problems, youth violence and other forms of lowered frustration tolerance are related to it. It's OK to miss some occasionally, but don't do it often, and try to fix your sleep schedule.

We can compensate and recover by sleeping more during weekends. But it does not compensate sleep deprivation period and irregular sleep schedule, which has been linked to poorer school performance and behaviour problems.

30 to 45 minutes daytime nap can refresh and re-energize you. But naps should not replace adequate night sleep.

*Trust yourself, and sleep before you fight.* –John Armstrong

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## 2.3 Wakefulness

If your sleep debt is very large, no amount of stimulation can keep you awake. There are two companions for helping you in waking. Your biological clock

and external stimulation, e.g. noise, light, anger, pain, excitement, etc. if both of these companions are not helping you, then you cannot hold heavy sleep debt then you cannot stay awake no matter how hard you try.

It's not right to think that, if boredom, a warm room or something else seems to cause you to feel drowsy, you have a sleep debt and you need to be stimulated in order to stay awake. A large sleep debt makes you vulnerable to apathy, inattention, and unintended sleep episodes. Poor grades in studies, errors, accidents, injuries, deaths, and catastrophes can be the result.

The major role of the *biological clock* [see section 3.5 ] in the regulation of sleep and wakefulness is to provide an internal and very powerful wake-up signal to the rest of the brain. This powerful signal is called clock-dependent alerting, and when present, it powerfully opposes the tendency to fall asleep. In the presence of any other stimulation, the process of clock-dependent alerting alone can usually keep us wide-awake throughout the entire day. This may not be true if we have large sleep debt. Usually clock-dependent alerting is always in harmony with the daytime hours.

There are a number of professions, such as, factory workers, medical professions, night shift salesmen, etc. , that necessitate work at night and sleep in the daytime. Medical science observations have shown that the replacement of night sleep by daytime sleep does not affect the health in these cases. However, it is necessary to allot a sufficient number of hours for sleep, and to create conditions favourable for sound sleep in the daytime. However it is harmful to children for their normal night sleep to be replaced by sleep during the day.

Nerve cells require several dozen times more oxygen than do muscular or glandular cells. Nervous system is the first to weaken and become fatigued during prolonged intervals without sleep, and it requires proper rest before any of the other systems of the organism do.

Disorders in the sleep may be the result of over excitation before going to bed, or of deep impressions, strong emotions, and intensive mental work. This pertains in particular to elderly people in whom inhibitory processes weaken with age, and the mobility of nerve processes decrease. It must be taken into account that a heightened interest and anxiety over sleep is in itself a disturbing

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reason that prevents a person from falling asleep. When the mind is focused on thoughts about quickly falling asleep this creates a site of excitation in the brain that is an obstacle to sleep. Thus, excessive worry over falling asleep may prevent sleep.



People who have difficulty in falling asleep should avoid anything that might excite them in the evening. It not advisable for such individuals to indulge in conversations of an emotional nature before going to bed, or look late night TV dramas, or to read absorbing or exciting literature.

Where water power and electric light had been developed, everyone seemed normally intelligent. When these appliances did not exist, and the natives went to bed with the chickens, staying there till daylight, they were far less intelligent.

### **Sleep Deprived Students**

Most college students suffer the consequences of less sleep. Check yourself from the following points.

1. Feel tired, irritable, and stressed during the week.
2. Usually fall asleep during the class lecture.
3. Need an alarm clock to wake up in the morning.
4. Often during journey do you feel drowsy?
5. Have dark circles around your eyes.
6. Feel slow with critical thinking and in problem solving.
7. On weekends you get up from the bed very late.
8. Have trouble in concentrating and remembering.
9. Often fall asleep when watching TV.
10. Often fall asleep while relaxing after dinner.

More than three points applied, means you are not getting enough sleep.

While sound sleep is a guarantee of good health, efficient work is an important condition conducive to sound, healthy sleep.

For also there is that neither day nor night seeth with his eyes.

*Lost sleep meant more time and opportunity.*

## **2.4 How much sleep you need**

Total sleep amounts differ greatly across species. Generally, large mammals tend to sleep less than small mammals. Giraffe and elephant, for instance, sleep only 2 to 4 hours a day, while bats, opossums, and armadillos sleep 18 hours a day or more. And as a human being, you must know how much sleep you need in an average night to feel your best. Common recommendation is 8 hours.

Individual needs vary greatly. Most adult people seem to need 7 to 9 hours. The amount of sleep you need decreases with age. A newborn baby might sleep 20 hours a day. By age four, the average is 12 hours. By age ten, the average is 10 hours. Seniors usually have 6 or 7 hours. Most young adults sleep 7½ hours on average. There are some who need as little as 5½ hours and to some as much as 9½ hours. Sleep patterns may be genetically influenced. Your requirement depends on the following factors.

1. The inherited genetic need.
2. The quality of sleep.
3. The circadian rhythm i.e. 24-hour daily cycle.
4. Daily activity includes exercise, smoking and drinking tea.

What you read or watch TV by sitting in a bed and how much exposure to light you have looking at that computer screen will also alter both the quantity and quality of your sleep.

The powerful brain mechanism that regulates the daily amount of sleep is called the sleep homeostat. By increasing the tendency to fall asleep progressively in direct proportion to the increasing size of the sleep debt. This homeostatic process ensures that most people will get the amount of sleep they need. Usually when daytime sleepiness occurs, we go to bed early or sleep late. When we ignore or resist nature's signal that we need more sleep and if we resist far too long, then falling asleep can be tragic! Sometimes [not always!] we get by with just a few hours of sleep. The majority of the really deep sleeping comes in the first half of the night, so by getting 4 hours or so, we can still extract enough of the restorative benefits that deep sleep gives us.

Everyone has a specific daily sleep requirement to feel his or her best. For most people, that's about 8 hours. Some people need less, some need more. However, research has indicated that most people are kidding themselves about how little sleep they need. Its very rare person who needs less than 7 hours of sleep. The sleep needed to maintain a good health may be shortened by its soundness. The most generalized rule that can be formulated is that the older a person becomes the less sleep he needs. When people are tired out, or weakened by a disease they need more sleep to restore their lost strength.

*Six hours in sleep, in law's grave study six,  
Four spend in prayer, the rest on Nature fix. –Cobbett*

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## 2.5 Adolescent Sleep Needs

As adolescents move through their teenage years, they need increasing amounts of sleep. It is about 9 hours nightly, as compared to 8 hours needed by adults. Excessive sleepiness in teenagers and young adults is related to physiological changes during teens. Yet, school/college starting times get earlier and earlier

as students mature, despite the fact that teens demands more sleep. This may have serious physical, mental, and social consequences for adolescents and negative impact to their academic performance.

The research show that students with higher grades reported that they obtained more sleep and go to bed earlier on school nights than students with lower grades. In some institutions the time of first class is 8:00 a.m. For a student having to travel long distance, he/she has to leave home as early as 7:00 a.m. One hour adjustment of the starting time of the school/college can improve a student's sleep time.

There is medical evidence that amount of sleep, time of day and the rhythmic cycles of the body, do play a part in how prepared an adolescent is to learn. The research show that sleep deprivation is associated with memory deficits, impaired performance and alertness, and delayed responses. The loss of REM sleep can increase irritability, anxiety and depression, decreased socialization, reduced concentration and decreased ability to handle complex tasks and to be creative. Students experiencing sleep deprivation can also experience an increased potential for intoxicants, drugs and chances for more accidents.

Research show that the students do their best learning in afternoon. One study found that afternoon reading instruction produced the greatest increase in reading scores as compared to morning instruction.

Adolescents experience a natural circadian phase delay and therefore, stay up later and sleep in later than childhood. It is not uncommon for many teenagers to sleep until the mid-afternoon during the weekends. Many students are in school/college when they are least alert and are free to go at the time they are reaching their peak alertness.

*One hour's sleep before midnight is worth three after.* –George Herbert

## Children

Children must never be allowed to go to bed late. Children younger than nine years should be put to bed between 8 and 9 o'clock at night. They must take a nap during the daytime. They should not be told bedtime stories that might frighten or excite them.

It is harmful habit for children to become accustomed to falling asleep only with the aid of some auxiliary means e.g. rocking or singing. It is also bad when parents start walking around on tiptoe after putting their children to bed. This leads to the parents being forced to limit their activities significantly. They cannot lead a normal life after their children have gone to bed. And as a result, the child develops a habit of sleeping very lightly and restlessly. One should know that any ordinary external irritants do not disturb the sound and calm sleep of babies. It is highly important for children to become accustomed to sleeping in ordinary surroundings, when their parents are at home sitting at the table, having supper, working or talking.

It is harmful for children to sleep on their stomachs, face down. Such a pose interferes with proper breathing. Infants and young children should be turned from one side to the other. If a small child sleeps on its back it may choke on food that it sometimes cast out again during sleep. Children should be trained to keep their hands outside the blankets during sleep.

A child's growth can be stunted by less sleep. The relationship between maturity at birth and REM sleep suggests that REM sleep plays a role in the development of the brain.

Many children do not use their full brain capacities to learn and absorb information because of their chronic sleep deprivation.

It is unhealthy to remain lying in bed after waking up in the morning; this is especially true for children, as it weakens the body and nervous system, lowers their will power. One should get out of bed immediately upon waking up, do physical exercises in front of an open window, and then take a shower.

*The vigorous are no better than the lazy during one half of life, for all men are alike when sleep.*     –Aristotle

## 3.1 Sleep Problems

### Insomnia

People who have insomnia don't get enough sleep at night. They may have trouble falling asleep or may wake up frequently during the night or early in the morning. It has many possible causes, including jet lag, stress, anxiety, poor sleep habits, depression, disorders of biological clock and medications.

### Snoring

When you fall asleep, many muscles in your body relaxes. If the muscles in your throat relax too much, your breathing may be blocked and you may snore. Sometimes snoring is caused by allergies, asthma, or nasal deformities that make breathing difficult.

### Sleep Apnea

A temporary suspension of breathing occurring repeatedly during sleep that often affects overweight people or those having an abnormally small throat opening. It can cause daytime sleepiness. It may be associated with high blood pressure and risk for stroke and heart attack.

### Narcolepsy

Disorder involving sudden and uncontrollable sleep attacks that may last for minutes or hours and that may occur several times a day. Other symptoms include periods of paralysis and hallucinations as sleep begins. It is a brain/nerve disorder that causes excessive daytime sleepiness. Genetic and environmental factors are involved. Naps are often refreshing for people with narcolepsy.

### Restless leg syndrome

Discomfort in the legs and feet peaks during late evening and night. They may feel creeping or crawling sensations in the legs. They may feel an urge to move their legs and feet to get temporary relief. It is a treatable condition. Cut your caffeine intake, take a warm bath or relaxation exercises before bed.

### Nightmares

Nightmares are frightening dreams. They can be caused by stress, anxiety and some drugs. These are common in children but can affect adults who are experiencing emotional or psychological problems.

### Circadian Rhythm Disorders

Light resets the biological clock and can move it forward or backward. These include **jet lag**, **adjustments to shift work**, **delayed clock** (cannot fall asleep and wake up on time), **advanced clock** (you fall asleep and wake up too early). People who drink tea or coffee and smokers have more sleep problems.

Exercise and proper diet is best defense against many sleep problems.

## 3.2 *Sleep Disorders*

*Sleep disorders are illness and disturbances of sleep and wakefulness that are caused by abnormalities existing during sleep. These abnormalities typically produce symptoms during wakefulness that are easily recognized if the person is aware of their significance, but the fundamental pathology exists during sleep.*

*A person suffering from REM Sleep Behavior Disorder (RBD) goes through each night with such behaviors such as; body or limb jerking, moaning, talking, picking up a bedside clock, leg twitching or kicking, punching their partner, leaping out of bed, or leaving the bedroom entirely have all been observed in RBD patients. Sometimes RBD has preceded development of both Alzheimer's and Parkinson's disease. It has also shown up in otherwise healthy, neurologically sound people who behave quite normally in the waking world.*

*It is found that some of these RBD patients are strong tea or coffee drinkers, or a long habit of alcohol and amphetamine abuse. Some of them, when they discontinue their coffee or strong tea habit, the symptoms are gone and after being removed from the drug remained symptom free.*

*To think that, during sleep, we might be able to jump out of bed, walk outside the room, it certainly someone needs to think about the states of consciousness.*

*What a fine line it is that separates the healthy from ill; how just a little malfunction can turn an exciting dream enjoyed by one, to an act of violence which poses a threat not only to the dreamer, but also those around the dreamer.*

### **Sleep Catalyst**

*One of the conditions promoting sleep is a monotonous, continuous type of stimulation. Everybody knows how conducive to sleep are the monotonous continuous raining, the rumble of a moving train's wheels, or the low and rhythmic swishing of the waves at the seashore. All lullabies are usually of a monotonous, plaintive, lulling nature. According to Pavlov, the soporific effect of monotonous, rhythmic, repeated stimulations is due to a prolonged excitation of one and the same brain cells, leading to a formation in them of protective inhibition that is then diffused over all the higher sections of the brain, thus producing sleep.*

One should not chase sleep, but only to begin the hunt for sleep to fly away faster than a bird. –Dubois (Swiss scientist)

### **3.3 How to sleep well**

*The quality and quantity of your sleep can make all the difference in how productive you will be the next day. The research show that students who have higher GPAs sleep more at night and are less sleepy during the day than students with lower GPAs. The students who get more sleep have the ability to be more alert and pay more attention during class. The following are few tips to sleep well.*

**1. Make your bedroom a sleep sanctuary.**

*Sleep in a cool [16 to 18 °C] , dark room that is free from noises. A hot room can be uncomfortable.*

**2. Sleep on a comfortable foundation.**

*Use a mattress. Don't use a bed too small, too soft or too hard.*

**3. Make yourself sleep for sleep.**

*Give yourself permission to go to bed. It will reduce your time to awake in bed.*

**4. Develop sleep rituals.**

*Do the same things each night just before bed signals your body for sleep.*

**5. If not sleepy, get up.**

*If not feel sleepy within 15 minutes, get up and sit quietly in the dark, read something in dim light or do something boring. Don't expose yourself to bright light.*

**6. Exercise regularly.**

*It will relieve tension and stress. Don't exercise too close to bedtime.*

**7. Keep a fixed schedule.**

*Keep regular hours, so that your biological clock would be in check for same bedtime and waking time each morning, even for weekends.*

**8. Stay away from stimulant after 6 p.m.**

*Caffeine and nicotine are stimulus. Cigarettes, tea, coffee and chocolate interfere with your ability to fall asleep.*

**9. Take light snack before bed.**

*A warm glass of milk or a biscuit or a slice of bread is recommended. Empty stomach or heavy meal before bedtime can interfere with sleep.*

**10. Have a hot bath one hour before bedtime.**

*It will raise your body temperature, but it is the drop in body temperature that may leave you sleepy.*

**11. Don't take naps.**

*It will make you sure that you are tired at bedtime. If its necessary, sleep before evening time.*

*God grants sleep to those he loves.*

### 3.4 Sleeping Habits

While sleeping, most animals close their eyes and adopt particular positions referred to as sleep postures. Humans typically lie down to sleep. Some animals, such as dolphins, can sleep while they are moving.

Sleeping styles vary with schedule and with individual persons. In a college life, a student resident or non-resident, usually confronts with lack of sleep. College includes many hours of homework, study and social obligations. Students have to face many challenges and changes, being a turning point in their lives.

Sometimes the living conditions of a students hostel affect his sleep. Going to sleep at 2 a.m. and waking at 7 a.m. and sometimes the environment is not appealing. Might be heating problem or unhygienic conditions affect sleep schedule. Someone becomes more social and stays up late night and sleep about 6 hours a night. Sometimes at start of academic session to catch up the deficiency a student have to spend more hours of awakening at night. A day's scholar might have one-hour journey from college to his home. He will sleep less because he gets home later. A change in the regular hours of sleep sometimes is significant in college life. You stay up to watch TV late evening. Sometimes 5 hours of sleep and always tired for another day of college.

People vary in their individual daily patterns. Some being night persons like owls and some are day persons like larks! Thinking is sharpest and memory most accurate when people are at their daily peak in circadian arousal. With age, we tend to shift from being owls to larks. Most college students are evening persons, their performance typically improves across the day. Most adults are morning persons, with their performance declining as day wears on.

People assume the most various attitudes in their sleep. Some lie on their backs, stretching out their legs or folding them, placing their hands under their heads or stretched out along their sides, often they curl up into a huddle. Still others sleep on their stomachs. Adults need no particular restrictions in selecting the pose that suits them best. Children should keep their hands outside the blankets during sleep. Elderly people are not advised to sleep on their left side, as this often interferes with cardiac activity and evokes unpleasant sensation and nightmares. Many people sleep well on low pillows, but most sleep better on a high one. Often insomnia may be overcome simply by changing the position of the head.

*A higher and more comfortable pillow may help well than any soporific agent. During sleep the head should always remain uncovered, while the feet should be covered warmly, as this facilitates sound sleep. All serious mental work should be ceased an hour before retiring for the night.*



## **Before Sleep**

The face, hands, and feet should be washed, the teeth brushed, cleanness of nightclothes and bedclothes checked, before going to bed. Warm washing and baths are conducive to the rapid onset of a healthy sleep, while cold water does just the opposite, stimulating the nervous system and preventing sleep. The cold-water showers should be taken in the morning, not at night.

It is not advisable to go to bed right after supper. The meal should be taken at least 1½ hour before sleep. This meal should be easily digestible food. No strong tea and coffee should be taken at night. Especially children should not take stimulating drinks before going to bed. No exercise should be done before sleep; however, a short untiring walk is nice.

## **After Sleep**

*Morning bath etc. should be done with cool water. After a good night's sleep one should start work directly. Working capacity is high in the morning. Start each day with a good night's sleep and taking control of their sleep environment can effectively reduce stress and will improve your quality of life.*

## **Biological Rhythms**

Like the ocean, life has its rhythmic tides. Over varying periods of time, our body fluctuate, and with them our minds. These biological rhythms are controlled by *Biological clocks*. They are:

**Annual cycles**—geese migrate, grizzly bears hibernate, and human may experience seasonal variations in appetite, sleep length, and moods.

**28 days cycles**—The average of female menstrual cycle.

**24-hour cycles**—Humans experience 24-hour cycles of varying and falling alertness, body temperature, and growth hormones.

**90-minute cycles**—We cycle through various stages of sleep.

The sleep cycle repeats itself about every 90 minutes. As the night wears on, deep Stage 4 sleep gets progressively briefer and then disappears. The REM sleep period gets longer. By morning, our average night's sleep, some 100 minutes has been REM sleep.

*We spend one-third of our lives asleep, so bed hygiene is a serious matter.*

### 3.5 Biological Clock

A master clock appears to exist in the brains of most animals, communicating its timing signals chemically to the rest of the body.

*The human biological clock is located in a tiny clump of cells at the base of the brain, just above the optic path, its receiving input is from the retina. This biological clock regulates such basic drives as hunger, thirst and sexual desire. That also regulates our daily cycle of sleep and wakefulness. It enables living things to follow the rhythms of nature e.g. day and night and seasons. These cells are strongly influenced by daily change between sunlight and darkness as well as the seasonal flux of light and the planets rotation.*

When living things are deprived of normal cues, they display a free running period of not 24 hours and drift slowly out of phase with the natural world. Our bodies display hundreds of circadian (daily) rhythms [see the glossary] including sleep and wakefulness, body temperature, blood pressure, the production of hormones and digestive secretions.

Light, especially bright light, is the most powerful synchronizer of daily rhythms. The amount of indoor bulb light can resynchronize the body's cycle of sleep and waking.

Sleep studies in the laboratory and with shift workers reveal that bright light helps reset our biological clocks. Thus, to speed the resetting of your biological clock after a long flight, spend the first day outdoors. Bright light in the morning facilitates awakening. Bright light at night helps delay sleep.

Our circadian rhythms “program” us to sleep at night and awake in daytime. Its hard to eat in night hours when our digestive system close down. That's why we don't get hungry and wake up at night. Although we get hungry every few hours while we are awake.

Biological clocks have four functions.

1. Circadian rhythm—a daily, rhythmical change in behavior or physiological process.
2. Basic rest—activity cycle (BRAC)—90 minute period, controls occurrence of REM sleep.
3. Daily schedule—e. g. anticipation of lunch.
4. Seasonal rhythms—pineal gland secretes—melatonin when directed to do so.

*My eyes stay open through the watches of the night.*

## 4.1 How Brain Works

During sleep the brain in human beings undergoes a characteristic cycle of brain-wave activity that includes intervals of dreaming.

*During certain stages of sleep, the brain is testing, strengthening, or somehow improving our neurons.*

The brain is what tells us when it is time to sleep. Sensation of light taken in from the retina is transferred through the nerves to a minute structure of the brain called the hypothalamus. This hypothalamus determines the amount of light exposure and adjusts the body accordingly. This is all part of the circadian rhythms and the body's sleep-wake cycle.

*A master switch in the brain that allows people to go to sleep has been seen by scientists. They found that a cluster of nerve cells turns off arousal systems that keep people awake. This active cluster is responsible for generating sleep. Histamine is believed to be the primary chemical agent stimulating wakefulness, which is why drugs called antihistamines are thought to cause drowsiness.*

Animal studies have shown that the area containing neurons become most active before and during sleep. Many of these neurons are activated by heat, which explains how a warm bath or hot day at the beach causes sleepiness.

## Brain Waves

If we attach electroencephalograph (EEG) machine to a person's head, we can record the person's brainwave activity. The EEG is a summation of the activity of post-synaptic cerebral neurons, so it's a kind of measurement of brain activity-not only measuring the frequency of neuronal firing, but the amplitude of firings as well. A distinguishing factor between the waking state and the various levels of the sleeping state comes from observing and recording the different frequencies/amplitudes of our neuronal firing. An awake and relaxed person generates *alpha waves*, having frequency of about 10 cycles per second. An alert person generates *beta waves*, having frequency of about 20 cycles per second.

As we enter into sleep, EEG patterns tend to become more synchronized, the frequency of firing slows, but the amplitude of those pulses increases.

During sleep slower waves having oscillations less than 3.5 to 7 cycles per second execute. As a person falls asleep and sleep deepens, the brainwave pattern slow down. The harder we need to think, the more frequently our neurons have to fire.

*I sleep, but my heart waketh.*

## 4.2 Dreams

According to Joel Achenback, brain creates dreams through random electrical activity. The random and discontinuous images may tell us something about ourselves, just as what we see in an inkblot can be revelatory. Our mind may be working on deep-seated problems. The following have some characteristics.

1. Dreams usually involve you. They are egocentric.
2. They tell a story.
3. They incorporate deep wishes and fears.
4. They involve things that have happened to you recently.
5. Noise in the environment or some food/fruits smell worked into a dream.
6. Dreams give brain a chance to organize memories.

*Dreams are meaningful mental products that express important wishes, fears, concerns, and worries of the dreamer. It's a form of mental activity that occurs during sleep. Visual experience is present in almost all dreams. Primarily auditory experience occurs, touch, taste, smell and pain are rare. Emotion such as fear or anger is usually present.*

Many scientists have in their time pointed out the part played by dreams in the origin of the conception of animate nature. According to Allan Hobson, when people interpret a dream as if it were meaningful and then sell those interpretations, it's quackery. And Jonathan Swift write, those dreams that on the silent night intrude, and with false fitting shapes our minds delude, are mere productions of the brain. And fools consult interpreters in vain.

Even when you are deeply asleep, your brain somehow processes the meaning of certain stimuli. You move around your bed, but you manage not to fall out of it. The sound of your name, a stimulus our selective attention is ever alert for. We process most information outside of conscious awareness. More commonly, we dream of events in our daily lives, a meeting at work, taking an exam, relating to a family member or friend. For Menander of Athens, what one has dwelt on by day, these things are seen in visions of the night.

Even those who claim they never dream will, more than 80 % of the time, recall a dream after being awakened during REM sleep. They spend about 600 hours a year experiencing some 1500 dreams, or more than 100,000 dreams over a typical lifetime. Unlike the fleeting images of Stage1, REM sleep dreams are often emotional and usually story like, but never acted out. People usually recall dreams when awakened from stages other than REM sleep, but these dreams usually contain a single vague image.

*As dreams are made on, and our little life,  
Is rounded with a sleep. –Shakespeare*

### 4.3a Old Memory

Old memory seems immutable, like audio/video tape that can be taken down from a shelf and played over and over with same recording.

It is suggested that a seemingly permanent memory is not only changeable, but changes every time it is called to mind. According to Joseph Le Doux, “your memory is only as good as your last memory, rather than based on your initial memory”. New research show, a memory can be put at risk when it is called and then placed back into storage, or reconsolidated.

Someone traumatized by a terrible memory might be able to call it up and then while it was still in a vulnerable or labile state, erase the memory using drugs that kept it from being reconsolidated. One of the survey shows that when memory reactivated, it return to a labile state that needs new proteins to be stored all over again.

*We should not think of memory as something you pull up and put back in the same way you would a computer file, but its much more dynamic.*

### 4.3b Creativity

Creativity is the ability to produce ideas that are both novel and valuable.

Results from tests of intelligence and creativity suggest that a certain level of aptitude is necessary for creativity. Generally people with high intelligence scores also do well on creativity tests. Exceptionally creative scientists, architects and engineers usually score no higher on intelligence tests than do their less creative fellows. The following 5 factors promote creativity.

1. **Imaginative thinking:** It provides the ability to see things in new ways, to recognize patterns, to make connections. You must first master basic elements of a problem, then redefine and explore the problem in a new way.
2. **Well-skilled:** The more ideas, images, and phrases we have to work with, through our accumulated learning, the more chances we have to combine them in an innovative way.
3. **Natural motivation:** You will be most creative when you feel motivated primarily by interest, enjoyment, satisfaction and challenge. Creative people focus not so much on meeting deadlines, impressing people or making money.
4. **Environment:** A creative environment speeds, and supports creative ideas. Prominent scientists were mentored, challenged and supported by colleagues.
5. **Daring:** They tolerate ambiguity and risk, perseveres in overcoming obstacles, and seeks new experiences instead following precedent. They have willingness to persist after failures.

*Our birth is but a sleep and a forgetting.* –Wordsworth

## 4.4 Learning during sleep

During sleep, the brain is extremely active. It never sleeps. When we are awake, we are conscious of the real world. During sleep, our awareness of the outside world is completely shut down and we are conscious only of the inner world.

The sleep can help consolidating memories and students are capable of learning while they sleep. Some researchers are precise in making sure that their subjects are in electroencephalogram (EEG)—defined sleep before giving “lessons”. Student obtaining more positive results begin their lessons at sleep onset, therefore involving the learning process during wake and sleep hours.

Introducing new material right before sleep improves the memory of that which has just been learned. After encountering new material, memory of this material increases slightly for a short time before falling. Stimuli presented at the same time interfere with memory. Sleep blocks outside distractions. Neurons may continue to store memory while the learner sleeps.

Brain works and processes information before and after learning sessions for optimum learning, not just when one is studying. You can learn during sleep by taking sleep –assisted instruction for new material, so that it can learn when awake.

Many people make connections between their learning in sleep and wake periods by solving problem in their dreams. In their dreams, which are associated with their daily problems, they may solve their problem. Analysis of their metaphorical dream may reveal their solution. So the mind can process information and think things through during sleep. In order for sleep learning experiences to be useful, the sleepers must remember them when they wake up to apply the newly learned information.

We spend one third of our lives in sleeping. If we can learn during our sleep, we can save lots of time.

There are companies that would have you believe that you can play a learning tape, such as one for a foreign language, in your sleep, and learn the subject without any effort because your brain can do your work for you while you sleep.

*When deep sleep falls on men as they lie on their beds. He opens their ears in times like that, and gives them wisdom and instruction.*

## 4.5 Math inclination

It is known that math is hierarchical. It has been widely reported that infants who listened to Mozart's<sup>1</sup> music do better in math. Perhaps the neural patterning happens through experience, not through study or instruction. Mazzocco and other researchers say they don't know at what point difficulty with math becomes a learning disability. There is no specially designed test for the check.

According to David C. Geary, the human brain is not designed to accept math easily, except basic counting and simple arithmetic. Language, including foreign languages if they are introduced early, is a completely different matter, as the brain is pre-wired to learn this.

New neuro-imaging techniques are making clearer how different areas of the brain are tapped for various visually and linguistically based mathematical tasks, which helps explain the ways someone can trip over math. Fact retrieval appears to be the most common type of problem for elementary school students, for instance, and spatial difficulties may interfere with geometry learning.

Most girls develop language skills faster and most boys develop spatial and visual abilities faster. It explains why boys are better in math and some girls have steered away from it. Different teaching approaches early in a child's life can make up for these gender differences.

Poor instructions are primary culprit for students' math struggles. It is never too late, to learn math, if the spirit has not been broken. Children should be asked to learn concepts before they are ready.

*You might prove anything by figures.* –Thomas Carlyle

<sup>1</sup>**Mozart, Wolfgang Amadeus** (1756-91)

*Austrian composer, centrally important composer of the classical era, and one of the most inspired composers in Western musical tradition. By the age of 6 Mozart had become an accomplished performer on the clavier, violin, and organ and was highly skilled in sight-reading and improvisation. Five short piano pieces composed by Mozart when he was 6 years old are still frequently played. His more than 600 works show that even a child he possessed a thorough command of the technical resources of musical composition as well as an original imagination. His instrumental works include symphonies, divertimentos, sonatas, chamber music for a number of instrumental combinations, and concertos. Mozart's creative method was extraordinary.*

## Glossary

**Acacia:** Any of numerous frequently thorny trees (include peas, beans & mimosas) and shrubs constituting various species; found especially in arid regions of Australia and tropical Africa, with small flowers in spikes or globular clusters.

**Alzheimer's:** Mental deterioration occurring in middle or old age, owing to progressive generalized degeneration of the brain; (premature) a loss of mental faculties; Chronic mental and emotional deterioration caused by organic brain disease.

**Amphetamine:** *A synthetic drug, or a tablet, used as a decongestant and central nervous system stimulant.*

**Amphibians:** *A creature that lives both in water and land.*

**Amplitude:** **The maximum extent of vibration or oscillation from an equilibrium position.**

**Anatomy:** **The science of the structure of the bodies of humans, animals, and plants.**

**Animate:** **Pertaining to or denoting living beings.**

**Apathy:** **Insensibility to suffering or emotion; passionless existence; lack of interest.**

**Archive:** A record preserved of historical value; in computers, transfer to a store of infrequently used files, e.g. from disk to tape.

**Armadillo:** Animals native to South and Central America, which have bodies encased in bony plates and are able to roll themselves into a ball when threatened.

**Artery:** Any of the muscular-walled tubes forming part of the system of vessels by which blood is conveyed from the heart to all parts of the body.

**Axon:** The extension of a neuron, ending in branching terminal fibres, through which messages are sent to other neurons or to muscles or glands.

**Biological:** The science of life, dealing with the morphology, physiology, anatomy, behaviour, origin, and distribution of living organisms.

**Brainstem:** The brain's basement—its oldest and innermost region. It begins where the spinal cord enters the skull and swells slightly, forming the medulla.

**Caffeine:** A crystalline of vegetable origin, which is found especially in tea and coffee plants and is a central nervous system stimulant.

**Caffeinism:** Headache, sleeplessness, and palpitations due to excessive intake of caffeine.

**Carbohydrate:** Any of a class of organic compounds that contain hydrogen and oxygen in the same ratio as water (2:1), and can be broken down to release energy in the animal body, e.g. sugars & starch.

**Cardiovascular:** Pertaining to or involving the heart and blood-vessels

**Catastrophe:** A sudden or widespread or noteworthy disaster; an extreme misfortune

**Central nervous system:** The brain and spinal cord.

**Cerebral:** Of or pertaining to the brain



**Chronic:** Of a disease etc.: lingering, lasting; of slow progression and often gradual onset.

**Circadian:** From the Latin *circa*, “about”, and *dies*, “day”. Of physiological activity etc.: occurring or recurring about once a day.

**Circadian rhythms:** The physiological and behavioral characteristics that follow a daily patterns even in absence of external cues such as sunrise or sunset, they depend on internal timers. e.g. our body temperature rises as morning approaches, peaks during the day, dips for time in early afternoon, and then begins to drop again before we go to sleep.

**Cornea:** The transparent circular outer covering at the front of the eye, over iris and pupil.

**Cue:** A feature of a perception or of something perceived that is used as an aid in the brain's interpretation of the perception.

**Depression:** Pathological state of excessive dishearten / dejection, characterized by a mood of hopelessness, with feelings of inadequacy, and sometimes physical symptoms.

**Diabetes:** One in which the pancreas secretes insufficient insulin and the body in consequence fails to metabolize glucose, leading to loss of energy and accumulation of glucose in the blood and urine;

**Diaphragm:** The muscular sheet which in mammals separate the thoracic and abdominal cavities and whose contraction lead to expansion of the lungs in respiration

Egocentric: **Centred in the ego; self-centred, egotistical.**

**Electroencephalogram (EEG):** The traces of the voltage waveforms associated with the brain taken from electroencephalograph machine.

**Electroencephalograph:** A sensitive instrument that records the voltage waveforms associated with the brain. The trace obtained is known as an electroencephalogram.

**Electroencephalography:** Study of brain waveforms observed by electroencephalograph.

**Endocrine:** Designating a gland that secretes directly into the blood or lymph; of or pertaining to such glands or their secretions (hormones).

**Flux:** A flowing out of fluid material; the flow of the tide.

**Frequency:** The rate of recurrence *of* the pulse, respiration, or other periodic bodily function.

**Gland:** Any cell or organ which synthesizes and secretes some particular chemical substance or substances for use by the body or for excretion; an organ resembling a gland.

**Hallucination:** The apparent perception of an external object or sense-datum when no such object or stimulus is present; an instance of this; the mental state of being deceived, mistaken, or deluded; an unfounded idea or belief, an illusion.

**Hierarchy:** A body of people, animals, or things ranked (in grades, orders, or classes) one above the other, esp. with respect to authority or dominance; *spec.* in logical and scientific classifications, a system or series of terms of successive rank.

**Hierarchical:** Belonging to a priestly hierarchy or a body of ecclesiastical rulers.

**Histamine:** An ammonia compound, widespread in animal and plant tissues, stimulates gastric secretion and smooth muscle contraction, and is released by certain cells in response to wounding and in inflammatory, allergies.

**Hormones:** Chemical messengers, mostly those manufactured by the endocrine glands, that are produced in one tissue and affect another.

**Homeostat:** A system which maintains relatively constant conditions in the body by internal processes.

**Hormone:** Any of numerous organic compounds secreted into the body fluids (especially the blood) of an animal by a specific group of cells, and regulating the activity of *certain other cells*.

**Hypertension:** Abnormally or excessively high pressure of arterial blood or intra-ocular fluid; A state of great emotional or nervous tension.

**Hypnagogic:** That accompanies the process of falling asleep.

**Hypothalamus:** A lower part in the forebrain in vertebrates, which in mammals controls and functions independently such as temperature.

**Immutable:** Not varying in different cases; invariable; not subject or liable to change; unalterable.

**Impair:** Become less effective or weaker; deteriorate; suffer injury or loss.

**Indole:** A crystalline compound, which has a molecule consisting of fused benzene and has an unpleasant odour, and occurs in coal tar, in faeces, and (as derivatives) in plants.

**Iris:** The circular coloured membrane of the eye.

**Jet Lag:** When we travel rapidly to other time zones, it may occur during the sleeping hours, then we experience some sleep problem called *jet lag*. It occurs when a traveler's internal biological clock (circadian rhythms) is out of synchronization with the time zone of his destination, thereby disrupting the normal daily rhythms of sleeping, eating, and other activities. Some or all of the symptoms may last up to several days until the body has adjusted to local time. An eastward traveler typically experiences more severe jet lag than a westward traveler. Since the day is shorter for an eastward traveler. This can be reduced by sleeping and eating meals according to the time at home.

**Labile:** Emotionally or behaviourally unstable.

**Lark:** Any of various small brown singing birds of the family Alaudidae, with an elongated hind claw; specially the skylark

**Linguistic:** Of or pertaining to the knowledge or study of languages; of or pertaining to language or languages.

**Lullaby:** A song or soothing refrain to pacify or put a child to sleep.

**Mammals:** A furred, warm-blooded, animal of the vertebrate class Mammalia, members of which are characterized by the possession of mammary glands in the female (from which the young are fed) and a four-chambered heart, are typically viviparous, include humans, rodents, bats, whales, ungulates, carnivores, etc.

**Mandatory:** Of an action: obligatory in consequence of a command, compulsory

**Marsupial:** A mammal (e.g. a kangaroo or an opossum) of the order Marsupialia, characterized by young that are born imperfectly developed and are usually carried after birth in a pouch on the mother's belly, over the mamillae

**Medulla:** The base of the brainstem; controls heartbeat and breathing.

**Melatonin:** An indole derivative formed in the pineal gland of various mammals (principally from serotonin), which inhibits melanin formation and is thought to be concerned with regulating the reproductive cycle.

**Metabolism:** The sum of the chemical processes, in a cell or organism, by which complex substances are synthesized and broken down, and growth and energy production sustained; anabolism and catabolism considered together; the overall rate at which these processes occur; the sum of the chemical changes undergone in the body by any particular substance.

**Metaphor:** A figure of speech in which a name or descriptive word or phrase is transferred to an object or action different from, but analogous to, that to which it is literally applicable; an instance of this, a metaphorical expression.

**Mimic:** A poor or feeble imitation

**Mimosa:** Any of various tropical or subtropical leguminous shrubs, trees, lianes, etc., of the genus *Mimosa*, chiefly with bipinnate leaves and small pink or white flowers in ball-like clusters; especially the sensitive plant, *Mimosa pudica*. Also, any of certain, chiefly Australian, trees of the related genus

**Moan:** Complaint, lamentation; a complaint, a lament.; A state of grief or lamentation; A long low mournful sound indicative of physical or mental suffering.

**Monotonous:** (Of sound, utterance, etc.) continuing on the same note; having little or no variation in tone, pitch, or cadence

**Morbid:** Pertaining to or caused by, disease; sickly; unhealthy.

**Morphology:** Branch of biology, deals with living organisms and relations of their structure.

**Nerves:** Neural “cables” containing many axons. These bounded axons, which are part of the peripheral nervous system, connect the central nervous system with muscles, glands, and sense organs.

**Nervous system:** The body’s speedy, electrochemical communication system, consisting of all the nerve cells of the peripheral and central nervous systems.

**Neurology:** The branch of biology or especially medicine that deals with the anatomy, functions, and organic disorders of nerves and the nervous system.

**Neuron:** A nerve cell; the basic building block of the nervous system.

**Nicotine:** A toxic colourless or yellowish oily liquid alkaloid which is the chief constituent of tobacco, acting as a stimulant in small doses, but in larger amounts blocking the action of autonomic nerve and skeletal muscle cells.

**Nook:** A small or out-of-the-way corner or recess; a secluded or sheltered spot.

**Obesity:** The condition of being very fat; extremely bulky or fleshy of body.

**Opossums:** Any of various small or medium-sized marsupial mammals, mostly arboreal, of the mainly neotropical family Didelphidae, which have an opposable thumb on the hind foot and a usually prehensile and hairless tail; especially (more fully *Virginian opossum*) the common N. American species, *Didelphis virginiana*, which is the size of a cat

**Organic compound:** A compound (or material) containing carbon combined with hydrogen, and often also with oxygen, and other elements.

**Palate:** 1. The roof of the mouth of a human; the structures of bone and flesh separating the oral from the nasal cavity.  
2. A convex projection of the lower lip of certain two-lipped flowers, e.g. the snapdragon, which closes the throat.

**Parkinson's:** A chronic, slowly progressive disorder of the central nervous system that occurs chiefly in later life as a result of degenerative changes in the brain and produces tremor, rigidity of the limbs, and slowness and imprecision of movement. Also called *Parkinsonism*.

**Pathology:** The science of the causes and effects of diseases; especially the branch of medicine that deals with the laboratory examination of samples of body tissue for diagnostic purposes; Pathological features considered collectively.

**Peril:** Liability or exposure to the possibility of imminent injury or destruction; a danger; a threat regarded as emanating from a particular people, race, or country.

**Peripheral nervous system:** The sensory and motor neurons that connect the central nervous system to the rest of the body.

**Physiology:** The branch of science that deals with the normal functioning of living organisms and their parts.

**Pineal gland:** A small outgrowth behind and above the third ventricle of the brain, which has an endocrine function, in some vertebrates forming a light-sensitive median eye involved in control of circadian rhythms, and in others secreting melatonin.

**Pons:** A portion of tissue joining two parts of an organ; specially a band of nerve fibres in the front part of the brainstem, connecting the medulla oblongata and the thalamus, and also the two hemispheres of the cerebellum.

**Predators:** An animal that naturally preys on others; an animal that habitually catches and eats prey.

**Psychological:** Of or pertaining to the functioning of the mind, mental; affecting or pertaining to the mental and emotional state of a person; having a mental not a physical cause.

**Pupil:** The opening in the iris of the eye, through which rays of light pass to the retina.

**Regimen:** A prescribed course of exercise, way of life, or diet, especially for the promotion or restoration of one's health.

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**Reptiles:** A creeping or crawling animal, include snakes, lizards, turtles, crocodiles, etc.

**Retina:** The inner, sensitive coating of the eye containing the ends of the nerves of sight; the part of the eye that receives images of the object.

**Revelatory:** Serving to reveal something, especially something significant; yielding a revelation.

**Rhythm:** Regularity in the repetition in time or space of an action, process, feature, opposing or different conditions, events, etc.; periodic or cyclical change or movement.

**Serotonin:** A compound present in blood serum, which acts as a neurotransmitter and is involved in the regulation of circadian cycles.

**Soporific:** A drug, influence, etc., which induces sleep.

**Stimulus:** A thing that provokes, increases, or quickens bodily activity; a material agency that evokes a specific reaction in an organ or tissue.

**Synapse:** A junction between two nerve cells or their threadlike extremities, consisting of a minute gap between two specialized regions of the cell surface, across which an impulse passes by diffusion of a neurotransmitter. Also *loosely*, any junction between excitable cells by which an impulse may pass.

**Synaptic:** Of or pertaining to a synapse or synapses between nerve cells.

**Synchronize:** Occur at the same successive instants of time; keep time *with*; (of two sets of movements etc.) go at the same rate, have coincident periods, etc.; proceed exactly together; (of clocks etc.) indicate the same time as each other.

**Synthesize:** Make a synthesis of; put together or combine into a complex whole; make up by combination of parts or elements.

**Toll:** A tax or compensation paid for some special use, privilege, or the like, as for using a bridge.

**Trauma:** 1.A physical wound; external or internal injury; state or condition resulting from it.  
2.A psychic injury, especially one caused by emotional shock the memory of which may be either repressed and unresolved, or disturbingly persistent; a state or condition resulting from this.

**Ulcers:** An open sore on the surface of the body, often discharging pus.

**Vein:** Any blood vessel; any of the thin-walled tubes forming part of the system of vessels by which blood is conveyed back to the heart from all parts of the body.

**Vertebrate:** Of, pertaining to, characteristic of, or found in a backboned animal , which comprises animals with a bony skeleton, skull, and spinal column, and includes fishes, amphibians, reptiles, birds, and mammals.

**Vulnerable:** Able to be wounded; (of a person) able to be physically or emotionally hurt; liable to damage or harm, especially from aggression or attack, assailable