Samay

Newsletter- Indian Society for Chronobiology

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Office Bearers

Inside....

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Editor's note

New Year 2022 is here and it is time to share the hopeful New Year wishes with everyone in our lives.

The editorial team of SAMAY- the biannual newsletter of Indian Society for Chronobiology (InSC) wishes all its readers and supporters a Very Happy New Year 2022. We hope that this New Year brings happiness, adventures and new opportunities for all.

We, like everyone else around the globe, are also readjusting our rhythms to a new life style due to Covid19 pandemic.

Bhanu Pratap Singh
Editor in chief

Namram S. Singh
Editor

Even during this difficult times, SAMAY (the newsletter) has attempted to reach out to all its members. We are trying our best to bring latest research, engaging articles and upcoming events to our readers. It is a happy moment for all of us to mention that all our members are staying focused to drive the organization to new heights, much of which are reflected in events organised by Indian Society for Chronobiology and our previous and the present newsletter.

Our effort for the upcoming newsletters would be to include at least one trending topic for the Chronobiology community at large and we will be looking forward for suggestions from our readers. The present issue of SAMAY focuses on "Sleep" and related behaviours. The successful publication of this newsletter goes to the members and researchers who contributed on time to fulfil the publication deadline.

Aakansha Sharma
Editor

We extend our thanks and appreciation to all the contributors who promptly replied to our request. As always, drop us a line (**inscdu@gmail.com**) with any suggestions on topics you'd like to see us cover or things you like or don't like about what we're doing. We look forward for your feedback and suggestions.

From President's desk

Dear Colleagues,

Year-end greetings and very best wishes for the New Year 2022.

I greet you and your family during the holiday season and sincerely wish you all the best of health, and much joy, happiness and progress in the coming new year 2022. I do hope that your time during the year 2021 has been as good as possible under the prevailing circumstances.

In 2021, we all consistently were trying to learn and adjust to the new normal because of COVID-19. The year brought many new challenges before us, but in retrospect I think it has been also educative. For instance, we probably have begun to respect nature much more now, and may be this has a positive impact and enhances our interest in biology, in general, and biological time, in particular.

Friends, as I wrote in July 2021 issue, the perception of the situation is what that matters, and while working in the area of Chronobiology, we understand it much better. Despite the pandemic, the field has seen tremendous progress, and I am sure you all are aware of it through electronic media. I feel proud that although small in number, the InSC community has been active. After a very successful international conference in Chronobiology, a NCSTC-sponsored program for Science teachers and students of Uttar Pradesh was organized in Azamgarh, Uttar Pradesh.

I look forward to hearing from you about the activities related to Chronobiology you are current involved in, or you are planning to do in the next six months. The InSC will support you in all possible ways in conducting an activity that comes under its mandate.

Very best wishes to you all of you.
Vinod Kumar
President, InSC

Clock Disruption: Impact on sleep pattern and its consequences in humans

Anshu Dwivedi, **University of Lucknow**

Biological clock

The biological clock is the physiological system that is responsible for measuring time in living organisms. The biological clock i.e. SCN (Suprachiasmatic nucleus) is a dense cluster of neurons located just above the optic chiasm in the anterior ventral hypothalamus of the mammalian brain. It lies at the base of the third ventricle, dorsal to the optic chiasm. Hence, SCN is said to be a master clock because it is responsible for regulating all the biological clocks to work in synchrony. To maintain synchrony between biological clocks with the environment, the light information is received by the retina of the eye and transmitted to SCN through the retino-hypothalamic tract (RHT). According to (Aschoff et al. 1971) the major zeitgeber (stimulus) involved in the synchronization of the biological clock with the environments is the photic cue i.e. light. The other non-photic stimulus such as food, exercise, and caffeine are also considered to be important synchronizers of the circadian clock.

What is Clock Disruption?

Our tiredness level day and night are different because of the circadian rhythms present inside our body, which governs our rest and activity patterns. These circadian rhythms are governed by the biological clock present in our body. They control most of the physiological changes in our body such as body temperature, blood pressure, cortisol levels, melatonin levels, growth hormones, cognition, mood, etc. The biological clocks need to be synchronized with the environment so that they can perform in a rhythmic pattern. In humans, to keep the clock in synchronization with an environment the most common zeitgeber is the natural light and darkness (Ronnenberg et al., 2019).

India is among one the developing countries and has a society working 24/7. This is responsible for forcing people to work late at night and exposure to light at an inappropriate time. This inappropriate daily schedule has resulted in 'Clock disruption'. It can result in an extension of our day into nights contributing to various physiological and behavioral disorders such as sleep disorders, obesity, blood pressure, depression, digestive disorders, diabetes, insulin, lipid metabolism, and intolerance of glucose. (Sans-Fuentes et al., 2010; Stankiewicz et al., 2017; Potter et al., 2016). Hence, here in this article, we are going to focus on how clock disturbance impact sleep pattern in humans (adolescents).

Impact of clock disturbances on sleep pattern in adolescents

Sleep is a phenomenon of life that is highly essential for optimal health. It plays an important role in performing the various necessary function in our body such as proper functioning of the brain, physiology, metabolism, and other systems of our body. Sleep appears to be generated by two broadly opposing mechanisms, namely the homeostatic drive for sleep and the circadian system that regulates the timing of both wakefulness and sleep. The circadian system helps our body to synchronize with environmental cues such as day and night. While homeostatic drive plays an important role in making our body remind us about the "need" for sleep and also regulates the intensity of sleep.

World health organization has defined the age group of 10-24 yrs. as adolescents and young adults . This period is the crucial time for maturation and development by causing various changes in the body at biophysiolo -gical and psychological stages. According to research conducted by national and state Youth Risk Behavior Surveys in 2015, about 57.8% and 72.7% of middle

school students and high students respectively were deprived of sleep. Recent research conducted by (Singh and Sharma et al., 2018) concluded that the prevalence of sleep deprivation increased from 83-87% to 92% in teenagers. There can be various reasons for the disruption in sleep among adolescents such as late usage of electronic gadgets, late-night study, irregular timings of sleep, etc. Sleep deprivation in adolescents has correlated with poor attendance also, indirectly associated with mood and academic performance. Apart from academic performance students with delayed bed time were having high depression scores. Hence, we can summarize that the sleep pattern in adolescents is delayed which needs to emphasize for a better future and high achievements in their carrier by living a healthy lifestyle.

Take home message

- Match the body clock with the natural environment (day/night cycle).
- Focus on a healthy diet and good sleep practice.
- Limit artificial light exposure at night such as TV, laptops, mobile, etc.
- Parents should notice the sleep schedule of their children and guide them constantly in following a healthy lifestyle.
- Parents should give proper time to their children and counsel them regularly to make them mentally fit.

A Saga of Neurodegenerative Diseases and Associated Sleep abnormalities

Khushboo Chaturvedi, University of Lucknow

Degeneration in particular brain areas often lead to sleep disorders. Sleep disturbances in such condition usually precede clinical onset of disease. It is considered that poor sleep quickens the rate of neurological degeneration, thereby leading to pathological condition. For monitoring sleep disturbance in neurodegenerative diseases, polysomnography (PSG) is performed, which distinguishes rapid eye movement (REM) sleep and non-REM sleep, and stages 13 (N1N3) of non-REM sleep. Three of the most prominent neurodegenerative diseases leading to sleep abnormalities are Parkinson's disease, Alzheimer's disease and Huntington's disease.

Parkinson's disease is a complicated neurological disorder pertaining to movement. It is more common in older adults relative to young people. Common symptoms include slowness of movement, tremors in hands or legs, unsteady walk and balance, stiff muscles and coordination problems. Besides, it may also cause non-motor symptoms such as, impact your mood and sense of smell and vision. Most of the symptoms could be medically managed however, there is no known cure. With the progression of disease, neurons in specific brain regions die for e.g., dopaminergic neurons in Substantia nigra pars compacta degenerate, Lewy bodies formation takes place, and abnormal accumulation of α-synuclein in neurons occur. Often times, Parkinson's disease leads to REM sleep disorder in which person 'enacts dreams' i.e. make abrupt movements while sleeping as if they are involved in any physical activity. At least 2/3 people affected with Parkinson's face difficulty in falling asleep. In fact, these kind of sleep difficulties are being identified as a potential early predictor of Parkinson's disease. In such patients, sleep disturbance contributes to cognitive deficit, which in turn exaggerates sleep disturbance. Additionally, level of alertness and quality of life deteriorates not only of the patient, but also of the care taker.

Sr.no.	Disease	Abnormalities during sleep	Molecules/Genes/Area involved
1.	Parkinson's disease	Insomnia, fragmented sleep, excessive daytime sleepiness, very vivid dreams, emotional dreams or nightmares, circadian rhythm sleep disorders, nocturia, and Willis-Ekbom Disease	• loss of serotonin in the striatum, raphe and hypothalamus • lack of dopamine and norepinephrine synthesizing and releasing neurons
2.	Alzheimer's disease	Shorter or fragmented sleep, changes in the sleep cycle and other sleep disorders such as increase in daytime sleepiness, insomnia, decreased slow-wave sleep and REM sleep, prolonged REM latency, increased proportions of stages N1 and N2 non-REM (N-REM) sleep, and increased sleep fragmentation, obstructive sleep apnea and restless leg syndrome	• Hippocampal, parahippocampal and thalamic regions • change in timing and release of melatonin hormone, accumulation of beta-amyloid and tau protein
3.	Huntington's disease	Reduced sleep efficiency characterized by frequent nocturnal awakening involving severe anxiety and excessive chorea, and increased time awake after sleep onset, delayed REM sleep onset, and an increased proportion of time spent in the lightest stage of sleep (N1) versus a reduction of time spent in slow wave sleep and REM sleep	• Disrupted expression of circadian clock genes mPer2 and mBmal1 in Suprachiasmatic nucleus (SCN), motor cortex and striatum and reduced prokineticin 2 expression in SCN • Neurodegeneration in striatum and globus pallidus, also in the cerebral cortex, cerebellum, amygdala, thalamus, and hypothalamus • polyglutamine expansion repeat in exon 1 of the huntingtin gene, located on the short arm of the fourth chromosome, leading to abnormal expansion of a CAG repeat sequence

Alzheimer's disease is the most common type of dementia characterized by progressive, irreversible memory loss, thinking and reasoning abilities, behavioral changes and decrease in sleep duration due to sleep abnormalities. It is found that the neurons in Suprachiasmatic Nucleus, which regulate our biological clock, get damaged. According to recent studies, a protein called β-amyloid is found to be upregulated in Alzheimer's patients. β-amyloid is a waste product that builds up from the interstitial fluid in the brain. Increase in this protein has been linked to reduced brain function. The accumulation basically happens in the thalamus and hippocampus of the brain. In case of Alzheimer's patient's brain, this protein clumps together forming amyloid plaques, thereby impairing neuron to neuron

communication in the brain. Another protein called 'Tau' is found to be lumped in the brain of people with Alzheimer's. This protein helps in regulating signalling between neurons, and their knots in the brain indicate damage to nerve cells.

Huntington's disease is an autosomal-dominant inherited neurodegenerative condition, characterized by progressively worsening motor dysfunction, cognitive abnormalities, psychiatric symptoms, weight loss, autonomic nervous system dysfunction Huntington's disease leads to atrophy in locus coeruleus (a brainstem structure) which keeps a check on transition between sleep stages. This disease is quite rare as compared to the other two diseases; approximately 48 individuals per 100,000 in the general population get affected. Due to this reason, it is difficult to perform PSG studies in such patients, because large number of subjects could not be recruited. One way to rule out this problem is to incorporate meta-analytics. Another contrasting fact about this disease is that it's monogenic.

This feature enables the development of transgenic animal models through which corresponding pre-clinical studies could be done. Huntington's disease however, is an incurable disease that leads to disability and a significant reduction in quality of patients' life.

Treatment of sleep abnormalities in a patient with a neurodegenerative condition commences with an elaborated evaluation of this sleep characteristics, via questionnaires, objective scales, and investigations, so as to ascertain primary contributing factors such as depression, medication or nicotine use. Secondary measure of treatment includes bright light therapy. Sedative agents are only used in the event of failure of all other measures. Clinicians prefer implementation of conservative measures and non-pharmacol -ogical interventions for treating such patients. Recent studies show that the spectrum of pharmacological options is increasing with orexin antagonists showing promising results.

Links between sleep and Neurodegenerative disorders

Ankit Sharma, JNCASR, Bangalore

Neurodegeneration refers to death of neurons and is characterized by a gradual decline in functions of nervous system functions, often beginning with small defects in movement. Examples of such neurodegenerative conditions are - Alzheimer's disease (AD), Parkinson's disease (PD) and Huntington's disease (HD). Because of the late onset of these disorders, neurodegenerative conditions impose a large burden on economies in today's world, when average life expectancy has increased. Each neurodegenerative condition has its own characteristic features, likely resulting from differences in the mechanisms by which they affect neurons. Additionally, regions of the brain that are initially and predominantly affected in these disorders are also different.

Nevertheless, some behavioral phenotypes are common to many of these disorders such as sleep and circadian rhythm defects. Observations from animal models, particularly over the last two decades, have shown that expression of mutant neurodeg -enerative genes lead to both circadian rhythm and sleep defects. Changes in activity patterns, core body temperature rhythms and increased variability in heart-rate rhythm point towards defective circadian output, whereas increase in latency period, sleep fragmentation, and increase in day-time sleep suggests defect

in sleep circuits. Sleep is an important behavior shown by almost all the metazoans The importance of sleep has been demonstrated by sleep deprivation studies in various model systems, wherein organisms that were sleep deprived experienced serious ill-effects on health including increases in ROS levels, defects in memory and learning, neuron degeneration etc. In current times, the focus of research has moved toward understanding the interaction between sleep and neuro-degeneration. Given sleep defects have been observed in many neurodegenerative conditions, this observation raised important questions 1) Can early sleep onset deficits aggravate the neurodegenerative phenotypes? 2) Can improvements in sleep slow down the neurodegenerative phenotypes?

To understand the first question, initially it might be important to investigate whether sleep defects are manifested during the early stages of the disease progression. In this regard, recent studies on Alzheimer's and Parkinson's diseases hints toward sleep defects being manifested early in the disorders. However, no systematic study has been performed till now to provide insights on whether sleep deficits aggravate the neurodegenerative phenotypes. One major reason could be association of sleep centers with circadian circuit. As sleep defects were also observed on perturbation of circadian circuit, it becomes challenging to unravel the nature of the relationships between breakdown of sleep and other rhythmic processes and the overall effects of neurodegeneration. However, studies perturbing the nighttime sleep (leading to sleep fragmentation), in presence of mutant neurodegenerative proteins can provide crucial insights in this regard. Based on the sleep deprivation studies mentioned earlier in the article, it is proposed that impaired sleep will accelerate the neurodegenerative phenotypes.

Finally, can improvement in sleep parameters be useful in mitigating the symptoms of neurodegenerative disorders? Some studies have tried to answer this question by using pharmacological approach and have shown that feeding sleep-inducing drugs like Gabadoxol, Alprazolam in model systems like Drosophila and mouse improves behavioral phenotypes caused due to expression of neurodegenerative proteins. However, the detailed mechanisms are still unclear. These studies suggest that improving sleep might be beneficial in neurodegenerative conditions. Overall, available literature hints toward bi-directional interaction between sleep and neurodegeneration, yet detailed and systematic studies are required to support these results and gain more insights in this regard. Longitudinal studies are required to validate positive effect of sleep therapies and in understanding whether long term use of sleep-inducing drugs is safe for patients. If so, improving sleep can turn out to be a useful for slowing the progression of neurodegenerative conditions.

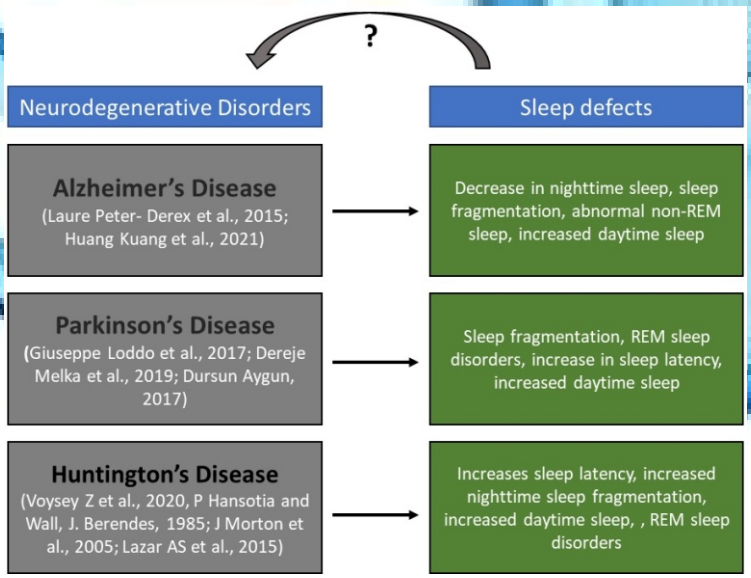


Figure 1: - Schematic summarizing effects of neurodegenerative disease on sleep phenotypes and missing link of the effect of sleep defects on progression of neurodegenerative disorders.

Sleep deprivation An impediment to cognitive function

Meenakshi, MSc (F), Department of Zoology, University of Delhi

The connection between sleep and learning is entrenched since the mentions of Charak Samhita “Untimely and excessive sleep and prolonged vigil takes away both happiness and longevity.” The contemporary human society however believes in a 24-hour culture, to the extent that sleeping less and working more is considered as hallmark of robustness. Partial sleep deprivation (PSD) or sleep restriction is a common condition that affects more than one-third of normal adults (Mishra, 2020). Effects of total sleep deprivation and a PSD have been extensively studied and demonstrated via various cognitive tests to unravel their effect on cognitive function. Cognitive functioning is known to be impaired post sleep deprivation and fluctuate throughout the day Total sleep deprivation (SD) may impair attention and working memory, and have long term effects on memory retention and decision-making. Such effects have been recently studied and reported using Karolinska WakeApp by Holding et al. 2021. This study reported that sleep deprivation causes significant increase in Response Time (time period between stimulus and response), increase in odds of lapsing, and increase in Response Time Variability (intra individual standard deviation in response time). Sleep loss causes largest effects on simple attention amongst other functions and leads to greater number of lapses with increasing sleep loss which clearly stands by state of instability hypothesis. Further, sleep deprivation condition exhibits a significant increase in odds of making mistakes during solving arithmetic problems and increases the response time. Sleep deprivation also leads to a decrease in episodic memory ability and significantly increases the odds of misremembering a word and sleep deprivation fosters impairments in working-memory capacity and increases the odds of making a working memory mistake.

Partial SD is also found to influence attention, especially vigilance. Acute PSD is more common than total sleep deprivation in college students. PSD affects executive function and RTs (Response Times) in students. Synaptic plasticity and strength require sleep, as a consequence of which cognitive abilities such as learning and memory (especially long term) are impaired following its deprivation (Mishra, 2020). Short periods of sleep restriction, say even an hour, after cognitive learning, can impair formation of memory.

There are time dependent effects of sleep deprivation, such that the response time for cognitive tasks such as simple attention and work memory is highest during afternoon and lower during mornings. Time-of-day appears to be particularly influential for sleep-deprived people, while well-rested people show less significant time of day effects. These diurnal effects are likely driven by circadian processes, but also influenced by extrinsic factors such as food intake and light levels and intrinsic increased awake time.

Total sleep deprivation leads to significant increase in sleepiness which is most profou -nd during afternoon. In cases of short term partial sleep deprivation, similar effects are observed. However, in chronic PSD cases, the sleepiness is proportional but not comparable to the dip observed in cognitive performance For e.g. In a study done by VanDongen, subjects taking 6 hours of sleep for two weeks exhibited poor cognitive performance in the following days but didn’t rate the sleepiness as higher as subjects with total sleep deprivation. Their performa -nce declined progressively and was

comparable to total SD subjects in 10 days whereas subjects with 4 hours of sleep took sooner to reach same level. This is alarming and shows that the cognitive ability continues to decline without a physiological sign as we continue to push our limits. These findings have relevance for the scheduling of work tasks in order to keep performance as high as possible. For example, for a sleep-deprived person, a period around midday may be the best time to schedule tasks requiring episodic memory whereas for someone well-rested, performance is likely to be stable throughout the day. It is noteworthy that effects of 6 hours of regular sleep are as poor as 4 hours and comparable to total SD over a stretch of time.

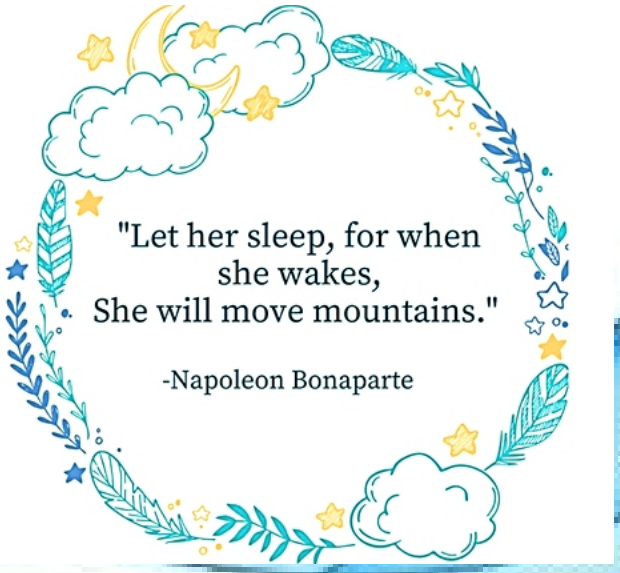
Generally, adults require 7-9 hours of non-fragmented sleep for optimum cognitive function. It is also important to know how sleep loss affects different psychiatric populations differently in order for better management of disorders. For example, ADHD is associated with a delayed circadian rhythm and sleep problems and sleep loss affects cognition in subjects with high ADHD-symptoms more than others. The effects of sleep deprivation appear to show dependency on time of day, often differing from the time-of-day effects seen in well-rested controls. This fact can be exploited towards the possibilities of cognitive testing using smart phones, to the potential benefit of scheduling tasks in order to best preserve cognitive ability following sleep deprivation.

Sleep dysfunction, and Endometrial cancer: The reason to the result

Megha Das, Banaras Hindu University

Night shift work means poor sleep quality. With various other chronodisruption related diseases, night shift increases endometrial cancer risk conceivably through lowering melatonin production. We also know that sleep and melatonin are like positive partners, as a good sleep habit maintains a good melatonin level in our body that keeps the body free from 'free radicals'. But night shift work increases the light exposure at night consequently suppressing melatonin production. Hence, potentially elevate cancer risk through mitotic, antiapoptotic, lowering immunity, and angiogenic mechanisms. With relevance to the risk of endometrial cancer which is estrogen-sensitive cancer, an increasing body of literature is suggesting that adequate sleep produces an adequate level of melatonin which in turn suppresses local estrogen production by modulating aromatase activity. Therefore, possess the ability to lower the cancer risk. Researchers also have implicated the possibility that sleep patterns influence endometrial cancer risk. In addition to the previous reports on the etiology of endometrial cancer, we demonstrated that the night shift downregulates uterine Aanat gene expression which further down-regulates Bmal1 core clock gene expression and together induces endometrial adenomyosis by activating PKCα/PI3K/Akt pathway (unpublished). Now after the prognosis of endometrial cancer, we are considering the importance of sleep while receiving medical treatment for endometrial cancer. Almost all worldwide cancer patients experience uncontrolled postoperative pain following major operative procedures, despite continuing progress in surgical measures and ancillary care. Despite multiple antagonistic side effects, opioids are given to those patients for substantial pain relief. Bout these opioids are not utterly

effective for a permanent solution. These unrestrained post-surgery pain and continuous consumption of painkillers negatively affect the quality of life, slow the recovery rate, increase complications, and thus produce poor postoperative consequences in cancer patients. Hence a group of scientists from the University of Pittsburgh, Pennsylvania started to pursuit a novel adjustable factor for post-surgery ache that could convert as a target of pre-surgery interventions. They proved the importance of sleep the night before surgery to reduce poor postoperative consequences. They reported that taking zolpidem a sleeping pill used for short-term treatment of sleeping problems and cognitive-behavioral remedy for insomnia, the night before endometrial cancer-related major surgery improved sleep efficiency, lowered the post-surgery pain along reduced the requirement for analgesic medications. Till now we were talking about sleep dysfunction as a reason of etiology and poor postoperative consequences of endometrial cancer. Sleep dysfunction can be a result too in endometrial cancer survivors. Epidemiology suggests a higher incidence of sleep dysfunction in 40-55% general gynecologic cancer survivors, than sleep disorders in the general population i.e. 4-33%. Worth mentioning in endometrial cancer survivors suffer a higher rate of insomnia than general people. Previous year (2020) data given by Nock and group from the USA, demonstrated that 72.3% of endometrial cancer survivors (72.3%) possess poor sleep quality, among them 71.2% of endometrial cancer survivors reported to have slept less than 7 hours per night. Reduced sleep quality results in decreased metabolism, insulin resistance, and finally obesity and increased obesity simultaneously associated with poor quality of life and depression which again cause people insomniac. Overall, sleep is the golden chain that ties our physical health and mental health together and gives us a quality life.



Sleep and Smell: Can we process smell in our sleep?

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The TV plays in the background, there is the chitter-chatter of people and yet if one is sleepy all these noises faint down and die out eventually as they fall asleep. When one is asleep, they're in their most vulnerable state. However, living organisms do retain some sense of their external environment; this was first found out in the 1960s when sleeping humans responded to their names being called.

The sleeping brain has been an interesting mystery to unravel for scientists and thanks to our fly pals, *Drosophila melanogaster*, it has now been possible to discover some neuronal circuitry of sleep. Recently in 2020, a research group led by French et al., from the Imperial College London has discovered a neuronal pathway in *Drosophila melanogaster* that stays awake to process smells while they are asleep.

The group made a robotic 'ethoscope' setup monitored by an automatic camera system where they placed two groups of flies; well-fed and starved, in tubes and deployed

air-puffs of different odours 5 minutes after the flies had fallen asleep(detected by the flies' inactivity in the tubes).They observed that response to different odours varies across the night; it being a minimum in the early stages of sleep and a maximum during the later stage of the night (siesta). In order to understand if internal states had any bearing on the flies' response to smell, the team exposed the flies to ethanol vapours prior to sleeping. The flies showed a reduced arousal threshold post alcohol consumption, a response that is much alike humans post alcohol consumption or general sedation. Similarly, a reduced threshold was observed for flies after being put into forced wakefulness. Additionally, starved flies were more responsive towards food-related odorants than other odorants. These observations could possibly suggest that flies are capable of showing 'stimulus filtering' even in sleep.

To find out the neuronal circuitry of this sensory processing, the researchers sought to trace the interaction of neurons known to be involved in modulation of odour valence and novelty-mushroom body output neurons (MBONs)- with a known sleep regulatory area in the fly brain- fan-shaped body (FSB). This was achieved using trans-synaptic labelling technique. Switching on and off some of the MBONs affected the flies' ability to detect odours thereby suggesting that this circuit connecting peripheral olfactory input to sleep regulatory neurons might be a functional circuit involved in the sensory processing during sleep. The team has suggested that although this circuit might be anatomically different in humans however there is much overlap in the functional properties.

Due to the homology in terms of genes as well as complex behaviour shared between humans and fruit flies, this recent finding might serve as a good start to further research on unravelling the underpinnings of sensory processing in the sleeping brain.

PANDEMIC induced LOCKDOWN: A potent SLEEP disruptor

Piya Majumdar, University of Kalyani, Kalyani, West Bengal

The present outbreak of the coronavirus illness 2019 (COVID-19) has wreaked havoc on the world's peace since this pandemic has had far-reaching health, economic, and societal consequences. Nations were put on lockdown because of the paucity of medicines or vaccines to stop the virus from spreading. In response to this serious situation, worldwide home confinement and social distancing measures to protect against the danger of infection have become an essential strategy for prevention from infectious transmission. This obligatory self-isolation had a deleterious influence on each individual's physical and emotional well-being, and hence on healthy lifestyle practices. Staying at home for an extended period reduced daily physical activity and increased sedentary habits which have also been identified as a possible risk factor for poor sleep quality. Limited access to family and friends, causing loneliness, anxiety, and depression, and encouraging heavy use of digital devices to battle solitude, which has the potential to change people's sleep patterns, physical activity, and mental well-being.

Studies reported disorientation in sleep patterns due to induced lockdown in a varied group of people. In India, the first reported study from Majumdar et al. (2020) concluded compromises in health, well-being, and sleep as a result of disruptions in daily living routine, anxiety, worry, isolation, elevated family and job stress, and excessive screen time among corporate sector professionals working '95' from home

during this phase of the pandemic, as well as among undergraduate and postgraduate university students, confirms that, compared to the pre-lockdown condition, they had extensive feelings of sleepiness, with significantly increased daytime nap duration and depressive symptomatology. The imposed schedule and confinement resulted in widespread usage of digital media and a significant increase in sedentary behaviour among the school children of India (Dutta et al., 2020). Sleep behaviour is disrupted as the length of time spent in front of a screen increases by them. The same research group (Dey et al., 2021) had identified discontinuation of sleep, the shift of mid-sleep time, increase in depression, plus stress and anxiety among traffic police personnel that affected their chronobiological milieu. Also, sleep disturbances are highly widespread among shift working nurses, and the situation is increasingly frightening as a result of COVID-related stress. Due to the considerable night shift workload and unstructured shift patterns, the study by the research team (Majumdar et al., 2020) found a high frequency of disrupted mental health, physical health, and poor sleep quality among shift working nurses, with night shifts strongly related to altered alertness. Furthermore, the constant stress of living through a pandemic caused a slew of health symptoms, including headaches, sleeplessness, digestive issues, hormone abnormalities, and exhaustion. Many other studies throughout the world had reported disturbed sleep patterns, physical alterations, and mental disorientation which was partly due to pandemic induced lockdown where, the people facing problems in the induction of sleep thereby altering sleep latency, sleep duration, and sleep inertia.

Do you also sleep-procrastinate? Here are the reasons you should not:

Nikhila Kulkarni, Institute of Chronobiology Education and Research, Pune

We literally run errands to strike the last item on our daily to-do list, sometimes even by skipping our sleep. Now, this may sound like a normal thing to do, and you must be wondering there's no harm in losing a couple of days' sleep, but that's where we need to take a step back. A study conducted by Soomi Lee helps us understand the stress our body goes through after losing sleep for consecutive days. Her study shows that even one night of sleep pushes the trajectory of our daily functioning to the negative side. The participants recorded the changes they observed in a sleep diary where they slept for lesser hours than their regular schedule for 8 consecutive days. In addition, the negative emotions like anger, frustration, irritability, and nervousness, which reduce mindfulness and responsiveness, increase with the loss of sleep. Along with that, the physical symptoms also peaked for the first three days and worsened after 6 days. The body tries to adjust initially; however, the sleep loss and its effects are not ignorable. The adverse effects did not return to baseline unless they had at least 6 hours of sleep. The study highlights the impact of the sleep debt that accumulates on the weekdays continuously. The current lifestyle and stresses, including the pandemic, harm our sleep schedule, and overcoming long-accumulated sleep loss is nearly impossible for the body. It can result in long-term health issues.

So, if you're thinking of pulling all-nighters to finish your tasks, we suggest you think again. Prioritize your health!

Rock-a-bye fly: What the fruit fly has in common with babies

Rutvij Kulkarni, JNCASR, Bangalore

The dew-loving, dark-bellied fruit fly, *Drosophila melanogaster*, is a darling of modern biology, with five Nobel prizes to its credit. But to most people, it is little more than an annoying pest. After all, how do you relate to a tiny critter with bulging, red eyes that hovers around garbage? But as any *Drosophila* researcher will tell you, it is remarkable how similar to humans they can be. A case in point is work by Lone et al., who show that flies can be put to sleep by gentle, repeated motion just like human babies. While the 'rocking effect' occurs in adult humans (think of naps on public transport) and mammals such as chimps and mice, this work shows that our distant evolutionary cousins, the invertebrate fruit flies are no exception.

Identifying sleep in animals can be tricky, especially in animals that lack eyelids. One solution is to check if the animal is not moving. To measure activity in flies, scientists house them in tubes with an infrared beam passing perpendicularly through the middle. Whenever a fly moves past this beam, a computer records the break in the beam as activity. When Lone et al. placed flies on a rotating platform, they found that activity decreased when the platform was in motion. This inactivity could have many explanations. Perhaps the flies were simply tired. Or they got dizzy and fell unconscious.To determine if this inactivity was 'sleep', the researchers needed to establish that it exhibited classic properties of sleep.

They started by showing that inactive flies move readily if shaken physically or startled with a bright light. This suggested that inactivity could be reversed and was not due to exhaustion or loss of consciousness. Next, they saw that inactive flies were more active after the rotation stopped. This pattern, familiar to people who struggle to sleep at night after napping in the afternoon, is a feature of sleep called homeostasis. Finally, they showed that inactivity was lost if flies were given caffeine. These properties of reversibility, homeostasis and caffeine sensitivity were clear signs that rotation does not simply stop flies in their tracks but actually lulls them to sleep.

This demonstration of the rocking effect in flies is more than mere curiosity. The reason why Lone et al. chose the fly is because scientists have groomed it as a model organism i.e. an organism where biological processes can be studied in detail and generalized to other organisms such as humans. Using genetic tools developed for the fly, Lone et al. were able to discover neurons which sense rotation and brain regions which convey this information to sleep centers. These details are impossible to study with humans or even mice. These results also pave the way for research on non-drug based sleep therapies using the fruit fly. Ultimately, we can only wait to see the scientific implications of this work. For now, it is a reminder that despite stark differences among living things, we remain alike in mysterious ways.

Environmental factors affect sleep architecture

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As we know that sleep-wake cycle is regulated by the internal mechanisms, however, a number of external factors can vividly affect the equilibrium of sleep-wake system. The quantity and quality of sleep generally decreases and becomes more fragmented with age and associated factors (like stress, medical conditions, chronic pain etc.). The external or environmental factors that affect sleep include light, food and

temperature. Disparity in these factors result into increasing sleep bouts and limit the quality of sleep. Above all light is the most important environmental factor that affects sleep directly, by causing discomfort for people to fall asleep, and indirectly, by influencing the biological clock through specialized light sensitive cells present in the retina via SCN. Light acts as the predominant pacemaker to set our internal clock. But problem occurs when duration of light exposure increases. Extended light exposure during evening leads to delay in the phase of biological clock that later affects the normal sleep pattern. Not only the light duration and intensity hampers the sleep quantity and quality but wavelength of light also affects sleep. Short wavelength i.e., blue colour of light largely suppresses the plasma melatonin level, while it is slightly affected by green light, but red light hardly affects the melatonin level, so blue light has more arousing property than the other two wavelengths.

Like light, quantity and type of food also contribute in shaping the sleep pattern. However, very less attention has been paid to the effect of feeding pattern and type of food on sleep. The amount of food also affects the sleep architecture. Overeating can cause discomfort and disrupt sleep by increasing body temperature, which counter the body's normal rhythm. Most researches show that carbohydrate rich food intake is associated with Slow Wave Sleep (SWS) and increase in Rapid Eye Movement (REM), whereas high fat diet decreases Sleep Efficiency (SE) and REM but increas -es SWS and awakening.On the other hand, restricted feeding regime weakens the arousal state and boosts the sleep urge during the food anticipation.

As sleep-wake rhythm, organisms also have temperature rhythm that has a cyclicity of 24-hour. The core body temperature increases during the awakening state and lowers during the sleep phase. Sleep has direct relation with body temperature, therefore, balance between the sleep-wake cycle and body temperature rhythm is essential for sound sleep. Surrounding temperature is one of the factors that can affect sleep because thermo-regulation is directly associated with the mechanism regulating sleep. Several studies suggest that high temperature affects the SWS and REM while there is no effect of cold temperature on sleep, however it will affect falling asleep and may adversely affect the health.

Therefore, it is important for people to know how the environmental factors affect sleep and health. Simultaneously, it is the need of hour to initiate discussions on how to change lifestyle pattern to improve sleep quality as sleep is considered as an important aspect of health. Technological advancements take their toll on human health by affecting sleep quality, quantity and timings. Weight gain, sedentary lifestyle and consumption of caffeine, alcohol and nicotine like substances also hamper the sleep.

"Sleep is not an optional lifestyle luxury.
Sleep is a non-negotiable biological necessity"
-Matt Walker

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THE HINDU

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August 30, 2020 Hemani Sheth talks about how according to a new research from the University of South Australia (UniSA), a combination of coffee and power naps can help reduce sleep inertia and stay alert on the night-shift.

Read full article at
https://www.thehindubusinessline.com/news/science/caffeine-nap-helps-to-surviving-nightshifts-study/article32478822.ece

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THE TIMES OF INDIA

Why asthma worsens at night

September 7, 2021 This article suggests that circadian-induced drops in pulmonary function at night may explain why asthma worsens at the night time.

Read full article at
https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/why-asthma-worsens-at-night/articleshow/86004768.cms-rate/

Upcoming events

Center for Circadian Biology Annual Symposium

February 7-9, Scripps Forum, La Jolla

Details: https://ccb.ucsd.edu/

Society for Research on Biological Rhythms 2022- Conference

May 14-18, 2022

at Omni Amelia Island Resort in Amelia Island, Florida

For details: https://srbr.org/2022-conference/

12th International Symposium on Avian Endocrinology (ISAE2022)

July 24th-28th

Edinburgh

For details: https://www.avianendo2022.efconference.co.uk

European Biological Rhythms Society 2022- Conference

July 24-28, Zürich

For details: https://www.ebrs-online.org/events/ebrs-events