Sleep and Dreaming

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1 Sleep

The quality of sleep is essential for survival as food and water. Most body systems enter the anabolic state during sleep and help maintain normal body function (Sollars and Pickard 2015).

1.1 Structures Involved in Sleep

Many parts of the brain control sleep, like the hypothalamus.

The brainstem, thalamus, and pineal body that creates melatonin are also crucial for controlling sleep in both directions, REM and NREM (Roenneberg et al. 2013).

1.2 Circadian Rhythms and Sleep

The term circadian means "around the day" in Latin, so circadian rhythms are physical, mental, and behavioral changes that follow a daily cycle by responding to light and darkness. They are also present in plants, animals, and microbes. At the same time, biological clocks are a collection of specific proteins that interact with cells throughout the body and act as innate timing devices to produce and regulate circadian rhythms (Schupp and Hanning 2003).

The circadian rhythm controls sleep patterns. SCN is triggered by incoming light from the optic nerve and controls the production of the melatonin

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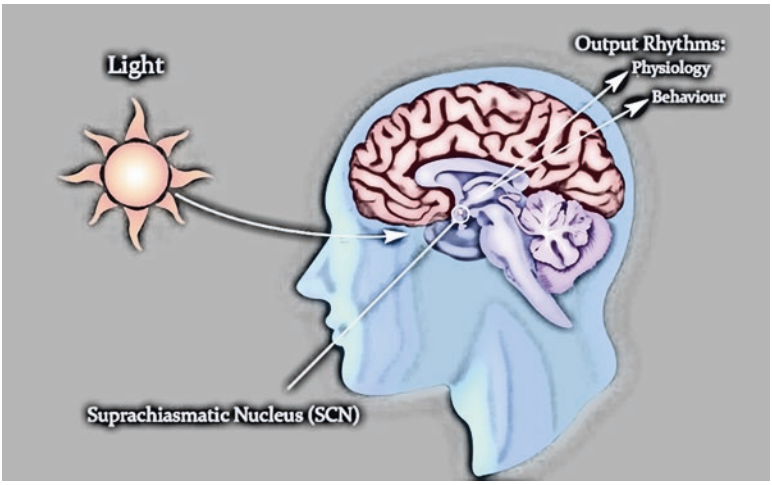

Fig. 1 The effect of light on SCN

hormone—responsible for sleeping. When the incoming light decreases the SCN, it stimulates the brain to produce more melatonin to make us drowsy and prepared for sleep (Fig. 1). In this way, the circadian rhythm controls sleep and wakefulness throughout the day and night to create a stable regular cycle. Disruption to this circadian system can result in sleep difficulties and disturbances.

1.3 Sleep Types

Two types of stages for sleep are discussed. They are (Fig. 2):

1. Non-Rapid Eye Movement (NREM).
2. Rapid Eye Movement (REM).

1.3.1 NREM Sleep

This represents the first part of the sleep cycle, and it is subdivided into three distinct stages: stage I, stage II, and stage III (also known as N1, N2, N3). Muscle paralysis does not occur appropriately during NREM sleep; that's why some people do not progress to REM sleepwalk during their sleeping because they do not lose their motor function; also, dreaming rarely occurs in this type (Tubbs et al. 2019).

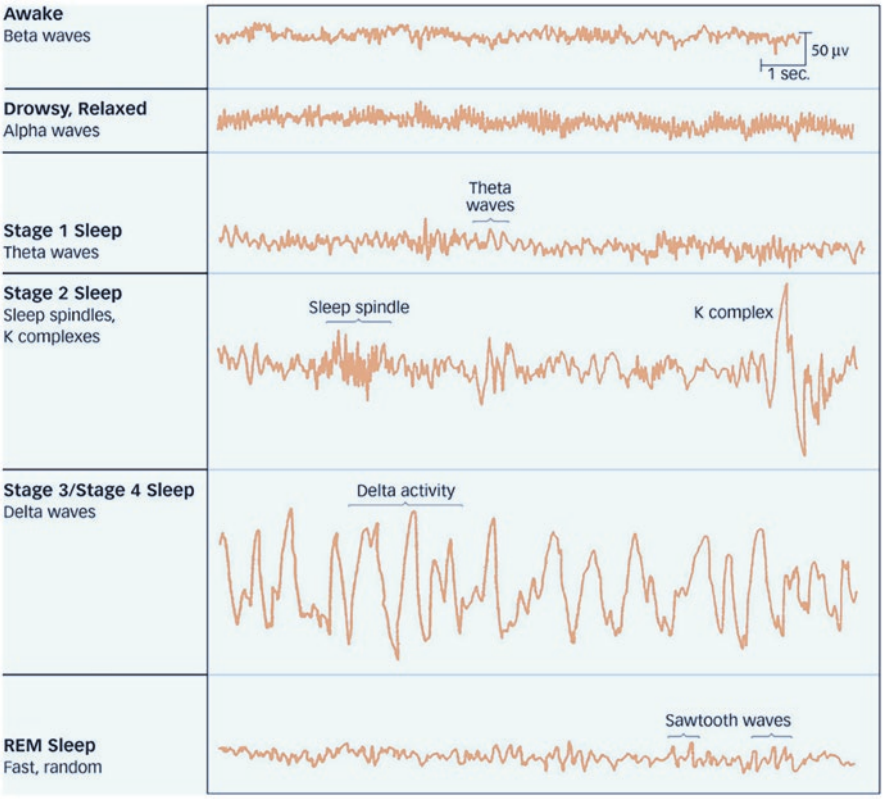

Fig. 2 NREM and REM sleep

Stages of NREM Sleep

Stage I

Sleep starts by a transition from wakefulness to drowsiness state, during wakefulness—when eyes are open—alpha and beta waves are present, and beta waves are the predominant ones, while during the drowsiness state—when eyes closed—alpha waves (with frequency 8–12 Hz) become predominant. Stage I starts when these alpha waves are replaced by theta waves (with frequency 4–7 Hz). During this stage, a selective arousal threshold will determine if a specific minor stimulus is worth responding to and trigger the wakefulness state or should ignore it and proceed to the next stage of sleep. Typically, this stage lasts for 5–10 min only, and it's the entry point for stage II.

Stage II

It is a short stage in the first two cycles ranging from 10 to 20 min. Then, it becomes dominant.

Heart rate, body temperature, breathing will decrease in this stage, and muscle will relax even further (Varga et al. 2018).

Stage III

They are also called slow-wave sleep (SWS), representing the deepest sleep stage and the most difficult to awaken. Older people spend less time in this stage. That's why they have a light sleep and are easily awakened. However, waking during this stage will cause a transient phase of mental disorientation and a moderate decrease in mental performance for a short period: body repair tissue growth (Della Monica et al. 2018).

REM Sleep

This type of sleep is characterized by brain waves similar to the awake state, muscles paralysis—except the diaphragm and upper airway muscles—to prevent acting out of the dreams by inhibiting motor neurons in the brainstem and rapid jerking eye movement from side to side. It occurs after 90 min of falling asleep. The average time of the first REM period after falling asleep is 90 min, and the individual who is deprived of REM sleep one night has increased REM sleep the next night (REM rebound). Dreams mainly occur during this type and are free of sensory experiences, visual content, and emotional reasoning. So, REM dreams play a role in memory consolidation and emotional processing of complex events. Time spent in REM sleep decreases with typical aging.

1.4 Sleep Disorders

Poor or insufficient sleep is associated with a wide variety of disturbances in most body systems, including endocrine, metabolic, and nervous system disorders. Now we will go through most of them and explain the main characteristics (Léger et al. 2008).

1.4.1 Insomnia

Approximately 30–35% of adults experience transient insomnia at some point in their lives. The diagnosis is made when these difficulties are reported for at least three nights per week and more than 3 months.

Insomnia is further subdivided into primary insomnia, which is not attributed to any other medical or psychological conditions, and secondary insomnia, which may be associated with other conditions like psychological stress, chronic pain, restless leg syndrome, drugs, and medications (Morin et al. 2006; Harvey et al. 2014).

1.4.2 Circadian Rhythm Sleep-Wake Disorders

Many disorders emerge under this title. The ICSD-3 classifies the circadian rhythm sleep-wake disorders into seven types which include:

1. **Delayed Sleep-Wake Phase Disorder:** There is difficulty sleeping and waking up (more than a 2-h delay in sleep period) and later than normal individuals. This leads the patient to delay and poor performance at work or school due to daytime sleepiness.
2. **Irregular Sleep-Wake Rhythm Disorder:** Characterized by disorganized sleep and wake patterns. It's more observed in older adults and patients with neurodegenerative disease (Spicuzza et al. 2015).
3. **Non-24-h Sleep-Wake Rhythm Disorder:** Also called free-running disorder and characterized by a gradual delay of sleep-onset time from 1 day to the next, so the individual begins to sleep during the daytime hours and then drift back into the night due to failure of the circadian system to entrain to the 24-h day. Mainly occur in totally blind people (Baumann et al. 2014).
4. **Shift Work Disorder:** Occurs to individuals who work on night shifts due to misadjustment of body circadian rhythm to work schedules lead to drowsiness during shift work difficulty falling asleep during the day.
5. **Jet Lag Disorder:** Occurs in individuals who travel to regions with different time zones because the body can't reset its circadian time to the new time zone upon arrival, so it takes some time to correct this (Rosenberg and Van Hout 2014).
6. **Circadian Sleep-Wake Disorder not Otherwise Specified:** Occurs secondary to medical or neurological disorders, for example, dementia, movement disorders, and blindness (Molaie and Deutsch 1997; Salminen and Winkelmann 2018).

1.4.3 Sleep-Related Breathing Disorders

They are abnormalities of respiration that occur during sleep often associated with a wide variety of comorbidities. The degree of airway narrowing can range from snoring to complete collapse of the airway and cessation of airflow. According to ICSD-3, they are classified into four types: obstructive sleep apnea (OSA), central sleep apnea (CSA), sleep-related hypoventilation, and sleep-related hypoxemia disorder (Maurer et al. 2010).

1. **Obstructive Sleep Apnea (OSA):** One of the diseases commonly found among patients relates to the respiratory system (Fig. 3). Usually, OSA is accompanied by snoring and individuals unaware of their breathing difficulty even when

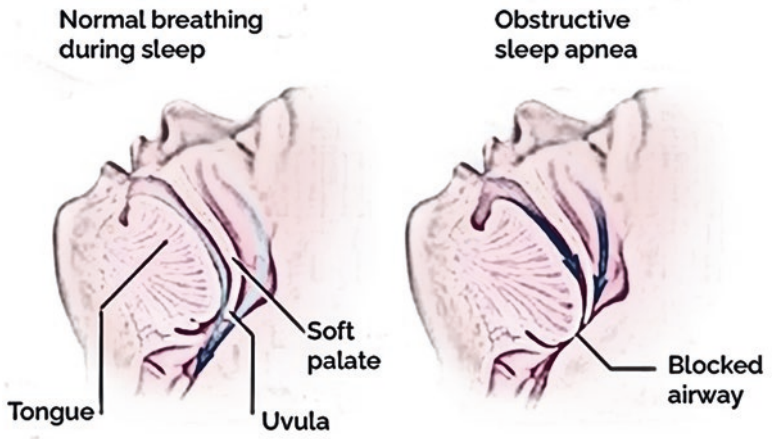

Fig. 3 Mechanism of obstructive sleep apnea

walking at night until their sleep partner or others recognize it. These events occur primarily during sleep stages I, II, and REM and are associated with severe desaturation, while sleep stage III is protective against OSA with less severe desaturation. In addition, individuals may have symptoms of unexplained daytime sleepiness, restless sleep, morning headache, and mood changes. Causes of OSA may be due to old age, traumatic brain injury, decreased muscle tone, and obesity. The gold standard for OSA treatment is continuous positive airway pressure (CPAP).

2. **Central Sleep Apnea (CSA):** It means that the origin of the pathology comes from the brain that stops ventilation repetitively due to lack of brain signals that drive respiratory muscles to control breathing during sleep, so there is no respiratory effort, and this is in contrast to OSA where respiratory signals from the brain are normal and the problem in the upper airway which obstructs and not open properly. CSA is divided into two categories:

   (a) ***Hypercapnic type:*** In this type, the brain fails to send signals to stimulate respiratory muscles for breathing due to narcotic drugs (e.g., opioids), stroke, or trauma that affects the brainstem and inhibits respiratory signals, or due to neuromuscular disease (amyotrophic lateral sclerosis, multiple sclerosis) which leads to weakness in respiratory muscles then leads to a buildup of carbon dioxide.

   (b) ***Hypocapnic type:*** Occurs because of aberrant pacing and control of respiration that leads to quick deep breath. Treatment of CSA depends on the cause and the patient's comorbidities; however, we can use CPAP and oxygen supplementation. Also there is an implantable device that stimulates breathing muscles.

3. **Sleep-Related Hypoventilation:** Characterized by insufficient ventilation results in accumulation of carbon dioxide and elevation of $PaCO_2$ during sleep.

It may be accompanied by daytime hypoventilation which further worsens the symptoms.

4. **Sleep-Related Hypoxemia:** Low O_2 saturation to <88% during sleep. As a result, individuals may have complications of polycythemia, heart failure, pulmonary hypertension, and cognitive dysfunction (Van der Salm et al. 2014).

1.4.4 Central Disorders of Hypersomnolence

Cataplexy is a sudden loss of muscle tone with full consciousness when exposed to emotional triggers, and it's the main feature that differentiates between both types of narcolepsy sleep fragmentation and can also be seen in narcolepsy type 2; it is atypical for IH.

The loss of orexin neurons occurs due to genetic and environmental factors like autoimmune attack and destruction in susceptible individuals. Individuals with narcolepsy pass abruptly from waking to REM sleep with a bit of or absent non-REM period.

Idiopathic hypersomnia (IH) is characterized by long non-refreshing naps with/without long sleep time. The main mechanism is unknown and usually doesn't respond to normal treatment used in narcolepsy.

Treatment includes a combination of pharmacological and behavioral therapy. Modafinil is the drug of choice for narcolepsy; it improves wakefulness by reducing the reuptake of dopamine to decrease excessive daytime sleepiness. Venlafaxine is a serotonin-norepinephrine reuptake inhibitor and antidepressant agent used to reduce cataplexy. Usually, to get a maximum effect of these medications, we use them with lifestyle modifications like advising the patient to take scheduled short naps during the day and maintain a regular bedtime. This will reduce daytime sleepiness. However, these naps are ineffective in patients with IH. We also need to treat other comorbidities that accompany narcolepsy because people with narcolepsy tend to be obese, which may affect their lives. Safety precautions should be taken before doing some activities like driving cars and working in jobs that require full alertness during the day because patients with narcolepsy can have serious injuries or death if they fall asleep.

1.4.5 Parasomnia

It means abnormal movements and actions occur during sleep (before sleep, during sleep, or at arousal period after sleep) (Stefani and Högl 2019).

Parasomnias Associated with NREM Sleep

This parasomnia group is associated with arousal and occurs during stage III of NREM sleep. In addition, certain triggers can induce this type of parasomnias like alcohol, sleep deprivation, physical activity, emotional stress, depression, and certain medications; this type includes:

1. **Confusional Arousal:** It's a brief episode of arousal occurring when sleep is interrupted, and the individual is awakened during the first half of the night (during stage III) and characterized by mental confusion, disorientation, amnesia of the event; that's why their sleep bed partner may only note the episode, and the individual can't understand what's going on. Most commonly occur in children and resolve by age 5, in rare cases may continue to adulthood.
2. **Sleepwalking (Somnambulism):** A series of complex behaviors that occur during sleep and ambulation. The individual looks awake with open eyes and performs inappropriate actions like moving around, but actually, they are asleep. This may lead to serious injuries because individuals are unaware of what they are doing due to altered consciousness and impaired judgment. This episode may terminate when the individual returns to bed or lies down outside and continues their sleeping. The exact cause of sleepwalking is unknown, but some studies show it runs in families.
3. **Sleep Terrors:** Patients wake up suddenly and start screaming and maybe crying as well, typically lasting between 30 s and 5 min. The affected individual appears confused, diaphoretic, tachypneic, tachycardiac, and may sleepwalk during attacks, and usually, they don't remember the event the following day. It is challenging to communicate and console the individual during the attack. Individuals with sleep terrors run or jump around in an attempt to avoid harm, thereby injuring themselves or others.
4. **Sleep-Related Eating Disorder:** The exact underlying mechanism of sleep-related eating disorder is unclear, but it is associated with other sleep disorders like sleepwalking, obstructive sleep apnea, narcolepsy, and periodic limb movement disorder; also some medications (e.g., zolpidem) may trigger it.

Parasomnia Associated with REM Sleep

It includes REM sleep behavior disorder (RBD), recurrent isolated sleep paralysis, and nightmare disorder.

1. **REM Sleep Behavior Disorder (RBD):** Recurrent episodes of verbal or complex motor behavior during REM sleep. Because the dream content is violent, the patient may exhibit jerky limb movement, punching, shouting, screaming, hitting, and running, resulting in serious injury to the patient and their bed partner. In addition, the patient may recall the events and dream content after waking up.

2. **Recurrent Isolated Sleep Paralysis:** Loss of voluntary muscle movement at sleep onset or upon awakening. The patient is conscious and may feel unable to breathe; although the diaphragmatic muscle function is unaffected, this may be due to atonia of accessory respiratory muscles. During the episodes, the patient may experience visual, auditory, or tactile hallucinations and usually resolve after seconds or minutes and can be aborted spontaneously by touching or speaking to the affected patient. Sleep deprivation, irregular sleep-wake schedule, stress, and sleeping in a supine position may trigger the episodes.
3. **Nightmare Disorder:** In contrast to other sleep parasomnia, patients with nightmares recall the details of the dream content. Nightmares commonly occur following acute stress disorder and post-traumatic stress disorder (PTSD) and result in episodes of fear, terror, and anxiety accompanied by increased heart rate and respiratory rate. Certain medications like antihypertensive can induce nightmares (e.g., beta-blockers), antidepressants (e.g., SSRI), dopamine agonists, acetylcholinesterase inhibitors, and alcohol.

Other Parasomnias

This category of parasomnia disorders can occur in both NREM and REM sleep as well as during the transition between sleep and wakefulness. They include:

1. **Exploding Head Syndrome:** A loud sound heard in the head upon awakening.
2. **Sleep-Related Dissociative Disorder:** Characterized by dissociative episodes that occur just before the sleep that last minutes to hours and mimic other parasomnias; however, it always occurs during wakefulness state. It may be accompanied with daytime dissociative symptoms and go away with treatment of a dissociative disorder. Patients may be agitated and violent during the episode and result in self-injury.
3. **Sleep-Related Hallucinations:** In this condition, the patient experiences auditory, visual, tactile, and kinetic hallucinations at sleep onset or upon waking. The patient wakes up terrified and may jump out of bed and get injured. This hallucination episode may last for a few minutes and go away when the light is turned on.

1.4.6 Sleep-Related Movement Disorders

They are a wide range of disorders explained one by one as in the following:

1. **Restless Legs Syndrome (RLS):** Also known as Willis-Ekbom disease, which is a chronic sensorimotor disorder characterized by an irresistible urge to move the legs accompanied by an unpleasant sensation in the legs. To ensure that the case is RLS, we must exclude other conditions that explain the symptoms like sleep-related leg cramps, positions, discomfort, habitual foot tapping, akathisia, and arthralgia. RLS can be idiopathic or secondary. Idiopathic form usually begins slowly before 40 years of age, and the patient may have a family history

of RLS, while in secondary form, it has a later onset in life and is associated with other conditions like neurological disorders (e.g., multiple sclerosis), end-stage kidney disease, iron deficiency, or pregnancy. Dopamine dysfunction may have an essential role in the pathophysiology of RLS. Although many patients show significant improvement after administration of dopaminergic agents, recent studies show hyperdopaminergic states in RLS patients, in contrast to the hypodopaminergic state, which is thought to be the primary mechanism for this disorder. Other non-pharmacological treatments like sleep hygiene, pneumatic pressure therapy, exercise, massage, and hot baths may be helpful to reduce the symptoms (Stumbrys et al. 2012).

2. **Periodic Limb Movement Disorder (PLMD):** The contractions last 0.5–10 s, and each episode consists of at least four consecutive movements, with 5–90 s intervals in between. PLMD occurs in the first half of the night during NREM sleep. PLMD is present in about 80–90% of RLS patients. Dopaminergic region dysfunction within the hypothalamus and impaired iron availability in the brain may be involved in PLMD.
3. **Sleep-Related Leg Cramps:** Intense, short-lived painful contractions of calf or foot muscles relieved by stretching, messages, and heat application on the affected muscles. Most commonly occur at night or during the sleep-waking of the patient. Older adults are most commonly affected. Although sleep-related leg cramps are more prevalent among elderly people, they may result from neuromuscular disorders (e.g., radiculopathies, myopathies, and Parkinson disease), electrolyte disturbances, and medications (e.g., long-acting beta) agonists and thiazide diuretics) and could be idiopathic with no relation to other diseases. One-half of patients with sleep-related leg cramps have several episodes per week or day. This may lead to sleep disturbances, difficulty falling asleep, awakening at night and excess daytime sleeping.
4. **Sleep-Related Bruxism:** Polysomnography and masseter electromyography are used to confirm the diagnosis. Sleep bruxism can result in morning jaw muscle pain, temporal headache, tooth destruction, masticatory muscles hypertrophy, and temporomandibular joint discomfort. Unfortunately, there is no effective treatment that cures or stops sleep bruxism. However, oral appliances can be used to protect the tooth from damage.
5. **Sleep-Related Rhythmic Movement Disorder (SRRMD):** Rhythmic, stereotyped with large-amplitude and low-frequency (0.5–2 Hz) body movements that involve large muscle groups and occur before falling asleep or during sleep (particularly stage II NREM sleep). Movement episodes last for a few minutes and manifest as body rocking, headbanging, and head rolling. Severe cases of SRRMD can be treated with benzodiazepines such as clonazepam.
6. **Benign Sleep Myoclonus of Infancy (BSMI):** It is a benign self-limiting disorder characterized by repetitive flexion, extension, abduction, and adduction myoclonic jerks during the NREM sleep period that last for a few seconds and disappear with arousal or movement. Myoclonus jerks are more prominent in upper than lower extremities and begin during the first month of life (first

observed at a median age of 3 days) and go before 6 months. Neurological assessments of the infant are typically normal (Stumbrys et al. 2012).

7. **Propriospinal Myoclonus at Sleep Onset (PSM)**: Repetitive axial jerky movements during the sleep-wake transition period result in sleep-onset insomnia. These movements generate in the spinal cord and spread rostrally and caudally via propriospinal pathways. It is important to do polysomnography with multichannel surface electromyography (EMG) to diagnose PSM. Few cases of PSM occur due to structural lesions in myelin, but the majority are due to functional movement disorders.

2 Dreams

Many cultures worldwide suggest that dreams are a gateway to communicate with other worlds and supernatural entities (Baird et al. 2019).

Throughout their theories, Sigmund Freud and Carl Jung put the first step about dreams interpretations. Sigmund Freud hypothesizes that our subconscious can reveal the wishes that used to be repressed by our conscious mind, so, during dreams, we live out our deepest wishes and desires as he stated that dreams are the "royal road to the unconscious." Carl Jung had another view on dreams that, in contrast to Freud view he believes dreams are attempts to lead the individual toward wholeness through dialog between the ego and the self (ego represents our conscious mind while self represents the totality of our physical, biological, psychological, social, and cultural being that involve the conscious as well as the unconscious).

Dreams mainly occur during REM sleep, so at this stage, circuits in the brainstem are activated then trigger areas of the limbic system responsible for emotions, sensations, and memories, including the amygdala and hippocampus. Hence, the brain tries to interpret this electrical activity to create meaning from these signals.

In cognitive neuroscience, the present theory assumes that dreams have a role in memory consolidation and long-term memory enhancement. Other theories suggest that dreams have a role in controlling emotions and resolving the problems that occur in our daily lives (Baird et al. 2019).

2.1 Dream Properties and Content

Dreams are characterized by multimodal perceptual content, dominated mainly by visual and auditory elements, while smell, taste, movement, and tactile sensations are less frequently experienced. Emotional content is an important feature of a dream; the dreamer mostly experiences negative emotions like fear or anxiety. Sometimes dreams appear strange, unrealistic, or fantasy in content compared to waking state. This "bizarreness" of dreams could be classified into two types:

temporal discontinuity when the scene changes suddenly with little or no transition in between, for example, when the dream starts at a specific place (e.g., at home) and suddenly change to an unrelated location (e.g., in a ship). The other is the unlikely combination where two or more dream elements are unlikely to be combined at the same time according to waking experience (e.g., playing golf on the plane). These bizarre events are taken seriously as real-life experiences by the sleeper as they are unaware this is not real and just a dream until waking up (except in lucid dreams).

Memory recall of dreams at awakening is poor; that's why we forget the exact elements of the dream. Some individuals may have difficulty in a verbal description of their dreams due to inherent bizarreness. Assessment of dreams scientifically is not easy because the dreamer is the only observer of his dream, so a third observer can't access any subjective experience they pass through. The only way to obtain the dream information depends on personal memory recall (Baird et al. 2019).

2.2 Dreams from Neurobiological Perspective

During REM sleep, the cholinergic neurons in pedunculopontine tegmentum (PPT) and laterodorsal tegmentum (LDT) are activated while serotonergic neurons in the raphe nucleus and noradrenergic neurons in locus coeruleus are repressed; this leads to an imbalance between these opposed neurons then leads to activation of the brain during this stage. At the same time, both sensory inputs and motor outputs are inhibited. Sensory suppression is caused by inhibition of presynaptic afferent fibers from sensory organs and muscles to the spinal cord, while motor suppression caused by inhibition of postsynaptic neurons of the anterior horn cells. When an individual has visual and auditory perceptions during REM sleep, this is due to endogenous activation of occipitotemporal cortical areas (inferior temporal cortex and fusiform gyrus both belong to visual association area), so lesions in this area lead to loss of these types of perceptions.

The primary visual cortex functionally separated from the visual association area during REM sleep leads to endogenous activation of the visual system away from the external environment.

Amygdala is one of two almond-shaped structures that accounts as a part of the limbic system located within the temporal lobes, medial to the hypothalamus and adjacent to the hippocampus and inferior horn of the lateral ventricle, typically amygdala responds to threatening stimuli and modulates the function of the hypothalamus.

Decreasing brain activity in the lateral prefrontal cortex and some areas of the parietal cortex may explain why the dreamer is unable to build logical, realistic, and meaningful dreams because these areas are working in combination and are responsible for high cognitive functions and episodic memory recall during waking state, so suppression of these cortical areas make the dreamer have bizarre events.

2.3 Lucid Dreaming

This type of dreaming is unique because it belongs to the area between dreaming and consciousness, defined as awareness of the dream state and environment with the ability to concentrate and make decisions. The individual can interpret the dream while dreaming and remember it after awakening and control the sequence of the events. The cardinal feature of transparency is the cognitive realization of "This is a dream!" or awakening within the dream. When this realization or awakening occurs, it is called a lucid dream. Although most lucid dreams occur during REM sleep, some studies show they can occur during NREM sleep. The same neurobiological basis of lucid dreams has not been identified yet. However, a hypothesis suggests that lateral prefrontal cortices (normally inactive during REM sleep) will remain active during lucid dreaming (Pigeon and Mellman 2017).

For most people, natural lucid dreams occur infrequently and may never occur in their lifetime. There are two types of lucid dreams; the first, when the individual becomes conscious and aware of their dream during the dream; this type is called "Dream-initiated lucid dreams." The second, when the individual is conscious and awake, then enter lucid dreams, and this type is called "Wake-initiated lucid dreams" (Pigeon and Mellman 2017).

2.4 Dreams, Sleep, and Consciousness Relationship

Consciousness is now considered to have two main aspects. First, consciousness as *awareness* (phenomenological meaning); second, consciousness as *strategic control* (functional meaning). As the phenomenological aspect is the primary concern, it is classified into three main types of awareness.

(a) **Awareness as a phenomenal experience of events:** It means the awareness of recognizing things and events and is sometimes referred to as primary consciousness, which is defined as the experience that results from a response to perception, feelings, thoughts, and memories. In primary consciousness, we are the subjects who do the thinking, feeling, and actions in response to external environments. The target of concern in phenomenal experience may be considered external or from the outside environment. In this condition, the awareness represents an indirect report of the external world (e.g., I can see a car or hear my friend's voice). Or the target of concern may be considered internal or from inside our body, and in this condition, the awareness represents direct reports of the inner world (e.g., I am hungry or I have pain in my arm).

(b) **Awareness as meta-awareness (also called meta-consciousness):** Means awareness of mental life itself or when our consciousness re-represents the contents of everyday experience. During a dream, meta-awareness is expressed in various ways and interpreted as reality testing, which is the mental action when the individual can decide whether an experience is a result of information out of

the brain (external world) or whether it is a product of the mind, as in the dream—also referred to as self-reflectiveness, which suggests that the dreamer consciously reflects the truth that they are dreaming. However, reality testing is vague in some situations, so the dreamer can't decide whether this is the result of mental activity or the external world. The dreamer may take part in the event or watch it as an external observer.

(c) **Awareness as self-awareness:** To activate the meta-awareness about the objects, events, feelings, and thinking, we must first be aware of ourselves or our entity. However, self-awareness can be present when meta-awareness is absent.

During the dream, phenomenal awareness is present. In contrast, meta-awareness is supposed to be absent so the individual can neither determine their thoughts that produce the dream nor experience the reality testing, so the dreamer is unaware that they are dreaming. This event is not actual, so this may explain the bizarreness of dreams. When meta-awareness is present and does not fade during a dream, dreamers can recognize that they are dreaming. That occurs in lucid dreams where the dreamer is aware of dreaming and the self as a dreaming subject and has cognitive insight and access to memory and the capability of control on their dream.

Self-awareness represents the conscious state where the individual's attention is oriented toward external events to their reflective consciousness and personal history. This type of awareness is implicated only in the direct experience of perception, sensation, and thoughts. All the operations involved in dream production are unconscious. From the functional point of view, the role of the conscious process in the dream is only the mental activities that monitor the output of the unconscious elaboration, interpretation of what is happening in the dream scene, self-awareness, and emotional experiences. In general, self-regulation and reflective consciousness are inefficient during dreaming. While the primary consciousness and self-awareness remain intact and efficient in the oneiric world, meta-awareness is not always preserved (Pigeon and Mellman 2017).

2.5 Dreaming About Future and Postconscious

Dreaming about one's future events and thoughts does not take enough time to be saved in our consciousness. That's why our postconsciousness releases them to make them satisfied and comfortable about the frightens. The dreams that cause you to be comfortable, which I will call good dreams, while others make you uncomfortable, and I will call them bad dreams. Postconsciousness creates these dreams to release the thoughts from our mind and to make us more tolerated and realistic with our reality, not with our imaginations, so it creates some kind of imaginations (could be real or not and could be good or bad), to fight our worries and stressing thoughts.

Multiple Choice Questions

1. Which stage of sleep is characterized by the (WHS Nervous System Flashcards. https://www.flashcardmachine.com/whs-nervous-system.html) presence of sleep spindles and K-complex with the decrease of heart rate, respiratory rate, and body temperature:
   (a) Stage I of NREM
   (b) Stage II of NREM
   (c) Stage III of NREM
   (d) REM sleep
   (e) None of the above

2. The minimal sleep requirement for a 4-year-old child is:
   (a) 9
   (b) 7
   (c) 10
   (d) 14
   (e) 11

3. The primary structure that is responsible for controlling our sleeping and waking cycle is
   (a) Suprachiasmatic nucleus
   (b) Medulla
   (c) Thalamus
   (d) Pineal gland
   (e) Amygdala

4. Insomnia characterized by all of the following features, except:
   (a) Dissatisfaction with sleep quality and quantity
   (b) Disturbance of sleep can be at sleep onset or/and sleep maintenance
   (c) May associated with psychological stress, chronic pain, restless leg syndrome, and drugs
   (d) Decrease in GABA neurotransmitters in the brain
   (e) It occurs *3 times:1 week* during at least 1 month

5. One of the following is NOT a feature of circadian rhythm disorder:
   (a) Difficulty in falling asleep and difficulty in waking up at the desired time mostly occurs in people with neurodegenerative disorders
   (b) Multiple short periods of sleep and wakes through the day with normal sleep duration
   (c) Jet lag disorder occurs in people who travel to areas with different time zones
   (d) May occur due to dementia and blindness
   (e) Usually, they are treated by timed blue light and melatonin

6. In obstructive sleep apnea all the following are characteristics, except:
   (a) Repetitive episode of upper airway obstruction due to relaxation of throat muscles
   (b) Occur during sleep stage III and REM and associated with severe desaturation
   (c) Associated with daytime sleepiness, mood changes, and morning headache
   (d) May occur due to old age, traumatic brain injury, and obesity
   (e) Best treatment option is continuous positive airway pressure

7. All of the following are parasomnia disorders associated with NREM sleep, except:
   (a) Sleep walking
   (b) Sleep-related eating disorder
   (c) Nightmare disorder
   (d) Sleep terrors
   (e) Confusional arousal

8. A 33-year-old female complains of an irresistible urge to move her legs that start after she finishes her work that increases at night and relieved by moving. She denied any short time painful leg contraction, other neuromuscular disorder, or joint pain. These features mostly indicate that she has:
   (a) Sleep-related leg cramps
   (b) Sleep-related rhythmic movement disorder
   (c) Restless leg syndrome
   (d) Periodic limb movement disorder
   (e) Propriospinal myoclonus of sleep onset

9. Activation-synthesis hypothesis of the neurobiological theory proposed that dreams are:
   (a) Imaginary visions and hallucinations
   (b) A way of connection between our world and God's world
   (c) Electrical brain signals that activate certain areas of the brain and pick random thoughts, images, and feelings of our memory
   (d) Training places to improve our skills to avoid real life-threatening situations
   (e) Have an important role in long-term memory consolidation and enhancement

10. One of the following is NOT a feature of lucid dreaming:
   (a) Belong to the area between dreaming and consciousness where the individual is able to make decisions and changes in his or her dream
   (b) May occur due to persistence activation of lateral prefrontal cortex
   (c) Mostly it occurs during REM sleep period
   (d) It can be induced using different strategies such as cognitive technique and external stimulation
   (e) Absent of meta-awareness and self-awareness

Answers

1. (b)
2. (e)
3. (a)
4. (e)
5. (a)
6. (b)
7. (c)
8. (c)
9. (c)
10. (e)

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