

Psychobiology of Altered States of Awareness: (Biological Explanation)

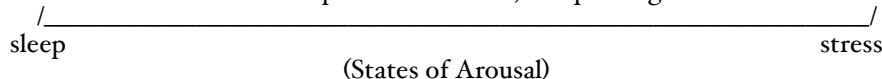
(How do genetic and lifestyle factors contribute to sleep deprivation in adolescents and how can the effects of this be mitigated in order to improve their physical and mental well-being?)

The biological and chemical processes within our brains and bodies that influence our levels of sleep and stress.

Circadian Rhythms- a 24-hour physiological cycle maintained by internal and external factors. Sleep/wake cycles, body temperature, blood pressure.

Sleep, Stress and Arousal (States of Awareness)-stream of consciousness (varies throughout the day)-

- Spectrum with sleep at one end and arousal at the other
- Stress is a condition that results from being in a state of heightened arousal over an extended period of time. Stress is something we are not always aware of experiencing.
- Arousal: influences how well we perform on tasks, and prolonged arousal can lead to stress.



Stress: Is a heightened state of arousal

Sleep: Is a low state of arousal

Demands are called: Stressors

What controls the way we react to stressors? Our nervous system!

Autonomic Nervous System:

Sympathetic Nervous System: Responsible for 'fight' or 'flight' response. (releases stress hormone adrenaline)

Para-sympathetic Nervous System: Looks after the workings of your body during rest & reparation.

Selye's General Adaptation Syndrome:

Alarm Reaction: Body is mobilized to defend against the stressor(s)

Resistance Stage: Arousal remains high as body tries to defend against & adapt to stressor

Exhaustion Stage: Resources are very limited; ability to resist is likely to collapse.

Sleep: A periodic, natural reversible and near total loss of consciousness.

Sleep is homeostatic: The longer we are awake, the stronger our desire to sleep (homeostatic process). Homeostatic drive accumulates in waking hours. Homeostasis- the process by which the body maintains a steady state of internal conditions.

Sleep debt: therefore, affects our desire to fall asleep. The difference between the amount of sleep that you need to function at an optimal level and the amount you actually had.

- Sleep debt does not accumulate over a lifetime e.g. if you missed 30 hours sleep, you would make it up by sleeping without alarms, light or noise, you would sleep longer for a few nights until it returned back to optimum amount of sleep required. (basically holds)

Sleep deprivation: a very common condition. When we do not get the sleep we need to function at an optimal level. A deficit in the quality or quantity of sleep over an extended period of time.

Therefore: Sleep deprivation increases as our sleep debt increases. (vica versa)

Common Symptoms of Sleep deprivation:

- Increased daytime sleepiness
- Hand tremors
- Slower than normal reaction time
- Poorer memory
- Lapses in attention
- Micro sleeps (can be dangerous when driving)

Sternberg (1995):

The effect of continuous sleep deprivation:

2nd night: people deny falling asleep

3rd day: people become tense, apathetic and irritable when disturbed, mood swings, micro sleeps and may have illusions and hallucinations.

4th day: people are paranoid.

ethical concerns:

- Possible harm
- informed consent
- voluntary participation
- Confidentiality & Anonymity
- Debriefing

GRAPH:

Alertness: obviously not alert in sleep. Alertness peaks late afternoon. (but can be highly dependent on the person and the activities they are engaging in.)

Core Body Temperature: Drop in core body temperature coincides with inducing sleep. (e.g. core temp. and melatonin are inversely proportional)

Secretion of growth hormones: Peak around midnight.

Relationships:

Circadian Rhythm → sleep/wake cycle → controlled by SCN (Suprachiasmatic Nucleus) which is a biological clock that regulates circadian rhythms

SCN (Suprachiasmatic Nucleus): A small cluster of nerve cells located in the hypothalamus in the brain. It keeps track of the time of day and is a biological clock that is primarily synchronized by the external cue- light.

How our biological clocks are set by light:?

- the **receptors** in **retina** the back of the eye detects the level of light outside the body
- light is converted into an electrical impulse that then travels from the retina through the **optic nerve** to the **SCN**
- SCN sends messages to the pineal gland to make the brain and body adapt to whether it is day or night, these changes can include our levels of sleepiness, body temperature and blood sugar.
- Mainly, the SCN sends messages to the pineal gland to adjust melatonin levels.
- Does this by regulating levels of **hormones** via **neurotransmitters**.

Melatonin: A hormone secreted by the pineal gland in the brain. It helps regulate other hormones and maintains the body's circadian rhythm.

Other Factors that can affect Circadian Rhythms:

Internal:

- genetic
- the way it is set in that time

External:

- illness
- Stress
- fatigue
- 'Post-lunch dip' some people experience after lunch (where Mexican Siesta comes from) and can be depend on carb intake at lunch. To fix this: (less carby lunch, walk after lunch, to smaller snack meals)

Neurotransmitter-chemical substance that helps nerve impulses to diffuse across synapse

Receptor-responds to external stimuli and transmits a signal to a sensory nerve.

Hypothalamus: Hosts SCN.

Sleep/wake cycle: interaction of light, brain and hormones. (1 cycle=90 mins)

Consciousness & Sleep:

Consciousness: An organism's awareness of its own self and surroundings.

Sleep: A behaviour & altered state of awareness

- Associated with the urge to lie down in a quiet environment
- Nature of consciousness changes as we sleep
- WE SPEND AROUND 1/3 OF OUR LIVES ASLEEP

Functions of Sleep: (Theories)

Repair and Restoration Theory:

- Helps us recuperate from daily activities (E.g. physical, emotional, intellectual fatigue)
- enables body and brain to rejuvenate
- evidence*- susceptibility to illness, decreased immunity

Evolutionary Theory:

- Sleep evolved to conserve energy and protect our ancestors from predators
- Energy conservation- *evidence* metabolism reduced by 10-25%, drop in body temp., lower metabolic rate

Memory Consolidation:

- Make sense of our memories (strengthening our neural circuits)
- Store in logical sense in brain
- Relate to quality of sleep
- evidence:* people who get plenty of REM and non-REM sleep compared to people who don't can

remember things better.

Why do we Sleep?

NREM:

- Rest and repair (recharging batteries)
- growing (growth hormone is released)
- some memory

REM:

- learning and processing, memory

Micro sleeps- When a person enters a state of sleep for a very brief period of time. (eyes can be open or closed.)

EEG: Brain > electroencephalogram

EMG: Muscle > electro myo graphic

EOG: Eye > electro ocular activity

Cycle through 5 Stages:

NONREM: Stage 1 & 2

Slow wave sleep: Stage 3 & 4

REM: Stage 5

- The deeper the sleep, the slower the brainwaves *

Alert: Beta waves

Relaxed, eyes closed: Alpha waves

Stage 1: (Theta waves) (NREM)

- Transition between wakefulness & sleep > period of drowsiness/easily awakened
- Breathing more regular
- Heart rate slows > BP decreases

Stage 2: (Sleep Spindles and K-Complexes) (NREM)

- Progressively more relaxed- light sleep > less responsive to environment
- Breathing settles further
- Heart rate slows > BP decreases

Stage 3: (Delta waves) (NREM)

- Deep sleep- hard to awaken
- Delta waves are <50% of brain wave activity

Stage 4: (Delta waves) (NREM)

- Deepest sleep
- Delta Waves >50% brain wave activity, slow, high amplitude
- Heart rate, BP & body temp. continues to fall
- No eye movement yet

Stage 5: (Resembles waking activity) (REM)

- Dreaming!!
- Wave activity- similar to wakefulness (small amplitude- high frequency)
- Breathing and pulse rate increase (irregular/erratic)
- Muscles deeply relaxed (paralysis)
- Paradoxical sleep: In some ways deepest sleep, in others the lightest sleep

- 3-5 cycles a night at 90mins each, after REM we cycle back through 2,3,4 (don't go back to 1 unless we wake up). *

Comparing:

Older people:

- Have less time in REM
- Wake more often
- Don't reach S4
- Take longer to go into SWS

Children:

- Spend most time in S4 (likely growth related)

Young Adults:

- Wake more often than children

Draw the relationship between time spent awake and sleep drive:

Draw sleep stage REM graphs: (REM sleep on same level as stage 1 because of similarities in brain wave activity).

Arousal: Means our overall state of awareness, alertness and activation.

Psychological and physiological arousal:

-Body's response to stressors is controlled by the automatic nervous system, which transfers information between the brain and the body, to control basic like functions such as heartbeat, digestion, respiration and response to stress.

Sleep: low state of arousal

Stress: high state of arousal

Demands on the body are called- stressors, our reaction is controlled by the nervous system.

Examples of Stressors:

- cataclysmic events
- chronic stress
- life changes
- hassles
- occupation

Autonomic Nervous System: includes..

Sympathetic Nervous System:

activates the body in response to a threat, it is activation the fight-or-flight response.

Para-sympathetic Nervous System:

Looks after the workings of your body during rest and reparation. is responsible to calming the body down, maintain energy levels and supporting everyday needs.

Flowchart:

Shocking/surprising stimulus>activates SNS>adrenalin & cortisol>fight or flight>PNS

DRAW SELYE'S GENERAL ADAPTATION SYNDROME:

General Adaptation Syndrome: describes how the body deals with stress over an extended period.

1-alarm: adrenalin release

2-resistance: parasympathetic nervous system conserves body reserves. Keeps up higher levels

3-exhaustion: body can no longer sustain the level of arousal.

Also stress can be negative or positive. E.g. wedding/funeral

DRAW YERKES AND DODSON CURVE:

Fight-or-Flight response: to a shock, surprise or threat. Sympathetic and endocrine system activated. Endocrine system secretes chemicals called hormones into the blood, esp. adrenalin and cortisol are

released from adrenal glands located above kidneys.

Physiological Arousal:

- increase in respiration to supply the blood with more oxygen
- blood is diverted from the skin to the muscles to reduce blood loss if skin is damaged and to increase supply of oxygen and sugar to the muscles.
- Temp. rise
- Sweat more- cool skin and muscles beneath
- Digestive system slows or stops as blood is diverted away to parts of body needed in emergency response

Psychological Arousal:

- Irritable, anxious, excitable, alert to threat

Arousal and Task Performance:

Simple, familiar tasks=higher level of arousal

Difficult, complex tasks=med. Low level of arousal

Also...the more familiar a task is, the higher the level of arousal is needed for optimal performance.

Sleep Disorders:

Delayed Sleep Phase Syndrome (DSPS)

- not a morning person
- go to bed late, get up late

It is common in adolescents. Who have naturally later circadian rhythms conflicting with early school start times which can cause them to get less sleep- accrue sleep debt over the 5-day week that they feel they need to compensate for on the weekend. (not a good idea)

Advanced Sleep Phase Syndrome (ASPS):

- Morning person
- Go to bed early, get up early

Interventions:

(ASPS) Bright Light Therapy (chronotherapy) in evening

(DSPS) Bright Light Therapy (chronotherapy) in morning

**melatonin supplements/meds

Sleep Apnoea: When a person's breathing stops periodically for a few moments while they are asleep due to obstructed airways which occurs due to complete relaxation of throat muscles which causes blockages. (pressure on internal organs)

Can cause...

- High blood pressure
- And irregular heart beat
- Fatigue/excessive daytime sleepiness

Most common in...overweight men over 40 years of age.

Treatments: positioning devices, weight loss, before bed no alcohol, sleeping tablets, tranquillisers.

(Continuous Positive Airway pressure) CPAP mask, blows air at low pressure into upper airway- to keep it open.

Narcolepsy: Is irresistible and unpredictable daytime attacks of sleepiness, lasting 5-30 mins. People have an uncontrollable urge to fall asleep and experience loss of muscle tension. Is triggered in heightened states of awareness (e.g. laughing, angry or driving) (Cataplexy is a type of narcolepsy). Go into REM sleep almost automatically.

Causes:

- Genetic

Treatments:

- medication

Insomnia: Causes a reduction in quality and quantity of sleep, making a person unable to function as they wish to during the day.

Conditioned Insomnia: Learned association between alertness & bed.

Causes: (3 Factors)

Physiological factors: persistent stress, heightened state of psychological arousal- prevents relaxation.

Lifestyle factors: drinking caffeine, smoking cigarettes are stimulants and may prevent sleep.

Environmental factors: such as noise/light can also prevent sleep.

Symptoms:

- fatigue
- impaired concentration
- poor memory

Common in : young people tend to struggle to get to sleep, whereas older people struggle to maintain sleep.

Psychological Interventions/ treatments:

Stimulus Control Therapy: Based on the assumption that where a person sleeps becomes associated with factors to do with staying awake. To remedy this conditioned pattern, given rules to follow that encourage only sleep-promoting behaviour in the bedroom.

e.g.

1. lie down in bed to go to sleep only when feeling sleepy
2. don't read, watch tv, eat or worry in bed
3. don't nap during the day

Sleep restriction therapy: Works on the theory that limiting the amount of time spent in bed will lead to more effective sleep.

Process:

1. person records est. amount of time of sleep each night for 2 weeks
2. work out ave. number of hours per sleep a night.
3. The person is then allowed to stay in bed for that ave. no. of hours plus 15 mins. But the total amount of time cant be less than 4.5 hours.
4. Get up same time each day. No naps allowed
5. When person sleep 75% of time in bed for 5 nights, they can go to bed 15 minutes earlier.
6. Repeat until at optimal amount of sleep.

Circadian Related Sleep disorders: Difficulty sleeping as a result of the body's rhythm being out of alignment with the day-night cycle.

Parasomnias: Behaviours during sleep such as nightmares, night terrors and sleep walking.

(NOT a sleep disorder)

Seasonal Affective Disorder (SAD): is a condition caused by lack of exposure to bright light.

Jet Lag and Shift-work in common:

The external cues of light conflict with the internal cues of melatonin and body temperature.

Jet Lag:

The external cues of light and dark conflict with the internal cues –biological clock and circadian rhythms. This occurs when travelling through different time-zones to get to a destination therefore causing the fatigue and disorientation associated with 'jet-lag'.

Symptoms:

- Increased fatigue
- loss of concentration
- increased irritability

NOTE: It is easier to make the days longer than shorter, as light is a stronger external cue than darkness. E.g. it is easier to stay awake in darkness than fall asleep in light. That is why it is easier to go from east to west, because the days will be longer not shorter.

NOTE: On average it takes about one day of adjustment for every hour of time-zone change experienced.

Shiftwork and Workplace Accidents:

Internal cues conflict with external environment. Especially hard for shift workers that change shifts often, as circadian rhythms take several days to adjust to a new routine.

Effects:

- Fatigue, irritability
- Sleep disturbances
- Digestive complaints
- More likely to have accidents
- **NOTE:** Takes an ave. of one full day to adjust to every hour of schedule change

DIAGRAM: of relationship between melatonin and body temperature:

When is it best for night workers to fall asleep? before the sun rises, otherwise their circadian rhythm may get 'confused.'

Helpful hints:

- Reduce factors such as light, noise and social factors
- Wear dark glasses if returning home from work in daylight to minimize exposure to light
- Change shifts as little as possible
- Artificial lights
- Try and change shifts forward not backwards, as people can better adapt to this.

Fatigue and the Road Toll:

Define Fatigue:

Someone who is drowsy more likely to fall asleep and has impaired performance such as slower reaction time.

- Could lead to an accident if someone actually falls asleep. Or it could simply increase reaction time and make the driver less attentive so that they are unable to avoid an accident as they would normally.

Prevention:

- Make sure you are getting 7-8 hours a night
- Don't travel for more than 8-10 hours each day
- Take 15 min breaks for every 2 hours on the road.
- On breaks, do brief exercise, eat healthy low fat meals to avoid feeling sleepy.

Sleep Hygiene: Relates to the behavioural factors in your control that can help optimize sleep quality and quantity.

Bad examples include:

- Exercising close to bed time
- Eating a meal after 8pm
- Intense mental activity late at night
- Consuming excessive amounts of caffeine/ stimulants

Solutions:

Melatonin Treatment: Melatonin can be externally administered e.g. insomniacs, blind people, re-synchronizing for jetlag.

Psychological Interventions for coping with stress:

Problem-focused strategies: aim to change the thing or situation that is causing the stress.

Emotion-focused strategies: aim to change the negative thoughts about the situation and the negative emotional consequences of the stress.

Ellis' rational-emotive behaviour therapy: maximize rational and minimize irrational thoughts. Therapist brings attention to irrational thoughts and then shows alternative logical and rational thoughts.

Beck's cognitive therapy:

- patients keep a journal to record thoughts and moods- therapist then questions these thoughts and moods and the patient's justifications for them.

Combining these is ___Cognitive Behavioural Therapy (CBT)

Involves changing behaviour by analyzing behaviours and creating a plan to overcome these behaviours and cognitions. **E.g.** when someone is having a panic attack, analyse the beliefs that lead to the panic attack and rationalise them.

Improving Stress Management:

- develop problem solving strategies
- avoid stressors by planning ahead
- manage time well
- social support (friends/family)
- physical strategies (exercise)
- Massage (lowers stress hormones, reduces depression, pain, anxiety)

Methods of Assessment:

Sleep and Fatigue:

Objective Measure: Electrodes are attached to the scalp that measure the wave patterns in the brain. Used to monitor sleep and awareness. An EEG machine translates brain activity into a visual record of what the brain is doing.

Subjective Measurement: Epworth Sleepiness Scale (asks you to rate your chance of dozing under a number of different conditions) and Stanford Sleepiness Scale. (asks you to rate your alertness at different times throughout the day)

Stress and arousal:

Objective measure: A polygraph (lie detector) measures heart rate, blood pressure, breathing rate and Galvanic skin response (GSR). It compares a person's relaxed state with their when asked an emotionally charged question. It associates stress with high irregular heart rate, increased BP, faster breathing, sweaty palms.

Subjective Measure: Social Readjustment Rating Scale (SRRS). Measures the degree of social adjustment to stressors required to live a relatively normal life. People rank their response. Items that require greater adjustment are considered more stressful and therefore worth more points.

Ethical Issues:

- Possible harm
- Debriefing
- Informed consent/voluntary participation

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