

Waking and Sleeping Rhythms

POWER Sleep

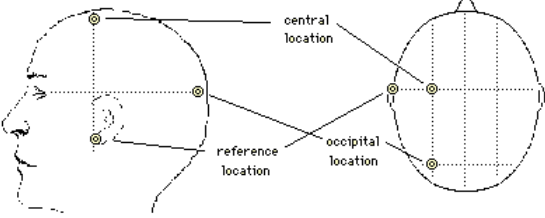

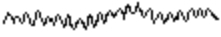

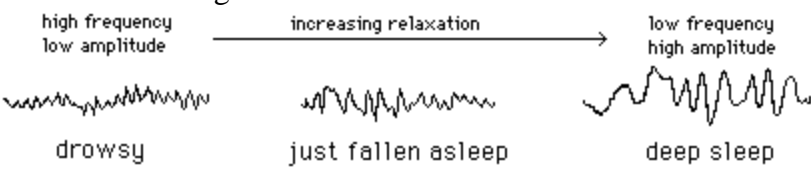
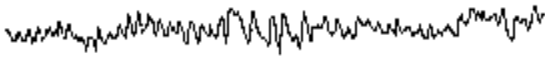
Consciousness

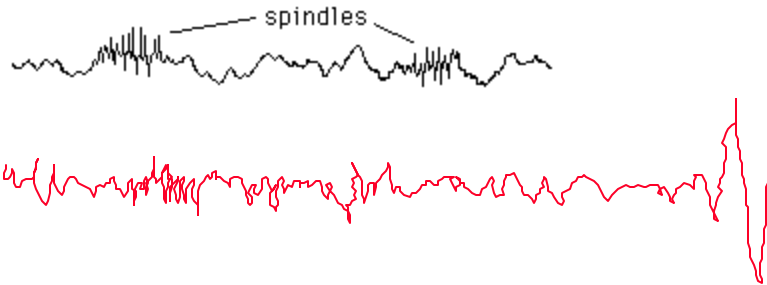
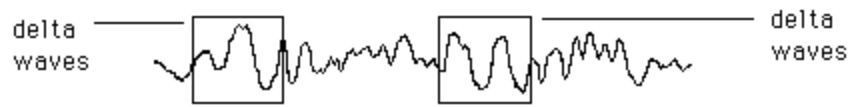
consciousness	<ul style="list-style-type: none"> • our awareness of ourselves and our environment • varies with our attentional spotlight • the visible surface of our brain's information processing.
conscious processing	<ul style="list-style-type: none"> • take place in sequence (serially) • slow* • limited capacity • skilled at solving novel problems*
subconscious processing	<ul style="list-style-type: none"> • parallel processing
daydream	<ul style="list-style-type: none"> • waking fantasies • nearly everyone has daydreams every day • can be adaptive
fantasy-prone personality	<ul style="list-style-type: none"> • imagines and recalls experiences with lifelike vividness and • spends considerable time fantasizing
Biological Rhythm	<ul style="list-style-type: none"> • periodic physiological fluctuations • controlled by internal biological clocks
body temperature	<ul style="list-style-type: none"> • rises as morning approaches* • peaks during the day • dips for a time in early afternoon • begins to drop again before we go to bed*
PMS	<ul style="list-style-type: none"> • premenstrual syndrome • some women do indeed experience not only menstrual discomfort but also premenstrual tension • women's physical and mental skills do not fluctuate noticeably with their menstrual cycles
circadian rhythm*	<ul style="list-style-type: none"> • [ser-KAY-dee-an] • the biological clock • suprachiasmatic nuclei, located in the center of the brain • controls rhythms of alertness (but not sleep), body temperature, and hormone production that occur on a 24-hour cycle • thinking is sharpest and memory most accurate when people are at their daily peak in circadian arousal.

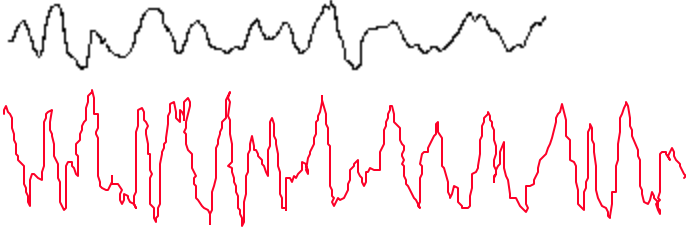
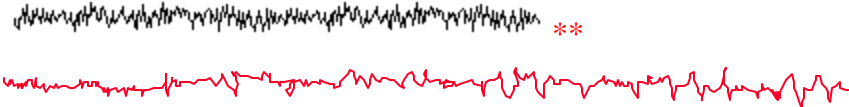
	<ul style="list-style-type: none"> • bright light helps reset our biological clocks <ul style="list-style-type: none"> • daylight → biological clock stop secretion of melatonin • bright light in the morning facilitates awakening • bright light at night helps delay sleep • function even in the absence of external time such as daylight and darkness • clock-dependent alerting process oscillates on a schedule close to 25 hours in length <ul style="list-style-type: none"> • young adults isolated without clocks or daylight typically adopt a 25-hour day. • make you feel less drowsy as morning proceeded though staying awake all night. *
Opponent-process model of sleep and wakefulness	<ul style="list-style-type: none"> • two opponent processes that determine our tendency to fall asleep or remain awake <ul style="list-style-type: none"> • 1) homeostatic sleep drive • 2) clock-dependent alerting process
homeostatic sleep drive	<ul style="list-style-type: none"> • a physiological process that strives to obtain the amount of sleep needed to provide for a stable level of daytime alertness • active throughout the night • Sleep is induced and maintained by our homeostatic sleep drive*
lark	<ul style="list-style-type: none"> • morning loving
owls	<ul style="list-style-type: none"> • evening-energized
<ul style="list-style-type: none"> • with age, → larks 	

Sleep

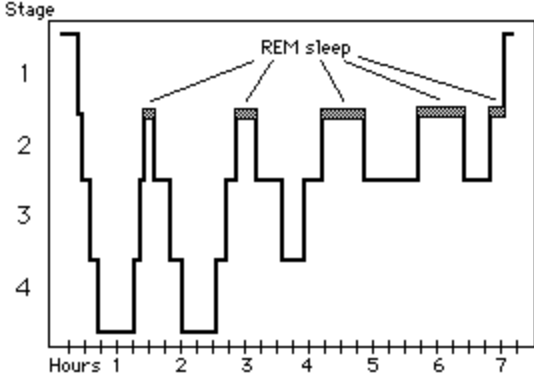
sleep	<ul style="list-style-type: none"> • periodic, natural, reversible loss of consciousness • distinct from unconsciousness resulting from a coma, general anesthesia, or hibernation • what actually defines sleep is the dramatic, measurable changes in the electrical and chemical activity of the brain.
sleep fact	<ul style="list-style-type: none"> • doesn't occur in response to boredom or mental or physical fatigue, or eating <ul style="list-style-type: none"> • heavy lunch, low dose of alcohol, warm room, dull lecture, boring meeting don't* causes sleepiness. simply unmask the physiological sleepiness already in body. • not the cessation of brain activity (happen only in animal hibernation) • overall level of neural activity drops by only 10% during sleep

	<ul style="list-style-type: none"> • “sleeping” brain is often significantly more active than the “awake” brain
EEG	<p>electroencephalogram an amplified recording of the waves of electrical activity that sweep across the brain’s surface. These waves are measured by placing electrodes on the scalp.</p> 
beta waves : awake	<ul style="list-style-type: none"> • high frequency, low amplitude • the relatively fast and irregular waves of an awake, alert state  <ul style="list-style-type: none"> • when the person opened his or her eyes and focused attention on something
alpha waves	<ul style="list-style-type: none"> • the relatively slow brain waves of a relaxed, awake state  <ul style="list-style-type: none"> • look like a teeth of a comb • with eyes closed • smooth and regular
drowsy	
Stage	<p>during the first hour or so after the person fell asleep Slower waves = greater relaxation</p> <p>high frequency low amplitude increasing relaxation low frequency high amplitude</p>  <p>drowsy just fallen asleep deep sleep</p>
Stage 1	<p>transition from wakefulness into sleep.</p>  <ul style="list-style-type: none"> • slowed / regular breathing / heart rate • irregular brain waves • theta brain wave • light sleep, half asleep, twilight sleep • hallucinations • hypnagogic sensations: sensation of falling (→ jerk) or floating

	<p>weightlessly</p> <ul style="list-style-type: none"> possible to maintain an awareness of environment and respond somewhat quickly
hallucinations	<ul style="list-style-type: none"> false sensory experiences seeing sth. in absence of an external visual stimulus
slow-wave sleep	<ul style="list-style-type: none"> Stages 2, 3, or 4 When awakened, 50 to 60% report sleep thoughts
Sleep thoughts	<ul style="list-style-type: none"> involve some issue or event that the person had been concerned about during the previous day. not genuine dreams because they lack the vivid, action-packed quality of a dream.
Stage 2	<ul style="list-style-type: none"> the person is truly asleep  <ul style="list-style-type: none"> theta waves are intermingled with K-complex waves* and sleep spindles <ul style="list-style-type: none"> sleep spindles \Rightarrow very brief bursts of rapid brain activity observed in stage 2 of the sleep cycle K-complex wave \Rightarrow single, high amplitude become actively disengaged from environment (outside stimulation).
deep sleep	<ul style="list-style-type: none"> stages 3 and 4 of the sleep cycle delta wave* \Rightarrow the large (high amplitude), slow (low freq.) brain waves associated with deep sleep (stages 3 and 4) pituitary gland releases a growth hormone (older adult spend less time in deep sleep)
Stage 3	<ul style="list-style-type: none"> theta and delta brain waves 10% to 50% appearance of delta waves 
Stage 4	<ul style="list-style-type: none"> deepest stage of sleep consist almost entirely of delta waves

	 <ul style="list-style-type: none"> • a person typically remains in Stage 4 only a short time • People who walk or talk* in their sleep, bed wetting* do so during Stage 4 sleep • night terror* typically occur during or immediately following stage 4 sleep • Hard to awaken (especially in young children). If awakened, will feel mentally groggy for several minutes. Won't be able to make much sense. • brain's auditory cortex responds to sound stimuli even during sleep • body <ul style="list-style-type: none"> • as close to hibernation as you get • complete muscle relaxation • blood pressure drops • pulse and respiration are slowed
	<p>→ Stage 3 → stage 2 →</p>
<p>REM</p>	<ul style="list-style-type: none"> • rapid eye movement sleep <ul style="list-style-type: none"> • the eyes move together in binocular synchrony • combination of <ul style="list-style-type: none"> • distorted visual tracking of dreamed images • involuntary contraction of muscles in the face owing to the activity of the trigeminal nerve  <ul style="list-style-type: none"> • brain waves <ul style="list-style-type: none"> • Theta waves intermingled with alpha waves • fast*, small*, irregular <ul style="list-style-type: none"> • similar to the pattern of alert wakefulness • but still sound asleep • saw-toothed • paradoxical sleep ⇒ highly active brain in a paralyzed body

	<ul style="list-style-type: none"> • the muscles are relaxed (except for minor twitches) • but other body systems are active
REM brain	<ul style="list-style-type: none"> • intense brain (motor cortex) activity • when awakened, almost always report true (vivid) dream
REM body	<ul style="list-style-type: none"> • motor cortex of the brain are blocked at the brain stem <ul style="list-style-type: none"> • almost complete muscle relaxation except for the eye muscles, which are very active • producing a kind of paralysis (you are paralyzed / motionless) • prevent people from hurting themselves during a dream • some older males : this area of the brain is damaged and movement is possible during REM sleep • dream : rapid eye movements • People rarely snore during dreams • aroused genital*, penile erection, increased vaginal lubrication, clitoral engorgement <ul style="list-style-type: none"> • in young men, sleep-related erections outlast REM periods • morning erection stems from the night's last REM period • regardless of whether the dream's content is sexual • "erectile disorder" (impotence) men, if have morning erections → prob. is not physical. • Body temperature, blood flow to the brain rise • heart rate, breathing, blood pressure rise and irregular • rapid and breathing
REM sleep	<ul style="list-style-type: none"> • sleeping pills and alcohol reduce REM sleep • following stressful experiences or intense learning, REM sleep increases • facilitates memory
REM rebound	<ul style="list-style-type: none"> • tendency for REM sleep to increase following REM sleep deprivation (created by repeated awakenings during REM sleep) • *illustrate that brain needs REM sleep
The sleep cycle	~ 90* (-110) minutes

	 <ul style="list-style-type: none"> • more REM sleep as morning approaches. * • Most individuals who sleep 6 to 9 hours per night have 3 to 5 periods of REM sleep. • most of the Stage 3 and Stage 4 sleep occurs in the first half of the night* • REM sleep occurs mainly in the second half of the night; thus getting to bed too late tends to cut into your REM sleep time.*
serotonin	<ul style="list-style-type: none"> • neurotransmitter that facilitates sleep
Amount of sleep	<ul style="list-style-type: none"> • The idea that everyone needs 8 hours of sleep is not true <ul style="list-style-type: none"> • Newborns: nearly 2/3 • adults : < 1/3 • most need 1 hr. sleep for 2 hr. sustained wakefulness <ul style="list-style-type: none"> • nearly a linear relationship between sleep reduction and subsequent daytime sleepiness* • allowed to sleep unhindered, most human will sleep 9 to 10 hours a night • To maintain maximum alertness during the day, the average college student needs approximately 9 to 9.5 hours*** of sleep per night. • Most adults need 8 hours sleep • Start time doesn't matter.* But should be regularly scheduled and enough hours for sleep. • *The greater the % of slow wave sleep in the first 2 of 8 hour night of sleep, and the greater the % of REM sleep in the last 2 of 8 hour night of sleep → the greater the performance
Advantages of slow-wave sleep	<ul style="list-style-type: none"> • Restoration→ body's resources can be mobilized for tissue repairs and growth <ul style="list-style-type: none"> • → infants and young children sleep so much • older adults sleep less and less as they age

	<ul style="list-style-type: none"> • Growth* (growth hormone by the pituitary gland) <ul style="list-style-type: none"> • older adults : loss of abdominal muscle strength, increase in fatty tissue and loss in exercise capacity is thought to be caused by a sudden drop in slow wave sleep* • increase natural immune-system modulators 																																										
<p>Advantages of REM sleep</p>	<ul style="list-style-type: none"> • *Memory Storage and retention (cognitive housekeeping task) <ul style="list-style-type: none"> • learn / experience ⇒ certain neurons in brain form specific connections with other neurons → neural networks / memory traces • more intense REM activity following periods of intensive learning* • Brain synapses are automatically activated. Intensive random firing of neuronal pathways that hold experiences and information → <ul style="list-style-type: none"> • Strengthening of memory circuits (degenerate if they are not used on a regular basis) • Dream • Memory Organization and reorganization <ul style="list-style-type: none"> • We cannot learn new things during sleep • solve problem in dreams • New learning and retention through replenishment of neurotransmitter (norepinephrine, serotonin) 																																										
<p>MSLT</p>	<ul style="list-style-type: none"> • Multiple Sleep Latency Test • a measure of alertness • best indicator of sleepiness (sleep tendency)* <div data-bbox="516 1297 1190 1608" data-label="Figure"> <table border="1"> <caption>Approximate data from the MSLT graph</caption> <thead> <tr> <th>Time</th> <th>Prepubescent</th> <th>Executives</th> <th>Elderly</th> <th>H.S./College Students</th> <th>Narcolepsy/Sleep Apnea</th> </tr> </thead> <tbody> <tr> <td>8am</td> <td>20</td> <td>14</td> <td>14</td> <td>4</td> <td>4</td> </tr> <tr> <td>10am</td> <td>20</td> <td>14</td> <td>14</td> <td>4</td> <td>4</td> </tr> <tr> <td>Noon</td> <td>20</td> <td>10</td> <td>10</td> <td>4</td> <td>4</td> </tr> <tr> <td>2pm</td> <td>20</td> <td>10</td> <td>10</td> <td>4</td> <td>4</td> </tr> <tr> <td>4pm</td> <td>20</td> <td>10</td> <td>10</td> <td>4</td> <td>4</td> </tr> <tr> <td>6pm</td> <td>20</td> <td>14</td> <td>14</td> <td>4</td> <td>4</td> </tr> </tbody> </table> </div> <ul style="list-style-type: none"> • no amount of motivation can make a fully alert person fall asleep on demand • exhausted high school, college students, people with serious sleep disorders (narcolepsy, sleep apneas) ⇒ similar result.* * 	Time	Prepubescent	Executives	Elderly	H.S./College Students	Narcolepsy/Sleep Apnea	8am	20	14	14	4	4	10am	20	14	14	4	4	Noon	20	10	10	4	4	2pm	20	10	10	4	4	4pm	20	10	10	4	4	6pm	20	14	14	4	4
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<p>Sleep deprivation</p>	<ul style="list-style-type: none"> • well-rested person takes 15-20 minutes to fall asleep • sleep debt/loss doesn't dissipate over time ; and it's cumulative 																																										

	<ul style="list-style-type: none"> • 43%* of adults are moderately to severely sleep deprived and know it • Most Cornell students average 6* hours of sleep per night • the spring forward to daylight time → less sleep → more* accident • suppression of the disease-fighting immune system • driving drowsy is the same as driving drunk • when young adult males were asked to sleep only 4 hours each night for 6 consecutive nights, they showed symptoms typically seen in senior citizens.
fragmented sleep	<ul style="list-style-type: none"> • caused by <ul style="list-style-type: none"> • Caffeine (after 2 p.m.) • Chocolate (after 2 p.m.) • Nicotine • Liquor** (within 3 hours of bed time) • Some medication
nap ; siesta	<ul style="list-style-type: none"> • A healthy benefit, not a sign of being lazy • If nap, schedule regular rest periods. • A 15- to 30-minute nap is ideal
prophylactic nap	napped in preparation for an all-nighter <ul style="list-style-type: none"> • recommended
Yawning	<ul style="list-style-type: none"> • stretches your neck muscles • increase your heart rate • increase bloodflow to your brain and your alertness
Eugene Aserinsky	<ul style="list-style-type: none"> • 1953: discover that rapid eye movements and specific changes in brain-wave activity signaled the likelihood that dreaming was occurring
Thomas Edison	<ul style="list-style-type: none"> • 1879 : invention of the electric light → 24-hour society
<p>Note</p> <ul style="list-style-type: none"> • Establish a regular sleep schedule <ul style="list-style-type: none"> • 4 weeks to stabilize effective cycle • If you're up late, don't sleep in • Keep the room at 65° F* <ul style="list-style-type: none"> • (Human body temperature: 98.6° F (37° C)) • Most people tend to feel sleepy about 8 hours after awakening • We should accept the concept of napping (power nap) 	

- Caffeine reduces REM sleep that night
- Any alcoholic drinks that you consume to help you fall asleep can actually cause a highly disruptive sleep pattern during your sleep period.
- Exercise regularly but not in the late evening (late afternoon is best)
 - endorphins
 - bodytemp. → delta sleep
- Area of the brain that is first to fall asleep and last to wake up is the prefrontal cortex*
- The major determinant of longevity is healthy sleep*
- Students were asked to solve verbal problems after staying awake all night. Functional MRI's indicated increased activity in the parietal lobe. *

Note

- Bright lights (at least 2,500 lux) that mimic the sun spectrum and intensity can help reset the body's sleep and wake cycles.
- For shift-work employer, should rotate shifts clockwise (day to evening to night)
 - workers adapt better to progressively later shifts
- People with a history of digestive tract disorder, diabetes, and epilepsy should avoid shift work.

melatonin	• a hormone that induces sleep
sleep inertia	feeling groggy for about 30 minutes following a long nap
microsleeps	brief episodes of sleep, lasting a few seconds at a time
sleep seizures	unintended longer episodes of sleep that occur as rapidly as a seizure, without warning in a severely sleep deprived person

Sleep disorder

- sleep disorders collectively constitute the number one health problem in America.
- 95% of people with sleep disorders are undiagnosed and untreated
- > 100 million Americans are chronically sleep-deprived

Dyssomnias	<ul style="list-style-type: none"> • difficulty in initiating or maintaining sleep, or produce excessive sleepiness • insomnia, sleep apnea, narcolepsy, etc.
insomnia	<ul style="list-style-type: none"> • recurring problems in falling or staying asleep • Drug : melatonin , L-tryptophan (potentially dangerous)
sleep apnea	<ul style="list-style-type: none"> • temporary cessations of breathing during sleep and consequent momentary reawakenings* • symptoms observed by bed partner : heavy snoring, brief gasps, whole-body movement • obstructed upper airway passage

	<ul style="list-style-type: none"> • 100-600 apneas per night • life-threatening • Drug : Vivacil • Apparatus : CPAP : Continued Positive Airway Pressure
narcolepsy	<ul style="list-style-type: none"> • excessive daytime sleepiness, cataplexy** (primary symptom), sleep paralysis, hypnagogic hallucinations • genetically linked • Drug : Modafinil • *most incapacitating for a commercial airline pilot in a sudden emergency • Narcolepsy Caused by Damage to Hypocretin System*
cataplexy	<ul style="list-style-type: none"> • momentary loss in muscle tonus provoked by strong emotion, such as surprise, laughter, anger, or elation • uncontrollable sleep attacks <ul style="list-style-type: none"> • goes directly from wakefulness into REM sleep**
sleep phase syndrome	<ul style="list-style-type: none"> • biological clock out of sync with preferred sleep-wake schedule • most effectively treated with bright light therapy*
sleep paralysis	<ul style="list-style-type: none"> • inability to move or speak during the transition between sleep and wakefulness
REM sleep behavior disorder	<ul style="list-style-type: none"> • act out dream • self-injury during sleep, injury to bed partner, and “night flying” out of bed* • Drug : Klonopin
night/sleep terrors	<ul style="list-style-type: none"> • sudden arousal from slow-wave sleep with a piercing scream or cry, accompanied by profuse sweating and intense fear. • occur during stage 4 sleep**, within 2 to 3 hours of falling asleep • seldom remembered • not nightmare (REM sleep*) • panic attack
sleepwalking (somnambulism)	<ul style="list-style-type: none"> • initiated in slow-wave sleep • eyes are typically wide open, with dilated pupils • not acting out their dreams • not easily woken up • genetically linked disorder

Jet lag	<ul style="list-style-type: none"> • circadian dysrhythmia ⇒ a disruption of the body's intricate biological inner-sleep cycle caused by crossing multiple time zones quickly. <p>Note</p> <ul style="list-style-type: none"> • when you fly eastbound (→)(loss time), or against the direction of the sun, jet lag tends to be more severe than when you fly west (←)(gain time). • The older you get, the more you are likely to experience effects of jet lag • Night owls typically fare better than morning larks when flying west, but the early-rising larks seems to cope better when flying in an easterly direction. • If you are very regimented in your living habits, you may suffer less from jet lag than if your schedule is more irregular. <p>Note on how to combat</p> <ul style="list-style-type: none"> • preset your biological clock 5 days before you leave: <ul style="list-style-type: none"> • If flying east, start going to bed and waking up earlier each day. • If heading west, stay up later and get up later. • As soon as you sit down on your flight, change your watch to the time at your destination and begin living by that time • Drink lots of water and juices • Avoid alcohol, smoking, overeating, spicy foods • Take off your shoes • Remove contact lenses while in flight • if arrive in the morning (flying eastbound), don't sleep, take a walk in the morning sunlight**
Disorientation	<p>a symptom of jet lag</p> <p>become confused and cannot remember where you are, especially when you wake up in the middle of the night</p>

Dream

<ul style="list-style-type: none"> • a sequence of images, emotions, and thoughts passing through a sleeping person's mind • hallucinatory imagery, discontinuities, incongruity • delusional acceptance of the content and later difficulties remembering it. • true dream ⇒ an engaging, realistic, yet often bizarre, sequence of events • REM dreams • almost everyone* has several dreams per night. <ul style="list-style-type: none"> • report vivid dream if awakened during REM sleep

<ul style="list-style-type: none"> • dream is a fleeting experience, and is usually forgotten by morning unless you are awakened <ul style="list-style-type: none"> • during the dream or • within about 3 minutes after the REM period ends. • first dream is short, but later REM periods can last up to an hour • many of which are negative emotions • can occur in all stages of sleep <ul style="list-style-type: none"> • occur most frequently in REM sleep and usually more vivid and emotional 	
<p>activation-synthesis hypothesis</p>	<ul style="list-style-type: none"> • the structure of dreams is determined by the location, timing, duration** • changing ambient temperature of a sleeper by adjusting the controls of an electric blanket* will have an effect on dreaming (higher temperature → more vivid dream) • dreams erupt from random neural activity* that spreads upward from the brainstem. dreams are the brain's attempt to make sense of it. given emotional tone by the limbic system. • dreams are the brain's interpretation of its own activity.
<p>manifest content</p>	<ul style="list-style-type: none"> • the remembered story line of a dream** • a censored, symbolic version of its latent content • Freud
<p>latent content*</p>	<ul style="list-style-type: none"> • underlying meaning of a dream • consist of unconscious drives and wishes that would be threatening if expressed directly • functions as a safety valve • Freud
<p>physiological function of dream</p>	<ul style="list-style-type: none"> • (associated brain activity of REM sleep) • provide the sleeping brain with periodic stimulation → develop and preserve brain's neural pathways • infant (neural networks are fast developing) spend large time in REM sleep