

Epilepsy Center  
of Excellence

SAN FRANCISCO VA MEDICAL CENTER

San Francisco VA  
Epilepsy Center of Excellence:

*State-of-the-Art Diagnostic &  
Therapeutic Services*

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# Epilepsy and Sleep

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# OVERVIEW

- SLEEP
- EPILEPSY AND SLEEP
  - Effects of Epilepsy on Sleep
    - Effects of Sleep on Epilepsy
- SLEEP APNEA
- OTHER SLEEP DISORDERS
- TAKE HOME MESSAGES

# Sleep

- Sleep is a vital aspect of all of our lives
  - We spend up to 1/3 of our lives asleep.
    - 8 hours/day
    - 2688 hours/year
- There are many theories as to why we sleep:
  - Memory Consolidation and Learning
  - Physical Restoration and Energy Conservation
  - Immune function

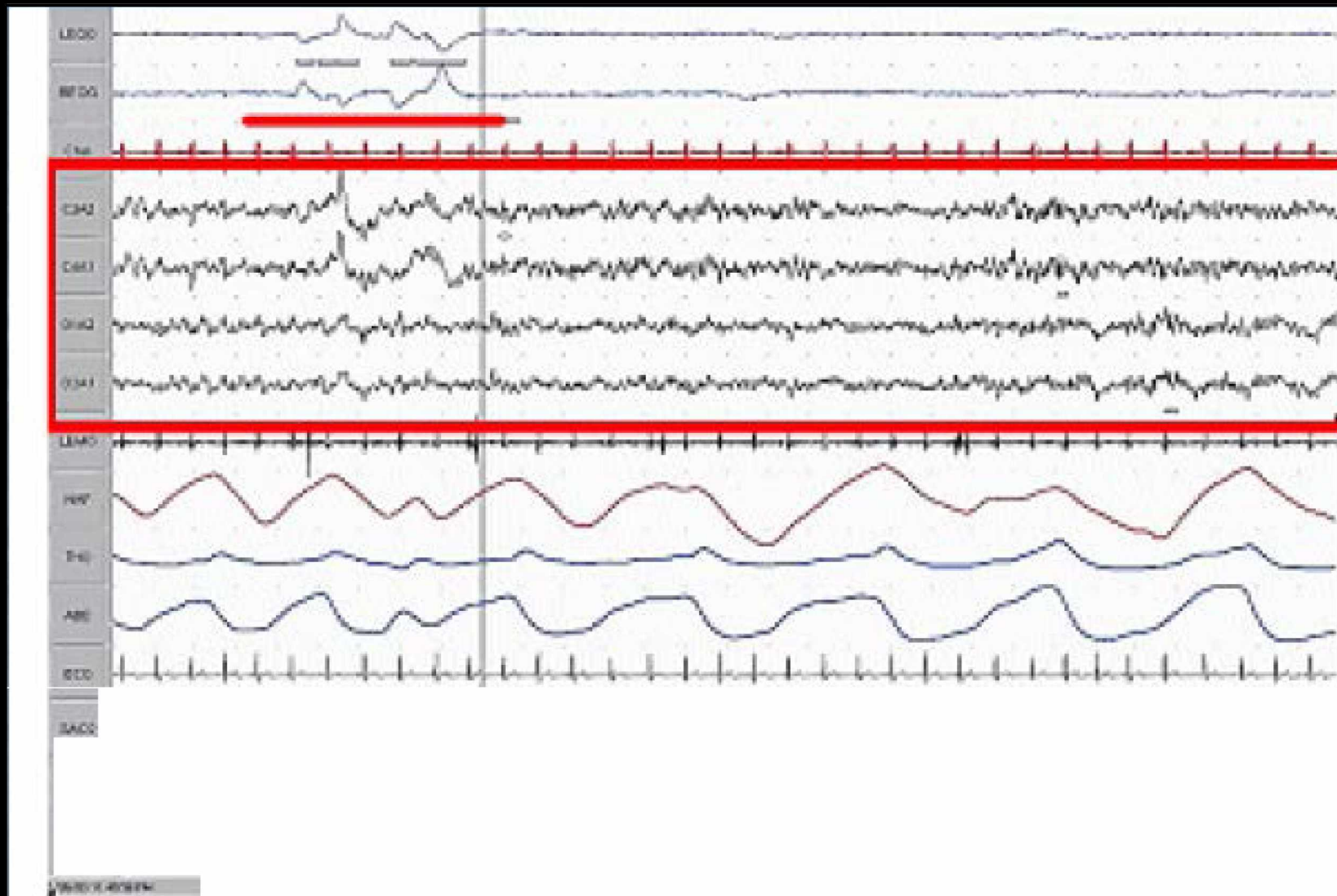
# How Do We Define Sleep

## Behavioral Criteria

- Lack of Mobility
- Slow Eye Movements
- Species Dependent Posture
- Reduced Responsive to External Stimulation
- Increased Reaction Time
- Elevated Arousal Threshold
- Impaired Cognitive Function

## Physiological Criteria

- EEG (Brain)
- EMG (Muscle)
- EOG (Eyes)
- Respiratory Patterns

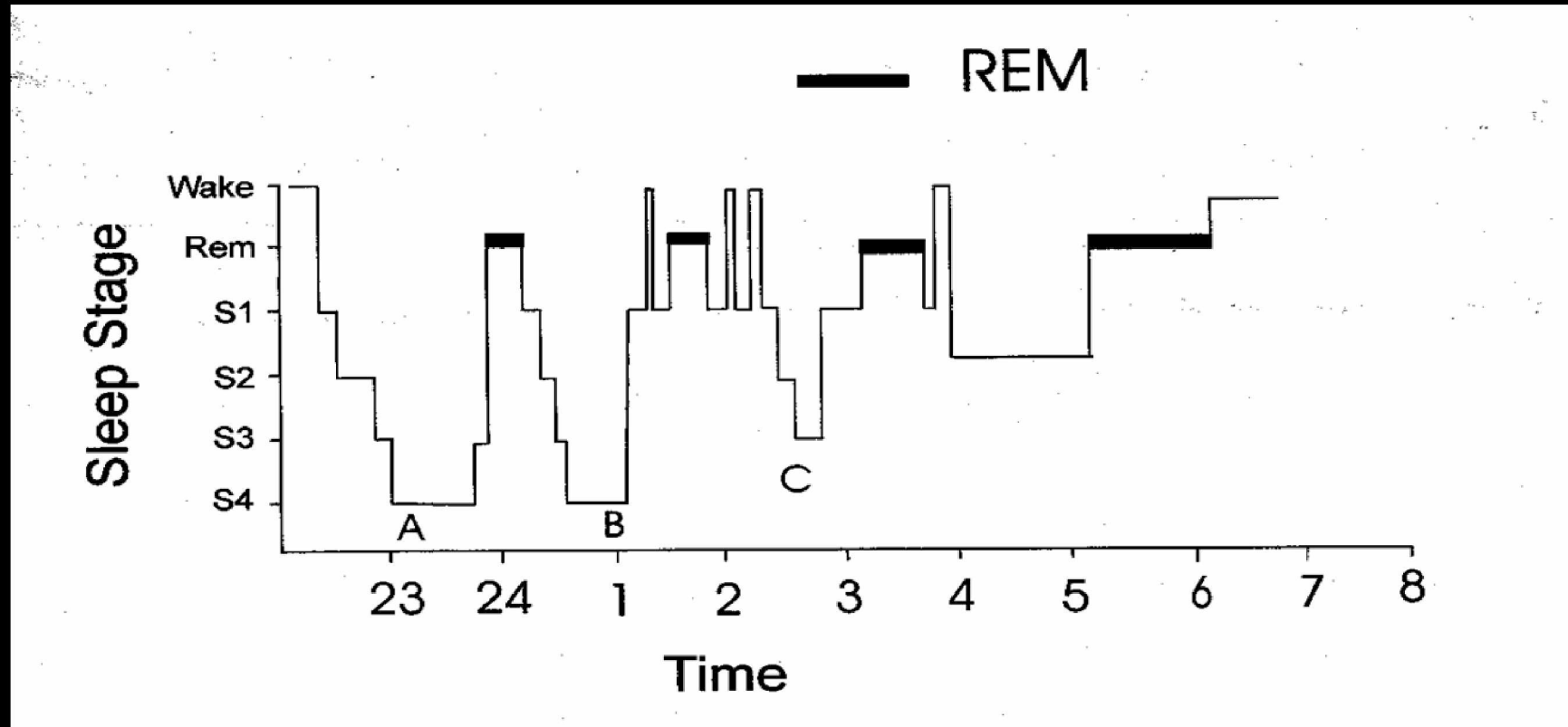


**Example of a Polysomnographic Record**

# Stages of Sleep

- According to the American Academy of Sleep Medicine, we classify sleep according to a staging system, with 4 primary stages:
  - Non-REM (NREM) and REM
    - Non-REM is divided into 3 stages
      - Non-REM 1 (N1)
        - Light Sleep
      - Non-REM 2 (N2)
      - Non-REM 3 (N3)
        - Slow Wave Sleep
    - REM Sleep is characterized by a loss of muscle tone and rapid eye movements.
      - This is often considered dream sleep

# Hypnogram

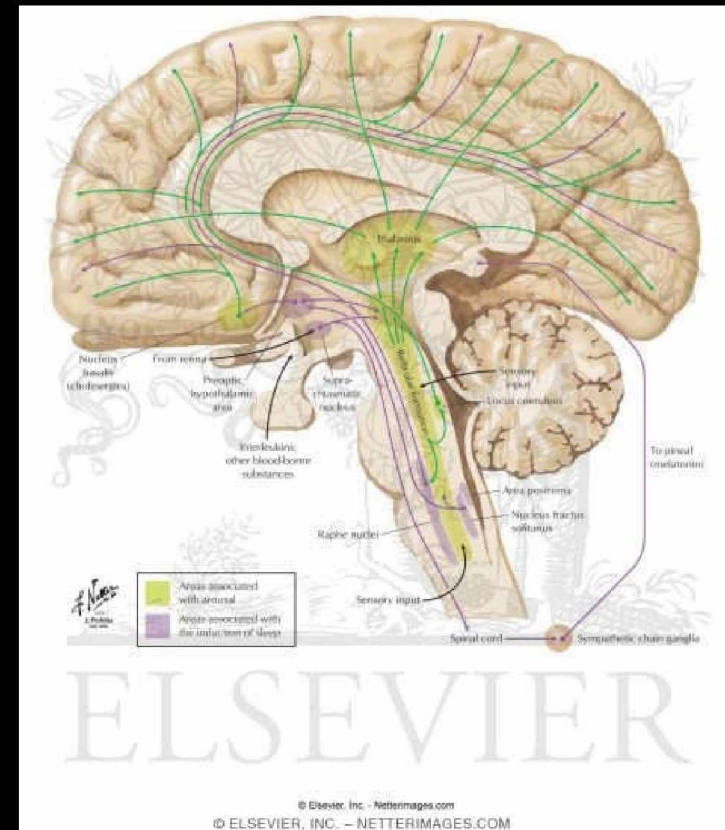


Throughout the night we cycle through these stages 4-6 times. SWS is more prominent in the first third of the night, while REM is more prominent in the last third.



# Biology of Sleep

- Sleep is the result of multiple complex interactions.
  - Multiple parts of the brain are involved
    - Cortex, Brainstem, Hypothalamus
  - Multiple chemical neurotransmitters are involved
    - Ach, NE, 5-HT, Histamine, Substance-P, Adenosine....



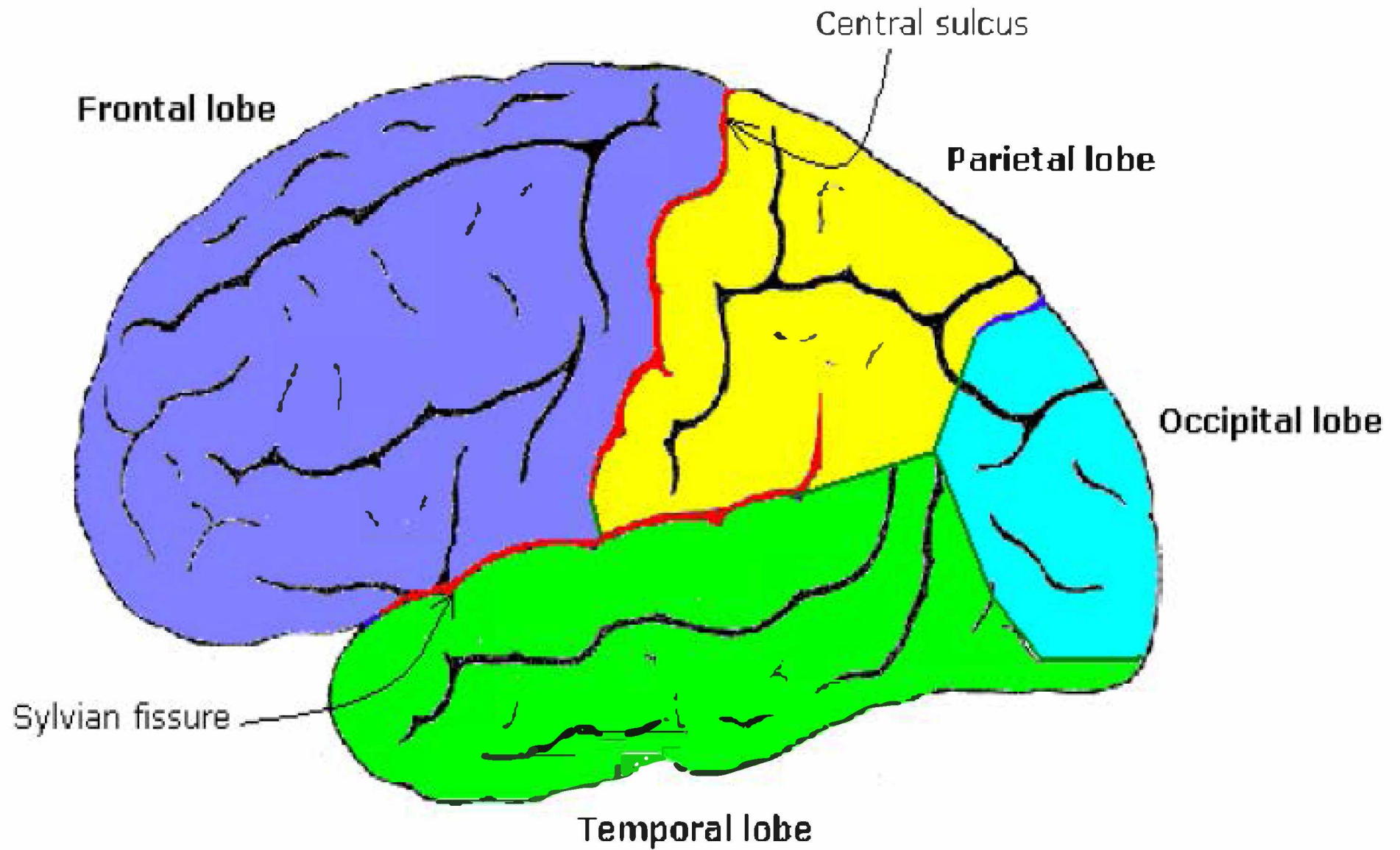
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# Epilepsy

- Seizure: discrete event due to transient, hypersynchronous, abnormal electrical activity of brain networks
- Epilepsy: disorder characterized by the tendency to have recurrent, unprovoked seizures
- Epilepsy/seizures can be classified as focal (arising from a certain focus) or generalized (arising diffusely).

# Lobes of the brain



# Effects of epilepsy on sleep

- In some patients **epilepsy** clearly worsens sleep.
- In general, patients with temporal lobe epilepsy have more disrupted sleep organization than those with frontal lobe or generalized epilepsy.
  - More nocturnal waking, decreased sleep efficiency, more light sleep, less slow wave sleep, more early morning awakenings.

# Effects of Seizures on Sleep

- **Seizures** cause further disruption in sleep patterns:
  - Increased arousals and awakenings
  - Decreased REM sleep after either diurnal or nocturnal seizures of any variety.
  - Nocturnal convulsions decrease total sleep time and total REM and increase light sleep.

# Conclusion

- Seizures worsen sleep.
- Some epilepsy syndromes appear to worsen sleep.
  - Not clear if this applies to all epilepsies

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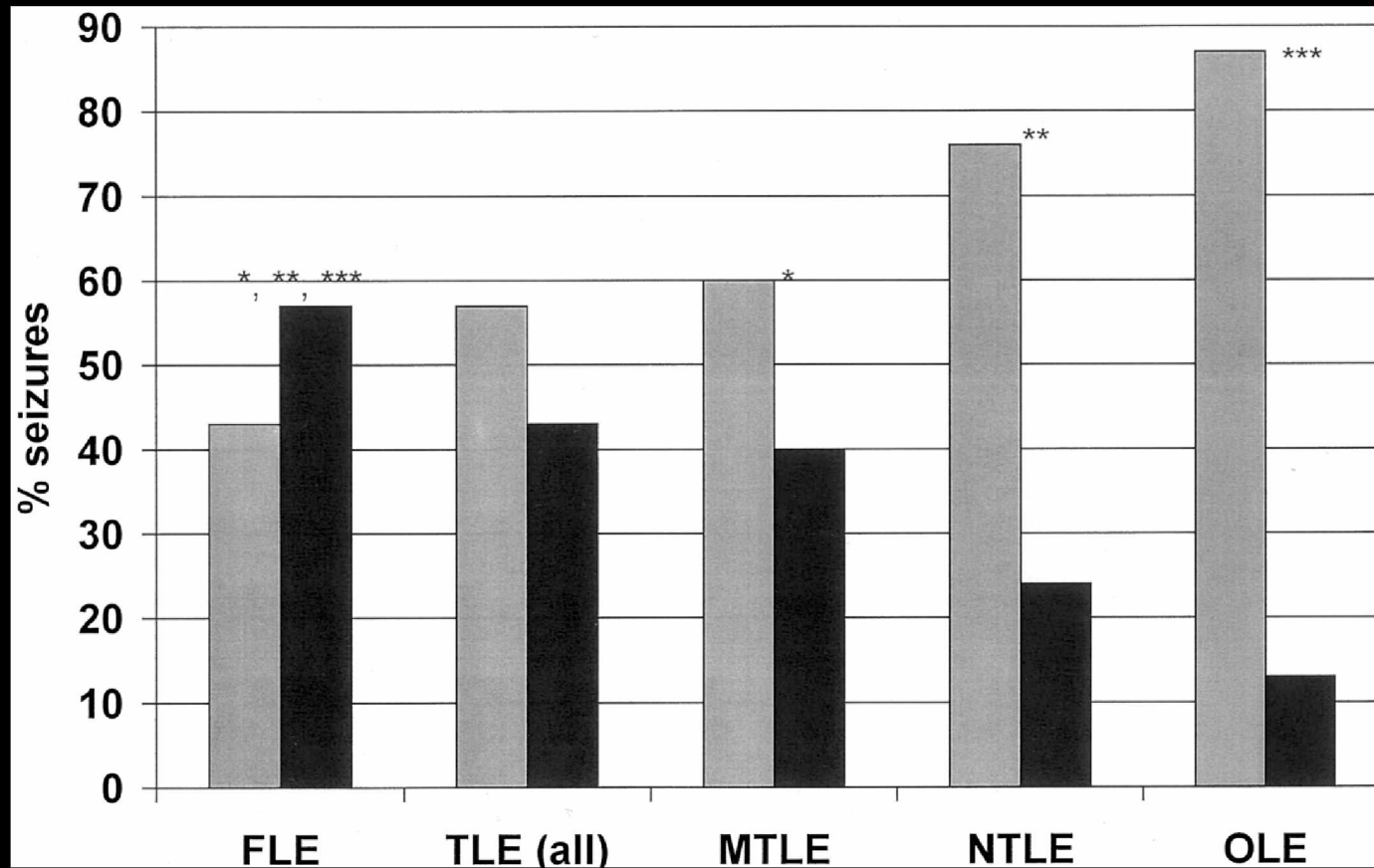
# Manifestation of Seizures at Night

- Like daytime seizures, sleep seizures vary:
  - Motor
    - Stiffening, shaking, jerking
  - Sensory experiences
    - Physical or Psychic sensations
  - Confusion
  - Arousals
  - Change in HR or breathing
  - Sleep walking

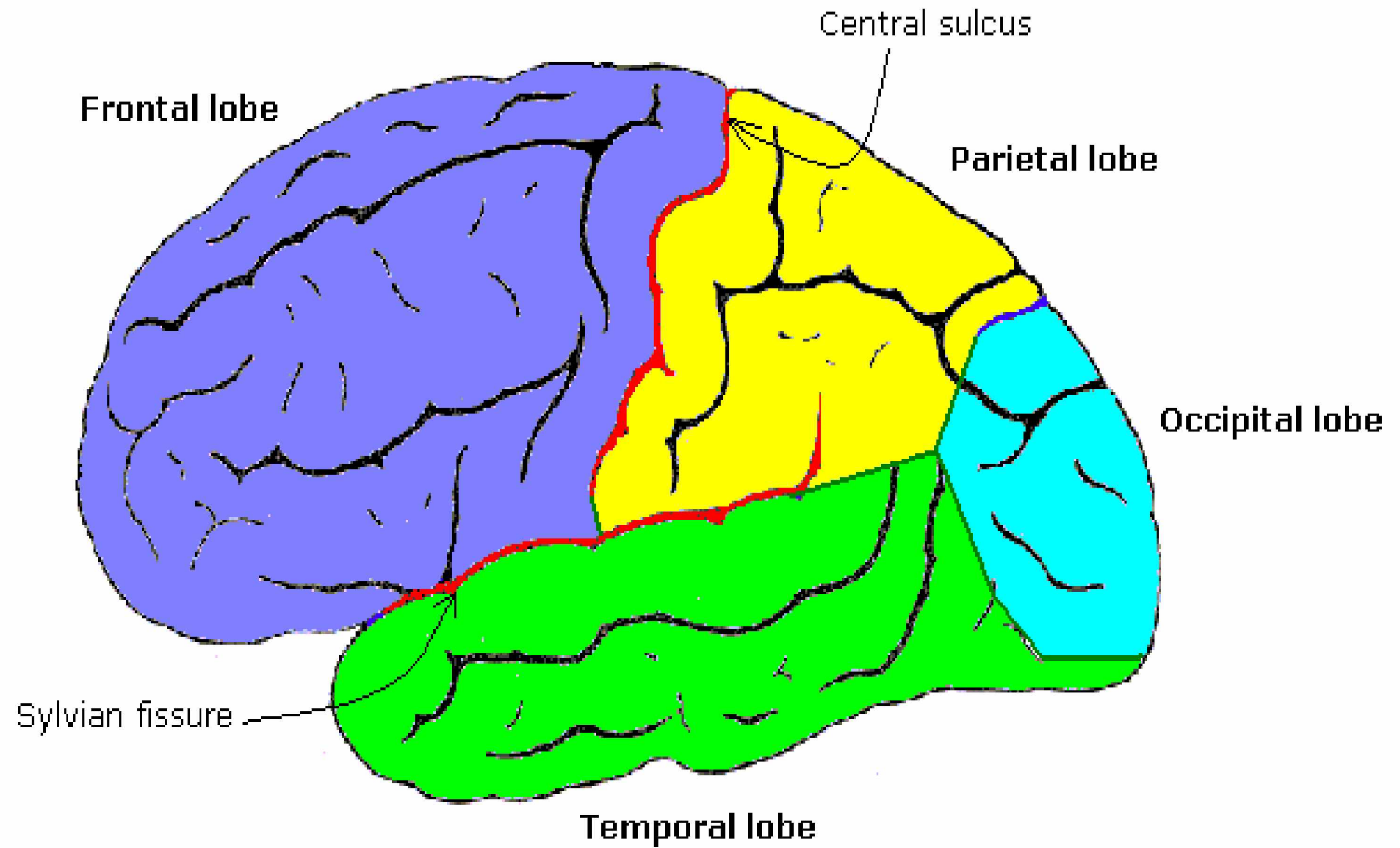
# Focal (Partial) Seizures

- Up to 59% of patients have reported isolated or predominantly nocturnal seizures.

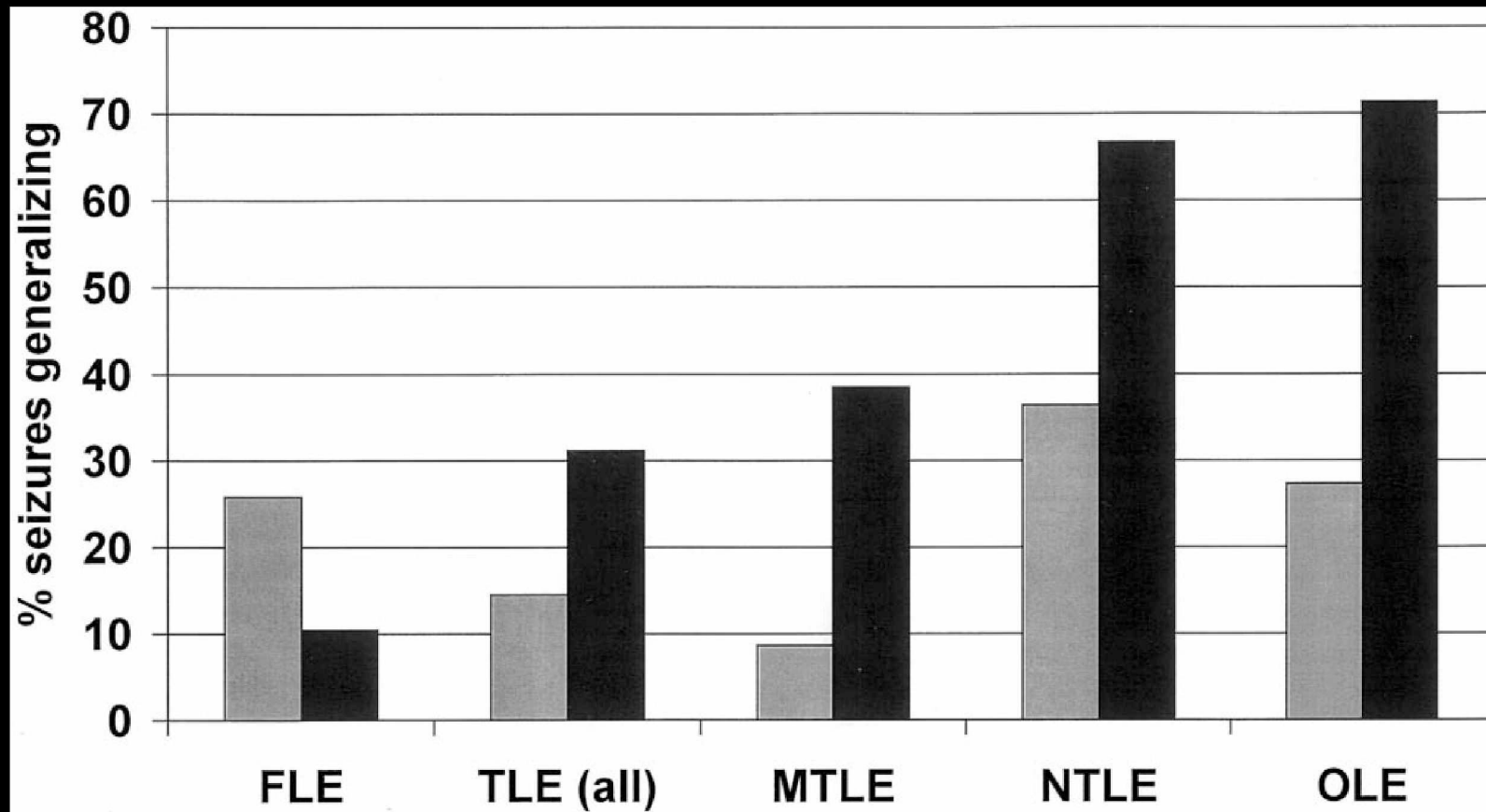
# When Do Seizures Occur?



# Lobes of the brain



# When Do Seizures Generalize?



# Convulsive seizures

- 55% of convulsive seizures occur during sleep.
  - More commonly convulsions arise from temporal lobe epilepsy than frontal lobe epilepsy.
  - Up to 60% of patients have convulsions only during sleep.

# Why do seizures happen more during sleep?

- Increased synchrony of brainwaves during NREM sleep
  - likely reflects increased connections of brain cells during sleep.
- This may allow abnormal electrical activity (seizures) to spread more easily.
  - Less spread during REM and waking, where there is less synchrony.

# Conclusion

- Based on location, some seizures happen more frequently during sleep.
- Convulsions appear more frequently at night.



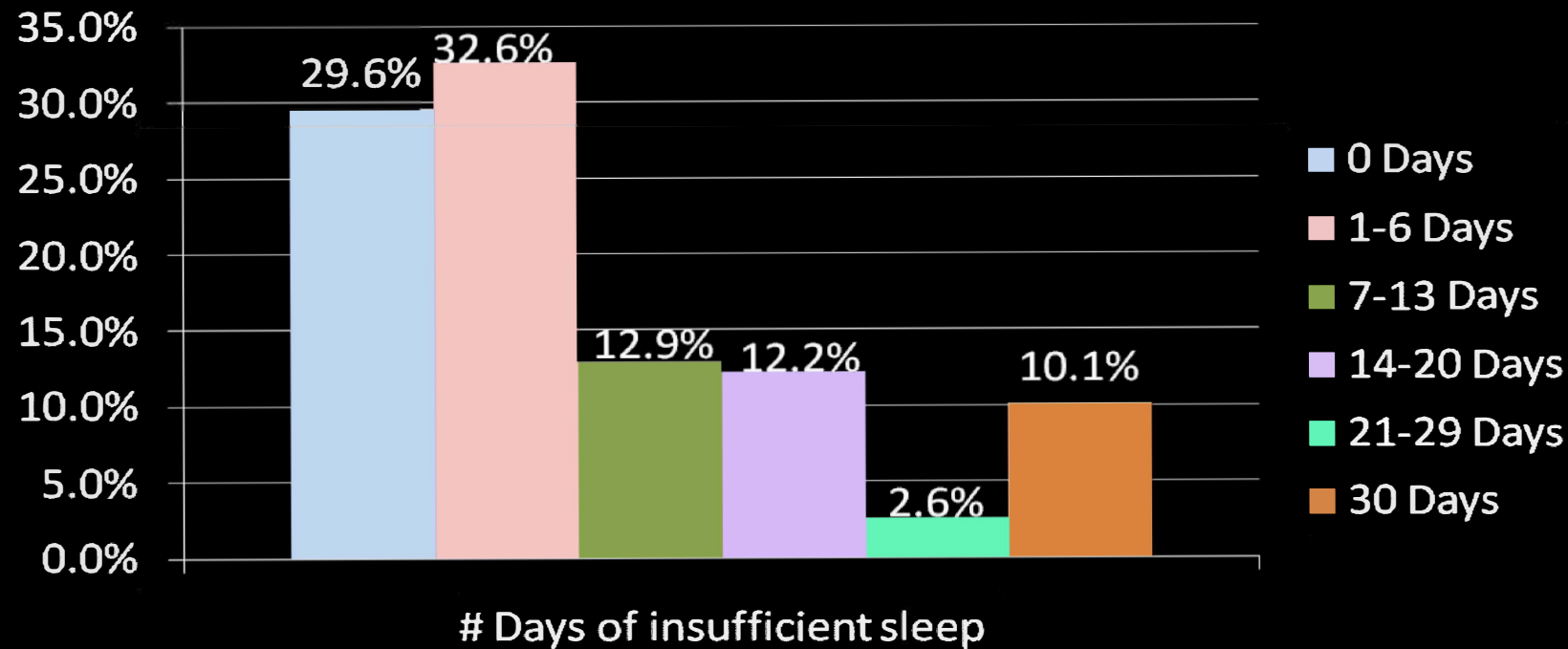
# **THE ROLE OF SLEEP DEPRIVATION**

# How Much Sleep Do You Really Need?

<b>Age</b>	<b>Sleep Needs</b>
<b>Newborns (1-2 months)</b>	<b>10.5-18 hours</b>
<b>Infants (3-11 months)</b>	<b>9-12 hours during night and 30-minute to two-hour naps, one to four times a day</b>
<b>Toddlers (1-3 years)</b>	<b>12-14 hours</b>
<b>Preschoolers (3-5 years)</b>	<b>11-13 hours</b>
<b>School-aged Children (5-12 years)</b>	<b>10-11 hours</b>
<b>Teens (11-17)</b>	<b>8.5-9.25 hours</b>
<b>Adults</b>	<b>7-9 hours</b>
<b>Older Adults</b>	<b>7-9 hours</b>

From "How Much Sleep Do We Really Need"  
at <http://www.sleepfoundation.org/>

# Average



<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5708a2.htm>

# Effects of Sleep Deprivation

- Short sleep duration is linked with:
  - Increased risk of motor vehicle accidents
  - Increase in body mass index – a greater likelihood of obesity due to an increased appetite caused by sleep deprivation
  - Increased risk of diabetes and heart problems
  - Increased risk for psychiatric conditions including depression and substance abuse
  - Decreased ability to pay attention, react to signals or remember new information
  - Increased risk of systemic illness
  - Possible worsening of epilepsy.

# Sleep Deprivation and Epilepsy

- Clearly correlated with activation of the EEG
  - Suggests increased abnormal brain activity
- Patients with epilepsy often report that sleep deprivation can precipitate seizures.
- Studies show conflicting results, but seem to suggest that it may affect some patients more than others.
  - e.g. Temporal Lobe Epilepsy and JME
  - Possibly need additional factors of stress and fatigue, not just sleep deprivation.

# Sleep Complaints in Epilepsy

- Up to 2/3 of epileptic patients reported poor quality of sleep.
  - 39% reported insomnia
  - 68% reported excessive daytime sleepiness
- Increased complaints in patients with partial epilepsy vs. generalized epilepsy
- Poor seizure control was associated with increased complaints
  - Increased nocturnal wakings
  - Increased early morning wakings

# Insomnia

- This is the inability to sleep or to sleep an adequate amount.
- It may refer to either difficulty falling asleep (Sleep Onset Insomnia) or staying asleep (Sleep Maintenance Insomnia).
- Insomnia is a frequent co-morbidity in many medical conditions: including epilepsy, anxiety disorder and depression.

# Causes of Insomnia

- There are numerous causes of insomnia
  - Medical Conditions
  - Psychological Conditions
  - Medications
  - Psycho-social factors
    - Stress, Poor Sleep Hygiene
  - Pain
  - Obstructive Sleep Apnea (OSA)
  - Restless Legs Syndrome
  - Periodic Limb Movement Disorder of Sleep



# Causes of Insomnia in Epilepsy

- Poor sleep hygiene
- Depression
- Anxiety
- Medications?
- Sleep Apnea
- Voluntary (Insufficient Sleep Syndrome)
- Epilepsy

# Treatment of Insomnia

- Treating underlying conditions
- Sleep Hygiene measures
- Cognitive Behavioral Therapy
- Medications

# Excessive Daytime Sleepiness

- A significant number of patients with epilepsy complain of excessive sleepiness during the daytime.
- ESS elevated ( $>10$ ) in 11-28% of epilepsy patients.
- Likely due to many reasons
  - Primary sleep disorders (OSA, RLS)
  - Seizures and Epilepsy
  - Seizure Medications
  - Depression
  - Insomnia

# Conclusion

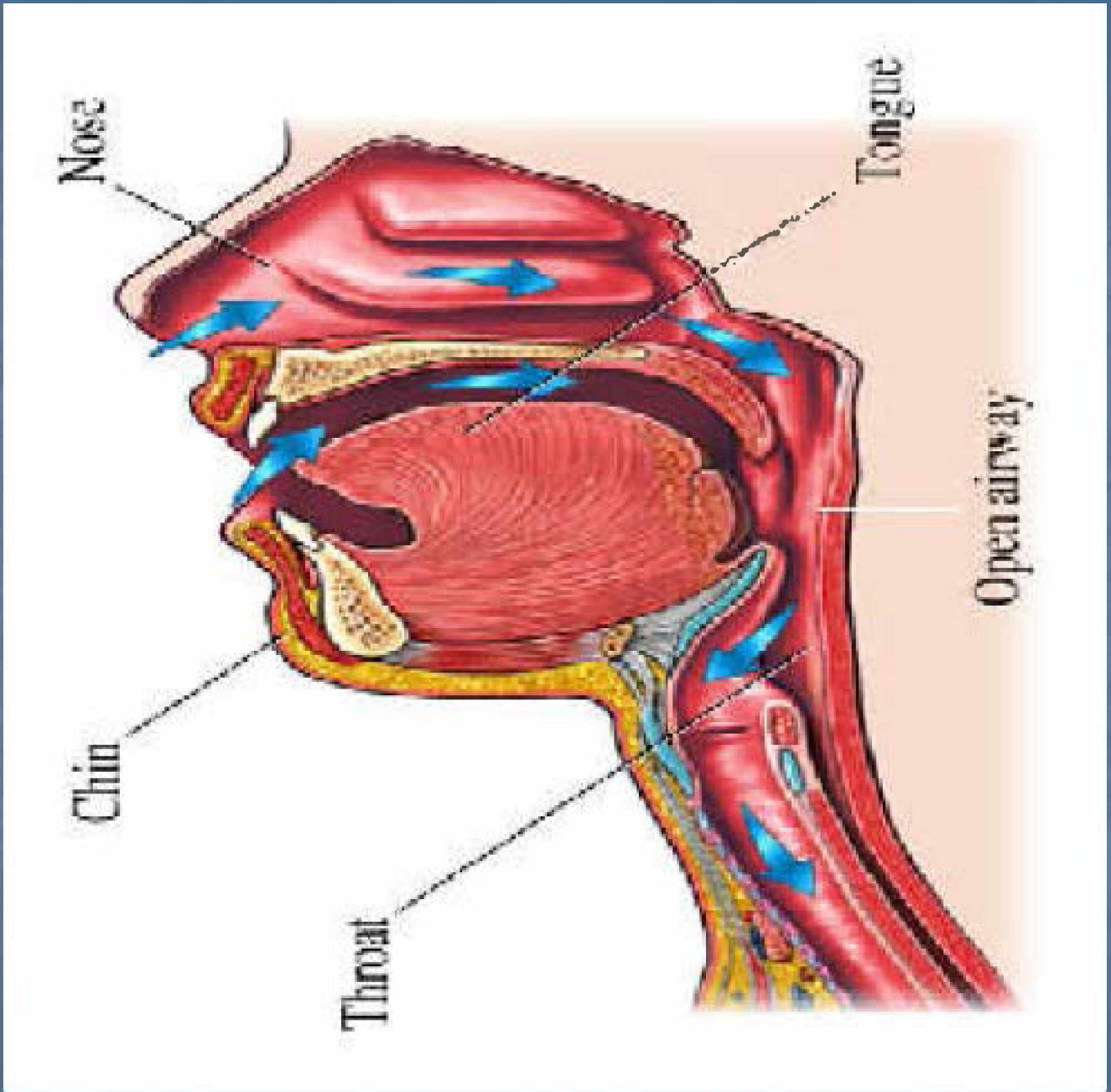
- Sleep complaints are very common in epilepsy.
- Many epileptics feel tired and many have difficulty sleeping.
- There are likely many reasons

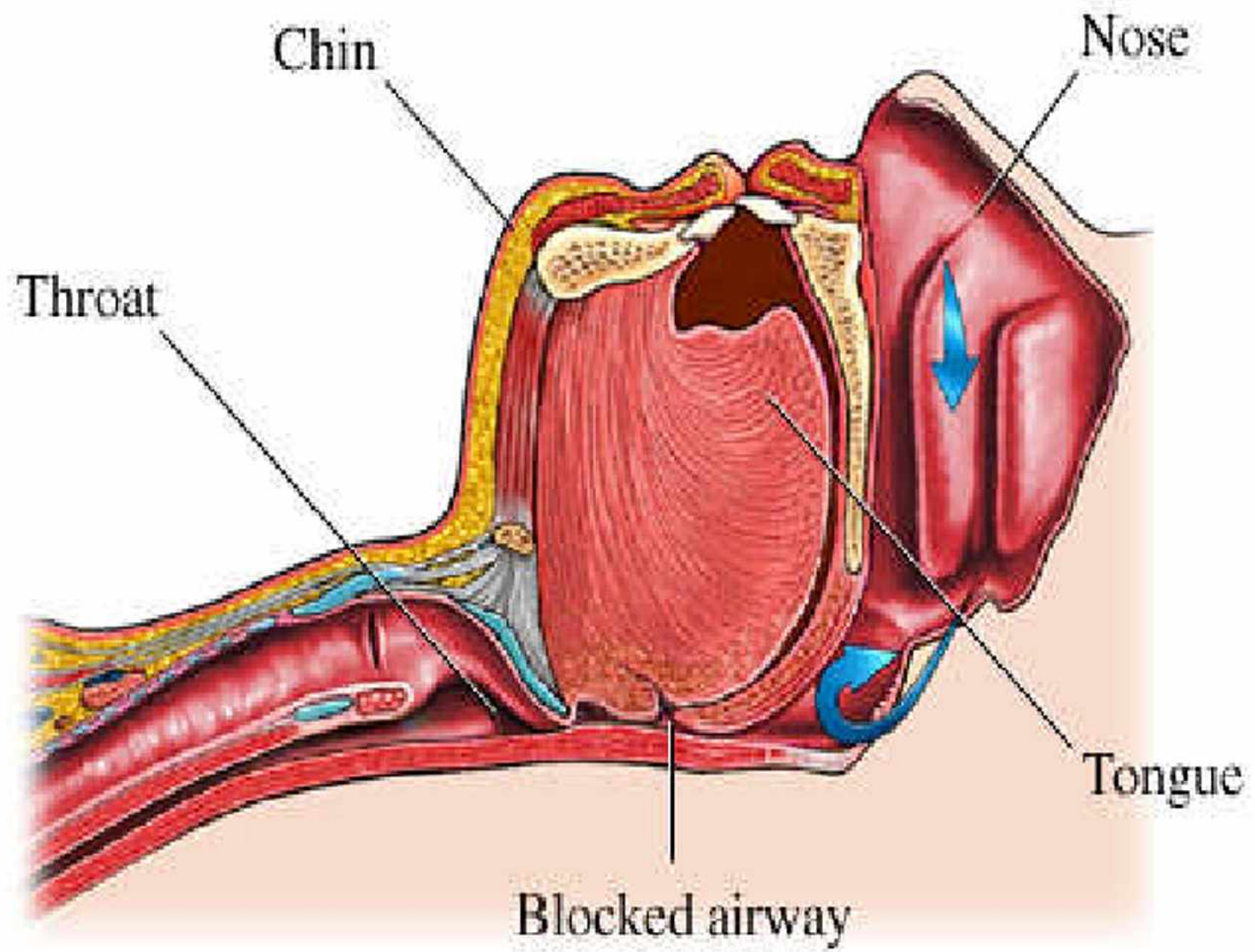
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# Obstructive Sleep Apnea

- Characterized by obstruction of the airway during sleep, leading to cessation of breathing
  - Associated with decreased muscle tone during the night causing the airway to close
- Affects 2-5% of the population
- Abbreviated OSA







# Factors that Increase Risk for Sleep Apnea

- Being overweight
- Increased age
- Larger neck circumference
- Being a man
- Post-menopausal women

# Signs and symptoms of obstructive sleep apnea:

## Nocturnal symptoms:

- Loud snoring (often with a long history)
- Choking during sleep
- Cessation of breathing (apneas witnessed by bed partner)
- Sitting up or fighting for breath
- Abnormal motor activities (*e.g.*, thrashing about in bed)
- Severe sleep disruption
- Gastroesophageal reflux causing heartburn
- Nocturia and nocturnal enuresis (mostly in children)
- Insomnia (in some patients)
- Excessive nocturnal sweating (in some patients)

## Daytime symptoms:

- Excessive daytime somnolence
- Forgetfulness
- Personality changes
- Decreased libido and impotence in men
- Dryness of mouth on awakening
- Morning headache (in some patients)
- Automatic behaviour with retrograde amnesia
- Hyperactivity in children
- Hearing impairment (in some patients)

# Consequences of Sleep Apnea

- Besides for the possible impact of sleep apnea on epilepsy, it also is associated with other conditions.
  - Cardiovascular
    - Hypertension, Arrhythmia, Heart Failure
  - Psychological
    - Depression, Anxiety
  - Endocrine
    - Diabetes

# Diagnosis and Treatment

- We usually diagnose Obstructive Sleep Apnea with a Polysomnogram which allows us to measure respirations at night
- The most common treatment is CPAP (Continuous Positive Airway Pressure), which keeps the airway open at night.



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# OSA and Epilepsy

- There is increasing literature suggesting that the relationship is more than casual.
  - 2-4% of the population have OSA
  - 5-63% of epileptics have OSA
- There is likely an increasing incidence of OSA with severity of epilepsy
  - Up to 30% of medically refractory epileptic patients may have OSA
- Possible explanation for abrupt worsening of epilepsy especially in older patients.

# Why is there an increased prevalence of OSA in epilepsy?

- The short answer is it is unclear
  - Increased Weight
    - medications, inability to exercise, chronic illness
  - Role of medications
    - Muscle tone relaxation
    - Weight gain
    - Reduce respiratory center reactivity
  - Epilepsy
    - Suggestion that seizures may worsen OSA

# Effects of treatment

- There is evidence that treating OSA can dramatically decrease or eliminate seizures in some patients.
- Epilepsy surgery curing sleep apnea has also been reported.



# **SEIZURE MEDICATIONS**

# Seizure medications

- Sleepiness is a common side effect of seizure medications
  - Most increased sleepiness on Phenobarbital
    - Also Depakote, Carbamazepine (Tegretol) and Dilantin
    - BDZ can be used as sleeping pills
- Other Side Effects
  - Phenobarbital, Benzodiazepines and Dilantin may contribute to muscle relaxation worsening OSA.
  - Levetiracetam (Keppra), Lamotrigine (Lamictal), Felbamate and Zonisamide (Zonegran) associated with insomnia

# Seizure Medications cont.

- Overall however, these medications are shown to have a good effect on sleep.
  - Increased sleep consolidation
  - Seizure control
  - Mechanism of action?

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# Things that go Bump in the Night.

- Epileptic Seizures
- Parasomnias
- Nocturnal Panic Attacks
- Non-Epileptic Events (Psychogenic Non-Epileptic Seizures)
- Hypnagogic Phenomena
  - Hypnic Jerks (Sleep Starts)

# Parasomnias

- These are events that characterized by abnormal movements or behaviors that occur while going into sleep or while sleeping.
- They are thought to be related to intrusion of sleep into waking.
- Like epilepsy, these may be episodic and rare or frequent and occur in clusters.
- These are subdivided into conditions that occur in Non-REM (NREM) sleep and those that occur in REM Sleep
- Interestingly, these happen more frequently in patients with epilepsy and their families.

# Parasomnias cont.

- There are a large number of described parasomnias, some of which can be easily confused with seizures.
  - NREM Arousal Disorders (usually arise from N3/4)
    - These are most common in childhood but in some they continue into adulthood
      - Confusional Arousals
      - Somnambulism (Sleep Walking)
      - Sleep Terrors
    - REM Behavior Disorder (RBD)
    - Nocturnal Panic Attacks\*

# Confusional Arousal

- These events are characterized by a sudden arousal from sleep with disorientation and confusion.
- +/- semi-purposeful behavior
- +/- speech which can be coherent.
- 1-10 minutes (or longer) in duration
- Difficult to wake while occurring.



# Sleep Walking

- This is the most common of the arousal disorders.
- Characterized by patients getting out of bed and walking, often out of the bedroom.
- Can complete purposeful or semi-purposeful tasks.
  - dressing, eating, and at times driving.
- +/- speech (often non-sensical)
- Few minutes-30 minutes in duration
- Often return to bed at the end

# Night Terrors

- Patients often wake from deep sleep with a blood-curdling scream and are extremely agitated.
- Often have fast heart rate and sweating
- Patients are inconsolable and hard to wake
- These last from minutes to longer.
- Amnestic to event afterwards

# REM Behavior Disorder

- Characterized by acting out of dreams while asleep.
  - Often dreams are violent or persecutory in nature.
  - Caused by a loss of muscle relaxation during REM Sleep
  - Can usually be woken by others during event.
  - Often recall the dream in vivid detail afterwards.
- Increases with age

# Nocturnal Panic Attacks

- Occur in 44-71% of patients who have daytime panic attacks.
  - Very rarely do they precede daytime attacks
- Described as feeling similar to daytime attacks
  - Feeling of fear/dread/anxiety
  - Heart racing
  - Shortness of breath/Sensation of choking
  - Sweating
  - Usually last 2-8 minutes.

# Symptoms Common with Seizures

- Abrupt Onset
- Confusion
- Disorientation
- Lack of recall of the event

# How do we differentiate?

- History

- Age

- Parasomnias tend to appear earlier

- Parasomnias can start at age 5

- NFLE average age of onset 14

- NREM Parasomnias often disappear in adolescence

- 4% of adults have some confusional arousal

- Clustering of events

- Rare in parasomnias, often occur rarely.

- Frequent in epilepsy (esp. Frontal Lobe Epilepsy)

# Differentiating cont.

- Timing of Events
  - Parasomnias arise from deep sleep, often 90-120 minutes after falling asleep.
  - Seizures can occur anytime, but frequently arise out of light sleep (esp. N2), and seen within 30 minutes of falling asleep.
- Semiology
  - Most seizures are highly stereotyped in appearance.
    - Stiffening and posturing are rarely seen in sleep disorders.
    - More variability in sleep disorders than in epilepsy

# Differentiating cont.

- Duration of events
  - Parasomnias frequently last >5 minutes
  - Most seizures last for < 2 minutes.
- Recall
  - Most arousal disorders are associated with a disconnect with surroundings and amnesia.
  - In many seizures, especially arising from the frontal lobe, there is often some recollection.



# Video EEG/PSG

- Gold standard for differentiation
  - Looks at brain waves during events
  - Allows us to see from which stage events arise
  - Although it is not a perfect test, it may help us to treat you appropriately.

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# Summary of What We Know About Sleep and Epilepsy

- Many patients with epilepsy have poorer sleep quality.
- Apnea may be more common and treatment may improve seizure control.
- Antiepileptic medications may worsen sleep and sleep related complaints.

# Tips for better sleep

- Have a set time to go to bed and to wake up.
- Sleep in a dark, quiet environment.
- Make sure the temperature is comfortable.
- Try to make the bedroom for bed-related activities only.
  - ie, no reading, texting, surfing, TV or radio
- Avoid napping during the day
- Avoid caffeine, alcohol, tobacco before bed

# Sleep, Epilepsy, and Alcohol

- Alcohol may increase chance of seizure (especially binge drinking)
- Alcohol significantly disrupts sleep
- Significant alcohol intake not good for seizure control or sleep

# Final Thoughts

- Try to get a good nights sleep
  - This will help your epilepsy and potentially other medical conditions
  - Poor sleep may worsen epilepsy and epilepsy may exacerbate poor sleep.
- If you are excessively sleepy talk to your doctor, there may be many reasons for this.
- If you have a change in the pattern of your epilepsy, consider OSA.
- If you have a new type of event during sleep, please tell your doctor.

**QUESTIONS?**