# Sleep apnoea

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# Learning objectives

- Normal sleep physiology
- Sleep apnoea overview
- Patho physiology / Consequences
- Systemic effects
- Types
- How to Dx?
- How to Rx?

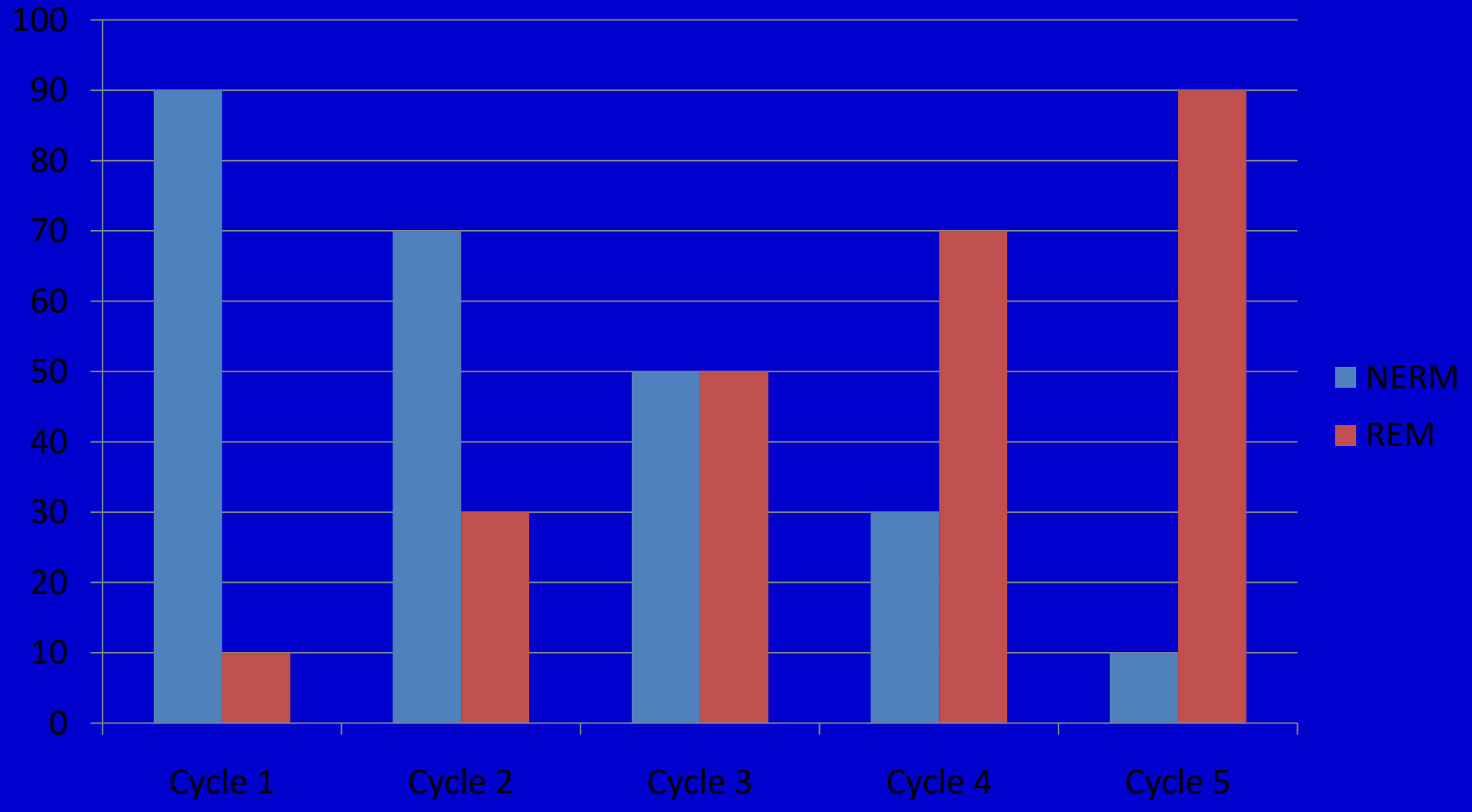
# Normal sleep physiology

- Sleep occurs in cycles.
- Each cycle – 90 min
- In 8 hrs sleep 5 cycles
- Each cycle

a) NERM(Non rapid eye movement sleep)

b) REM(Rapid eye movement sleep)

# Sleep physiology

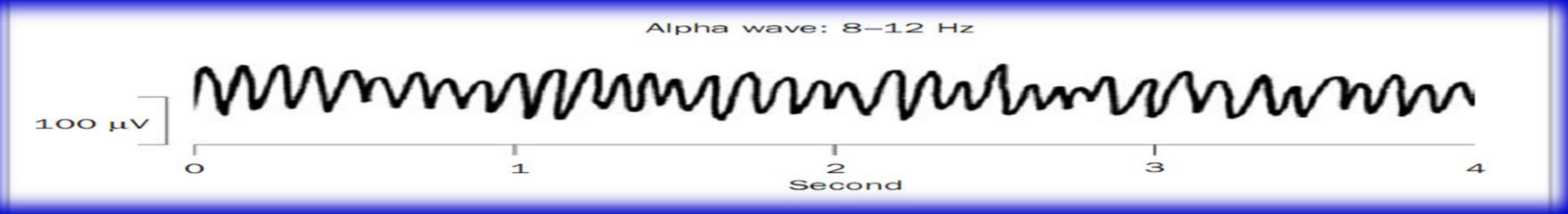


# EEG waves

- **The frequencies of brain waves range from 0.5-500 Hz.**
- **<u>The most clinically relevant waves:</u>**

1) ***Alpha waves*** **- 8-13 Hz**
2) ***Beta waves*** **- Greater than 13 Hz (18-30)**
3) ***Theta waves*** **- 3.5-7.5 Hz**
4) ***Delta waves*** **- 3 Hz or less**

# 1) Alpha waves




- Seen in all age groups but are most common in adults.
- Most marked in the parieto-occipital area.
- Occur rhythmically on both sides of the head but are often slightly higher in amplitude on the **nondominant** side, especially in right-handed individuals
- Occur with closed eyes , relaxation, wondering mind.
- Disappear normally with attention (eg, mental arithmetic, stress, opening eyes, any form of sensory stimulation), then become replaced with irregular low voltage activity.

# 2) Beta waves


- **Seen in all age groups.**
- **Small in amplitude , usually symmetric and more evident anteriorly.**
- Drugs, such as barbiturates and benzodiazepines, augment beta waves.
- **> 13 Hz/sec**

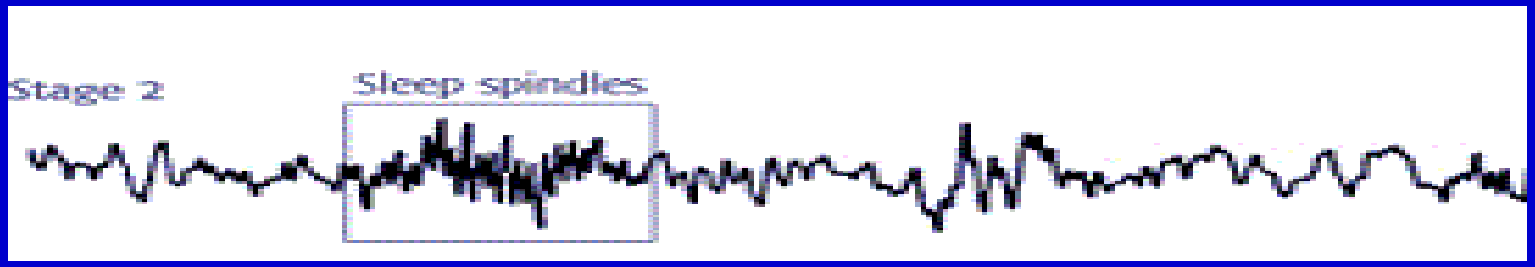
# 3) Theta waves


- Normally seen during sleep at any age.
- In awake adults, these waves are abnormal if they occur in excess.
- Theta and delta waves are known collectively as slow waves.

# 4) Delta waves


- Slow waves, have a frequency of ≤ 3Hz or less.
- Normally seen in deep sleep in adults as well as in infants and children.
- Delta waves are abnormal in the awake adult.
- Often, have the largest amplitude of all waves.
- Delta waves can be focal (local pathology) or diffuse (generalized dysfunction).

# Sleep spindles

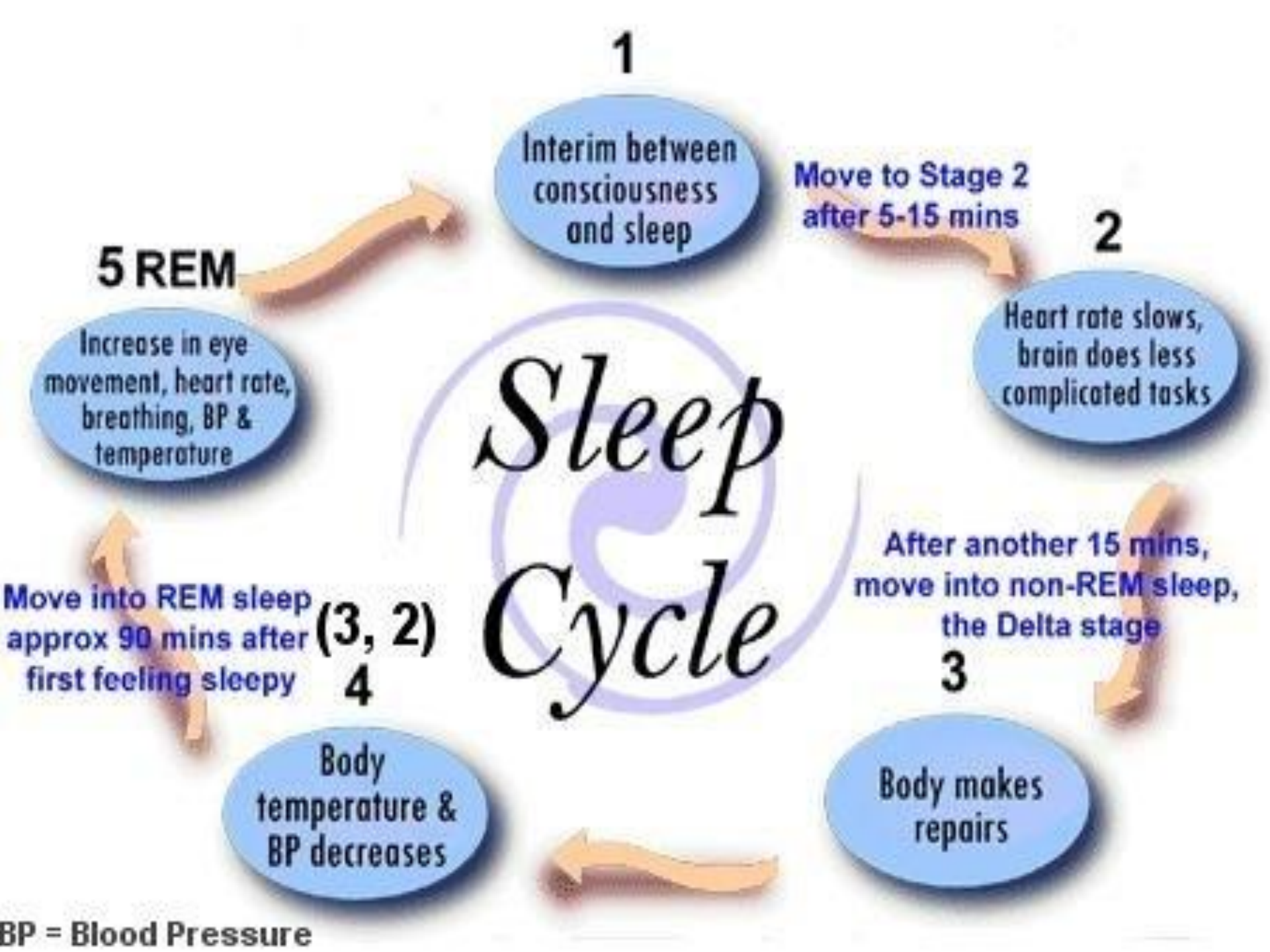



- Groups of waves that occur during many sleep stages but especially in stage 2.
- Have frequencies in the upper levels of alpha or lower levels of beta.
- Lasting for a second or less, they increase in amplitude initially and then decrease slowly. The waveform resembles a spindle.
- They usually are symmetric and are most obvious in the parasagittal regions.

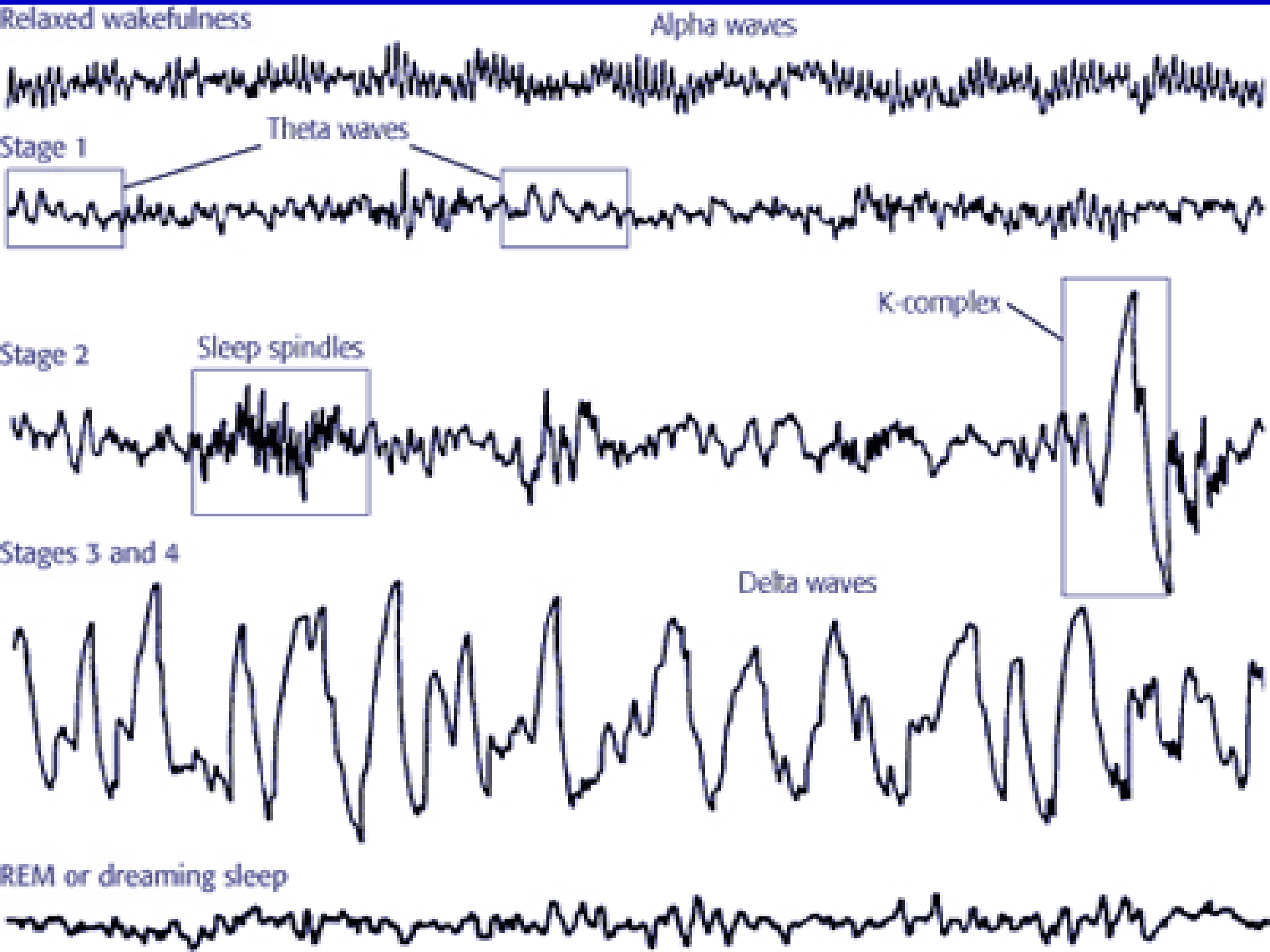
# Types and Stages of sleep

# Types of sleep "Depending on EEG criteria"

1. **Slow-wave sleep (non-REM):**
   - **Stage 1 NREM**
   - **Stage 2 NREM**
   - **Stage 3 NREM**
   - **Stage 4 NREM**
2. **Rapid Eye Movement Sleep (REM):**




BP = Blood Pressure


Relaxed wakefulness
Alpha waves
Stage 1
Theta waves
K-complex
Stage 2
Sleep spindles
Stages 3 and 4
Delta waves
REM or dreaming sleep

# Physiological Changes During NREM and REM Sleep

| Physiological Process | NNRENREM | REM |
|---|---|---|
| ***Brain activity*** | Decreases from wakefulness | Increases in motor and sensory areas, while other areas are similar to NREM |
| ***Heart rate*** | Slows from wakefulness | Increases and varies compared to NREM |
| ***Blood pressure*** | Decreases from wakefulness | Increases (up to 30 percent) and varies from NREM |
| ***Sympathetic nerve activity*** | Decreases from wakefulness | Increases significantly from wakefulness |
| ***Muscle tone*** | Similar to wakefulness | Absent |
| ***Blood flow to brain*** | Decreases from wakefulness | Increases from NREM, depending on brain region |
| ***Respiration*** | Decreases from wakefulness | Increases and varies from NREM, but may show brief stoppages; coughing suppressed |
| ***Airway resistance*** | Increases from wakefulness | Increases and varies from wakefulness |
| ***Body temperature*** | Is regulated at lower set point than wakefulness; shivering initiated at lower temperature than during wakefulness | Is not regulated; no shivering or sweating; temperature drifts toward that of the local environment |
| ***Sexual arousal*** | Occurs infrequently | Greater than NREM |

# Sleep Disorders

# Sleep disorders are divided in 2 sub-types

## I. Dyssomnias:

- Sleep disorders that are characterised by disturbances in the amount, quality or timing of sleep.
- E.g.:
  - Insomnia
  - Hypersomnia
  - Sleep apnea

## II. Parasomnias:

- Dysfunctions or episodic events occurring with sleep.
- E.g.:
  - Sleep-walking (somnambulism)
  - Sleep-related enuresis (bedwetting)
  - Sleep-talking (somniloquy)
  - Sleep-terrors and nightmares

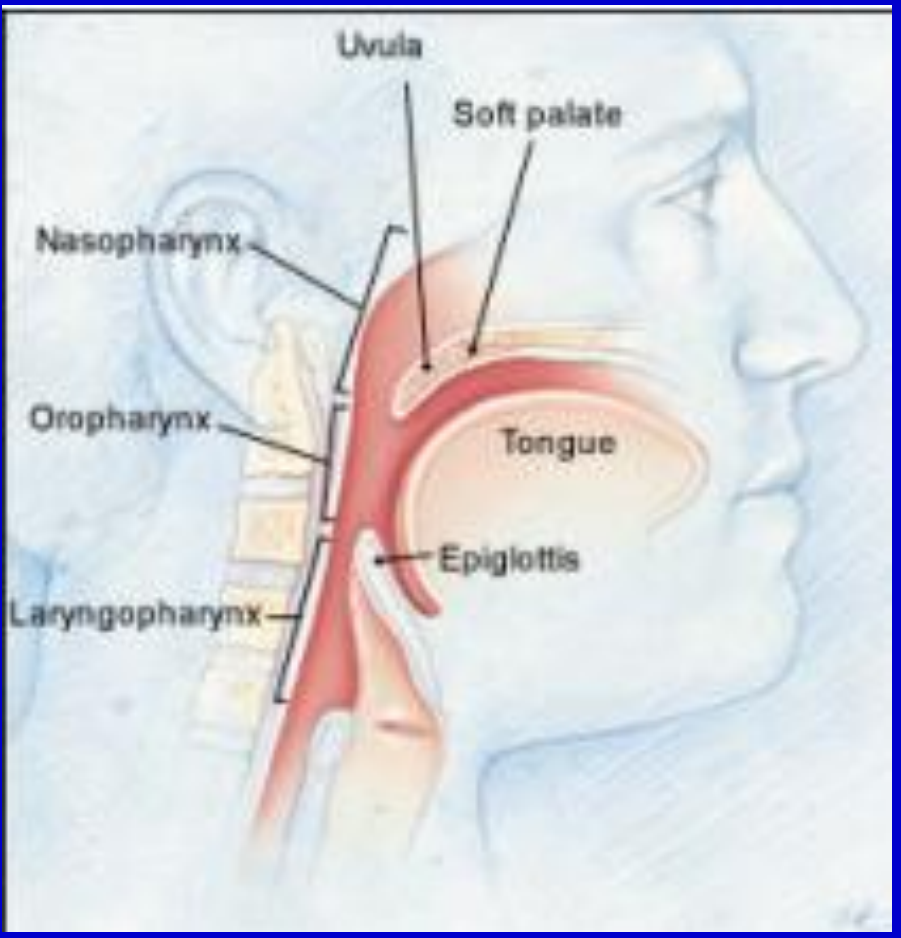
# Sleep Hygiene

1. Regular, daily physical exercises (preferably not in the evening).
2. Minimize daytime napping.
3. Avoid fluid intake and heavy meals just before bed-time.
4. Avoid caffeine intake (e.g. tea, coffee, cola drinks) before sleeping hours.
5. Avoid regular use of alcohol (especially avoid use of alcohol as a hypnotic for promoting sleep).
6. Avoid reading or watching television while in bed.
7. Sleep in a dark, quiet, and comfortable environment.
8. Regular times for going to sleep and waking-up.
9. Try relaxation techniques.

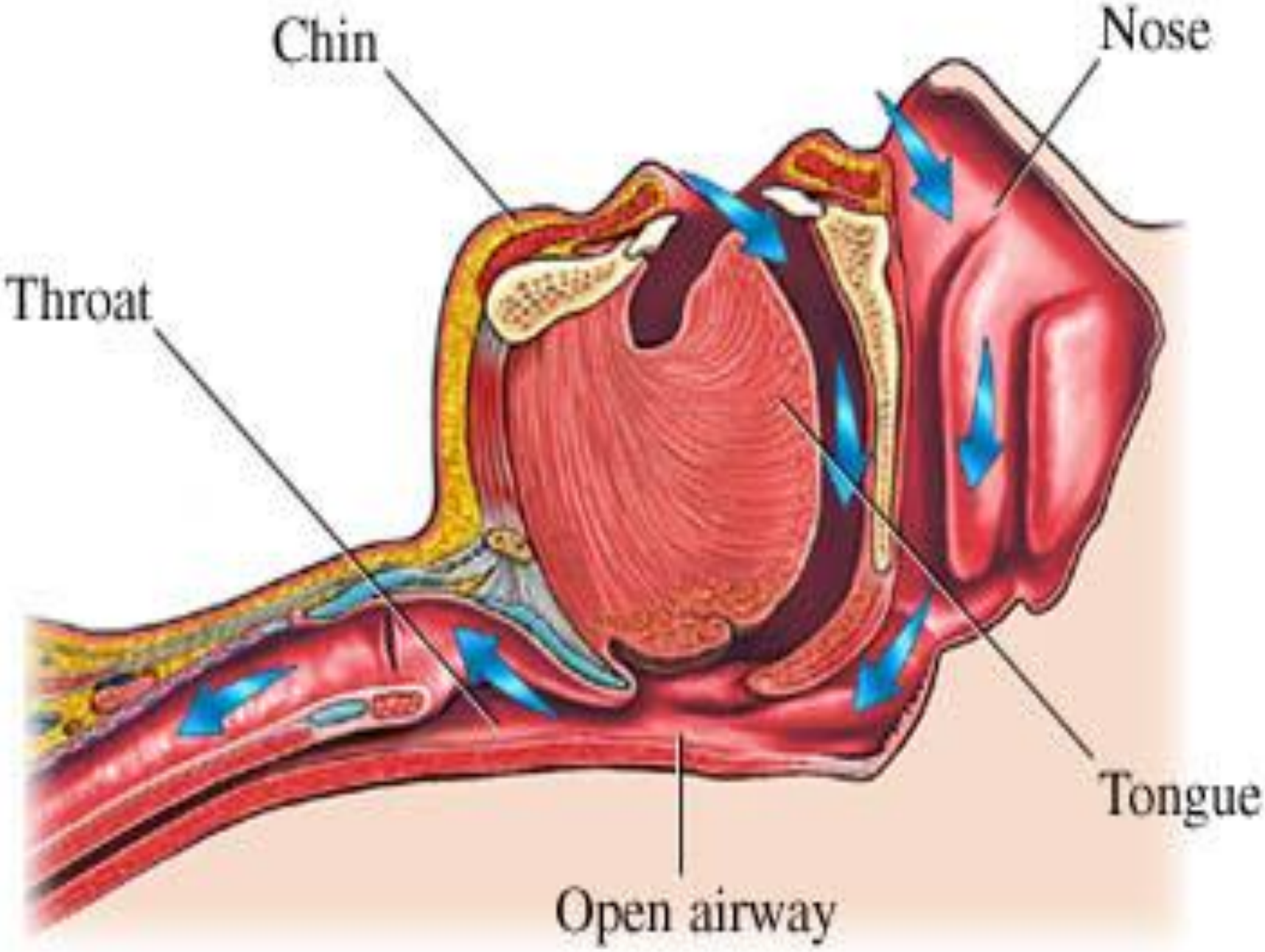
# Sleep physiology

- **NERM sleep:**

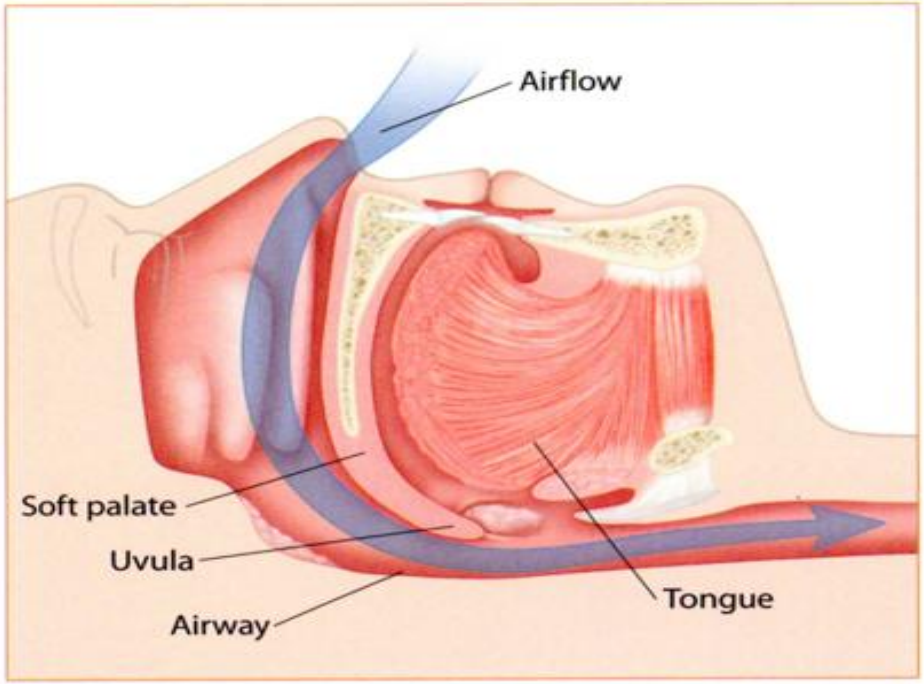
a) Stage-1
b) Stage-2
c) Stage-3
d) Stage-4


Uvula
Soft palate
Nasopharynx
Oropharynx
Tongue
Epiglottis
Laryngopharynx


Small or receding jaw
Tongue
Soft palate
Epiglottis
Uvula

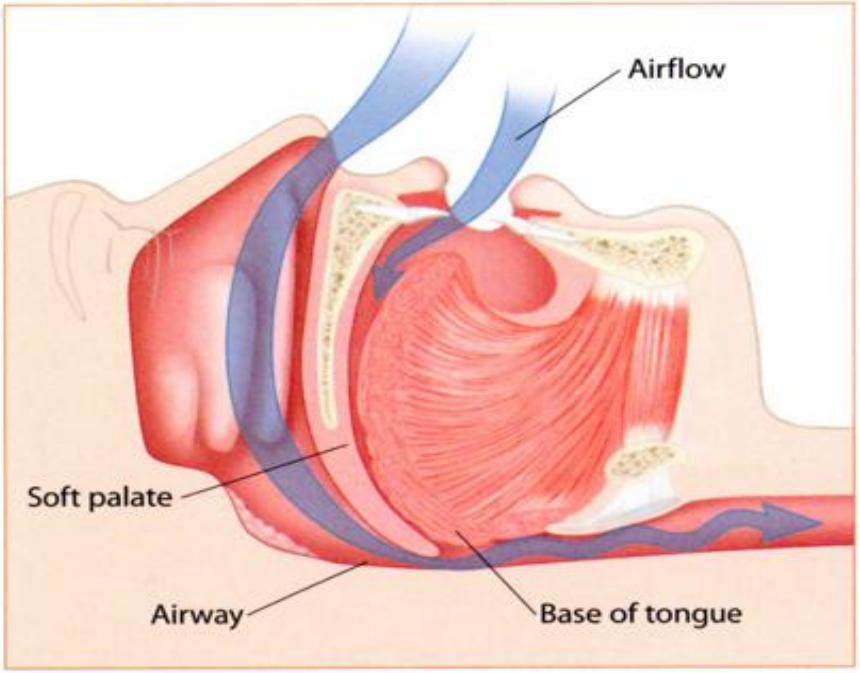

Chin
Nose
Throat
Tongue
Open airway

Normal

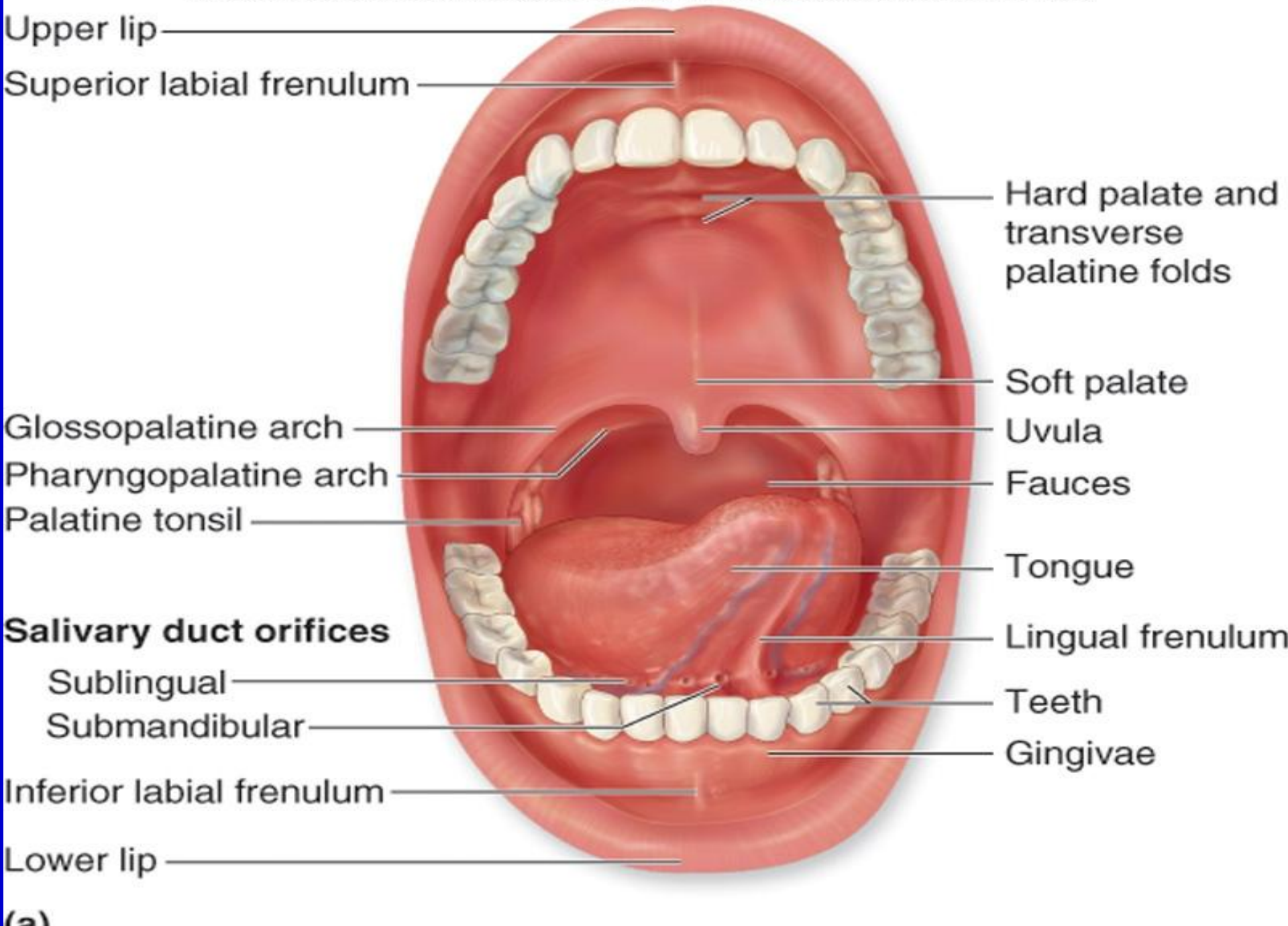



Air flows freely through the airway.

Snoring

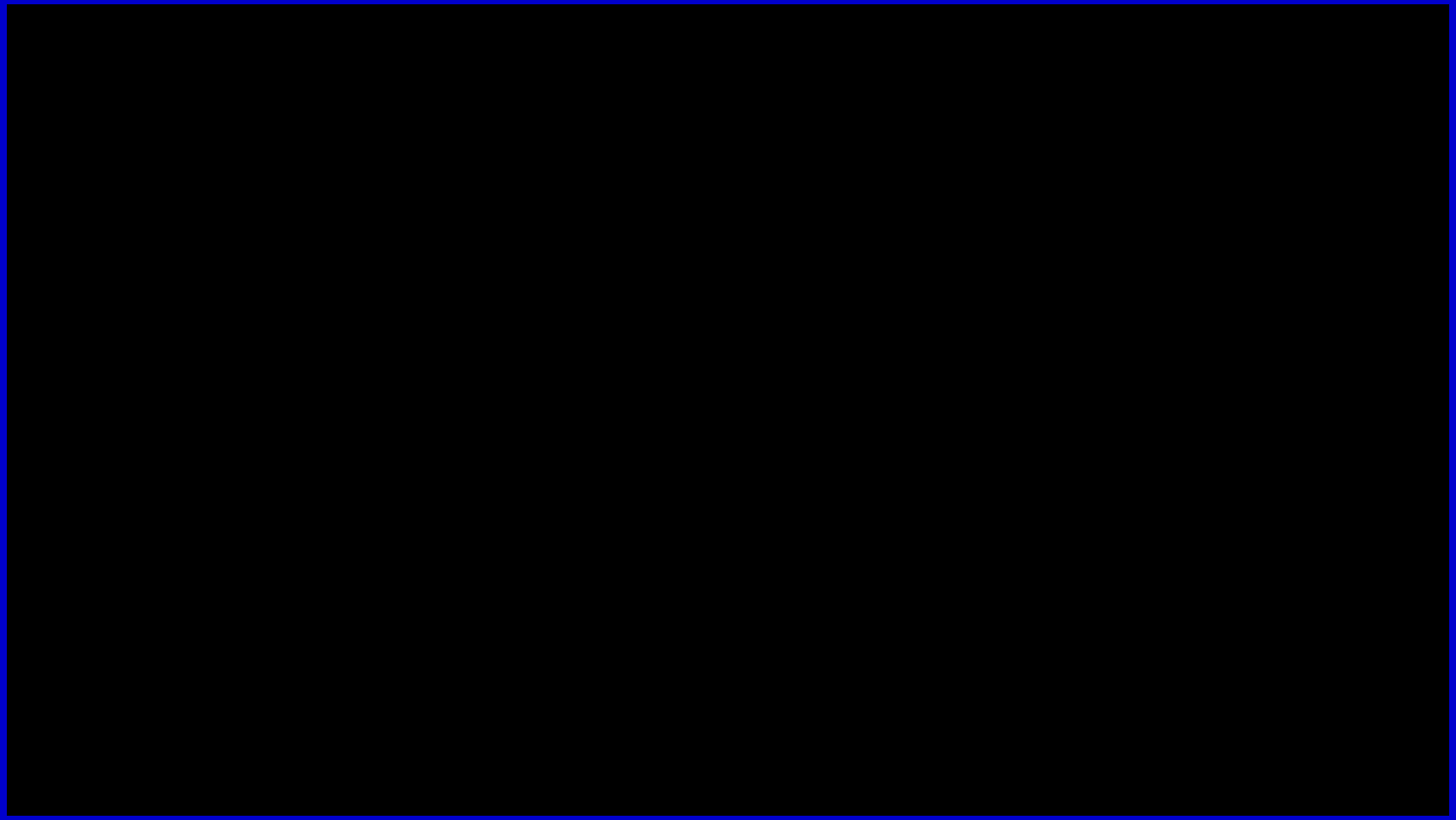



The soft palate and base of tongue partially block the airway, causing snoring.




(a)

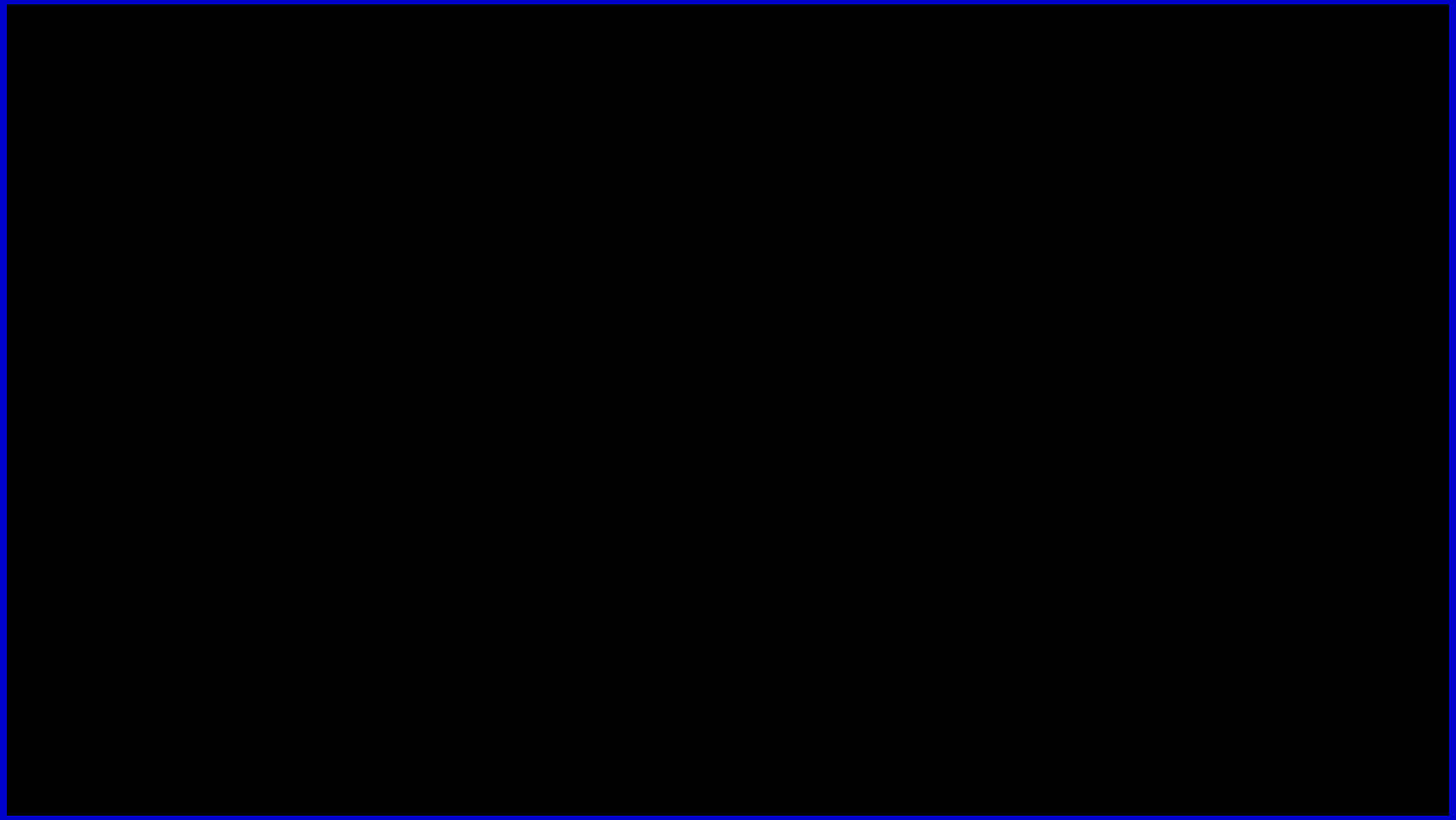
# Introductory video



# Video-2


Medically approved by:
dr. Ayaz M. Khan, MD and Sanne Stravens, Physician

# Video-3



# Definition

- **Sleep apnea is a chronic respiratory sleep disorder characterized by recurrent episodes of partial or complete upper airway obstruction during sleep (apneas, hypopneas) and are associated with repeated disruption of sleep resulting in excessive daytime somnolence and other medical co-morbidities.**

# Sleep apnoea video

# Sleep Disordered Breathing

- **Apnea:** complete cessation of airflow lasting 10 seconds or more
- **Hypopnea**: reduced airflow to about 50% lasting 10 seconds or more
- **Arousal:** a change in sleep state
- **UARS**: Respiratory event related arousals during sleep associated with excessive daytime sleepiness. No apneas or hypopneas
- **AHI**: number of apneas/hypopneas per hour of sleep. Used to grade severity of the Respiratory disturbance in sleep.

# Classification of SDB

- Intermittent snoring-nuisance, no health sequelae
- UARS-upper airway resistance syndrome
- Mild OSA- AHI 5-15
- Moderate OSA- AHI 15-30
- Severe OSA- AHI >30
- CSA-central sleep apnea

# Central Sleep Apnea

- Apneas occurring during sleep due to disordered control of breathing rather than obstruction to airflow. As opposed to obstructive apnea respiratory effort also ceases during the episode of apnea

  Cheyne stokes respiration is the most common and occurs commonly in heart failure

  It is treated with CPAP

Other conditions with CSA are neuromuscular diseases, pontine stroke etc

# What is the impact of SDB

- Road traffic accidents- mortality
- Lower productivity at school and work
- Morbidity-Impaired immune function, HTN, insulin resistance, stroke,pulm HTN, poor asthma control, ventricular arrythmias and sudden death
- Neurocognitive and mood dysfunction
- Reduced quality of life

# Neurocognitive effects of sleep deprivation

- Impaired mood, reduced vigilance, impaired concentration and reduced memory
- Impaired performance in surgical skills, anesthesia administration, intubation and EKG interpretation (*Weinger MB JAMA 2002)*

# Cardiovascular effects

- Associated nocturnal desaturations result in increases in C-reactive protein levels, neuropeptide Y, IL-6, IL-8 suggest predisposition to CVD risk
- Increased carotid artery atherosclerosis
- Increased incidence of HTN independent of obesity
- Increased odds for stroke in next 4 yrs with AHI>20 in cross sectional studies
- Ventricular ectopy-sudden cardiac death usually seen in pts with co-existing heart failure

# Metabolic effects

- Increased insulin and glucose levels during GTTs in people with BMI>29 and AHI>25 probably due to increased catecholamines, cortisol and growth hormone

# Pulmonary effects of Sleep apnea

- Decreased responses to changes in CO2 when awake
- Vagal stimulation leads to nocturnal exacerbation of asthma symptoms
- Complications of anesthesia with perioperative morbidity
- Pulmonary HTN can occur with AHI>70 and desaturations and/or coexistent obstructive lung disease, hypoxemia and hypercapnia

# When is snoring a problem?

- Snoring can be a symptom of Obstructive Sleep Apnea (OSA).
- Other symptoms include:
  - Daytime tiredness and overall fatigue
  - Restless sleep
  - Waking up choking or gasping
  - Morning headaches, dry mouth, or sore throat
  - Trouble thinking clearly or remembering things

# When is snoring a problem?

- Snoring can be a symptom of Obstructive Sleep Apnea (OSA). Some medical problems caused by OSA include:
  - Elevated blood pressure
  - Cardiac arrhythmias
  - Pulmonary hypertension
  - Automobile accidents
  - Social problems like divorce and spousal arguments, diminished job performance, lack of concentration and memory

# How do I tell the difference?

- Snoring, when accompanied by these other symptoms, prompts medical evaluation
  - –Epworth Sleepiness Scale
  - –Sleep study (polysomnogram)
  - –At-home sleep study

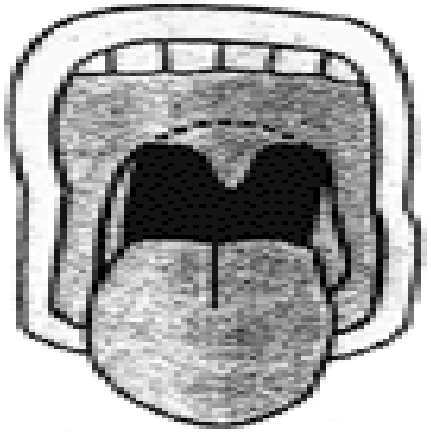
# Integral part of a general medical evaluation

- Ask about sleep habits including day naps
- Performance at work/school
- Interference with daily tasks
- Energy level
- Daytime sleepiness
- Snoring, choking, gasping, breathholding
- Refreshed upon awakening
- Drug use

# Physical exam features

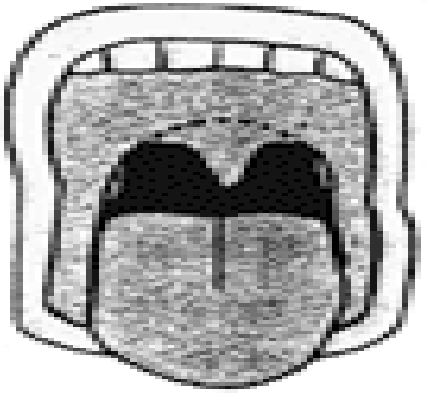
- Nasal passages
- Oropharyngeal passage
- TMJ function
- Body weight
- BP

# Mallampati Signs as Indicators of Difficult Intubation



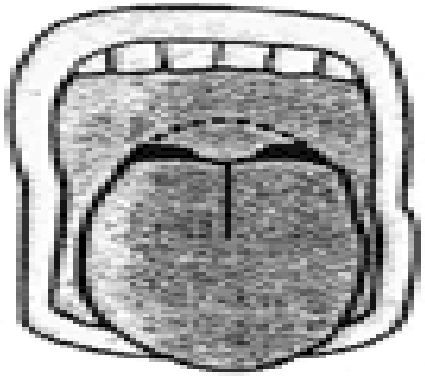
Class I: soft palate, uvula, fauces, pillars visible

**No difficulty**



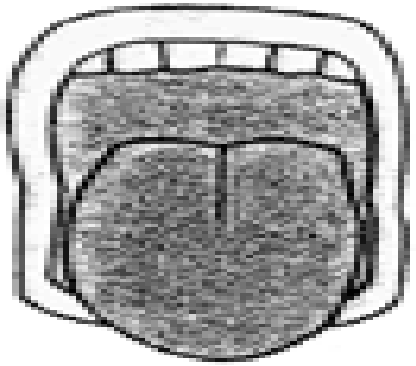
Class II: soft palate, uvula, fauces visible

**No difficulty**



Class III: soft palate, base of uvula visible

**Moderate difficulty**



Class IV: hard palate only visible

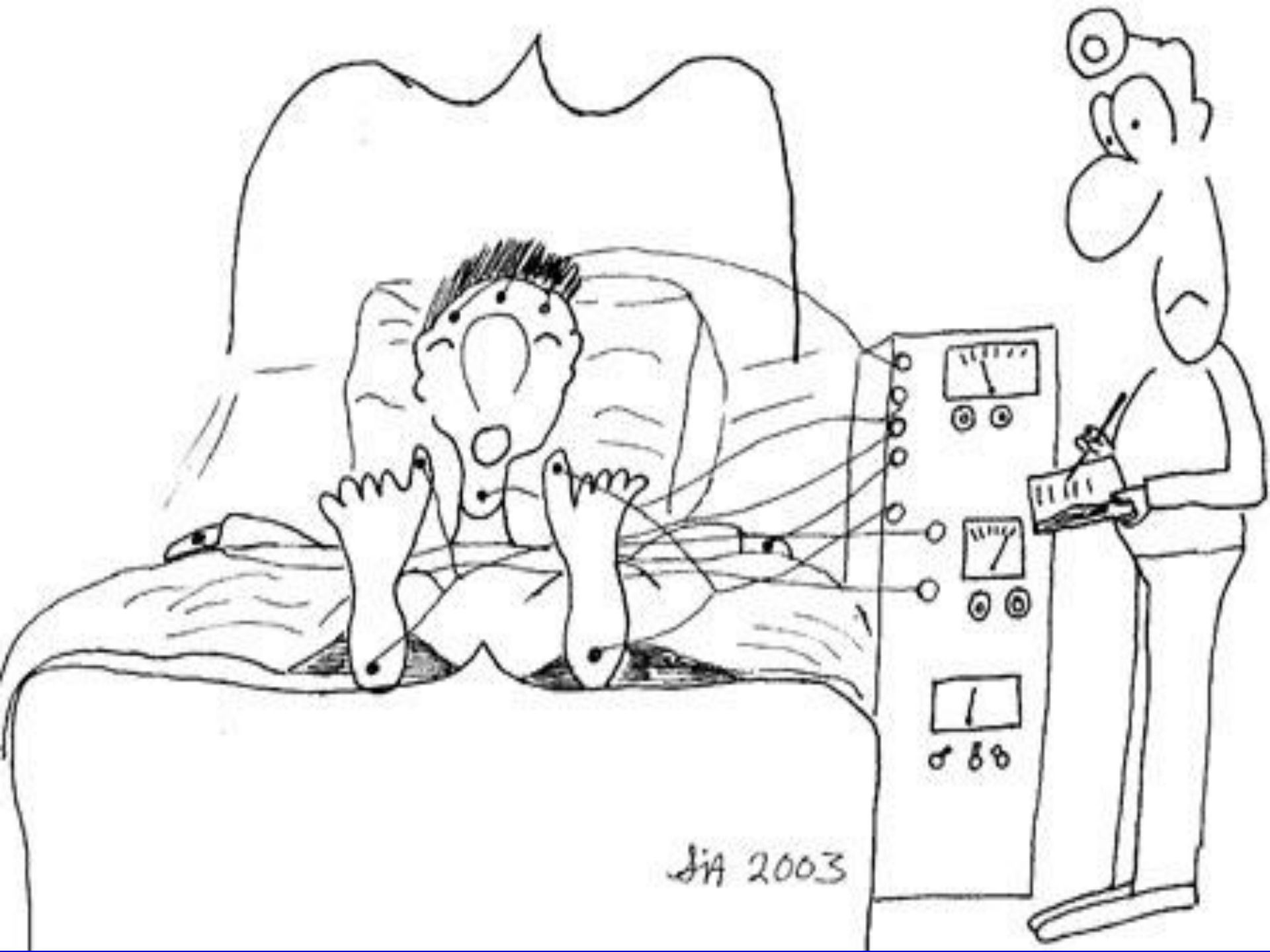
**Severe difficulty**

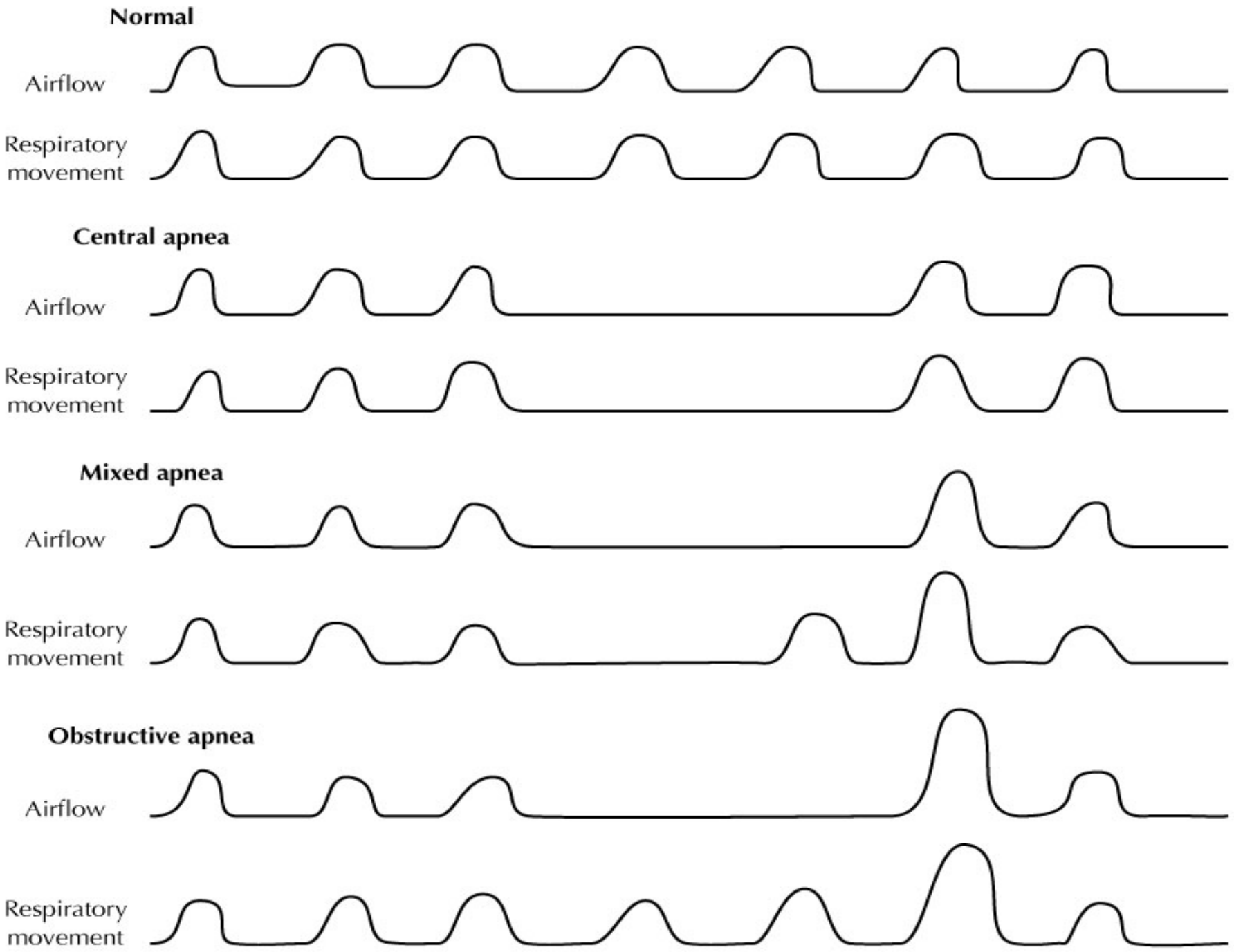
# Polysomnogram (PSG)

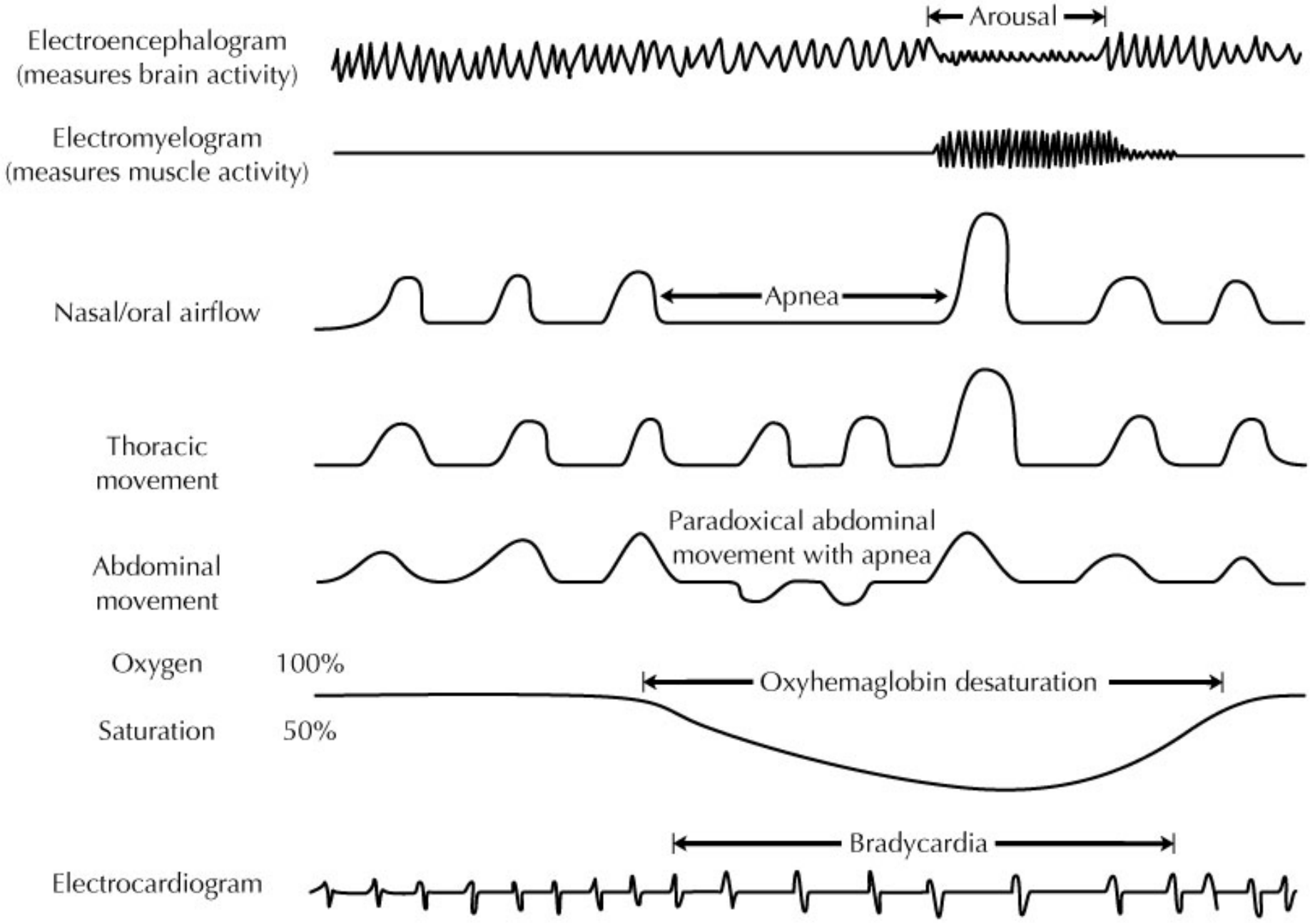
- Electroencephalogram
- EOG-oculogram
- Electromyogram-genioglossus and anterior tibialis
- Respiration
- Abdomen and chest wall motion
- Body position
- EKG
- O2 saturation
- Snoring

# How polysomnography done?

Introduction_To_The_Sleep_Lab_Sleep_Apnea_Diagnosis.WebM


JA 2003


Normal
Airflow
Respiratory movement
Central apnea
Airflow
Respiratory movement
Mixed apnea
Airflow
Respiratory movement
Obstructive apnea
Airflow
Respiratory movement


Arousal
Electroencephalogram
(measures brain activity)
Electromyelogram
(measures muscle activity)
Nasal/oral airflow
Apnea
Thoracic
movement
Paradoxical abdominal
movement with apnea
Abdominal
movement
Oxygen
100%
Oxyhemaglobin desaturation
Saturation
50%
Bradycardia
Electrocardiogram

# Treatment

- Weight loss
- Avoidance of drug and alcohol use
- Smoking cessation
- Postural training
- Nasal patency
- Dental appliances
- CPAP/BiPAP
- Surgery

# How do you treat OSA?

- Weight loss
- Continuous Positive Airway Pressure (CPAP)
  - The "mask" for breathing at night
  - Gold standard: it works every hour that you use it
  - Compliance can be poor
- Oral appliance
  - Repositions the jaw to move the tongue forward, decreasing obstruction

# CPAP

- Splints open airway during sleep
- Reduces blood pressure
- Improves heart function (in pts with CSA)
- Do not always need titration study

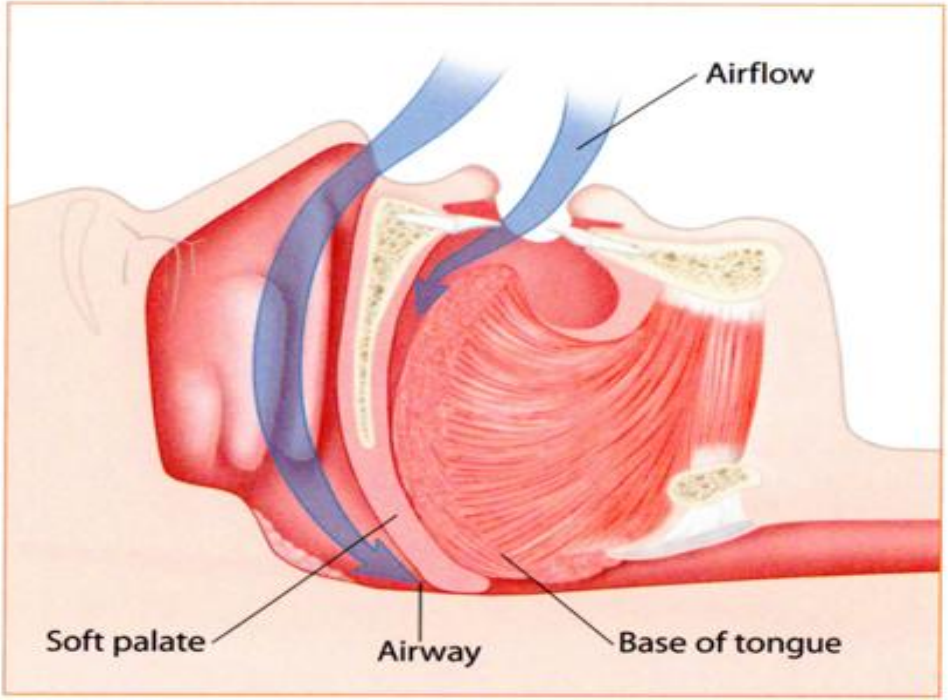
Needs to be used at least 6 hrs nightly

Medicare guidelines: AHI>15 for 2 hr sleep test or AHI>5 with sleepiness, impaired cognition, HTN, IHD or h/o CVA

# CPAP

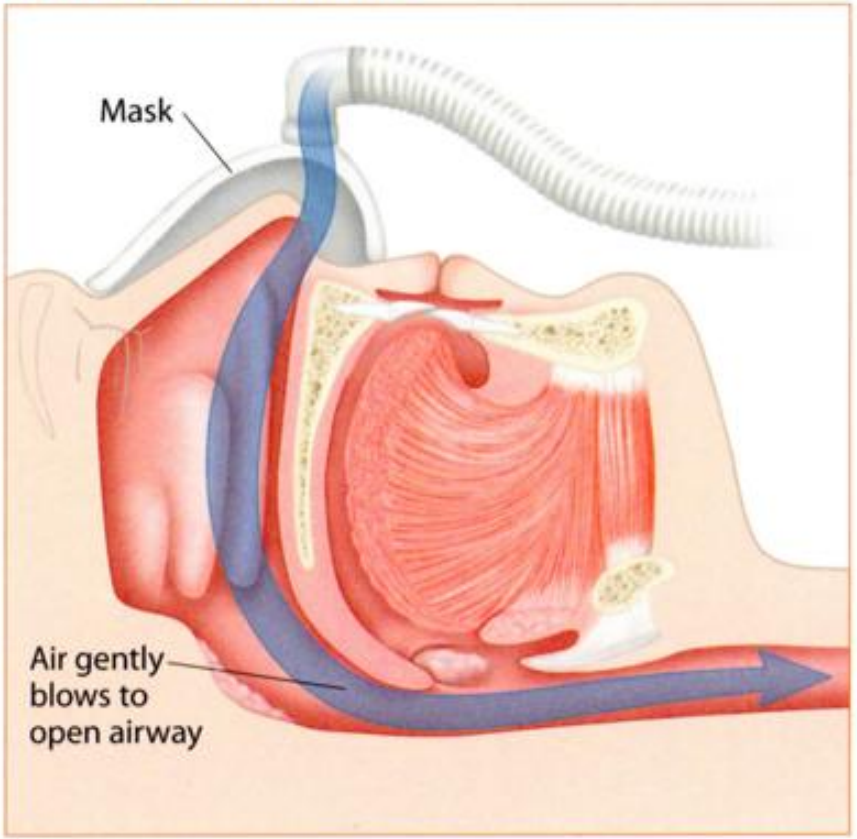
- Compliance poor in >40% of pts but best when significant daytime sleepiness present
- Side effects that decrease tolerance of CPAP are nasal and sinus congestion, conjunctivitis, noise, claustrophobia, mouth leak etc
- Humidification and regular follow up, help compliance

## Sleep Apnea

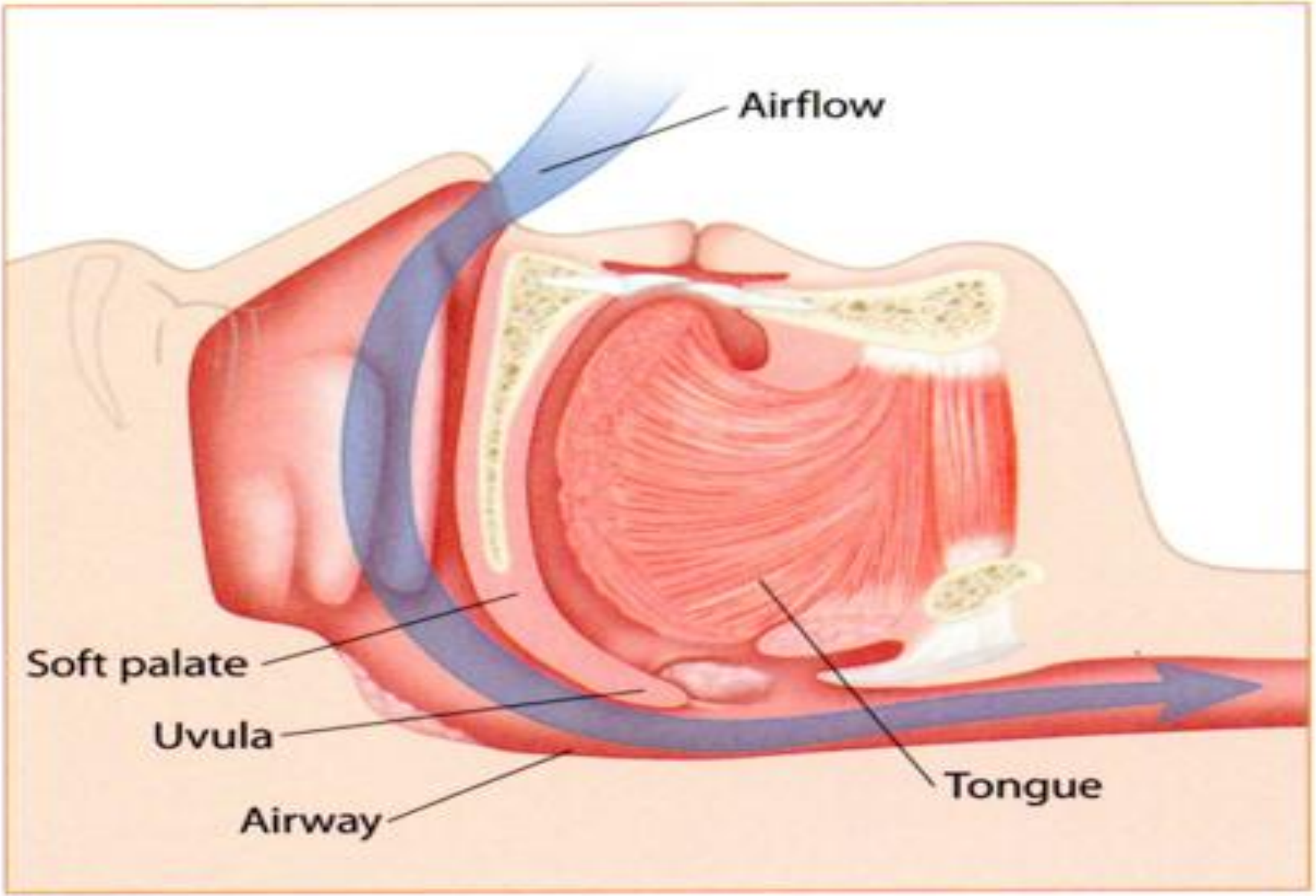



The soft palate and base of tongue block the airway, causing sleep apnea.

## Air Pressure Treatment



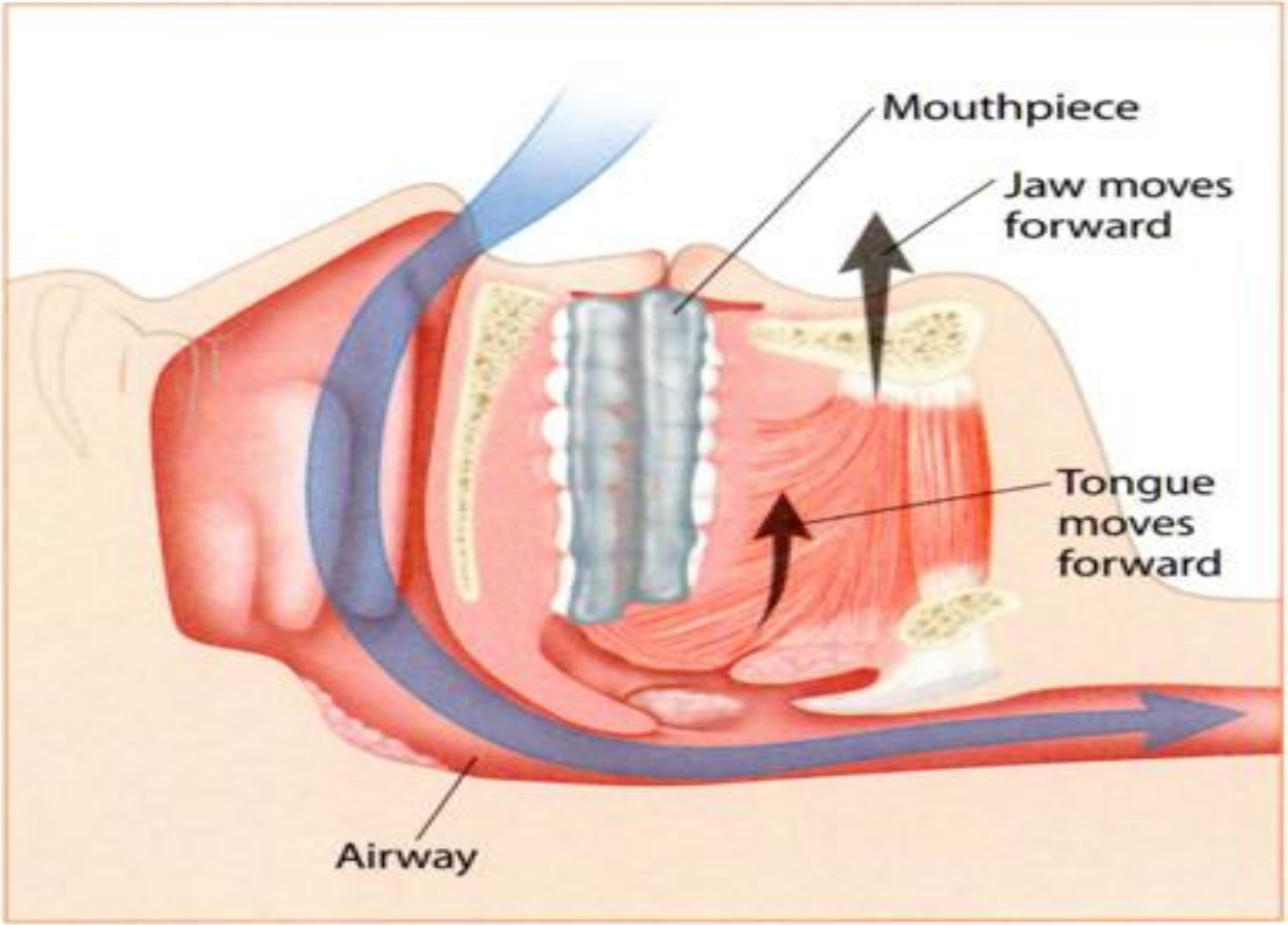
## Normal




Air flows freely through the airway.

# ORAL APPLIANCES

# Mouthpiece

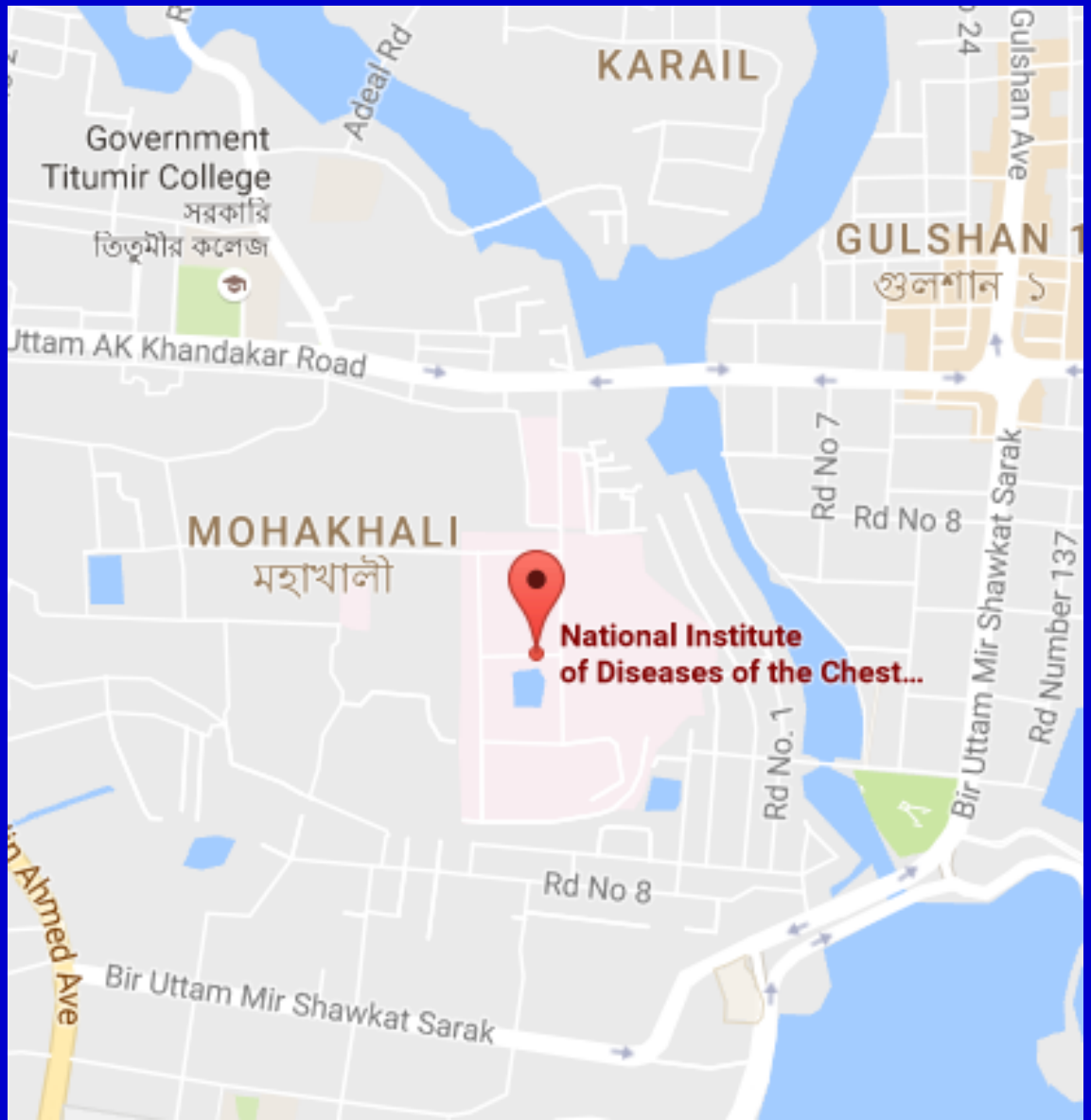


# How do you treat OSA?

- Surgery to correct the airway obstruction
  - Septoplasty/turbinoplasty
  - Tonsillectomy
  - Uvulopalatopharyngoplasty
  - Tongue base surgery
  - Genioglossus advancement
  - Tracheotomy
  - Maxillary-mandibular advancement
- Not all surgeries are for everyone. Some only work on certain types of obstruction
- More invasive surgeries have been more effective

- Radiofrequency ablation
  - Multiple procedures and poor for obese patients
- Tongue base suspension
  - Same
- Midline or Central tongue reduction
  - Complex, risk of paralysis, loss of function
- SMILE (Submucosal minimal lingual excision)
  - Significant learning curve and complications

# NIDCH


KARAIL
Government
Titumir College
সরকারি
তিতুমীর কলেজ
Adeal Rd
Gulshan Ave
GULSHAN 1
গুলশান ১
Uttam AK Khandakar Road
Rd No 7
Rd No 8
MOHAKHALI
মহাখালী
National Institute
of Diseases of the Chest...
Rd No. 1
Bir Uttam Mir Shawkat Sarak
Rd Number 137
Rd No 8
Ahmed Ave
Bir Uttam Mir Shawkat Sarak

# Department of Respiratory Medicine, DMCH (Respiratory Lab)

# Any Questions?