Diana Guth, BA, RRT

Sleep
&
Respiratory Care

Diana Guth, BA, RRT
Home Respiratory Care
2370 Westwood Blvd., Suite D
Los Angeles, CA 90064
310-441-4640 Fax 310-441-4642
Diana@hrcsleep.com

Why am I having trouble sleeping?

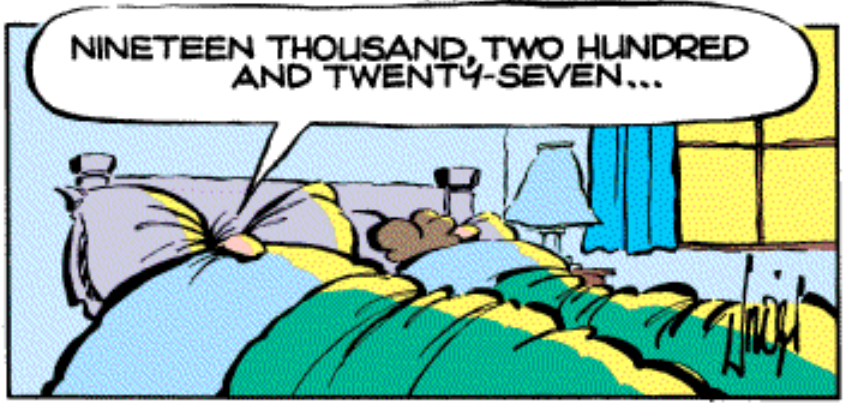
- Do I have a Sleep Disorder?
- Am I Hypoventilating?
- Is pain interrupting my sleep?
- How are the answers to these questions determined?

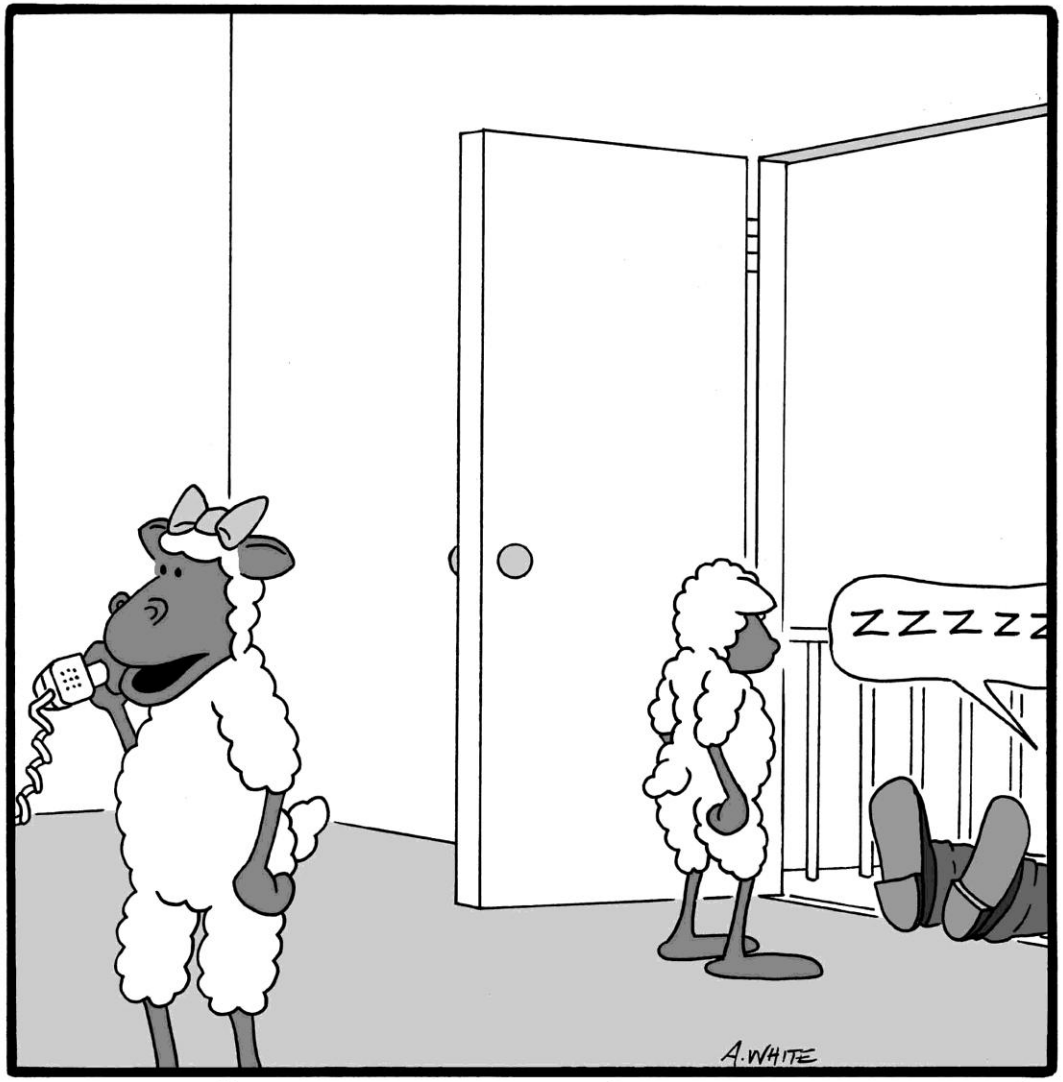
Sleep Disorders
vs
Hypoventilation

Sleep Disorders

HERMAN

JIM Unger





"Hello, Census Bureau? Another one of your census-takers fell asleep on our doorstep!"

Sleep Disorder Terminology

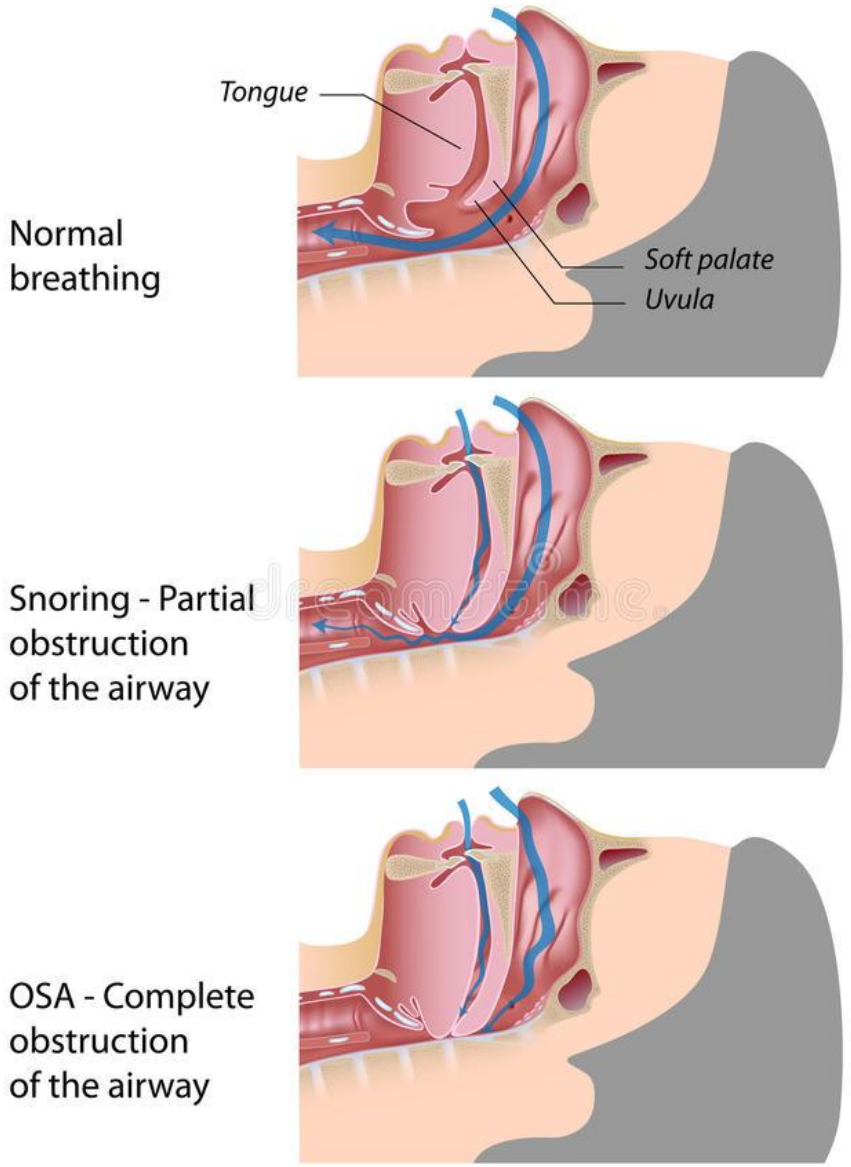
- **OSA**: **O**bstructive **S**leep **A**pnea
- **CSA**: **C**entral **S**leep **A**pnea
- **Mixed Apnea (both OSA & CSA)**
- **Complex Sleep Apnea**
- **Cheyne Stokes Respiration/ Periodic Breathing**
- **Hypoventilation:**

  AKA Respiratory Insufficiency

Mechanics of Obstructive Sleep Apnea (OSA)

- Soft tissues in the back of the throat relax, collapse and obstruct the airway

Obstructive Sleep Apnea



Central Sleep Apnea (CSA)

- Brain doesn't send out the signal to breathe
- Frequently seen in patients with cardiac and neurological disorders
- In PPS or other neuromuscular disorders, weak respiratory effort while asleep can mistakenly be interpreted as CSA

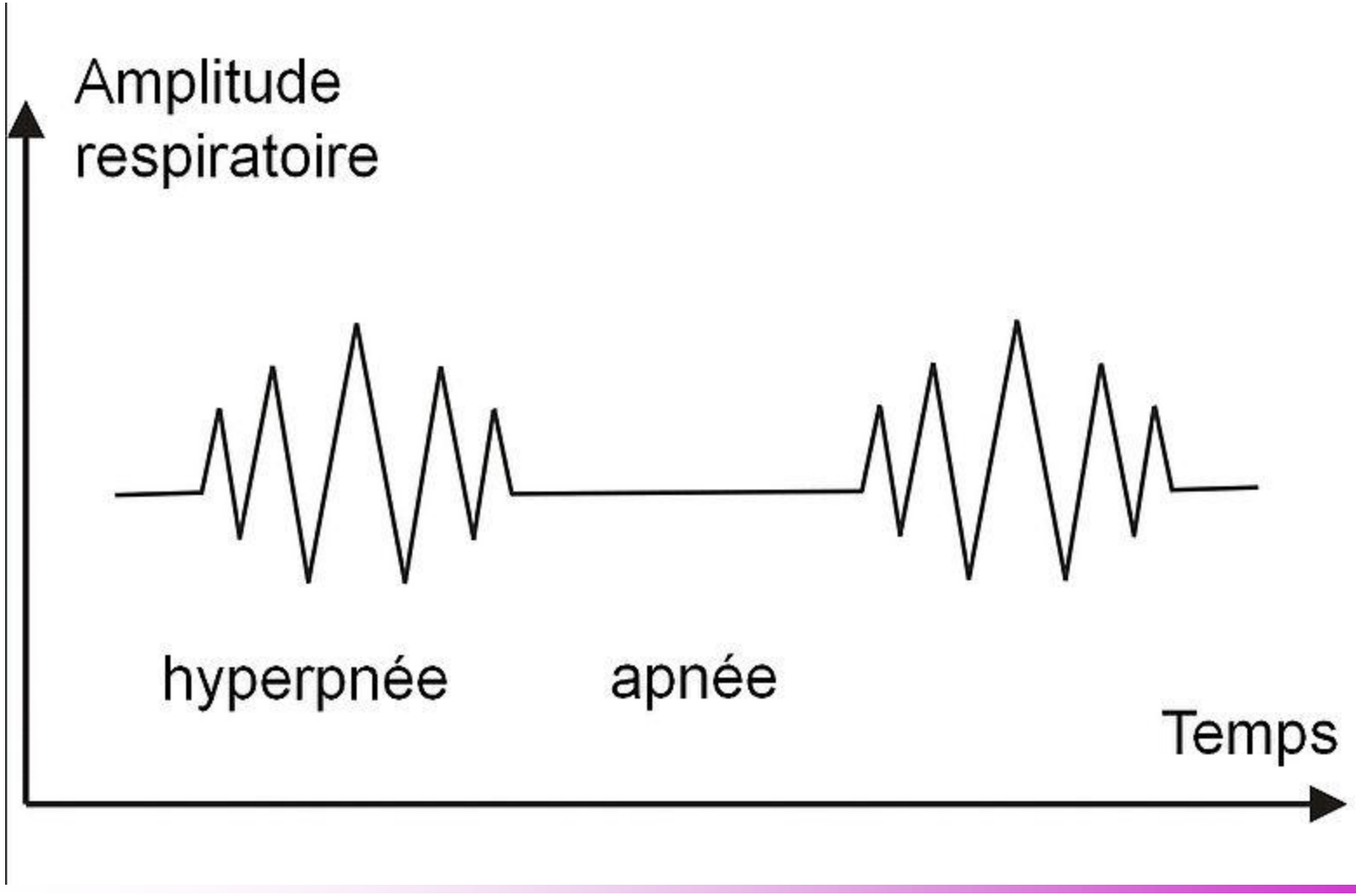
Complex Sleep Apnea

- Form of Central Sleep Apnea
- Patient has been diagnosed with OSA
- During the CPAP titration, central apneas emerge or persist as Positive Airway Pressure is administered in an effort to treat the OSA

Cheyne-Stokes Respiration/ Periodic Breathing

- A crescendo pattern of breathing followed by…
- A cessation of breathing
- Most commonly seen in patients with congestive heart failure, neurological conditions and central sleep apnea

Cheyne-Stokes Respiration/ Periodic Breathing



Symptoms of Sleep Apnea

- Snoring with pauses in breathing followed by a gasp for the next breath (witnessed)
- Excessive Daytime Sleepiness (EDS)
- Waking up tired
- Falling asleep at inappropriate & unsafe times
- Waking up with a dry or sore throat
- Insomnia
- Irritability
- Attention problems
- Morning headache (also for hypoventilation)

Causes of Sleep Apnea

- Overweight
  - If a person with sleep apnea loses weight, sometimes the sleep apnea disappears
- Anatomy
- Genetics
- Large neck size
- More common among men

Diagnosing Sleep Disorders

- Go to a pulmonologist (for people with PPS) who is also a sleep medicine specialist. Some neurologists are also boarded in sleep
- Sleep Studies
  - Attended split night sleep study in a sleep lab
  - Home Sleep Study

Sleep Test Definitions

- **Apnea**: The cessation of airflow for at least 10 seconds
- **Hypopnea:** An abnormal respiratory event lasting at least 10 seconds associated with at least a 30% reduction in the thoracoabdominal movement or airflow as compared to baseline, and with at least a 4% decrease in oxygen saturation
- **Apnea-Hypopnea Index (AHI)**: The Average number of episodes of apnea & hypopnea per hour of sleep without the use of a postitive airway pressure device
- Apneas & Hypopneas are also referred to as "events"

Attended Sleep Study

- Performed in a sleep lab. Administered and monitored by a Registered Polysomnographic Technician
- Usually a Split Night Sleep Study
  - First half of the night is diagnostic
  - Second half of night (if determined the patient has a sleep disorder), CPAP or BPAP pressures are titrated to therapeutic levels

Attended Facility Based Sleep Study Monitored Continuously & Simultaneously: What is Monitored?

- Electroencephalogram (EEG): Determines stages of sleep
- Electrocardiogram: See if the heart reacts to apneic episodes
- Electro-Oculogram (EOG): Identified REM (Rapid Eye Movement)
- Electromyogram: Measures muscle activity
- Airflow
- Respiratory Effort
- Oxygen Saturation
- Camera for tech to view and sometimes record

Home Sleep Test

- Perfomed unattended in the beneficiary's home using a portable, recording device.
- Different Types: Can have 3 to 7 recording channels
- None of them records EEG
- Cannot titrate PAP pressures.
  - If after data is downloaded and a report is generated and interpreted by a physician Boarded in Sleep Medicine, the PAP pressure determination is done via an Auto CPAP or Auto BPAP
- Situation where an attended titration should take place:
  - If Central Apnea emerge
  - Neuromuscular patient

Medicare Coverage of Sleep Devices

For CPAP

- F2F eval with treating MD before the sleep test
- AHI is ≥ 15 events per hour with a minimum of 30 events, OR
- AHI is ≥ 5 & ≤ 14 events per hour with a minimum of 10 event & documentation of:
  - Excessive daytime sleepiness, impaired cognition, mood disorders, or insomnia OR
  - Hypertenstion, ischemic heart disease, or history of stroke

For BPAP

- All of above plus CPAP has been tried & proven ineffective based on a therapeutic trial conducted in either a facility or in a home setting

Treatment of Sleep Disorders

This is different from treating hypoventilation!

Sleep Apnea Disease Management

- Sleep apnea is a serious medical condition
- Left untreated the person suffering from this disorder has at risk of heart attack, stroke and falling asleep at the wheel
- Sleep Apnea Disease management requires a team of experienced sleep specialists: physicians, polysomnographic techs, respiratory therapists, dentists, psychologists, ENT and maxillofacial surgeons

Device Terminology

- **CPAP**:
  - **C**ontinuous **P**ositive **A**irway **P**ressure
- **BiPAP**™ (Respironics) or **Bilevel PAP**:
  - **B**ilevel **P**ositive **A**irway **P**ressure
- **IPAP:**
  - **I**nspiratory **P**ositive **A**irway **P**ressure
- **EPAP:**
  - **E**xpiratory **P**ositive **A**irway **P**ressure
- **Pressure Support Ventilation**
  - Difference between IPAP & EPAP

Treatment for Obstructive Sleep Apnea

- Positive Airway Pressure (PAP) devices, Heated Humidifiers & Masks are the mechanism for treatment – Gold Standard
- Air Splint
  - Mechanical treatment for a serious problem
  - Blows air, under pressure, through the nose (and sometimes mouth) to keep the airway open

CPAP & Auto CPAP Devices & Indications for Use

- **CPAP E0601**
  - Treats OSA & Mixed Apnea
  - **Prescribe one pressure setting** (5-20 cm H2O)
    - Determined at PSGT or Auto CPAP
- **Auto CPAP E1399 or E0601**
  - Treats OSA & Mixed Apnea
  - Variable self adjusting single pressure (4-20 cm H2O)
  - Diagnostic & therapeutic applications
    - Can be used to determine therapeutic pressure
    - Patients with fluctuating weight
    - Therapeutic device for some patients
  - **Prescribe: Minimum & Maximum Pressures**

Two Types of "BPAP" Machines

- **BPAP S**:
  - Used to treat severe OSA
  - Has no back-up rate there should not be used for hypoventilation
- **BPAP S/T:**
  - Used to treat hypoventilation
  - Has a Timed Back-up Rate so if the patient does not initiate a breath, they will receive a supported breath

- **"S"** means **S**pontaneous:
  - The patient **S**pontaneously triggers each breath
- **"T"** mean **T**imed
  - There is a **Timed Back-up Rate**

Bilevel PAP Devices w/o Back-up Rate (BPAP S): Indications for Use

- **Bilevel PAP E0470 (without Back-up Rate)**
  - Sleep Apnea Diagnosis: Treats more severe OSA, Mixed Apnea, failed CPAP trial (PAP for OSA LCD)
  - Other Diagnoses: COPD, Obesity Hypoventilation Syndrome (RAD LCD)
  - Pressure ranges: 4-20 or 25 cm H2O (depending on model)
  - **Set/Prescribe 2 Pressures** – Higher **IPAP** & Lower **EPAP**

Auto Bilevel PAP S Devices EO470 Indications for Use

- Sleep Apnea Diagnoses: More severe OSA, Mixed Apnea, Failed CPAP trial
- Diagnostic & therapeutic application
  - Can be used to determine therapeutic BPAP pressure if not titrated in lab or failed CPAP trial
  - Patients with fluctuating weight
  - Therapeutic device for some patients
- Variable Pressures – **Set/Prescribe:**
    - **Minimum EPAP**
    - **Minimum IPAP**
    - **Maximum IPAP**
    - **Pressure Support**

Bilevel S/T Ventilators & Indications for Use

- **BiLevel Noninvasive PAP Ventilator**
  - Treats neuromuscular diseases (like ALS, Post Polio Syndrome, MD), Restrictive Thoracic Disorders, Severe COPD, Hypoventilation Syndrome
  - Set higher IPAP, lower EPAP in order to deliver pressure supported ventilation
  - Cannot set the size of each breath
  - Timed back-up rate
  - Some have Disconnect and power outage alarms
  - Does not have a built-in battery for portability or power outage

Philips Respironics BiPAP AVAPS™: Average Volume Assured Pressure Support

- Bilevel PAP S/T: Size of each breath is not set & sometimes the patient can't extract a large enough breath (end stage ALS)
- AVAPS: Can set Tidal Volume (size of each breath).
  - EPAP is fixed
  - IPAP adjusts to deliver each breath (set Minimum & Maximum IPAP pressure
  - Has Timed Back-up Rate
  - Has disconnect and power outage alarms
  - Does not have a built-in battery for portability or power outage

Bilevel Servo Devices & Indications for Use

- Treats Central Sleep Apnea, Mixed Apnea, Complex Sleep Apnea, Cheyne-Stokes Breathing, Periodic Breathing
- Provide Pressure Support Ventilation on a breath-by-breath basis
  - Evens out breathing pattern by memorizing patient's waking respiratory rate & volume; then duplicates it w/asleep giving pressure supported breaths during apnea/small breaths & little pressure when hyperventilating.
  - Adaptive to pt flow limitation and respiratory rate

PAP Comfort Settings/Features

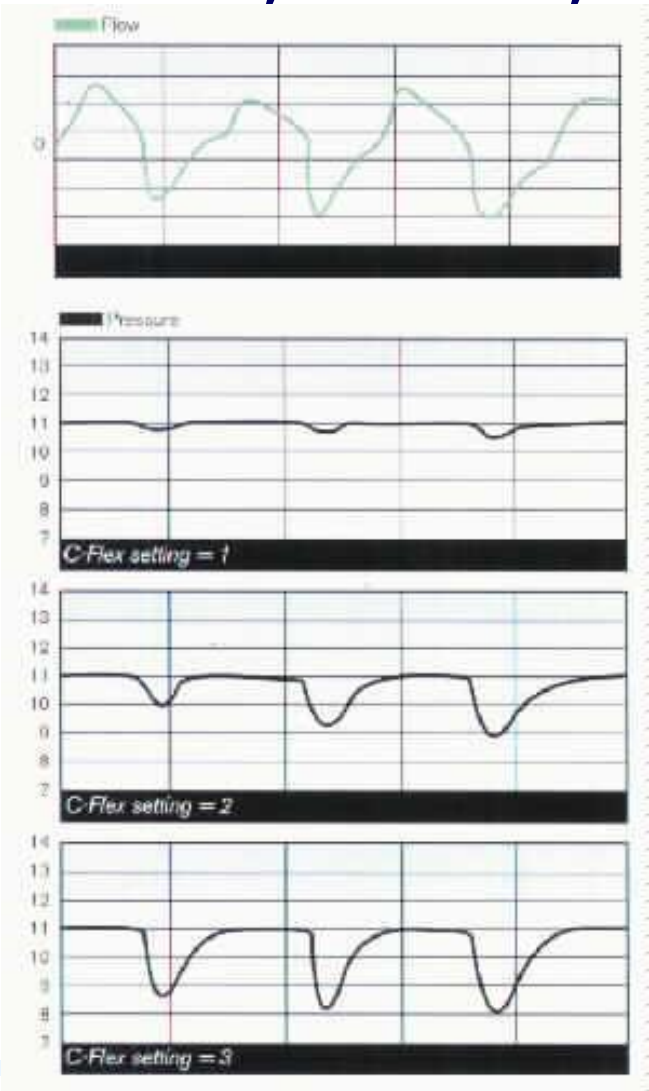
- Ramping
  - Pressure starts low & gradually increases to therapeutic pressure over 5-45 minutes
  - Purpose: to help patient initiate sleep
- Ramp Time – some fixed @ 20 minutes
  - Minimum
  - Maximum (some 45 minutes)
  - Ramp Start Pressure or Start EPAP for BPAP
    - Patient access
  - Auto Ramp – ResMed AirSense 10 PAPs & Respironics Dream Station

PAP Comfort Settings/Features

- Cflex™ or Biflex™ (Respironics) or EPR™ (ResMed)
  - Patient access
- Auto On & Auto Off
- SensAwake™ (Fisher & Paykel)
- Mask Resistance
- Mask fit indicator
- Mask Leak Alarm

Additional Features

- C-Flex, Bi-Flex, EPR



Common Features

- Permanent and/or disposable filters
- Auto Voltage detection: 110V to 240V
- Altitude compensation: Manual or automatic

Humidifiers

- PAP often has a drying effect on the sinuses causing
  - Uncomfortable dryness
  - Congestion – vasomotor rhinitis
- Heated Humidification can counteract that side effect
- Have contributed to higher treatment adherence

Condensation From Heated HumidifierS

- Causes water to accumulate in the tube creating an annoying gurgle in the middle of the night
- Caused by difference between the temperature in the air and that inside the tube
- Solutions
  - Insulate tube from the outside
  - Special warmed tube (coiled wire in tube)
    - Fisher & Paykel Icon
    - ResMed S-9 & S-10 platform uses a Climateline
    - Philips Respironics Heated Tube

ResMed AirSense ™ 10 Climateline Heated Tube

Additional Features

- Back up Power:

  Most devices use commercial AC power, and have 12 VDC capability via power cord used in automobile cigarette lighter receptacle.

  One company has a small add-on battery pack for their CPAP device.

Tracking PAP Treatment

- Many PAPs have data memories:
  - CPAP
    - Hours of usage per night
    - Leaks
    - AHI
    - Central apneas (ResMed)
  - Auto CPAP & Auto BPAP
    - Average pressure
  - BPAP Auto SV & BPAP
    - Tidal Volume
    - Minute Volume
    - Respiratory Rate

Extracting Memorized Data

- Medicare PAPs must have memories (more costly to DME company, not patient)
- Remote Monitoring via Modems (Wireless and Wired)
  - DME Company can give MD & Sleep Lab internet access to their patients
- Download Data Card (need manufacturer's software)
- Patient can download Data to an internet site
- Download to computer directly from PAP
- Patient can read off codes on PAP

PAP Platforms

- Most of the PAP manufacturers have built various models into a standard "box"
- Visually CPAP, Auto CPAP, Auto BPAP, Servo, BPAP S, S/T & AVAPS look identical
- Heated Humidifier
  - Proprietary coupling to the PAP
  - Integrated into the PAP

ResMed AirSense™ 10 Sleep System
Has Built-in Modem

Philips Respironics DreamStation

Bluetooth Connection to DreamMapper App

Optional Removeable Modem

Philips Respironics DreamStation PAP

ResMed S-9 Sleep System ™

ResMed S-9 Sleep System ™

Philips Respironics SystemOne Sleep Therapy System™

Philips Respironics
Sleep Therapy System ™

ResMed AirMini Travel CPAP

Somnetic Transcend "Travel" CPAP:

Very small, HME & Small Batteries

Solar Powered Battery Charger

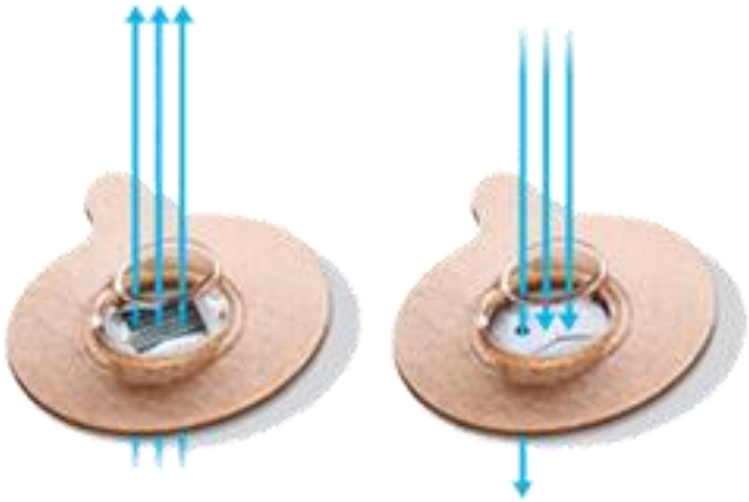
SoClean2

- Sanitizes without taking your CPAP apart!
- It kills 99.9% of PAP bacteria without water or any chemicals.
- Completely Automated Just drop your mask in – disinfects mask, tubing & PAP (it's so cool!)
- No water or chemicals Save time and fuss every day
- People rave about it!

Alternative Tx for OSA

- Mandibular Advancement Device
- Provent
  - Theravent for just snoring
- Winx Sleep Therapy System

Provent Sleep Apnea Therapy



Theravent for Snoring

Winx Sleep Therapy System

- Light Oral Vacuum
- Soft, flexible mouthpiece

Interruptions to Sleep

- Pain: Discuss pain management with your MD
- Hot flashes in women: Discuss Hormone Replacement Treatment with your MD
- Restless Leg Syndrome:
  - Medications
  - Relaxis Pad – Vibrating counterstimulation
- Periodic Limb Movement Disorder: Treatment is with medication

Hypoventilation

The problem with PPS is more likely **Hypoventilation**, not Sleep Apnea

"When can't breathe, nothing else matters"

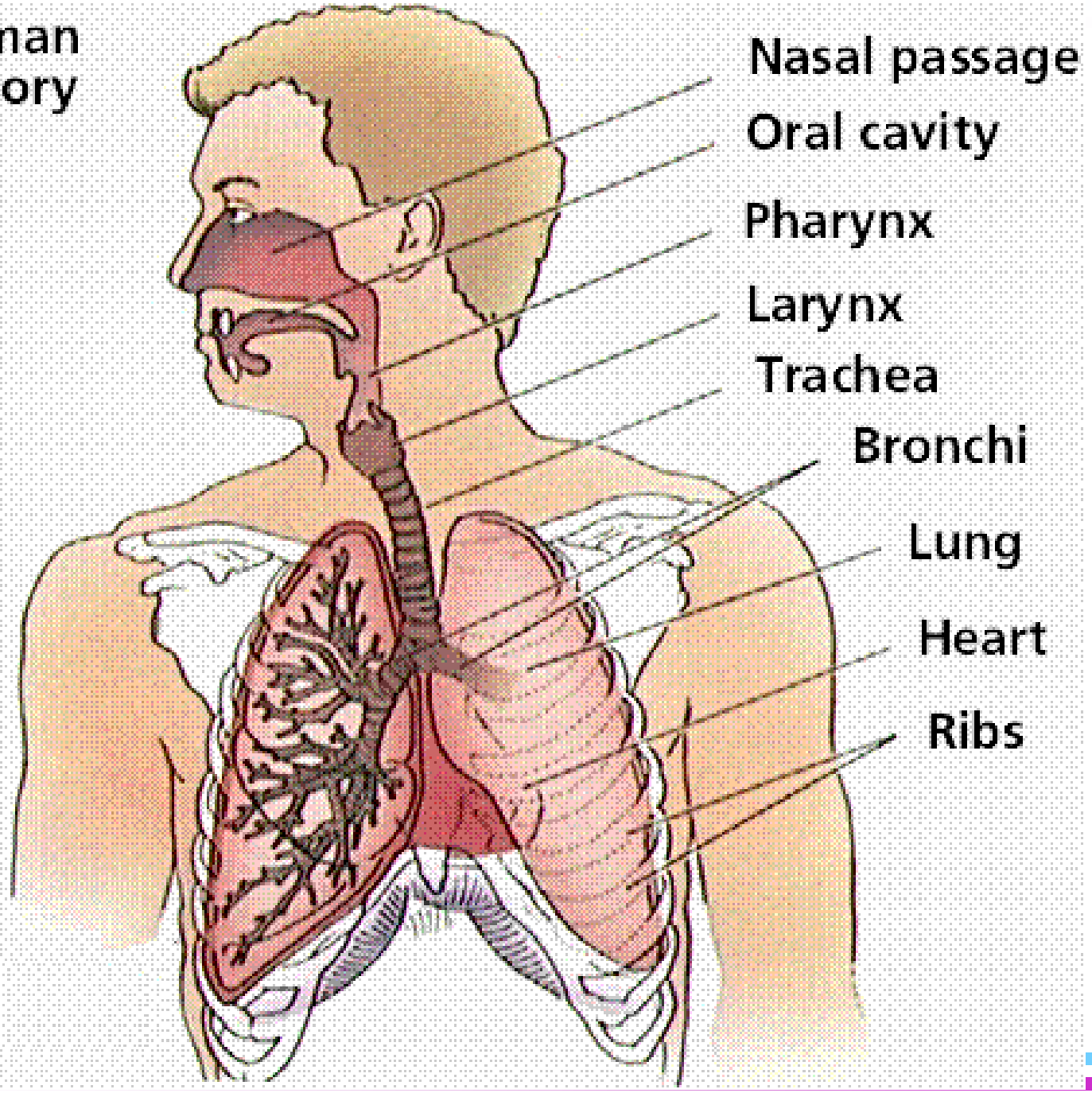
- Motto of the American Lung Association
- Puts one's priorities in perspective
- It is therefore important to maintain good pulmonary health by monitoring yourself, get treated if warranted & preventing emergency situations

Respiratory Physiology Review

Respiratory Tract:

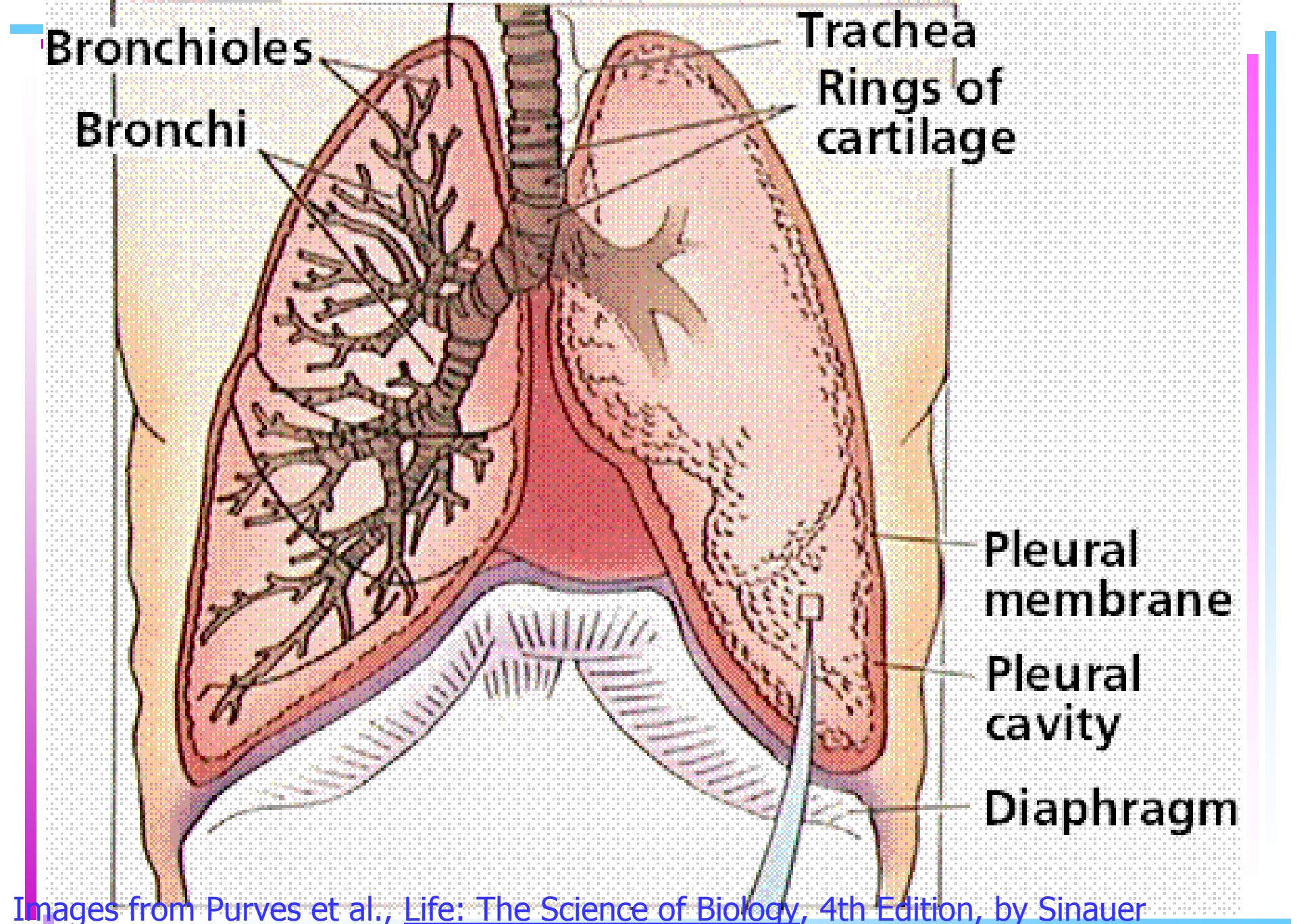
Nose & Tracheal Bronchial Tree

The Human Respiratory System

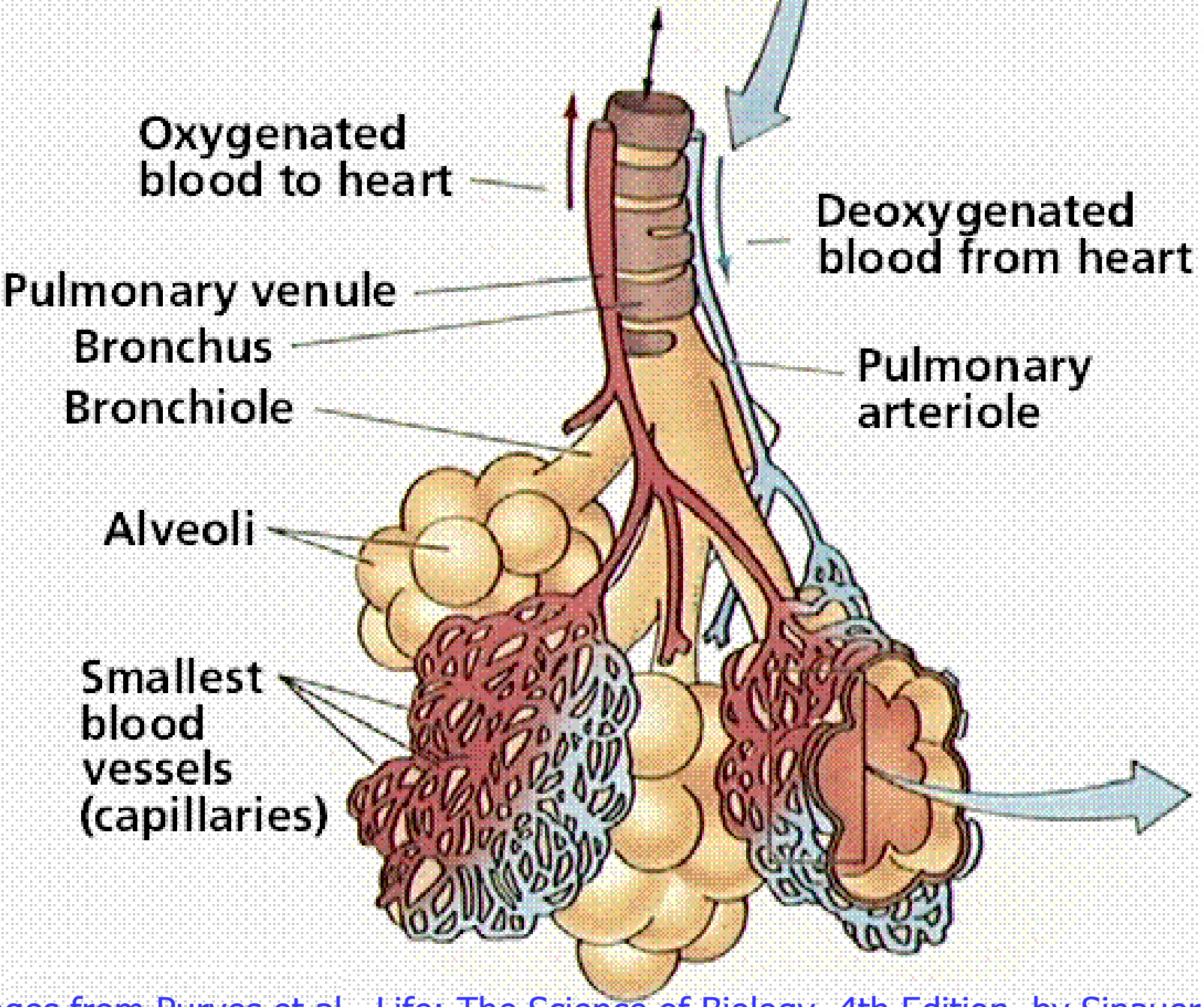


Respiratory Physiology Review

Lungs: Where gas exchange takes place
(the oxygen & carbon dioxide do-see-do)



Images from Purves et al., Life: The Science of Biology, 4th Edition, by Sinauer Associates



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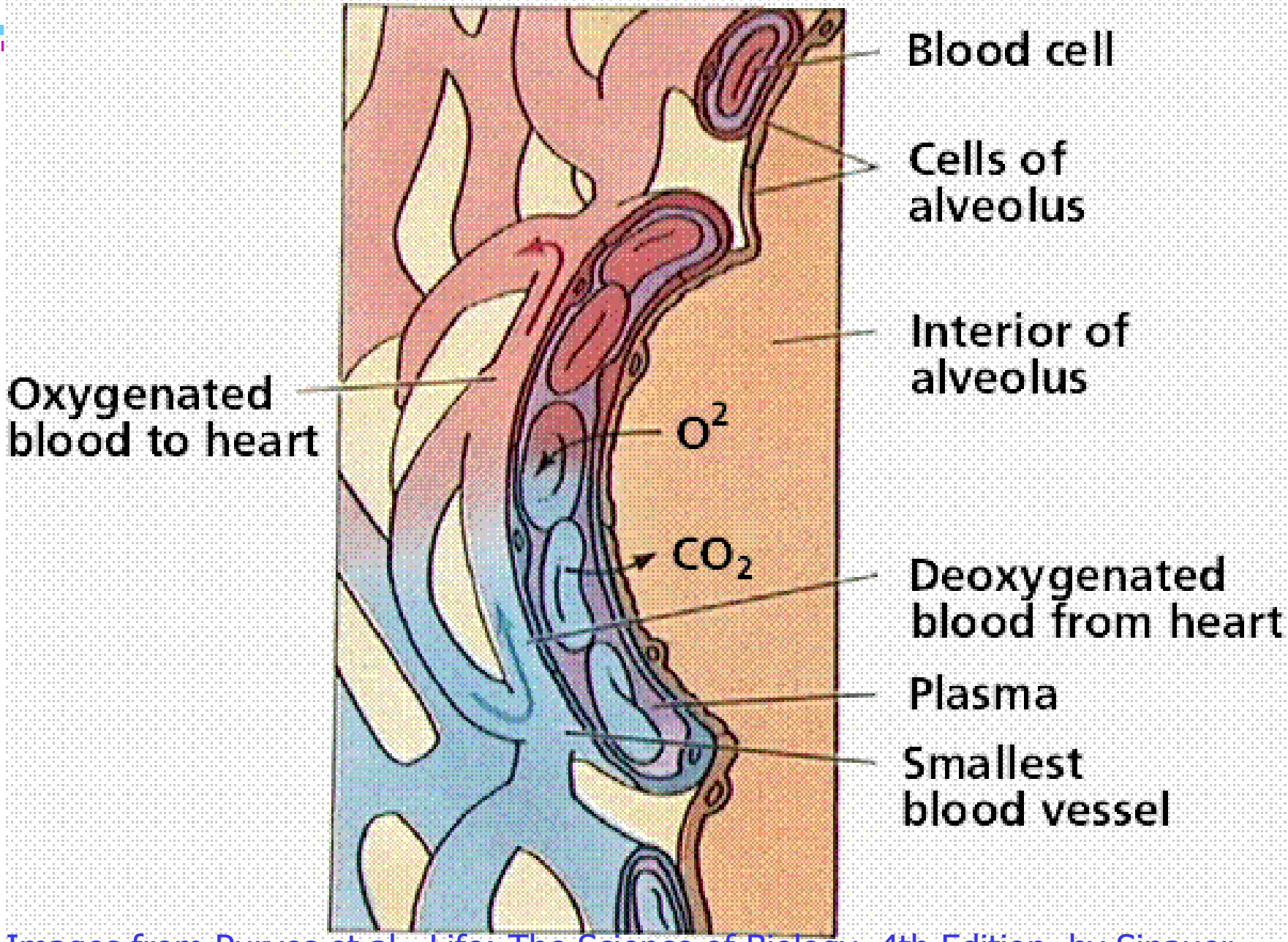

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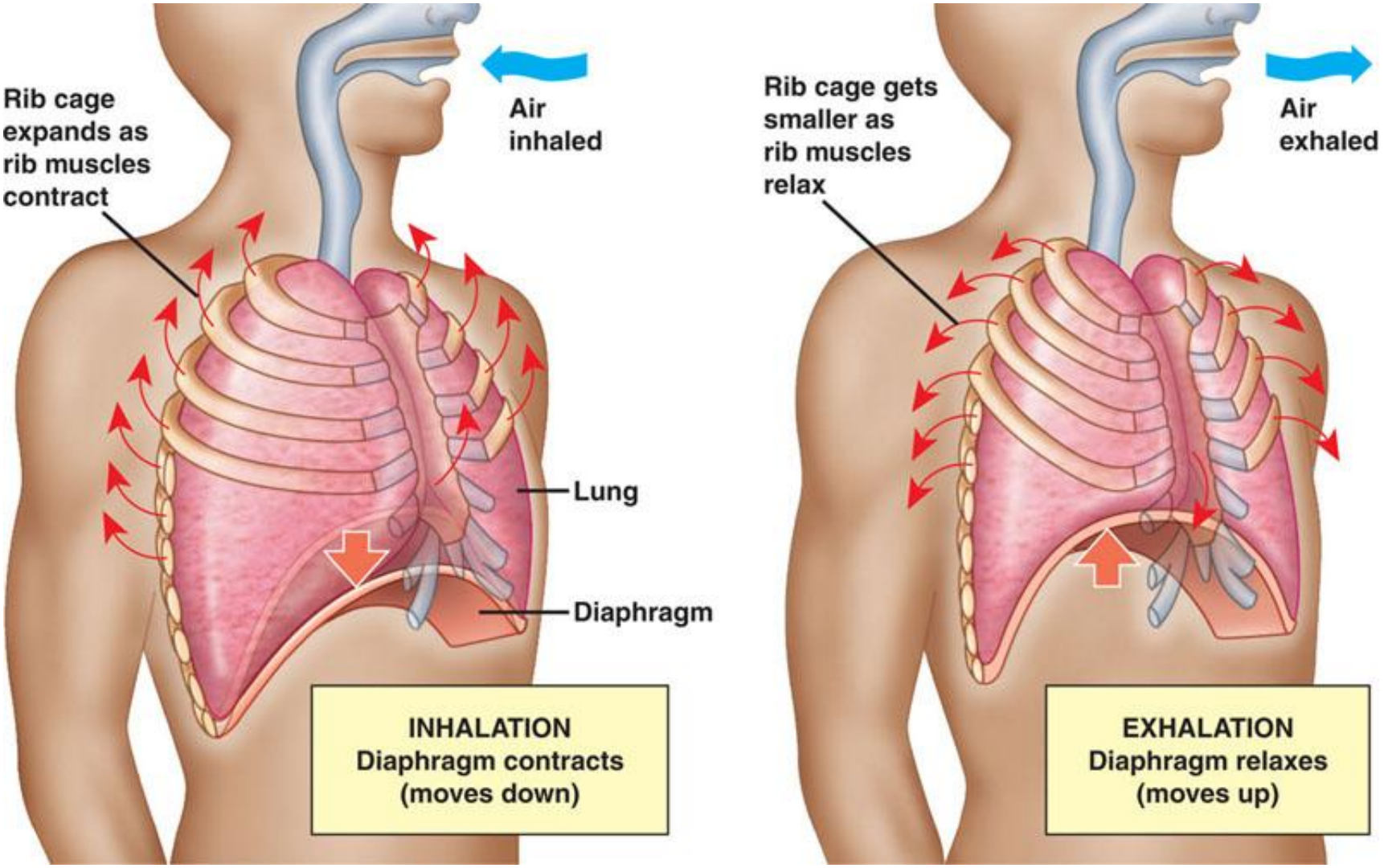
Respiratory Physiology Review

Mechanics of Breathing


Rib cage expands as rib muscles contract
Air inhaled
Lung
Diaphragm
INHALATION
Diaphragm contracts
(moves down)
Rib cage gets smaller as rib muscles relax
Air exhaled
EXHALATION
Diaphragm relaxes
(moves up)

Chemoreceptor Control of Breathing

- Chemoreceptors in the back of our brain respond to (stimulate us to breathe more):
  - Low levels of oxygen
  - High levels of carbon dioxide
    - If a person has is a chronically high level of CO2, they no longer respond to high levels of CO2.
    - If their oxygen level is also low, they are stimulated to breathe by an oxygen want drive
      - If they also need extra some oxygen to breath safely they have to be careful not to get too much oxygen
      - If they are given too much oxygen, this will suppress their drive to breathe. They will stop breathing.
    - Some people with PPS & respiratory insufficiency need to be careful not to get too much O2

Hypoventilation

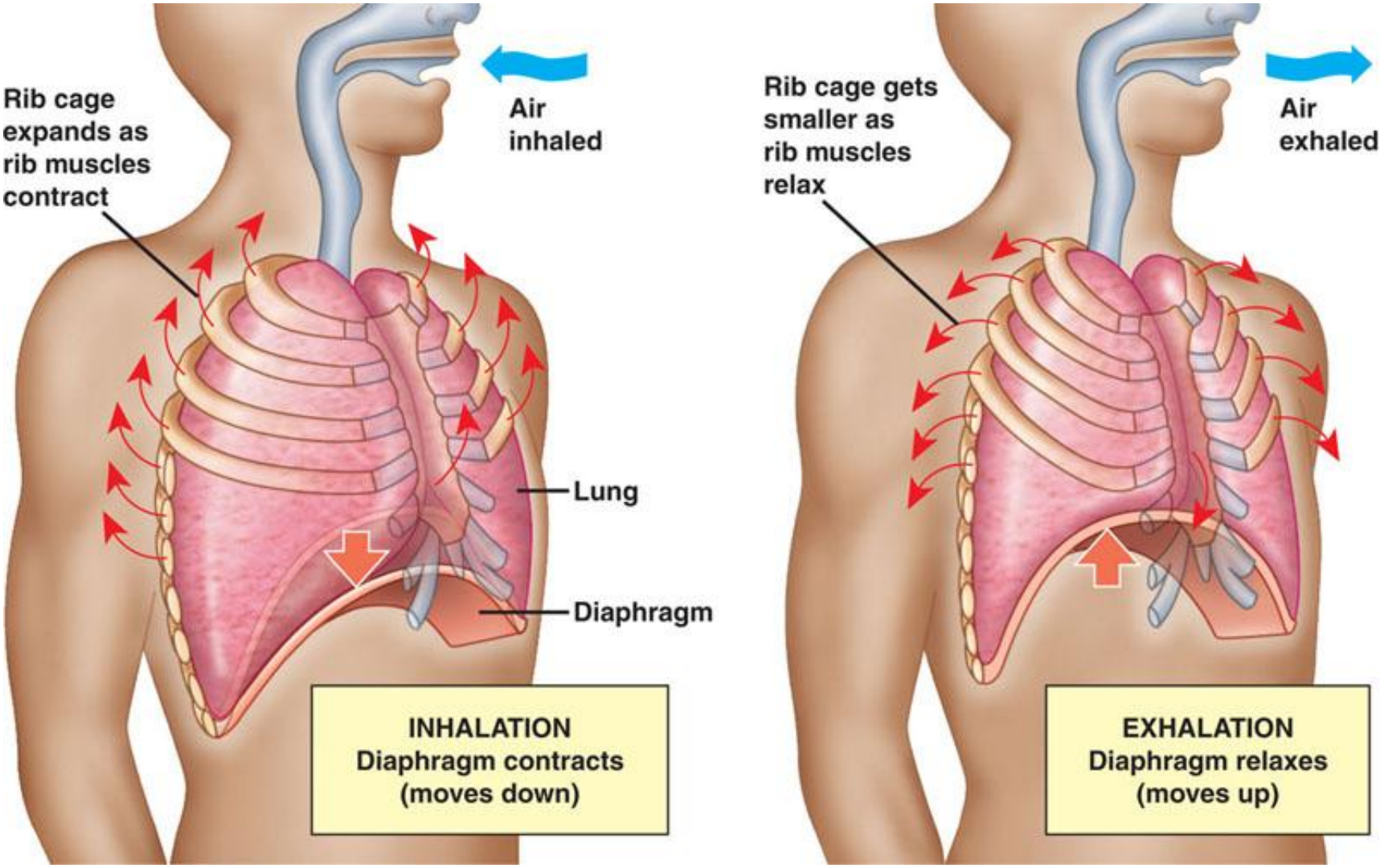
Definition: A respiratory problem where people intake air at inadequate levels for meeting metabolic needs, causing the amount of carbon dioxide in the body to rise.

Hypoventilation

- AKA Respiratory Insufficiency
- Not breathing adequately - each breath is too small
- What happens:
  - Carbon dioxide goes up
  - Oxygen can go down

Common PP Respiratory Limitations

- Weakened breathing muscles
- Thoracic abnormalities restrict breathing (Restrictive Thoracic Disorder)
- GERD: Gastroesophageal Reflux Disease ("heart burn")
  - Predisposes one to aspiration pneumonia
  - Excellent medications available
- COPD (Chronic Obstructive Pulmonary Disease) can be a component: bronchitis, asthma and/or emphysema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Diaphragm relaxes
(moves up)

Daytime Symptoms of Hypoventilation

- Shortness of breath on exertion
- Fatigue or exhaustion from normal activities
- Daytime sleepiness
- Poor memory & difficulty concentrating
- Decreased cough effectiveness
- Decreased voice volume, slurred speech
- Pulse Oximeter owners: Drop in oxygen saturation
  - We like people to have an O2 saturation above 90%

BUT

  - An O2 saturation above 90% doesn't mean you are breathing okay. CO2 still might be too high!

Sleep Associated Symptoms of Hypoventilation

- **Orthopnea** – Needing to sleep sitting up. Can't breathe well lying down.
  - Reason: Gravity helps your diaphragm move down. When you lie down, gravity can't help
- Morning headaches
- Restlessness with frequent arousals
- Non-restorative sleep
- Snoring with pauses in breathing (could be Obstructive Sleep Apnea)

Symptoms of Hypoventilation Among Ventilator Users

- If on pressure control: getting less volume
- If on volume control: peak pressure increase

Diagnosing Hypoventilation: (Medicare BPAP S/T Coverage Rules)

1. Diagnosis of a neuromuscular disease (PPS qualifies)
2. Pulmonary Function Tests (PFTs) - Ask that it be done while you are lying down
   A. Force Vital Capacity (FVC):
      - **Less than 50% of Predicted**

        OR

   B. Maximum Inspiratory Capacity (MIP):
      - **Less than -50 mm Hg**

        OR
3. Arterial Blood Gas Test
   - **PCO2 of 45 mm Hg or greater**

Pulmonary Function Tests

- Pulmonary Function Test: A group of tests that measure how well your lungs & respiratory muscles work
  - Spirometry: Measures the amount of air you breathe in and out & the speed with which you can exhale the air.
- Do PFTs upright & supine! Postural differences is normally < 8%
- Forced Vital Capacity – Looking for downward trend & <50% predicted to qualify for Medicare coverage
- MIP
  - <-60 cm H2O for Medicare coverage
  - May be the most sensitive measurement
- Difficult to measure if bulbar symptoms are significant

Sleep Studies

- Poses a hardship on NM patients
- Not usually necessary
  - Goal is to identify hypoventilation, not apnea. PSGT doesn't (usually) monitor hypoventilation
  - PSGT have apnea/hypopnea mission
  - Not needed for Medicare
- Needed for straight Medi-Cal? I believe so. If so ask for CO2 monitoring!

Problem With Standard Sleep Studies for PPS

- They are on an **apnea mission**. The goals are:
  - To determine if a person has apnea
  - What type & severity of the apnea
  - What the positive pressure sleep machine should be set at to treat the apnea
- **Hypoventilation is rarely monitored**
  - Sleep Techs are frequently not Respiratory Therapists
  - The degree of ventilation is not monitored
  - Sometimes Carbon Dioxide levels are monitored using:
    - End Tidal CO2 monitor
    - Transcutaneous CO2 monitor

Sleep Study Problems for PPS

- Results indicate OSA so BPAP S is prescribed
  - They don't do optimally well
  - Switched to S/T or AVAPS – they feel better & do better but I can't prove it
- Sometimes sleep study results look like CSA. It's okay. It qualifies for getting a BPAP S/T but don't get an Auto Servo

Treatment of Hypoventilation: Noninvasive Ventilation

Respiratory Disease Management

- Expert Respiratory Care is essential for the proper treatment of people who require respiratory support.
- Handout will be provided. Summary:
- "Titrate to patient comfort". Many companies will not accept this type of order. MD cannot know what the ideal settings are. They can give parameters.
- Assessment & Reassessment of the Patient
- Be able to administer different phases of treatment, perhaps starting out slow then adjusting as the patient becomes acclimated, stable times monitoring, take action with acute changes.
- Expert mask fitting with a wide selection of masks.
- Good communication with MD, family & others

Noninvasive Ventilation

- Provide noninvasive ventilatory support
- Provides larger, pressure supported, or volume supported effective breaths to maintain a normal PCO2 and PO2
- Sleep peacefully
- Feel better, more energetic
- Maintain an active lifestyle

Negative Pressure Ventilation +

- Negative Pressure Ventilation
  - Iron Lung
  - Cuirass
  - Pneumowrap
- Pneumobelt
- Rocking Bed
- Glossopharyngeal Breathing (Frog Breathing)

Advantages of NIV

- Provides relief from SOB
- Easy to use
- Noninvasive
- Portable
- Bilevel NIV - Entry Level Device: Gives the person an opportunity to try out assisted breathing w/o committing to invasive ventilation via tracheostomy

Different Types of NIV
Noninvasive
Positive Pressure Ventilation

- Bilevel PAP S/T
- AVAPS BiPAP
- Mouthpiece Bilevel Ventilation
- Hybrid Volume Ventilator
- Volume Ventilation via Mouthpiece
  - "Sip & Puff"

NIV Devices

- "BiPAP" S/T (Trademark of Philips Respironics)
  - Bilevel Postive Airway Pressure provides Pressure Support Ventilation
    - Set **IPAP: Inspiratory PAP**
    - Set **EPAP: Expiratory PAP**
    - The difference between the IPAP & EPAP determines the size of each breath
  - **S/T means** it has a **Timed Backup Rate**
    - "S": Spontaneous
    - "T": Timed
  - **DO NOT** order Bilevel PAP S!!!!! NO B/U Rate! Don't let the insurance companies switch!

Standard Bilevel PAP S/Ts

- Present models
  - Philips Respironics DreamStation BiPAP S/T
  - ResMed AirCurve 10 ST-A
- Old models:
  - Philips Respironics System 1 BiPAP S/T
  - Respironics BiPAP S/T & Liberty
  - Respironics Synchrony
  - ResMed S9 VPAP ST-A
- Disadvantage of standard Bilevel PAP S/T
  - Don’t know if we are ventilating adequately
  - As NM condition progresses, need press changes

Philips Respironics BiPAP AVAPS™: **A**verage **V**olume **A**ssured **P**ressure **S**upport

- Bilevel PAP S/T: Size of each breath is not set & sometimes the patient can't extract a large enough breath as their condition deteriorates (end stage ALS)
- AVAPS: Can set Tidal Volume. IPAP adjusts to deliver each breath
- **Prescribe: Tidal Volume, EPAP, Minimum and Maximum IPAP, Back-up Rate**

Philips Respironics DreamStation BiPAP AVAPS™ Monitoring

- Can remotely monitor patient and adjust settings via wireless modem

ResMed iVAPS

- **I**ntelligent **V**olume **A**ssured **P**ressure **S**upport
  - Targets alveolar ventilation and intelligent Back-up Rate (iBR)
  - Accounts for anatomical deadspace

Initiating Bilevel NIV Treatment: The Window of Opportunity

- **Medicare Criteria** (found in the Local Coverage Decision (LCD) for Respiratory Assist Device (RAD). Not required for coverage of volume ventilators but a good idea to justify order
  - **Diagnosis** - Progressive Neuromuscular Disorder **& one** of the following test results
    - **FVC: Forced Vital Capacity** <50% predicted.

      Measure lying down (*if close*) !!!

      OR

      - **MIP: Maximum Inspiratory Pressure of <**60 cm H2O**. Measure lying down (*if close*) !!!**

      OR

    - **ABG: Arterial Blood Gas:** PCO2 >45 mm Hg

Initiating NIV Treatment: The Window of Opportunity

- When to start: Better too early than too late
  - When symptoms first appear
  - Before symptoms are severe & and an emergency situation occurs
- Emergency situation
  - Counsel patient & family of what can occur so they can make informed choices

Some Reasons to Start NIV Early

- Improve QOL
- Correct hypoventilation during sleep, treat SDB, allow respiratory centers to regain normal function, reverse cascade of sleep related events
- Provide stability to the upper airway
- Avoid acute respiratory failure, crisis decision making and vulnerability to RF from an acute respiratory infection
- Provide time to learn needed skills
- Rest weak diaphragm ?

WARNING!!!

- **DON'T let it become an EMERGENCY!**
- Recognize the early, chronic signs while you can make careful, informed decisions!
- Let your decision makers know your wishes!
  - **Detailed** Advanced Directive for Healthcare
    - Intubation, trach
    - Feeding tube

Philips Respironics Trilogy 100 Ventilator

- Hybrid Ventilator
- Delivers all modes of invasive ventilation & noninvasive ventilation with special characteristics over BiPAP S/T & standard AVAPS BiPAP
  - AVAPS BiPAP
  - AVAPS BiPAP Mouthpiece Ventilation Mode (MPV)
  - AVAPS AutoEPAP (AE): Ventilation Mode specifically designed for patient who have severe upper airway dysfunction & need an automatic range of expiratory pressure adjustment in order to adequately ventilate them. Bulbar ALS patients have this special need.
  - BilevelPAP S/T
  - Volume Ventilation
- AutoTrak Sensitive (ATS) for people with weak respiratory effort

Philips Respironics Trilogy 100 Ventilator

- Daytime & Night time setting
- Passive Circuit
  - Use with Bilevel & AVAPS NIV modes
  - Can use masks with standard exhalation ports
    - Huge choice of masks – same as those used for OSA
- Active Circuit
  - Use for volume ventilation modes & invasive ventilation
  - Have exhalation valves, therefore…
  - Masks should NOT have exhalation ports
    - Very few to choose from
- Safety of internal battery backup should power fail
- Extra, detachable batteries

Philips Respironics Trilogy 100 Ventilator

Other Volume Ventilators

- Pulmonetic LTV 1150 (950 will no longer be serviced)
- Newport HT70 Plus
- Breas Vivo 50
- ResMed Astral 100

Viasys Pulmonetic LTV 1150

Newport HT70 Plus

ResMed Astral 100 Ventilator

Breas Vivo 50 Ventilator

NIV via Volume Ventilator

- Mouthpiece Ventilation requires customization – not "off-the-shelf" ready with one exception from PR (will show Px)
- With Active Circuits, Masks can't have exhalation ports so mask choices are limited
- Need daytime settings without alarms & different night time settings with alarms
- Sometimes have to "cheat" the vent so it doesn't alarm for MP ventilation

Mouthpiece Ventilation via Volume Ventilator

- Volume Ventilators (usually used via trach)
  - Portable
  - Have built-in batteries
- Delivers a set Tidal Volume
- Offers various modes of ventilation
- Has an Exhalation Valve: Tidal Volume is delivered then closes for exhalation
  - Patient inhales through mouthpiece & can remove mouth from mouthpiece to exhale & talk
  - Referred to as "Sip & Puff"

What is Sip and Puff Ventilation?

- It does not involve sipping ***and*** puffing.
  - ***It's just SIPPING.***
- The set-up looks similar to a Sip 'n' Puff switch
- The vent user "sips" on an interface to initiate a ventilator-supported breath.
- They take the "straw" out of their mouth after taking one or more breaths
- It generally applies to daytime application only.
- Nighttime ventilation is delivered via a secure noninvasive interface.

What is Sip and Puff Ventilation?

JUly 2008

NIV Limitations?

- NIV is generally NOT viewed as life support although many people have & do live many years via NIV
- Patients with severe bulbar symptoms may need TPPV
- For some NM patients (like ALS) Bilevel Pressure Support ventilation becomes ineffective and invasive ventilation via trach needs to be seriously considered
  - Has AVAPS made a difference? Possibly.

" people with progressive muscle weakness have 3 options…

- Do nothing
  - This ultimately results in death from respiratory failure.
- Tracheostomy
- **Noninvasive ventilatory support to facilitate both breathing and coughing**

John Bach, M.D.

Which NIV Should I Request? AVAPS Bilevel or a Volume Ventilator?

- **Advantages of AVAPS Bilevel**
  - Entry level, small, less intimidating device
  - Less expensive
- **Disadvantages**
  - It can't do mouthpiece ventilation
  - No built-in or detachable battery. Can buy an external one
  - If Medicare, unlikely to receive good Respiratory Care Service because you can't choose any DME company; must pick from a company that has a Competitive Bid Medicare Contract
  - Does not come with a battery (but patient can buy one to add on)
  - After 13 months, unit is owned, DME has no obligation to see patient
  - No coverage for 2nd unit

Which NIV Should I Request? AVAPS Bilevel or Volume?

- Advantages of Volume Ventilator (assuming Medicare Coverage)
  - Covered by Medicare by any company you choose. Not affected by Medicare Competitive Bidding
  - Respiratory Care Service is much better & stays with patient for as long as they have the vent
  - Has built-in & switchable battery
  - Mouthpiece Ventilation Mode
  - Many modes of ventilation to choose from with many alarms
  - Daytime settings and separate night time settings.
  - Can get a 2nd ventilator if used with a wheelchair (one at bedside and one on wheelchair)
  - Can breath stack & cough

Which NIV Should I Request? AVAPS Bilevel or Volume?

- Disadvantages of Volume Ventilator (assuming Medicare Coverage)
  - Far more expensive
  - Larger

Take Charge, Not Chances!

- Be prepared at ALL TIMES should you need to be hospitalized!!!!
- Hospital personnel are unfamiliar with people who have PPS!!!! You need to educate them!!!!
- **Take Charge, Not Chances** - Developed for ventilator users through a grant to IVUN
- Adapt it for your needs

Take Charge, Not Chances! Four Documents

- Patient's Vital Information for Medical Staff: http://www.ventusers.org/vume/PatientInfo.pdf
- Treating Neuromuscular Patients Who Use Home Ventilation: Critical Issues http://www.ventusers.org/vume/TreatingNeuroPatients.pdf
- Home Ventilator User's Emergency Preparation Checklist: http://www.ventusers.org/vume/HomeVentuserChecklist.pdf
- Caregiver's Emergency Preparation Checklist: http://www.ventusers.org/vume/CaregiversChecklist.pdf

Medicare Coverage

It is complicated. Must dot the "**i**"s and cross the "**T**"s otherwise the provider doesn't get paid.

Problems With Medicare Coverage of BPAP S/T or AVAPS BPAP

- Medicare does not pay for the Respiratory Care Services; we sort of "come with the equipment"
- Can only go to a DME company that has a Medicare Competitive Bid Contract
  - This highly flawed program has compromised patient access & care
  - They are not being paid very well, therefore they are going to provide minimal Respiratory Care Service
  - Not known for great service
- Device is rented for 13 months after which the patient owns it & the supplier has no obligation to provide any service.

Medicare NIV Choices as Dictated by Medicare

- Bilevel PAP S/T-As : Must use CB Contracted Provider. Unlikely to get attentive Respiratory Care Services.
- Volume Ventilators, Cough Assist & Suction: Can use provider of your choice (as long as you provide all the required documentation and orders).

Medicare Face-to-Face Requirements (Part of ACA)

- Must have Detailed Written Order Prior to Delivery (DWOPD)!!! (Being enforced now)
- Face-to-face Requirement
  - F2F must be done within 6 months before the order is written for DME
  - Thorough clinical documentation in Clinical Notes
  - Must medically justify why the patient needs the volume ventilator over a Bilevel PAP (or Cough Assist)…and many other DME devices!!!
- 2nd Ventilator
  - Don't refer to it as a "back-up" – it's not covered
  - Medicare will cover it if used on a wheelchair. Must prove you have a wheelchair

Open Ended Rx for NIV With Ranges

- AVAPS BiPAP: Titrate to patient comfort
- Respiratory Assessments & Monitoring PRN: Pulse oximetry, End Tidal CO2, Breath Sounds
- Back-up Rate: : 2-4 breaths less than patient's resting Respiratory Rate
- Tidal Volume: 200-1200 ml
- Pressure Support: 5+ cm H2O
- IPAP max: 9-30 cm H2O
- EPAP min: 3-6 cm H2O

- **Problem: Some companies will not accept open ended orders!**

Goals & Purpose of NM Respiratory Disease Management

- Assisted Ventilation
- Keep a Clear Airway

Prevent & Treat Atelectasis Maintain a Clear Airway

- Prevent & treat atelectasis & respiratory tract infection (RTI). Keep the lungs expanded via:
  - Breath Stacking with an Ambu Bag or a Volume Ventilator
- Keep airway clear via:
  - Cough Assist Device (AKA In-Exsufflator)
  - Manual Breath Stacking/Cough Assistance
  - Suction

Breath Stacking for Chest Range of Motion & Effective Coughing

- Take a breath…& hold it
- Take a second breath… & hold it
- Take a third breath… & hold it
  - For **Chest Range of Motion:** exhale slowly through pursed lips
  - For **Effective Coughing:** cough and push on abdomen

Breath Stacking via Ambu Bag

- Via mouthpiece or mask
- Hold mask by standing behind the patient
- Hold mask securely so it doesn't leak
- Coordinate bag inflation with patient's breathing efforts
- Give verbal directions & forewarn bag inflation: "1, 2, 3, inhale 1, hold, inhale 2, hold, inhale 3, hold and exhale (or cough)" the latter with or without abdominal thrust

Philips Respironics Cough Assist T70

- **Objective Measurement:**
  - Peak Cough Flow <270 LPM
- **Subjective**
  - Weak cough
  - C/O difficulty clearing secretions
  - History of airway emergency
- **Medicare requires a qualifying diagnosis and symptoms of impaired cough**
- **NM patient may need Cough Assist before a ventilator**

Cough Assist Device

- "Treadmill for your lungs" Betsy Thomason, RRT
- Deliver via MP, FFMask or Trach
- Set pressures plus & minus 35-45 cm H2O
- Hold mask on or via mouthpiece
- Quick inspiratory then expiratory then pause
- Sequence of about 4-6 cough cycles
- Rest 20 to 30 seconds between Sequences for secretion removal via expectoration or suction
- Rest
- A treatment is composed of 4 to 6 sequences
- Use one to several times a day and PRN; morning, before meals and before bedtime

Philips Respironics Cough Assist T70

Portable Suction

- Evacuates secretions from the mouth (use Yankour attachment) and lungs (use suction catheter)
- Some have built-in battery
- Can get a toothbrush attachment
- Other attachments

Interface Fitting

Expert Mask Fitting = Successful Treatment & Adherence

- Comprehensive Mask Fitting is **one critical element** of Sleep & Respiratory Disease Management that leads to a high level of treatment adherence
  - If the patient is comfortable, they are most likely to use the PAP

Many Interfaces Now Available Skilled Fitting is Vital

- Many excellent choice are now available
- Each interface has its own unique advantages and disadvantages; none are perfect
- Takes the skill of an experienced Respiratory Therapist to properly fit and give the patient an informed choice
- Need to have a wide selection of masks for the patient to try on

Comfortable Interface = Successful Treatment

- The devil **IS** in the details
- Paying attention to details of expert interface fitting results in the patient being comfortable with their mask
- If they are comfortable with their interface, they are likely to acclimate to their treatment and enjoy the benefits of restful sleep

Interface Fitting Goals

- Comfortable
- Easy to Use
  - Easy to take on & off
  - Easy to manipulate
- Effective
  - Deliver prescribe therapeutic pressure(s) or volume

Assessment: Physical & Psychological

- Determine Physical Limitations
  - Manual dexterity – Some people challenged
    - Veto masks w/small parts
    - Stretchy headgears may be easier to put on
  - Ability to raise arms
  - Other physical limitations
- Allergies or sinus problems? May need a Heated Humidifier
- Read to initiate sleep? Need glasses?
- Claustrophobic?
- Sleep posture
- Preferences

Provide Informed Individualized Choices

- Give informed choices from a wide selection of masks
- Interface should be tried on with patient lying in their normal sleep position(s), with the device on at the prescribed pressure(s)

Starting Point for Fitting: Assess How the Patient Breathes

- Determination of how patient breathes focuses the interface choices
  - Nose Breather
  - Nose Breather who leaks out of their lips or mouth
  - Mouth Breather
- How to determine this
  - Ask them
  - Observe how they breathe while talking with them

Avoid Excessive Mouth Leaks

- Large mouth leaks
  - Create High unilateral airflow causing
    - Dry mouth
    - Vasomotor rhinitis
    - Increased airway resistance
- Defeats the treatment
  - Loss of pressure
  - Patient is uncomfortable
- How to recognize it
  - Patient reports very dry mouth (“Felt like a dog that ate peanut butter”)
  - Using up all the water in their heated humidifier

Mouth Leakage Solutions

- Avoidance - If you know that patient is a mouth breather, fit with
  - Full Face Mask
  - Oral Interface
- If the patient is a nose breather but just leaks out of their mouth, fit with
  - A nasal interface/chin strap combination

Avoid Leaks into the Eyes

- Avoid leaks into the eyes
  - Causes dry eyes
  - Causes Conjunctivitis
- Solutions
  - Choose right size mask – Very important!
  - Use nostril style interface
  - When all else fails, use night shade

Interface Fitting Problems Try to Avoid

- Allergic Skin Reactions or Irritation (hard to predict)
  - Patient may report allergy to mask & headgear material
  - Wash mask before initial use
  - Change interface or mask
  - Use barrier cream - Sween Cream
- Patient discomfort

Interface Categories

- Nasal Pillow Style
- Nasal Mask
- Full Face Mask
- Oral Interfaces

Nasal Pillow Style Interfaces

- Fit into nostrils
- Held in place with straps or dental retainer (rare)
- Best Suited For:
  - Nose Breather or Nose Breather/Mouth-Lip Leaker used with Chin Strap
  - Those with prominent noses/high nose bridges
  - Patients who require lower pressures unless a Heated Humidifier is used
  - The claustrophobic

Nasal Pillow Type Interface

- Advantages
  - Least invasive
  - Easy to take on & off
  - Some have clear line of vision
  - Can wear glasses with some
  - Some have no straps on face
  - Avoids nose bridge irritation
- Disadvantages
  - Can cause nostrils to widen
  - Direct flow of air may be irritating especially at high prescribed pressures.
  - Soreness – Use nasal gels designed for that purpose

Nostrils

- Width
- Position
- Size - Small, Medium or Large
- Shape - Oval, round or uneven

ResMed AirFit P10™
For Him & For Her

ResMed Swift™FX

ResMed Swift™ FX for Her

Fisher & Paykel Opus™ 360 Nasal Pillow Mask

Philips Respironics DreamWear & Gel Pillows

Philips Respironics Nuance™ Gel Nasal Pillow Mask

Puritan Bennett Breeze™

CPAP Pro Oral Nasal Interface™

CPAP Pro
Boil & Bite
Dental Retainer

TAP PAP Nasal Pillow Mask

Clear the Way for Compliance.

INTRODUCING THE

TAP® PAP Nasal Pillow Mask

TAP PAP Nasal Pillow Mask

Nasal Mask Interface

- Fits around the nose
- Held in place with strap
- Some have adjustable forehead mechanism for proper fit
- Some have double cushions:
  - Bubble Effect: Air is trapped between the two cushions to seal w/o putting undue pressure on bridge of nose
  - Over tightening the strap can literally burst the bubble

Nasal Mask Best Suited For:

- Nose Breathers or Nose Breather/ Mouth-Lip Leaker if used with a Chin Strap
- For those who aren't comfortable with Nostril Type
- Those who wants to avoid stretched nostrils

Nasal Mask Interface (Cont.)

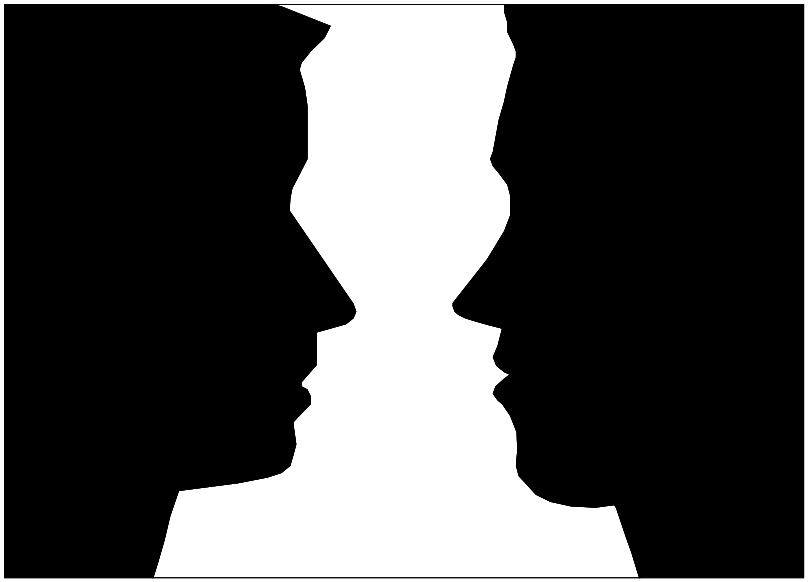
- Advantages
  - Largest interface selection
  - Indirect air flow is less irritating
  - Some have clear line of vision
  - Can wear glasses with some
- Disadvantages
  - Can blow in eyes
  - Can cause nose bridge ulcer
  - Leave marks on face

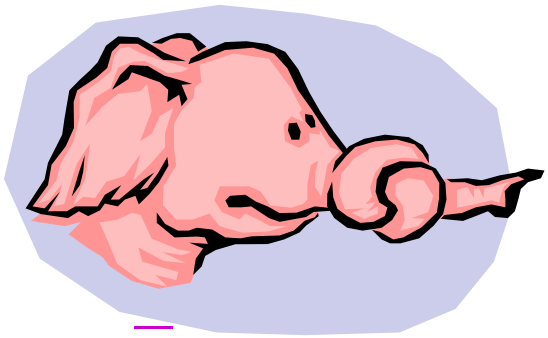
Nose Size & Shape

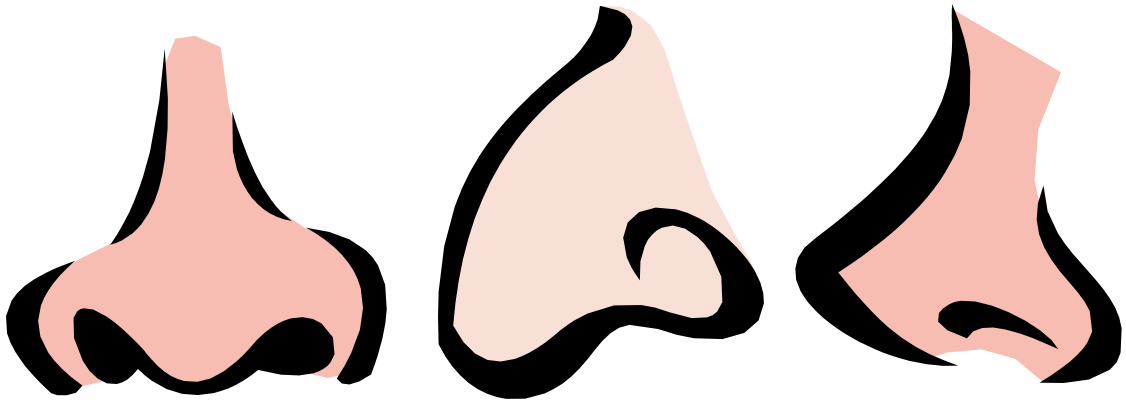
- Circumference of the nose - Template Sizing Gauges are only a starting point!
- Distance from bridge to below the nose (for Nasal Masks)
- Distance from bridge to below lower lip or below the chin (for Full Face Masks)

Nose Bridge: Very Important!

- Average
- Flat
- High - Prominent
  - Pointed
  - Wide







Avoid Nose Bridge Ulcers

- Nose bridge ulcers - Can be severe & serious
  - Usually from a poor fitting nasal or full face mask
  - More likely on people with high &/or narrow nose bridges
- Solutions
  - Choose the right size mask
  - Adjustable Forehead Arm or Spacer fills gap between mask & forehead
  - Change to a Nostril Style interface
  - If mask change isn't an option use wound care products or Gecko Pad

ResMed Gecko™ Nasal Pads

"Micro" Style Masks

- Fits below the nose bridge so size is less forgiving
- Smaller
- Lighter & more comfortable
- Easier to take on & off

ResMed AirFit N20 Nasal Mask

ResMed AirFit N10 Nasal Mask

Philips Respironics Wisp Nasal Mask™

Fisher & Paykel Eson™ Nasal CPAP Mask

Standard (Older) Nasal Masks

- Fits from nasal bridge to below the nose
- Therefore size needs to be more precise
  - Different lengths & widths
- Usually has forehead cushion for stability
- Has fitting features
  - Double cushion with “bubble effect”
  - Forehead adjustment – needs to be used

Adjustable Forehead Arm: Very important for proper fit

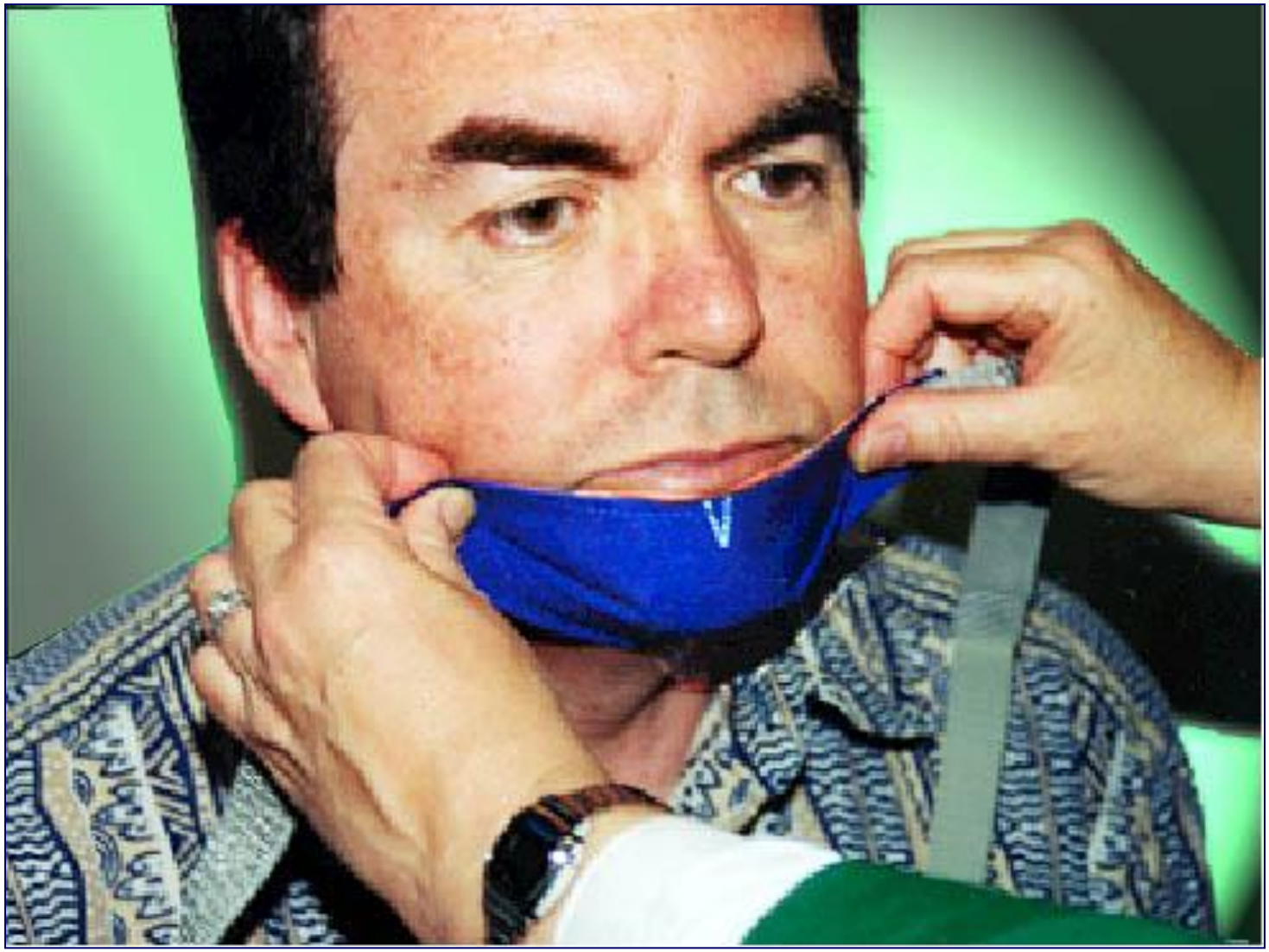
Fisher & Paykel Zest™ Nasal Mask

Circadiance SleepWeaver™ Mask Made from Cloth in fun colors Other styles available including a Full Face Mask

Chin Restraints

- For the lip leaker, not for the major mouth leaker
- Encourages patient to keep their mouth/lip closed
- Does NOT keep mouth completely sealed
- Goal is a "stiff lower lip: Snug material under lower lip to stop lip leak
- Various styles and materials

ResMed Chin Strap



Puritan Bennett Chin Strap™

Tiara Ruby Chin Strap™

Veronique Chin Strap™

Full Face Mask
Best Suited For:

- Nose Breathers or Nose Breathers who leak out of their Mouth or Lips
- Those people who are unable to keep their mouth closed
- Those people who are uncomfortable with the nasal interface/chin strap combination

Full Face Mask

- Various Fits
  - From below the bridge
  - From nose bridge to under lower lip
  - From nose bridge to under chin
  - Mouthseal with nostril connection & sometimes under the chin
  - Cushion fits around eyes & under lower lip
- Most have double cushions

Full Face Masks

- Have clever, fail-safe valves that allow patient to breathe room air if there is a power failure (anti-asphyxia valves)
- Held in place with straps of varied stretchiness.
  - Some have quick releases
  - But quick releases have become less common

Full Face Mask (Cont.)

- Advantages
  - May be the only option for successful treatment
  - More reliable & usually more comfortable than nasal interface with chin strap
- Disadvantages
  - Harder to achieve leak free fit; small leaks=loud noise
  - More difficult to take on & off
  - More prone to nose bridge ulcers
  - Can leave marks on face

ResMed AirFit or AirTouch F20 Full Face Mask

Respironics Amara™ Full Mask

Fisher & Paykel Simplus Full Face Mask

Fisher & Paykel Forma™ Full Face Mask

Hybrid Full Face Masks

- Delivers the pressure through the nose and mouth without pressing on the bridge of the nose.

Philips Respironics Amara View Minimal Contact Full Face Mask

ResMed Liberty ™

Respironics FitLife™ Face Mask

Oral Interfaces

- For the mouth breather
- Frequently used for NPPV

Oral Interfaces

- Fit into the mouth
- Some secured with a single strap
- Some seal over the mouth for sleeping
  - Fisher & Paykel Oracle 2™
  - Puritan Bennett MouthSeal™

Fisher & Paykel Oracle 2 ™

Acclimating to Treatment & Follow-up

- Even with skilled fitting, the patients don't really know how comfortable the interface is until they sleep with them at home
- Need to follow-up within 2-7 days of initiating treatment
- May need to go to a different mask
  - 30 Mask Guarantee Program
- May need re-education for the dexterously challenged

Two (or more) Interfaces

- No interface is perfect - pressure points with different interfaces. May want to switch off
- Rotate or use one for daytime use, another for sleeping (for NIV patients)
- Remind patients to check in periodically to see what is new; good time is when they need to replace an interface from wear


Bizarro
Kemosabe — you forgot to switch from your sleep mask to your crime-fighting mask again.
BIZARROCOMICS.COM
©DAN PIRARO
5·25·11

HERMAN®

by Jim Unger

"Now snore."

It is Clinically Gratifying

"Your success is our reward"

Glenn Noble, RCP, RPFT

Thank You

ANY QUESTION???