



THE UNIVERSITY  
*of*  
WISCONSIN  
MADISON

# Sleep Apnea

**Team Leader** - Colin Korlesky

**BSAC Representative** – Chris Beglinger

**Communicator** - Eric Howell

**BPAG** - Jon Elicson

**BWIG** - Carly Hildebrandt

# Overview

- Introduction
  - Background Information
  - Problem Statement
- Product Design Specifications
- Design
  - Current Designs
  - Design Alternatives
  - Design Matrix
- Future Work
- Acknowledgements



# Introduction

## Background Information

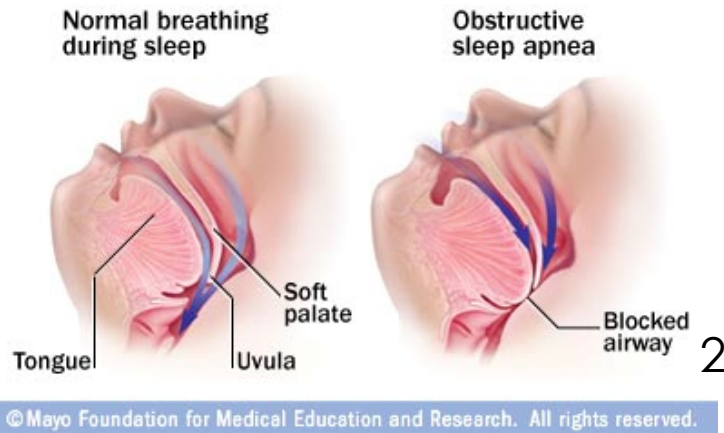


Figure 1: Obstructive sleep apnea

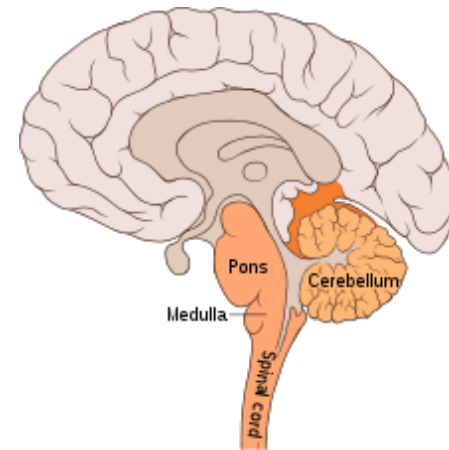


Figure 2: Central sleep apnea

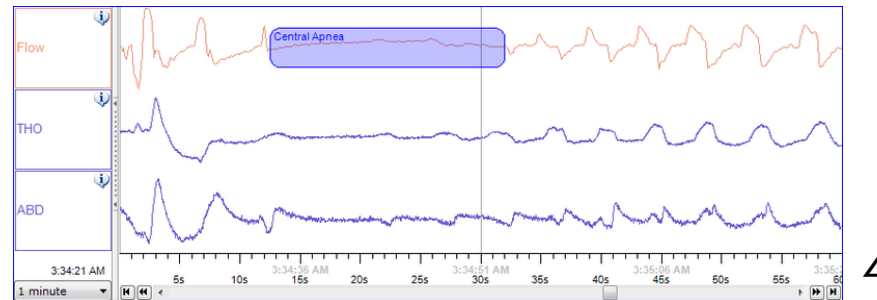


Figure 3: Carbon dioxide levels during apnea

# Introduction

## Problem Statement



- To develop a device that:
  - Monitors and maintains carbon dioxide concentration levels to prevent sleep apnea
  - Is easy to use
  - Is comfortable and minimally invasive
  - Is universally marketable

# Product Design Specifications



## ■ Product Requirements:

- Safety
- Performance
- Reliability
- Comfort
- Manufacturability/Cost

## ■ Client Requirements:

- Induces hypercapnic conditions
- Minimally invasive
- Comfortable

# Designs

## Current Designs

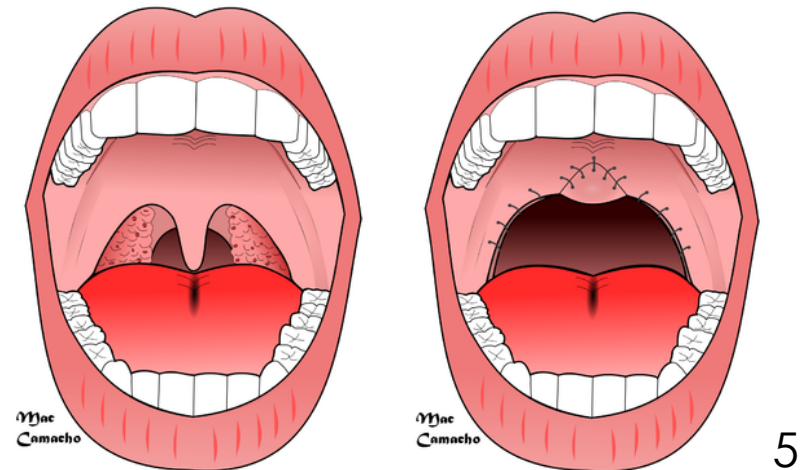
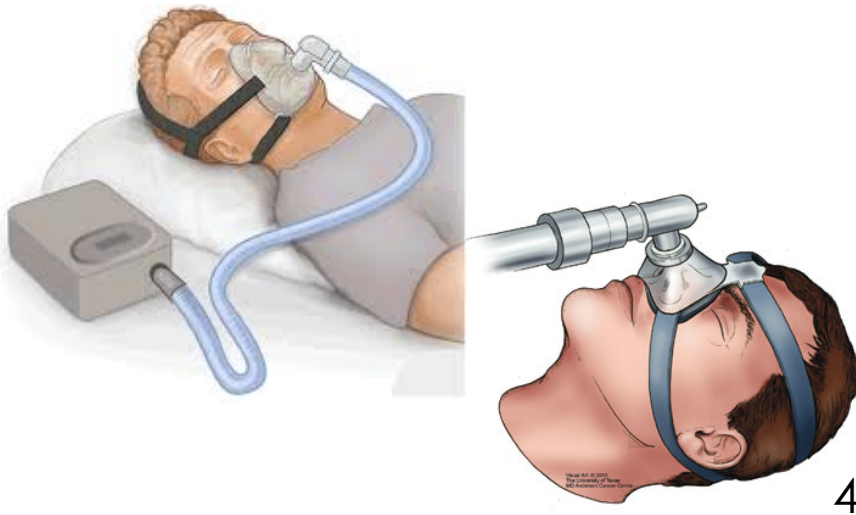


Figure 5: Available masks for:  
-Continuous Positive Airway Pressure (CPAP)  
-Adjustable Airway Pressure Device (APAP)  
-Bilevel Positive Airway Pressure (BPAP)

Figure 6: Uvulopalatopharyngoplasty surgery

# Designs

## Design Alternatives



## Scuba Mask:

### ■ Key Features:

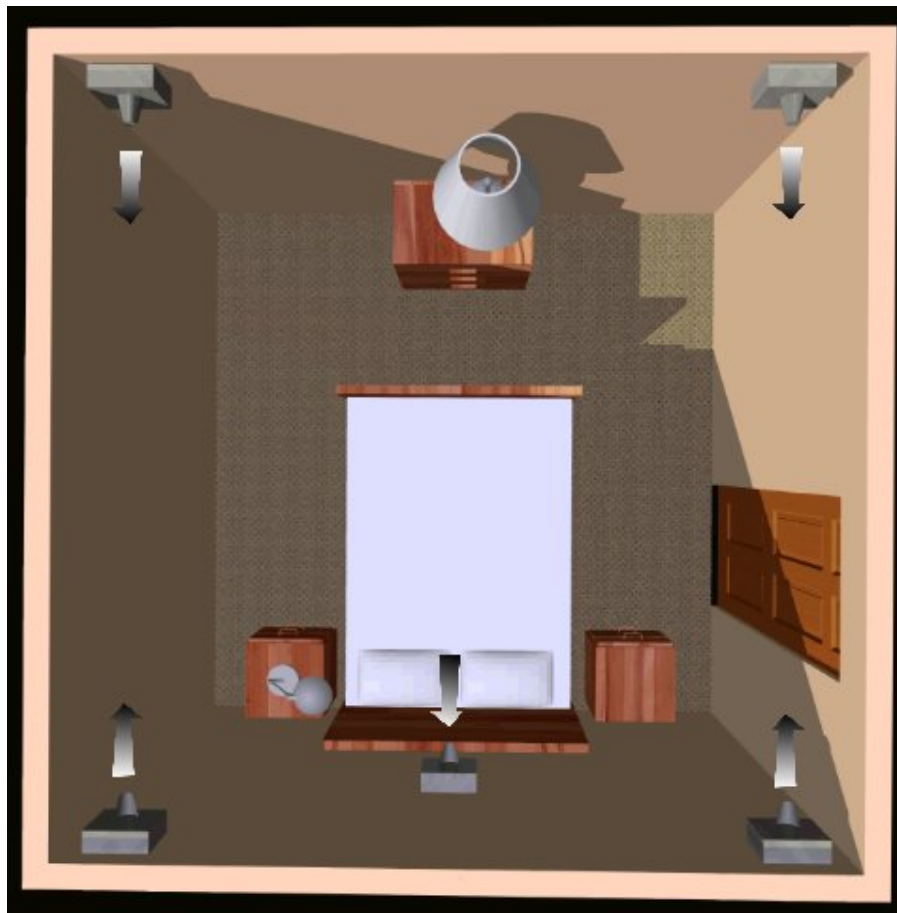
- Customizable
- Portable
- Comfortable
- Inexpensive

### ■ Downsides:

- Unpredictable
- Unsanitary

# Designs

## Design Alternatives



### CO<sub>2</sub> Room:

#### ■ Key Features:

- Comfortable
- Profitable
- Sanitary

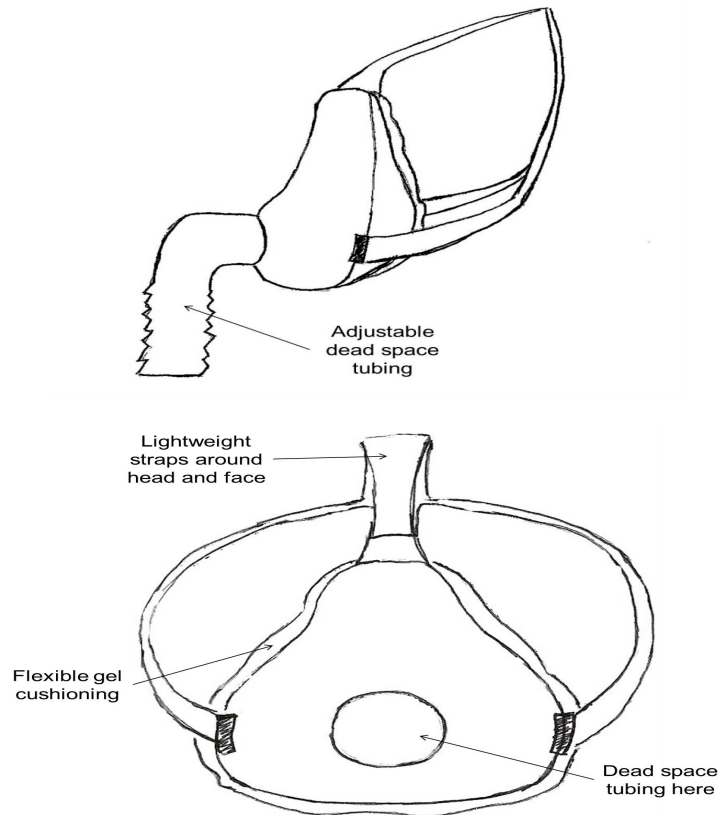
#### ■ Downsides:

- Cost
- Maintenance
- Portability



# Designs

## Design Alternatives



## Facemask:

### ■ Key Features:

- Manufacturability
- Reliable
- Comfortable

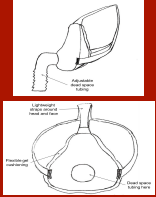

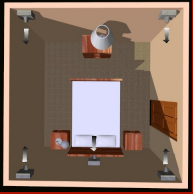
### ■ Downsides:

- Unsanitary
- Obtrusive

# Designs

## Design Matrix



Design	Facemask	Scuba Mask	CO <sub>2</sub> Room
Criteria (Weight)			
Effectiveness (20)	4	3	<b>5</b>
Comfort (15)	2	3	<b>5</b>
Safety (15)	<b>5</b>	4	1
Reliability (15)	<b>4</b>	2	3
Cost (10)	<b>3</b>	2	1
Ease of Use (10)	4	4	<b>5</b>
Feasibility (10)	<b>5</b>	4	1
Portability (5)	<b>5</b>	<b>5</b>	1
Total	<b>78</b>	64	62

# Future Work



- Observe with Professor Dempsey
- Continue literary research
- Fabricate prototype
- Design concerns:
  - Budgeting
  - Materials
  - Experimental testing regulations

# Acknowledgments



- John Webster, PhD
- Jeremy Rogers, PhD
- Jerome Dempsey, PhD
- Ailiang Xie, PhD
- David Patz, PhD
- David Wang, PhD
- Chris Reikersdorfer, MD

# Works Cited



- 1. "UW Nematode Diagnostic Lab." *UW Nematode Diagnostic Lab*. N.p., n.d. Web. 01 Oct. 2013. <<http://labs.russell.wisc.edu/uw-nematode-diagnostic-lab/>>.
- 2. "Sleep Apnea." *Idaho Surgical Arts* -. N.p., n.d. Web. 03 Oct. 2013. <<http://www.idahosurgicalarts.com/oms-sleep-apnea.html>>.
- 3. "Central Sleep Apnea (CSA)-An Overview." *Dr Paulose*. N.p., n.d. Web. 03 Oct. 2013. <<http://www.drpaulose.com/general/central-sleep-apnea-csa-an-overview>>.
- 4. "Sleep Apnea." *Wikipedia*. Wikimedia Foundation, 21 Sept. 2013. Web. 03 Oct. 2013. <[http://en.wikipedia.org/wiki/Sleep\\_apnea](http://en.wikipedia.org/wiki/Sleep_apnea)>.
- 5. "Positive Airway Pressure." *Wikipedia*. Wikimedia Foundation, 20 Aug. 2013. Web. 03 Oct. 2013. [http://en.wikipedia.org/wiki/Positive\\_airway\\_pressure](http://en.wikipedia.org/wiki/Positive_airway_pressure).
- 6. "Uvulopalatopharyngoplasty." *Wikipedia*. Wikimedia Foundation, 29 Aug. 2013. Web. 03 Oct. 2013. <<http://en.wikipedia.org/wiki/Uvulopalatopharyngoplasty>>.