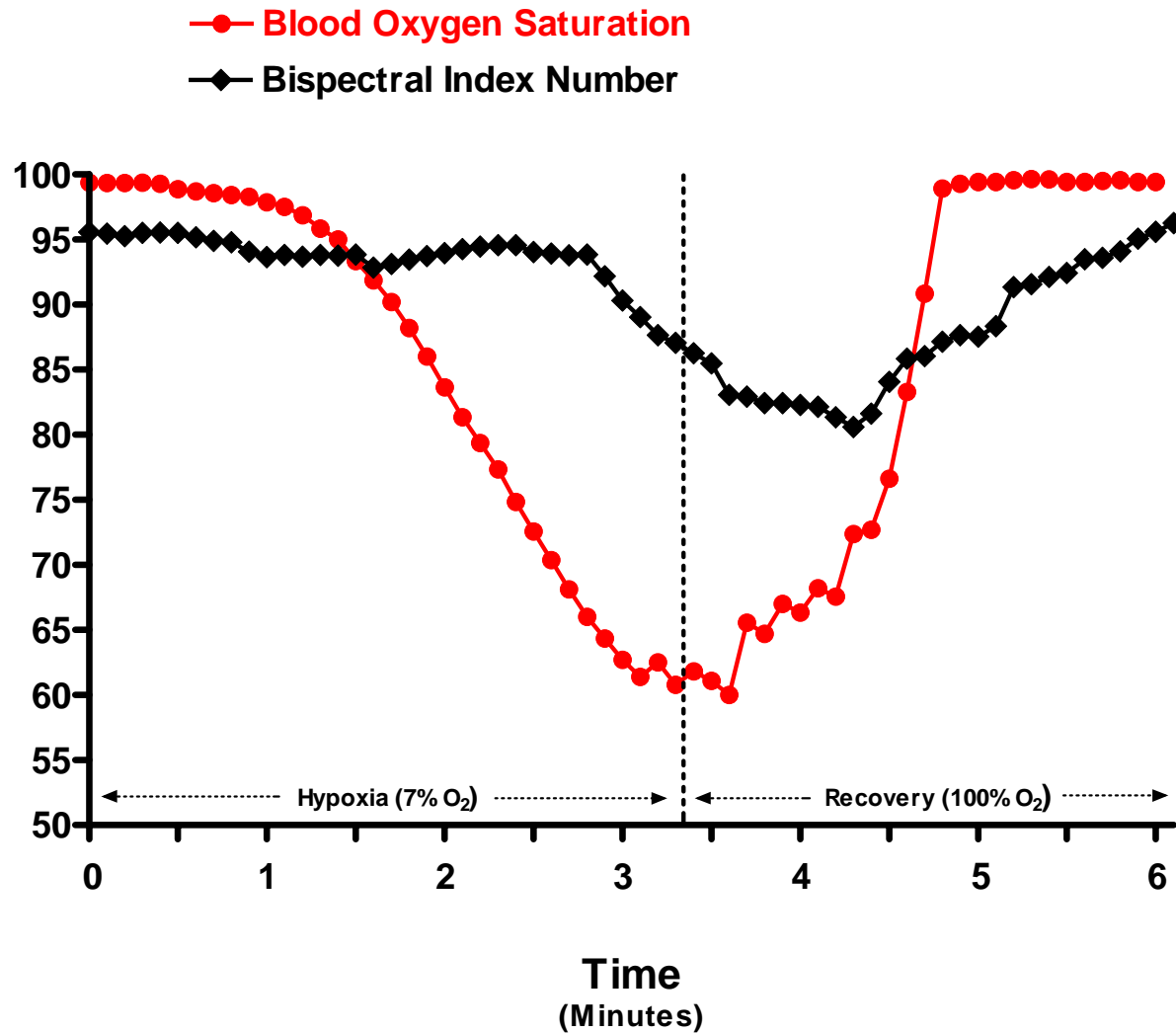
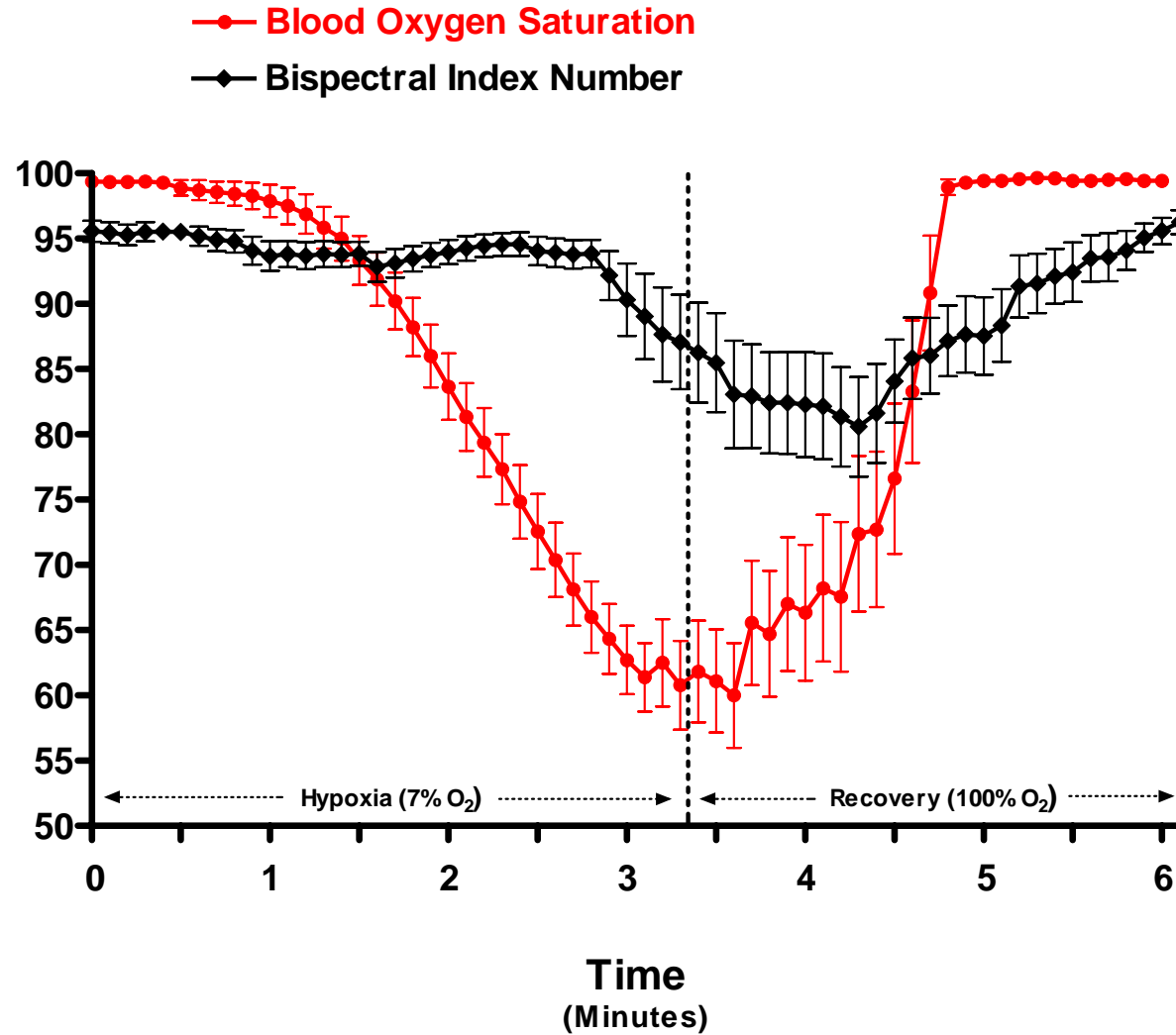


# Hypoxia Effects on BIS Number

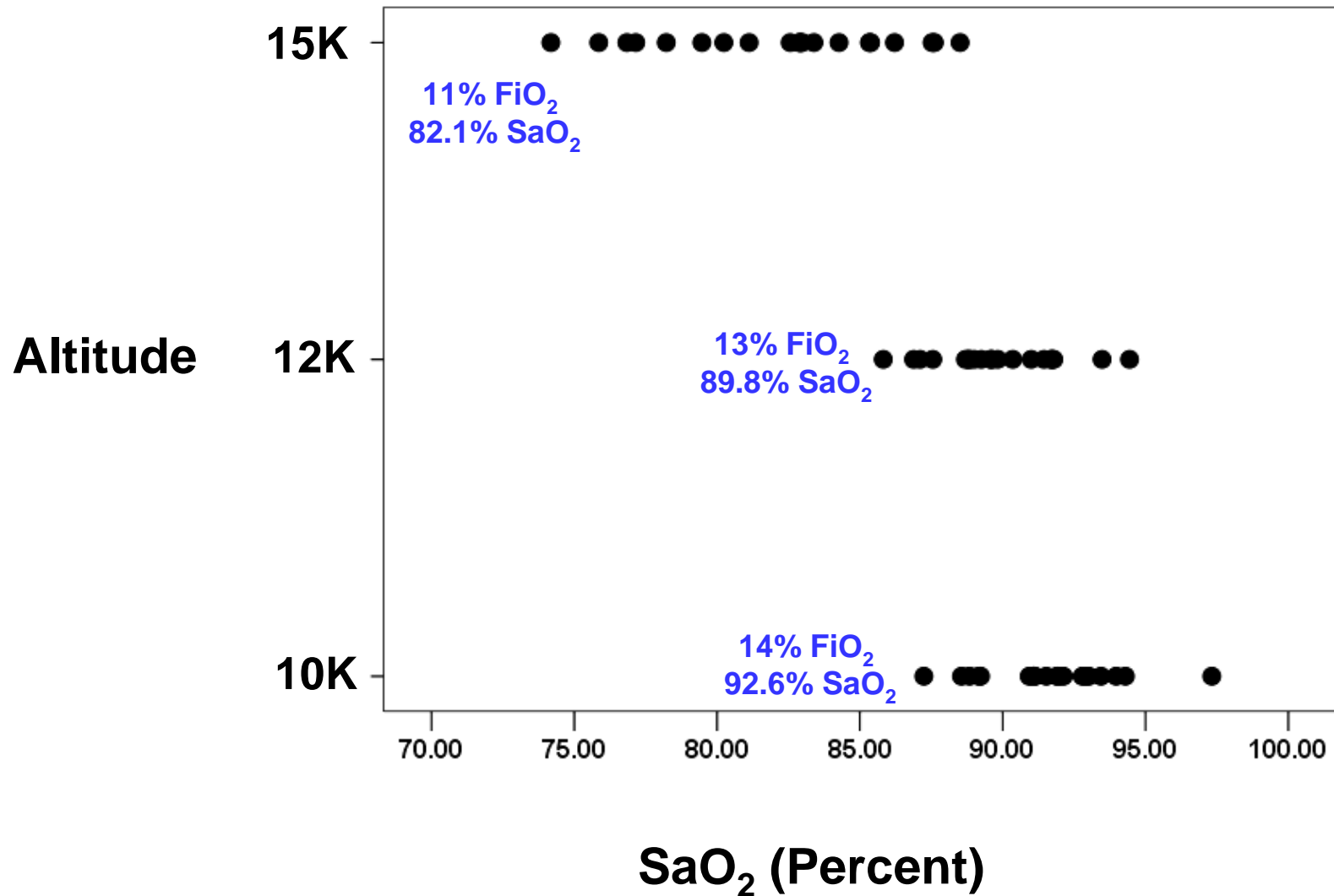


# Hypoxia Effects on BIS Number



# Human Variation in SaO<sub>2</sub>

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# Reported Hypoxia Symptoms

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Symptom	Median Likert Score	Percent with The Symptom
Difficulty Concentrating	3	94
Dizziness	3	88
Reduced Coordination	2	78
Shortness of Breath	2	72
Tingling	2	69
Tunnel Vision	2	69
Blurred Vision	2	66
Light Dimming	2	56
Euphoria	2	54

# Correlation of Decreasing CBF and Tissue Oxygenation with Brain Effects

(Source: AHA ACLS Manual)

CBF (mL/100g/min)	Effect on CNS	PO2 (mmHg)
50	Normal	100
30-40	Depression of EEG	??
20-30	Anaerobic Metab	40
15-20	ATP Depletion / Coma	25
8-10	Viability Threshold	12

# Correlation of Decreasing CBF and Tissue Oxygenation with Brain Effects

(Source: AHA ACLS Manual)

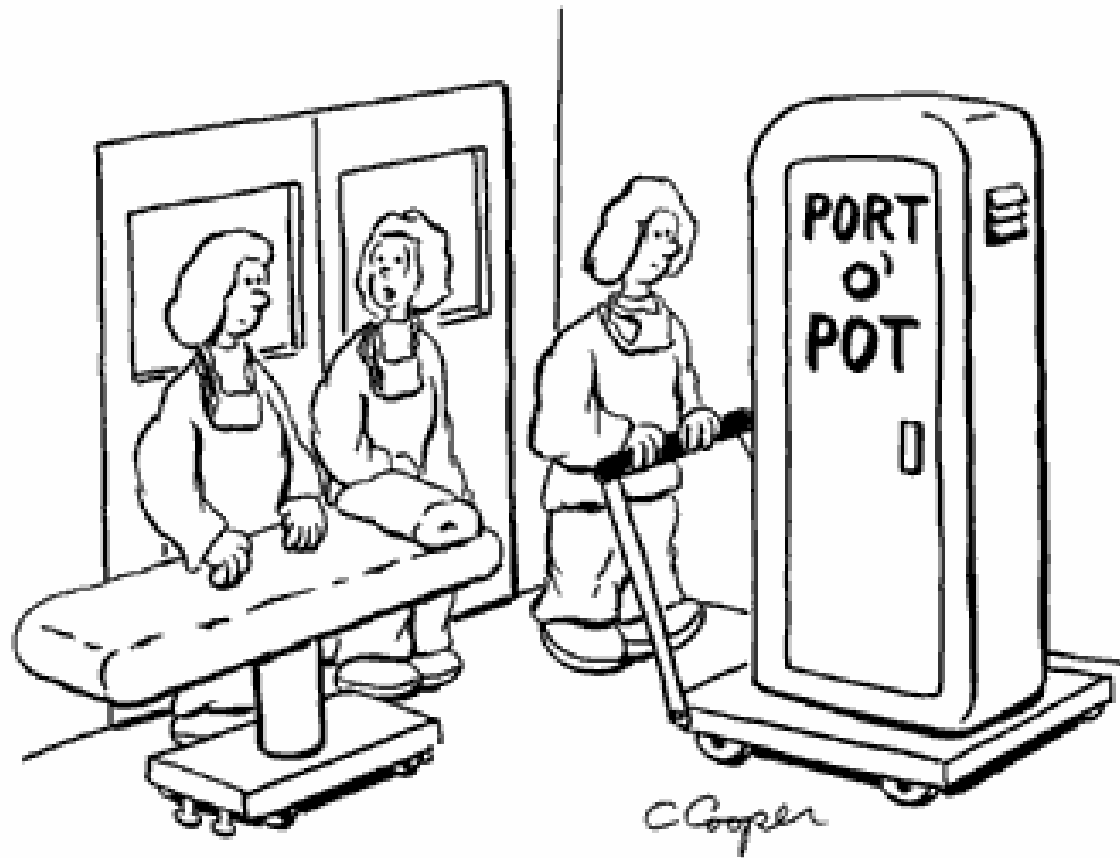
<b>CBF (mL/100g/min)</b>	<b>Effect on CNS</b>	<b>PO2 (mmHg)</b>
<b>50</b>	<b>Normal</b>	<b>100</b>
<b>30-40</b>	<b>Depression of EEG</b> <b>BIS ≈ 83</b>	<b>??</b> <b>PAO<sub>2</sub> ≈ 50</b>
<b>20-30</b>	<b>Anaerobic Metab</b>	<b>40</b>
<b>15-20</b>	<b>ATP Depletion / Coma</b>	<b>25</b>
<b>8-10</b>	<b>Viability Threshold</b>	<b>12</b>

# Potential ROBD Applications

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- **Drug Evaluation in Aviation**
- **Performance Enhancement**
- **Cardiac Stress Testing**



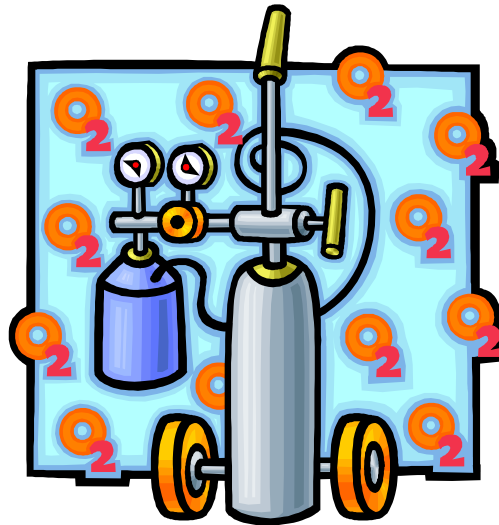


**“I take it the next case may run long.”**

# Too Much Oxygen

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- **Historical, Clinical, and Research Perspective on Hyperoxia**



# Historical Perspective

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- 1775
  - Priestly discovers oxygen
- 1782
  - Scheele discovered that enriched oxygen environments inhibited plant growth
- 1878
  - Bert published seminal research describing the universal nature of oxygen toxicity and the variation in sensitivity among species



# Historical Perspective

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- **1897**
  - Smith recognized that the inherent toxicity of oxygen might limit its clinical use
- **1920**
  - Little practical importance attached to the theory of oxygen toxicity..... until mechanisms to delivery high concentrations of oxygen were developed
- **1945**
  - Comroe et al. published “Oxygen Toxicity” in JAMA
- **1952**
  - Reports that linked the incidence of retrolentil fibroplasia in premature infants to the duration of oxygen therapy lead to recognition of the clinical importance of this syndrome

# Comroe et al. JAMA, July 1945

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**90 healthy males ages 19 to 31 inspired 50, 75 or 100% oxygen at one atmosphere for 24 hours**

- **Controlled for**
  - Delivery System
  - Oxygen Content
  - CO<sub>2</sub> Content
  - Humidity
  - Temperature
  - Gas Supply
  - Room Air Controls
- **Data Collection**
  - Symptoms
  - Vital Capacity
  - Pulse Rate
  - Physical Exam
  - Blood Studies

# Comroe et al. JAMA, July 1945

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- **Findings**
  - **Symptoms**
    - **Substernal Chest Pain**
    - **Cough**
    - **Sore Throat**
    - **Nasal Congestion**
    - **Decrease Vital Capacity**

**Potential for Pulmonary Fibrosis**

# Comroe et al. JAMA, July 1945

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- **Findings**
  - **Blood Studies**
    - RBCs
    - Hemoglobin
    - Hematocrit
    - WBCs
  - **Physiologic Parameters**
    - Pulse
    - Blood Pressure
    - Respiratory Rate
  - **Physical Examination**

# Evidence for Oxygen Toxicity

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## Journal Articles

- **Oxygen Toxicity in Man**
  - [NEJM, 1970](#)
- **The Toxicity of Oxygen**
  - [Anesthesiology, 1972](#)
- **Oxygen Toxicity**
  - [Respiratory Disease, 1979](#)
- **Pulmonary Oxygen Toxicity**
  - [NEJM, 1983](#)
- **Oxygen Toxicity**
  - [AANA Journal, 1989](#)