

Unit 3: *The Physiology of Diving and Nitrox*

- **Narcosis**
- **Decompression Sickness**
- **Physiological Effects of High Oxygen Levels**
- **Physiological Effects of High Oxygen Levels**





Student Performance:

By the end of the lesson you will be able to:

- **List the physiological effects of nitrogen in diving.**
- **State physiological effects of low oxygen levels.**
- **List the physiological effects of high oxygen levels.**
- **Recite signs and symptoms of oxygen toxicity.**
- **State limits of hyperbaric oxygen exposure.**

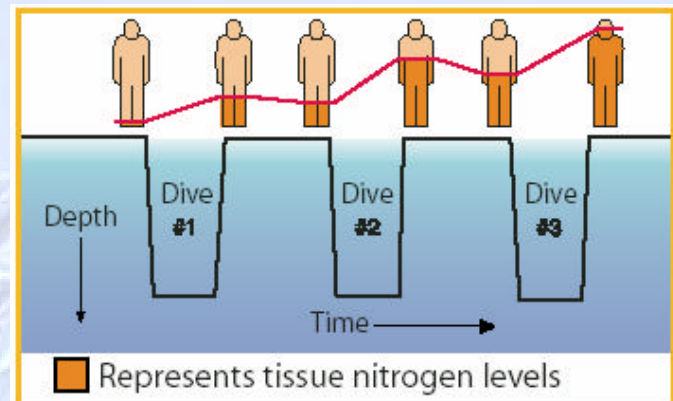


Nitrogen Narcosis

- **The mechanisms of nitrogen narcosis are similar to that of gases used in general anesthesia.**
- **Divers may not be aware that they are impaired.**
- **There is no appreciable benefit to breathing nitrox.**
- **Ascent to a shallower depth is all that is required.**

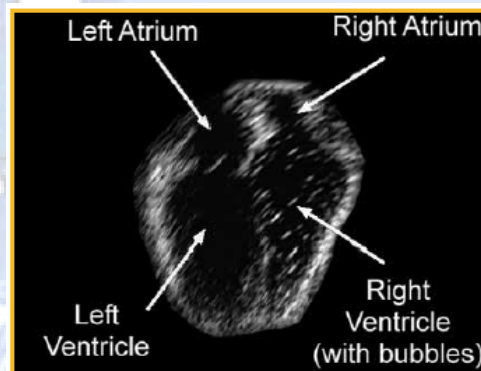
Decompression Sickness

- What causes it
- DCS signs and symptoms



Decompression Sickness continued

- **How to avoid DCS**
- **Treatment for DCS**





Oxygen: The Good and the Bad

- **Is necessary to sustain life**
- **Too high an oxygen level can be just as harmful as too low**



Oxygen and Metabolism

- **Oxygen is our life-support gas**
- **The primary waste product is carbon dioxide**



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Physiological Effects of Low Oxygen Levels (Hypoxia)

- Hypoxia means “low oxygen” symptoms begin to appear if the partial pressure of inspired oxygen falls below about 0.16 atmosphere
- Onset of symptoms at a PO_2 of about 0.16 ata
- Signs and symptoms include impaired mental performance and defective memory, blueness of the lips (cyanosis), fatigue, visual disturbances, and dizziness

Physiological Effects of Low Oxygen Levels (Hypoxia) continued

- If the PO_2 falls below about 0.10 ata more severe symptoms leading to unconsciousness will occur.
- Hypoxia must be monitored in some rebreather situations or deep diving applications.

Physical Effects of High Oxygen Levels

- **Central Nervous System Toxicity**
 - has a wide range of signs and symptoms, the most dramatic being epilepsy-like convulsions
 - CNS toxicity can result from relatively short exposures to high partial pressures of oxygen
- **Pulmonary Toxicity or Whole Body Toxicity**
 - results from prolonged exposure to elevated partial pressures of oxygen (above about 0.5 atmosphere)
 - not a concern for recreational nitrox diver

Oxygen Partial Pressure Limits

- **The generally accepted limit for nitrox diving is:**
 - 1.4 ata PO_2
 - 1.6 ata PO_2 as a contingency
- **1.4 ata PO_2 is more than adequate for 99.9% of the dives you may want to accomplish**

Central Nervous System Toxicity

- **Factors that can increase your susceptibility to CNS oxygen toxicity**
 - **heavy exercise, increased carbon dioxide build-up, chilling or hypothermia, and water immersion**
 - **One cannot predict oxygen toxicity**

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Central Nervous System Toxicity continued

- **Central Nervous System Toxicity**
 - The mnemonic acronym “ConVENTID” is useful for remembering the most obvious of them:
 - **Convulsions**
 - **Visual disturbances**
 - **Ears**
 - **Nausea**
 - **Twitching or Tingling**
 - **Irritability**
 - **Dizziness or Dyspnea**

Central Nervous System Toxicity

continued

- **Central Nervous System Toxicity**
 - Convulsions are the most obvious and most serious signs.
 - Possible precursors to convulsions are:
 - Visual disturbances, tunnel vision, dazzle or seeing “fireflies.”
 - Ear ringing, tinnitus, or sounds like an approaching train in a tunnel.
 - Nausea, including vomiting.
 - Twitching, especially of the lips and small facial muscles or the hands, or tingling (paresthesia) especially in the fingers.
 - Irritability, restlessness, euphoria, dysphoria (uneasiness or feelings of impending doom), anxiety, or general confusion.
 - Dizziness and vertigo or dyspnea (difficult or labored breathing).



Managing Oxygen Exposure

- **The best way to avoid oxygen toxicity problems is to stay within correct oxygen exposure limits.**

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Managing Oxygen Exposure

continued

- **NOAA Oxygen Exposure Limits**

- In addition to a general PO_2 limit, NOAA has oxygen exposure time limits for a range of oxygen partial pressures from 0.6 ata to 1.6 ata

NOAA OXYGEN EXPOSURE LIMITS		
PO_2 (atm)	Maximum Single Dive Limit (minutes)	Maximum 24-Hour Limit (minutes)
1.80	45	150
1.55	83	185
1.50	120	180
1.45	135	180
1.40	150	180
1.35	165	195
1.30	180	210
1.25	195	225
1.20	210	240
1.10	240	270
1.00	300	300
0.90	360	360
0.80	450	450
0.70	570	570
0.60	720	720



Avoiding CNS Toxicity

- **CNS toxicity is avoided by abiding by easily managed limits.**
 - Remember that the recommended maximum PO_2 for recreational nitrox diving is 1.4 atmospheres, with a PO_2 of 1.6 atmospheres as a contingency amount.
 - Plan your dives and choose a nitrox mix that is appropriate to the dive.

End of Unit 3

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