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SPARC Long-term exposure to intermittent hypoxia (or normoxia) using a custom in-cage computer controlled system

In 1 collection

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ABSTRACT

This protocol describes the procedures for conducting long-term exposure to various intermittent hypoxia (or normoxia) protocols in rats.

Keywords: intermittent hypoxia, chronic intermittent hypoxia, acute intermittent hypoxia, IH, dAIH, CIH, oxygen

- 1 Rats are exposed to either long-term normoxia or IH treatments (various protocols) for up to 28 days
 - 1.1 Rats are housed in custom-designed PlexiGlas gas exposure cages (Volume~16L) with free access to food and water
 - 1.2 Cages are fitted with a custom cage top equipped to deliver protocol-specific gas (O₂ balanced with N₂) in specified cycle intervals via programmable mass-flow controller (Therapeutiq, Madison, WI).
 - 1.3 Cages are filled with low-dust emitting bedding (Tek-Fresh) and are changed 3 times per week
 - 1.4 Rats and gas exposure system are monitored at least 1x/hour during daily exposure to ensure system functionality and rat health/wellbeing
 - 1.5 Gas flow rate through cages is set to 16 L/min (~60 air changes per hour) to prevent CO₂ and ammonia buildup
 - 1.6 All gases are medical grade and are filtered for small microparticles and bacteria using a high purity compressed air filter (Parker Hannifin)
 - 1.7 Filtered air is humidified to reach a relative humidity of ~30-50% in the final gas mixture. The humidification system is comprised of a Nafion Fuel Cell Humidifier (Perma Pure, Lakewood, NJ) connected to the filtered air line and a water bath.

- 2** Exposure Protocols Include: Normoxia (Nx), daily acute intermittent hypoxia (dAIH), chronic intermittent hypoxia simulating mild sleep apnea (apnea-hypopnea equivalent = 6 episdoes/hour) (IH-5/5), or chronic intermittent hypoxia simulating moderate sleep apnea (apnea-hypopnea equivalent = 15 episdoes/hour) (IH-2/2)
- 3** Normoxia Exposure:
 - 3.1** Continuous gas flow of 21% O₂ for 8 hrs/day
- 4** Daily Acute Intermittent Hypoxia Exposure (dAIH)
 - 4.1** 10, 5-minute episodes of 10.5% O₂ alternating with 5 minute normoxic intervals (21% O₂) for a total duration of 1.5 hours/day (10 hypoxic episodes per day)
- 5** Chronic intermittent hypoxia simulating mild sleep apnea (IH-5/5): this protocol results in 6 hypoxic episdoes per hour which is equivalent to the clinical criteria (apnea-hypopnea index, AHI) for diagnosing mild sleep apnea
 - 5.1** 5-minute episodes of 10.5% O₂ alternating with 5 minute normoxic intervals (21% O₂) for a total duration of 8 hours/day (6 hypoxic episodes per hour for 8 hours = 48 hypoxic episodes per day)
- 6** Chronic intermittent hypoxia simulating moderate sleep apnea (IH-2/2): this protocol results in 15 hypoxic episdoes per hour which is equivalent to the clinical criteria (apnea-hypopnea index, AHI) for diagnosing moderate sleep apnea

- 6.1** 2-minute episodes of 10.5% O₂ alternating with 2 minute normoxic intervals (21% O₂) for a total duration of 8 hours/day (15 hypoxic episodes per hour for 8 hours = 120 hypoxic episodes per day)