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

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We use this protocol and it's working

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Abstract

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

Troubleshooting

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)