Cardiovascular and Respiratory Effect of 6PPD in *Daphnia magna*

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**Background**

**Significance**
A recent study identifying the emerging contaminant, 6PPD, has been closely related to an increased mortality rate in Coho salmon in minimal concentrations at acute exposures (Zhenyu et al. 2021). In order to better understand the proved lethal effects of this contaminant, *Daphnia magna* should be used in a series of experimental designs to determine cardiovascular and respiratory effects.

**Objective**
1. Expose *D. magna* to acute and chronic concentrations of 6PPD.
2. Measure heart rate after acute exposure
3. Measure hemoglobin concentration using acute and chronic sample.
4. Measure oxygen consumption

**Hypotheses**
1. An altered heart rate should be observed due to a stress-related external stimuli.
2. An increased need in oxygen should be in relation to compensation of the metabolic rate.

**Specific Aims**
1. Toxicity evaluations
2. Cardiovascular approaches
   - Heart rate
3. Oxygen consumption

**Analysis of Hypotheses**

**Daphnia**
- Model organism
- Toxicology reports
- Environmental acclimations

**6PPD and Quinones**
- 6PPD-quinone similar to other quinones as seen in Figure 1 (DTSC 2001)
  - Influence over biological systems comparison

![Figure 1: Oxidation of 6PPD into 6PPD-quinone](image)

**Heart Rate**
- Energy expenditure compensation
  - Other biological systems

**Hemoglobin Concentrations**
- Oxidation (free radicals)
- Compensation
  - Oxygen consumption
  - Transportation of oxygen

**Oxygen Consumption**
- Contaminant related stress
- Metabolic rate

**Limitations**
- Invertebrate vs. vertebrate
  - 2021 study (Zhenyu et al. 2021)

**Research Strategy**

**Aim 1**
Toxicity Testing
1. Lab generate 6PPD
2. Calculate acute and chronic concentrations
   1. Acute (ng/L) → 24-hr. exposure
   2. Chronic (ng/L) → 21-day exposure

**Aim 2**
Heart Rate
1. Acute exposure (24 hrs.) of 6PPD on *D. magna*
2. Measure using microscopy and hand-held tally counter
3. Using spectrophotometry, measure absorbance at 410 nm.

**Aim 3**
Oxygen Consumption
1. Prepare respirometer based on a previous study seen in Figure 2 (Lampert 1986)
2. Measure pre-existing variables (algae oxygen production/consumption)
3. Use metabolic equation to determine respiratory rate

![Figure 2: Model of the respirometer used in this assay](image)

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**References**

