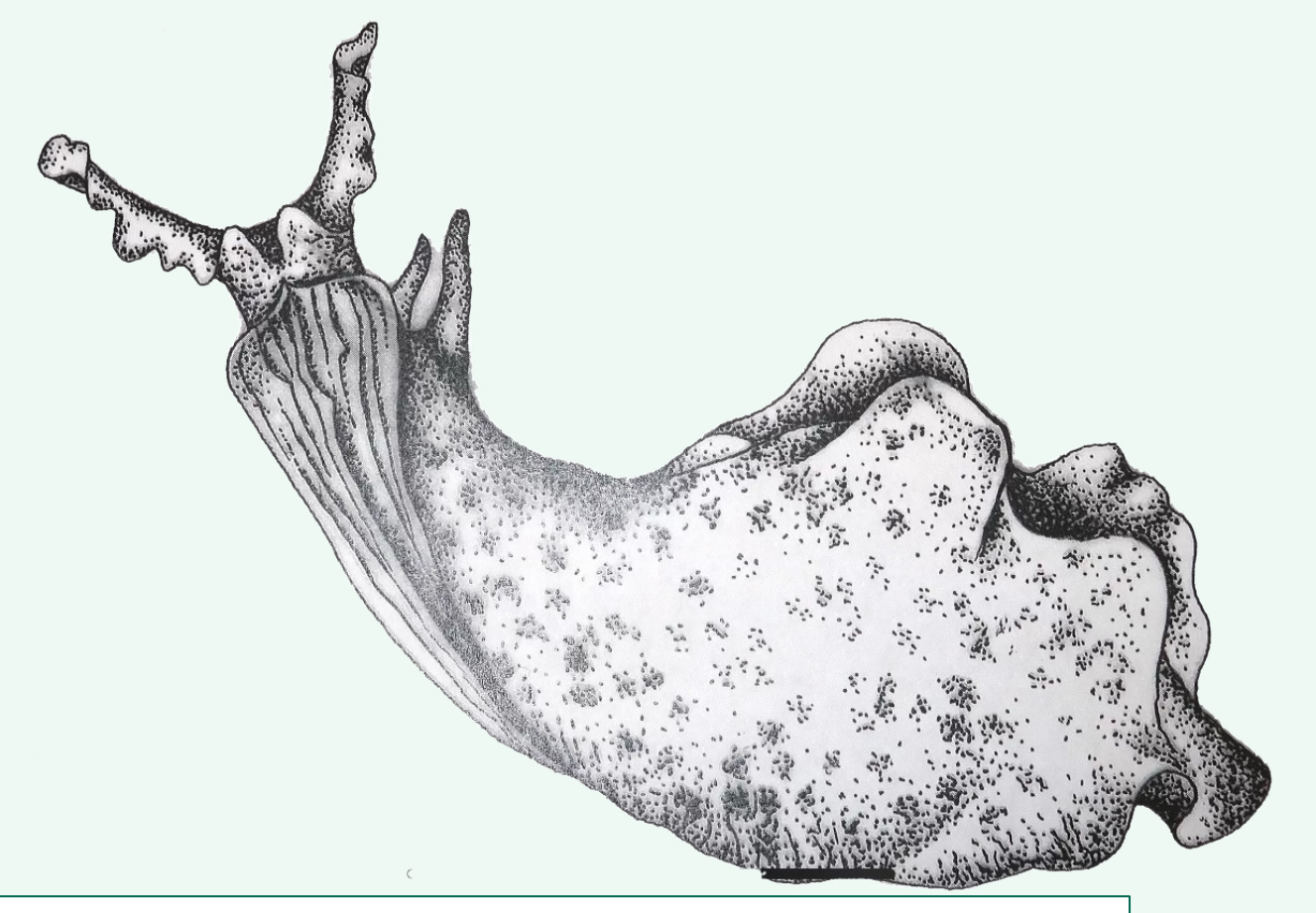




# Effects of parental background on hypoxia resistance in *Aplysia californica*

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## Introduction and Methods

*Aplysia californica* is an herbivorous gastropod mollusk from the Pacific Ocean of northern California to Baja California. *Aplysia* is a good model of the nervous system because it has relatively few neurons with large nerve cell bodies that are always at the same location. The goal of this study is to understand the effects of hypoxia on the nervous system of animals whose parents had either been exposed or not exposed to hypoxia. The hypothesis tested was that animals whose parents had been exposed to hypoxia would have a higher tolerance for hypoxia.

Sibling *Aplysia* from two groups, batch 60 and batch 71, were studied. Animals in Batch 60 originated from hatchery-reared parents that had not been exposed to hypoxia and were considered naïve prior to testing. Batch 71 were progeny of wild animals and thus considered pre-exposed to hypoxia. Animal weights and behaviors were analyzed prior to hypoxic exposures. Two behaviors were tested: Time to Right and Tail Withdrawal Reflex. Animals from both batches were subjected to hypoxia treatments at 20% dissolved oxygen in enclosed flow-through boxes for six hours.



The National Resource for *Aplysia* located at the University of Miami Rosenstiel School

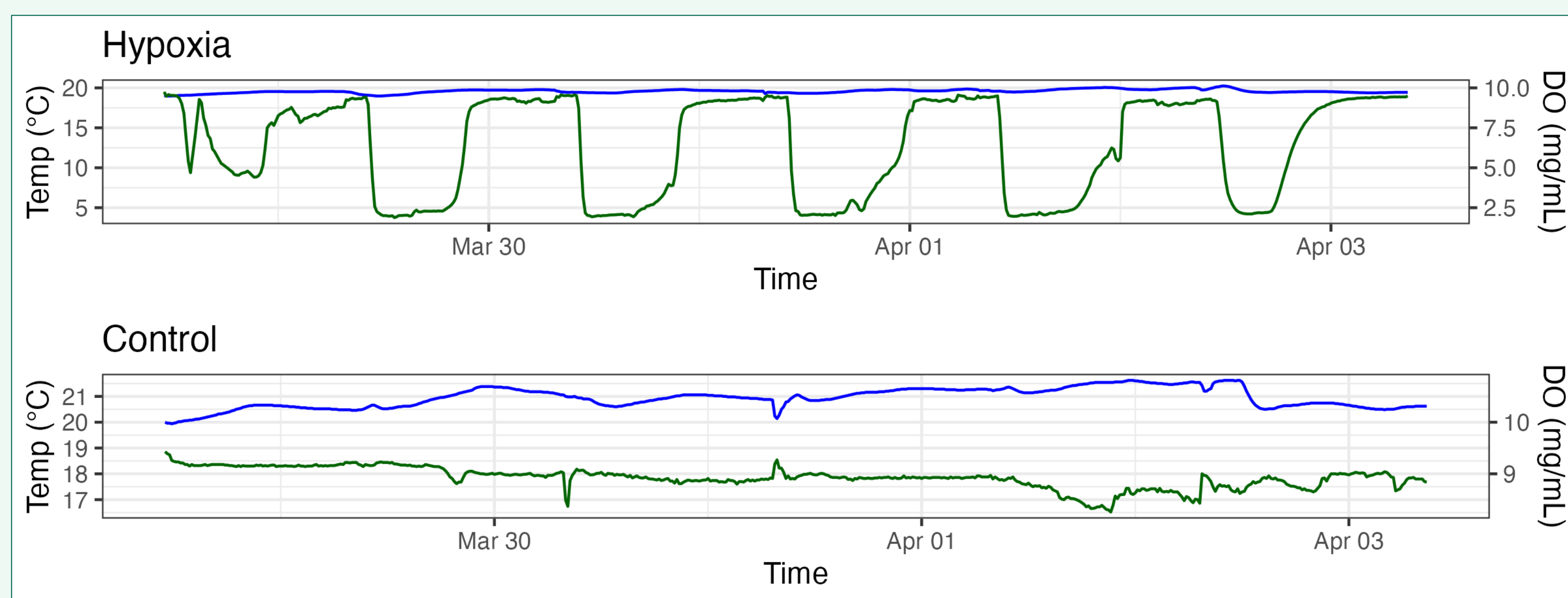
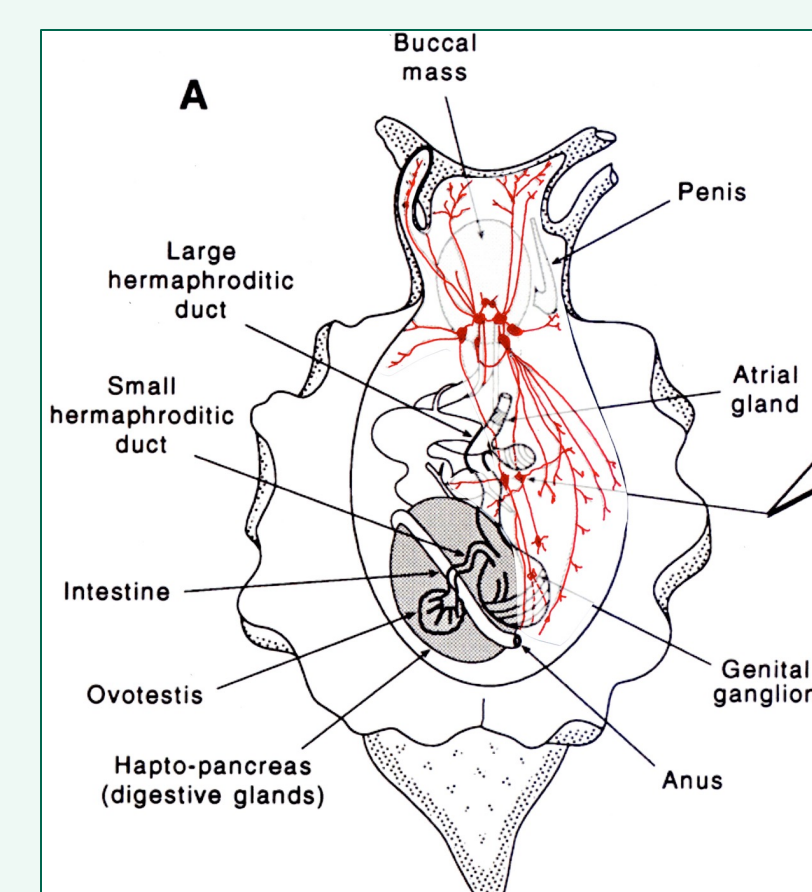


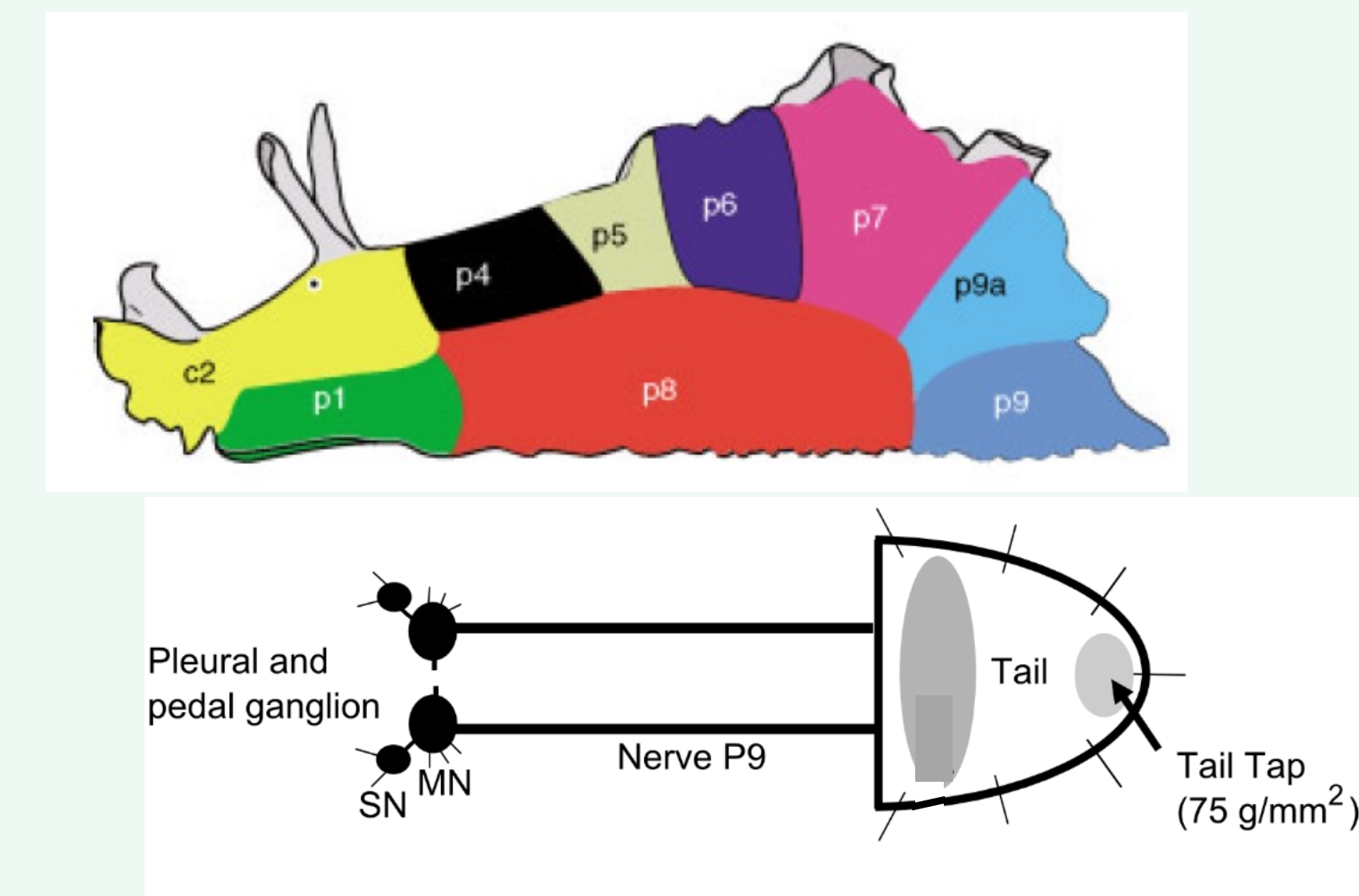
Fig. 1: Temperature (Celsius) and Dissolved Oxygen (mg/mL) over the span of the 7-day hypoxic exposure



Aplysia Tail Withdrawal Reflex



Aplysia "Natural" Hypoxia (behavior in hatchery induced by smell of food)



Epidermal fields served by 9 cerebral and pedal nerves of *Aplysia californica*, Walters et al 1983

## Results

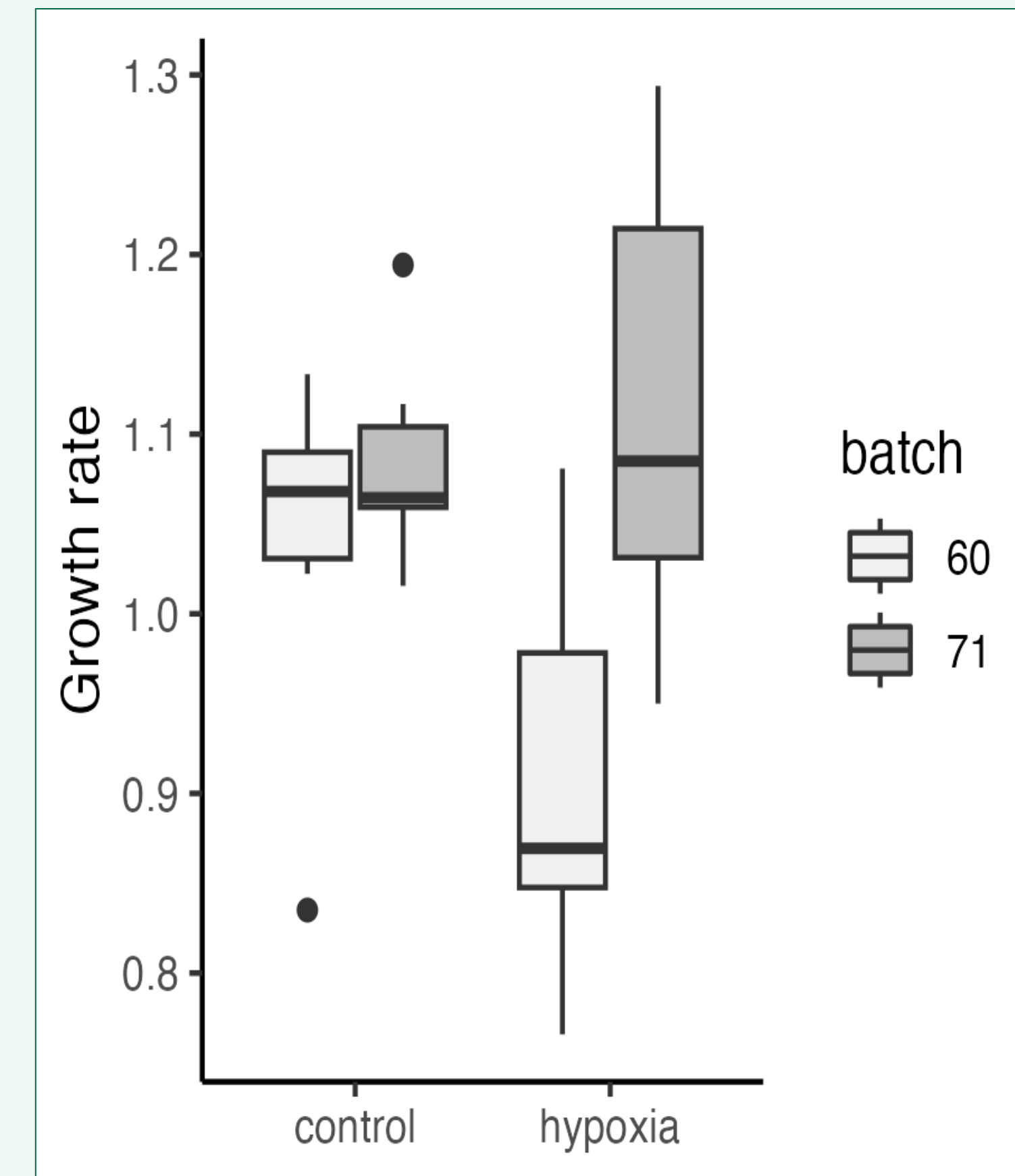


Fig. 3: Average growth rates for both batch 60 and 71 for control and hypoxic treatments.

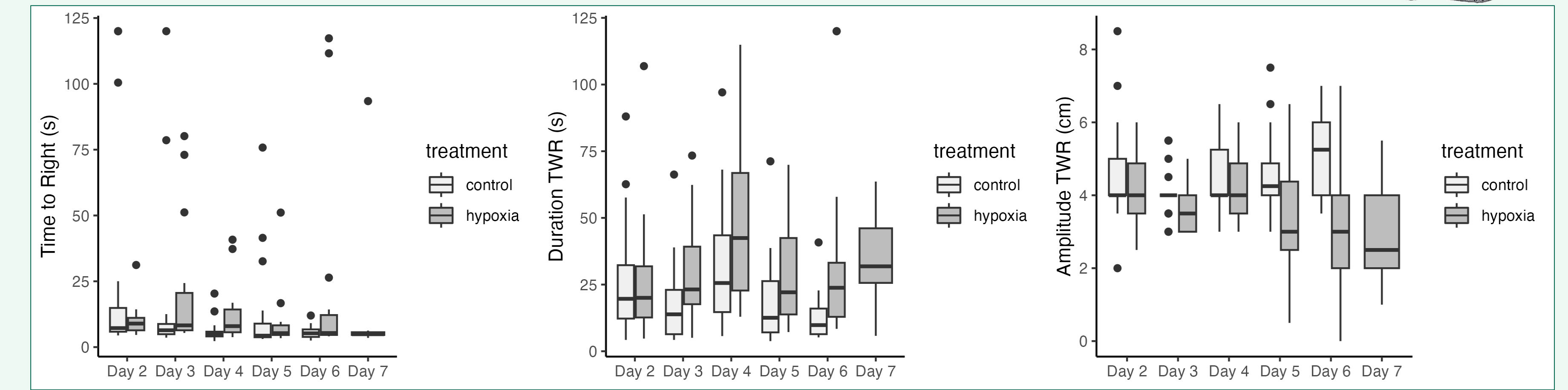


Fig. 4: Naïve *Aplysia* (Batch 60) behavior in response to hypoxia. Left panel: Time to Right during the seven-day exposure. Center panel: mean duration of the tail withdrawal reflex. Right panel: mean amplitude of tail withdrawal.

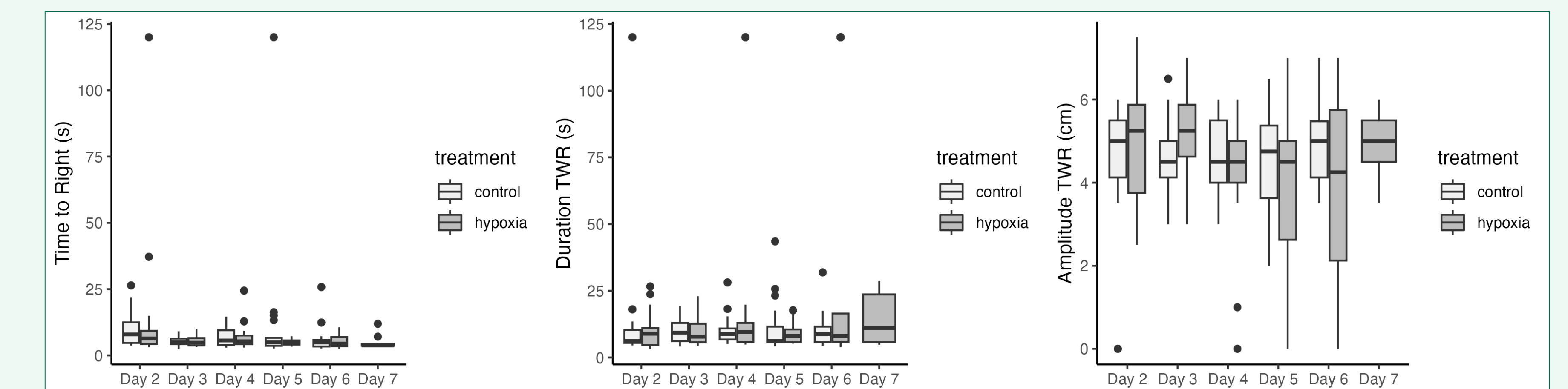


Fig. 5: Pre-exposed *Aplysia* (Batch 71) behavior in response to hypoxia. Left panel: Time to Right during the seven-day exposure. Center panel: mean duration of the tail withdrawal reflex. Right panel: mean amplitude of tail withdrawal.

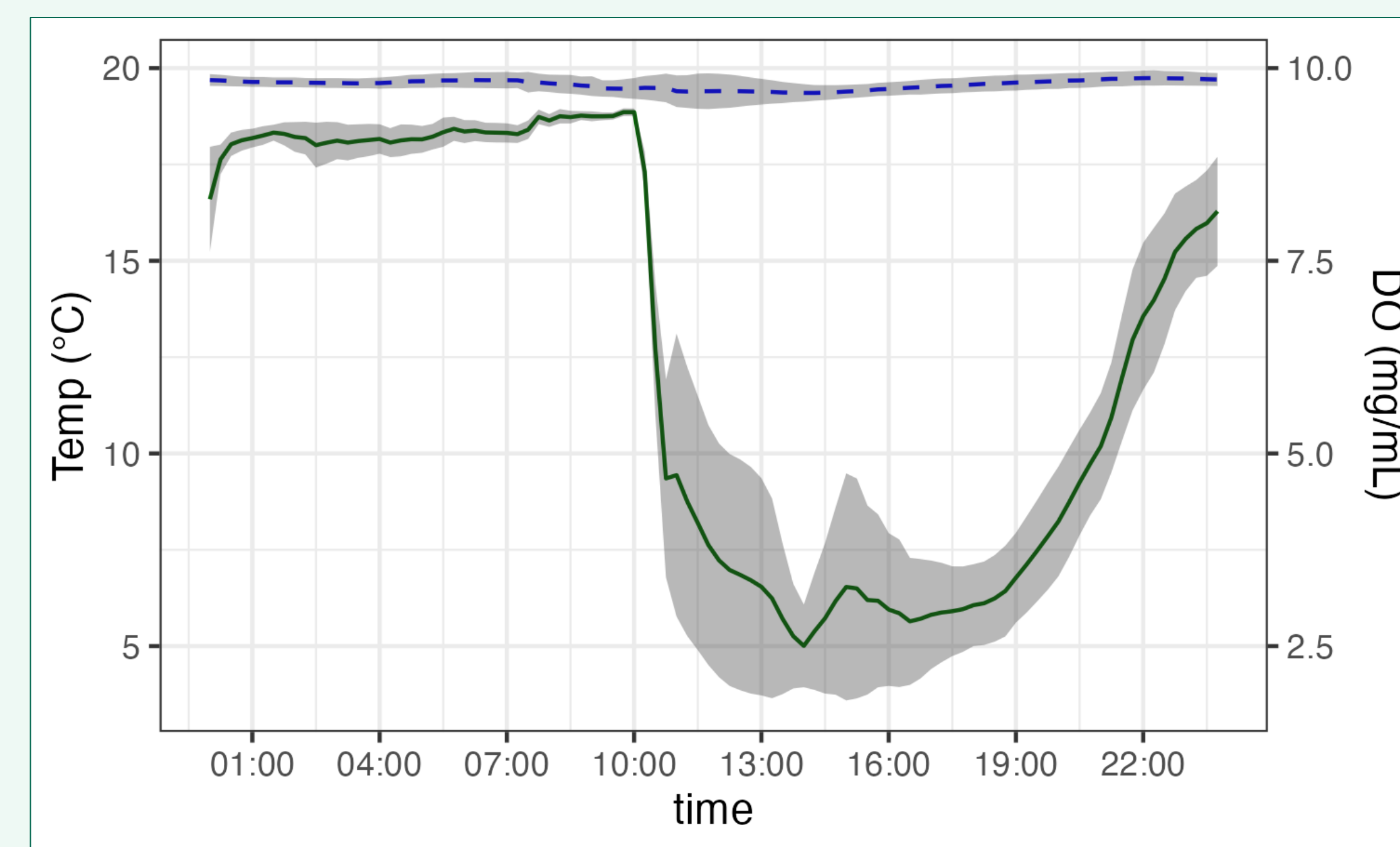


Fig. 2: Average temperature (dotted line) and dissolved oxygen (solid line) over the course of one day of exposure for treatment cages.

Behavioral data were evaluated in R using a premanova statistics test. Only animals naïve to hypoxia (B60; Fig. 4) showed hypoxia effects on behavior significantly different from controls ( $p \leq 0.001$ ). Similarly, only animals naïve to hypoxia (B60; Fig 3) showed effects on growth significantly different from controls ( $p \leq 0.008$ ).

## Conclusions

*Aplysia* whose parents were exposed to hypoxia had no significant changes in growth. In comparison, naïve animals to hypoxia had significant slowing of growth.

*Aplysia* whose parents were exposed to hypoxia had no significant changes in behavior when exposed to hypoxia. In contrast, animals naïve to hypoxia via parental history had slower or changed reflexes.

This research continues, focusing on gene expression differences in the sibling groups. Behavioral and genetic data help determine if resistance to hypoxia can be carried through to offspring, passed down through maternal or paternal genes.

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