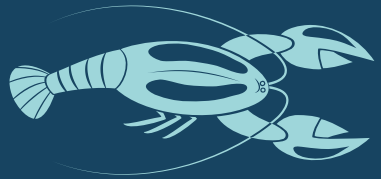


Fish 460: Project Proposal

Hemigrapsus oregonensis

Gabriela Ochoa, Coralia Alamina

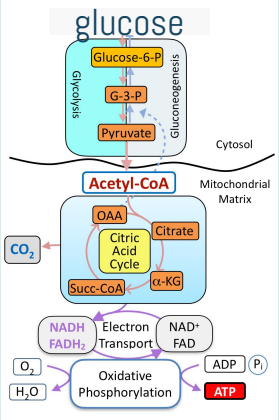
Title:

Assessing Hemigrapsus Oregonensis Glucose Metabolism under Temperature and Nutrient Stress

Metabolism overview

Glucose Metabolism

Upon feeding and intake of carbohydrates, blood sugar spikes. This leads to the mobilization of glucose to various tissues, allowing glycogen storage in their muscles or their hepatopancreas.



Crustaceans

However, decapods metabolism is controlled by neurons called the stomatogastric ganglion. This control on transit time varies by species and environmental factors.

Fed State

After meals and metabolism energy is readily available and fueling energetically intensive processes like protein synthesis

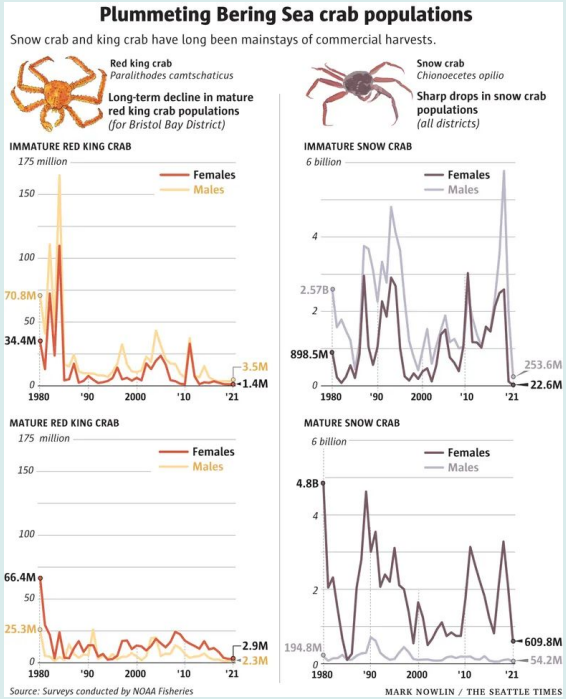
Fasted State

Mobilization of stored energy is crucial, because within their environment food availability can be unpredictable

McGaw, I. J., & Curtis, D. L. (2012). A review of gastric processing in decapod crustaceans. *Journal of Comparative Physiology B*, *183*(4), 443–465. https://doi.org/10.1007/s00360-012-0730-3

Hu, A. S. L. (1958). Glucose metabolism in the crab, Hemigrapsus nudus. *Archives of Biochemistry and Biophysics*, *75*(2), 387–395. https://doi.org/10.1016/0003-9861(58)90437-5

Crustaceans metabolism can be sensitive to thermal stress



Increasing Temperature

Recent crab declines have been linked to starvation because of warming oceans, which caused a big disturbance within aquaculture

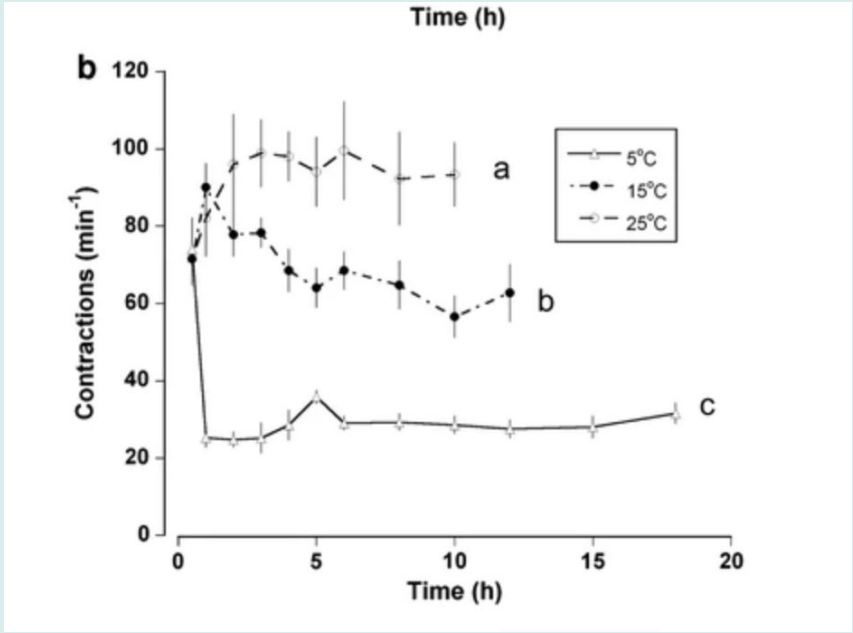
Metabolic Rates

This is due to the increase of metabolic rates leading to starvation, where the demand for food is higher than the supply.

Fisheries, N. (2023, December 5). *Research confirms link between snow crab decline and marine heatwave*
https://www.fisheries.noaa.gov/feature-story/research-confirms-link-between-snow-crab-decline-and-marine-heatwave

How can temperature increase metabolism?

The pyloric region of a decapod crustacean is where movement of food is controlled into the hepatopancreas. Within this figure we see an increase in pyloric contractions with an increase in temperature



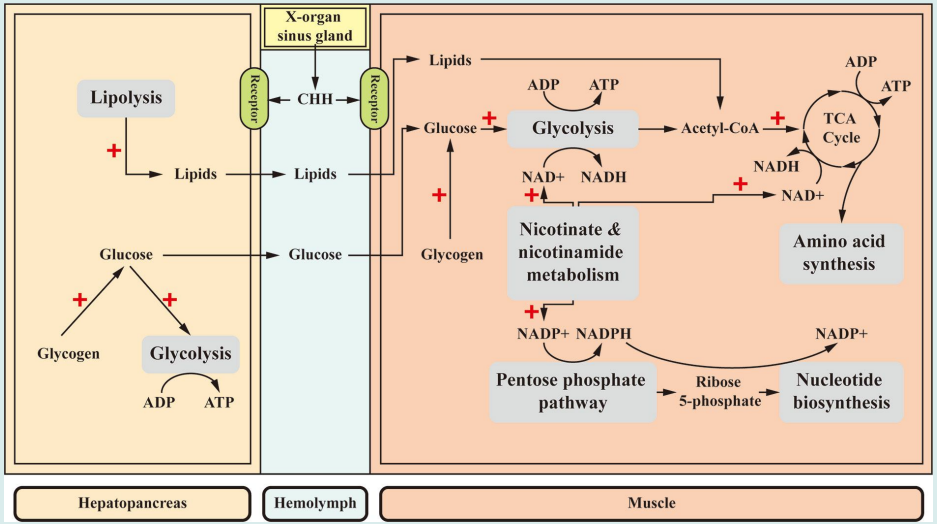
Green crabs *Carcinus maenas* contraction rate with varying temperatures.

McGaw, I. J., & Curtis, D. L. (2012). A review of gastric processing in decapod crustaceans. *Journal of Comparative Physiology B*, *183*(4), 443–465. https://doi.org/10.1007/s00360-012-0730-3

Another Stress response Considered

Crustacean Hyperglycemic Hormone

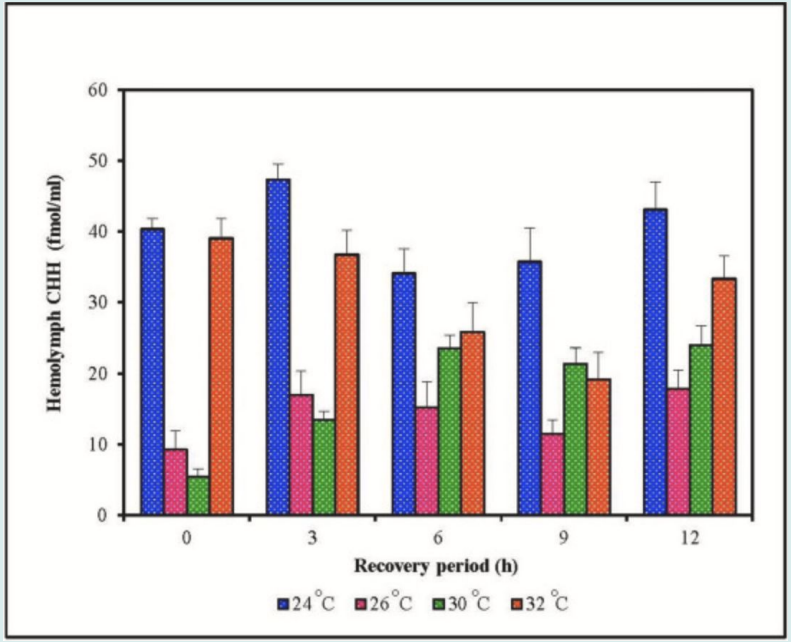
- Directly impacts the levels of glucose in the hemolymph
- When a stressful event occurs, this hormone is excreted through a sinus gland breaking down glycogen
- Allowing a mobilization of glucose to travel within the hemolymph to other tissues



Miller, S. (2023). *The Precise Release Time of Crustacean Hyperglycaemic Hormone (CHH) in Response to Environmental Stressors in the Shore Crab Carcinus Maenas* (Order No. 30565589). Available from ProQuest Dissertations & Theses Global. (2866084954).
https://www.proquest.com/dissertations-theses/precise-release-time-crustacean-hyperglycaemic/docview/2866084954/se-2

How can CHH may impact glucose levels within thermal stress?

A study found crabs that experienced heat shock demonstrated an increase in CHH and hemolymph glucose, and a depletion in hepatopancreas glycogen



Blue swimmer crab *Portunus pelagicus* levels of CHH in varying temperatures

Vasudevan, S., & Rajendran, S. (2021). Thermal stress induced hyperglycemia in the blue swimmer crab, Portunus pelagicus. *Journal of Thermal Biology*, *100*, 103076. https://doi.org/10.1016/j.jtherbio.2021.103076

Experimental Design

Theoretical framework

Key terms

- Fed & Fasted
- Glucose Curve
- *Hemigrapsus Oregonensis*

Thermal Stress

Metabolic response

Increased temperatures will increase metabolic rates and subject crab to malnutrition

Hormonal response

Increased temperatures will decrease the amount of stored energy

Our framework

Understanding how feeding state influences glucose levels under current and future thermal conditions is important for conservation

Research Question and Hypothesis

Research Question

01

How does thermal stress affect glucose levels in Hemigrapsus oregonensis under different feeding states?

Null Hypothesis

02

There is no significant difference in glucose levels in crabs experiencing thermal stress

Alternative Hypothesis

03

Crabs under thermal stress will display altered glucose levels within feeding states

Methodology

Groups

(total 20 crabs)

- **5 Elevated Fed**  Temperatures will be set at 20°C higher than normal temperatures at 10°C.
- **5 Elevated Fasted**  Fasted groups will not receive food for the entirety of the project.
- **5 Normal Fed**  Fed groups will receive high carbohydrate food, 1x a week
- **5 Normal Fasted**  Glucose levels will be checked by extraction of hemolymph and using glucometer

For each 10 crabs in Elevated or Normal temperatures:

01 Fed

Group of 5 will be fed a high carbohydrate meal 1 hour before starting

02 Fasted

The group of 5 that are fasted will have no access to food for the duration of the experiment, 3 weeks

Data collection

We will take glucose samples every 60 minutes. A total of 5 samples, alternating between the crabs hemolymph samples

Glucose curve

We will plot our findings as a function of time since meal and its corresponding glucose levels

Total: 3 treatments, 4 graphs per group per treatment

Aim to understand

How glucose levels change over time in *Hemigrapsus oregonensis* under different temperature conditions, and how these patterns reflect metabolic processes

- Glucose absorption and metabolism
- How temperature works as a stressor
- Predicting impacts of climate change

Thanks!

Do you have any questions?

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