Exploring the Role of Energy Reserves in Oyster Heat Stress Response

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Oysters: stimulus, stability, and safety

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- Economic value

Image credit: Taylor Shellfish Farms

Oysters: stimulus, stability, and safety

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- **Oyster aquaculture in US valued at $327 million**

NOAA Fisheries, 2025

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Image credit: University of South Florida

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Image credit: US Fish and Wildlife Services

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- **Ecosystem services valued at between $5,500 and $99,000 per hectare per year**

Ecosystem service values		**Minimum**	**Maximum**	**Average**
Oyster habitat state				
	Pristine	12,186	21,959	17,072
	Degraded	880	880	880
Finfish and mobile crustacean value				
	Recreational	n/a	n/a	n/a
	Commercial	4123	4123	4123
Water quality services				
	Chlorophyll a removal[a]	0	0	0
	Nitrogen removal[b]	1385	6716	4050
	Recreational use	n/a	n/a	n/a
	SAV enhancement[c]	0	2584	1292
	Bacterial removal	n/a	n/a	n/a
Carbon burial		n/a	n/a	n/a
Shoreline protection		0	85,998	860
Habitat for epibenthic infauna		0	0	0
Landscape processes		0	0	0
	Nonoyster harvest service total	5508	99,421	10,325

Grabowski et al., BioScience 2012

Ocean temperature, MHWs expected to increase

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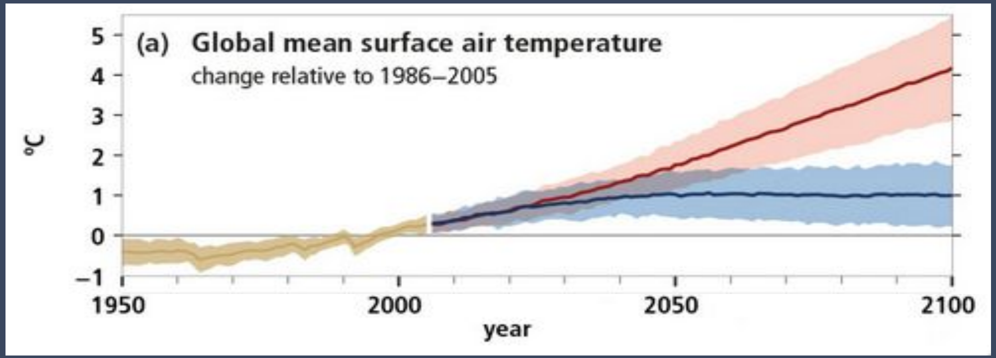

IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, 2019

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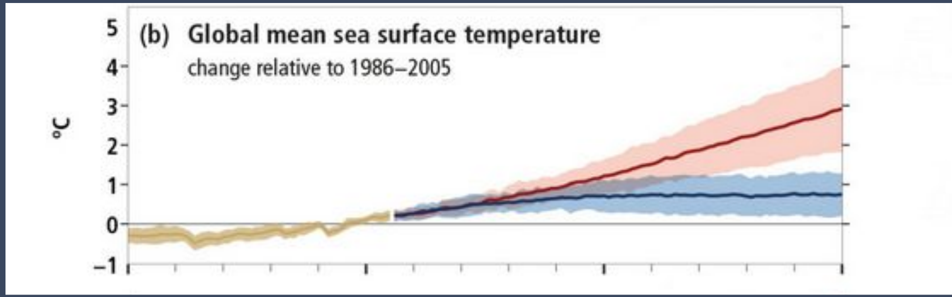

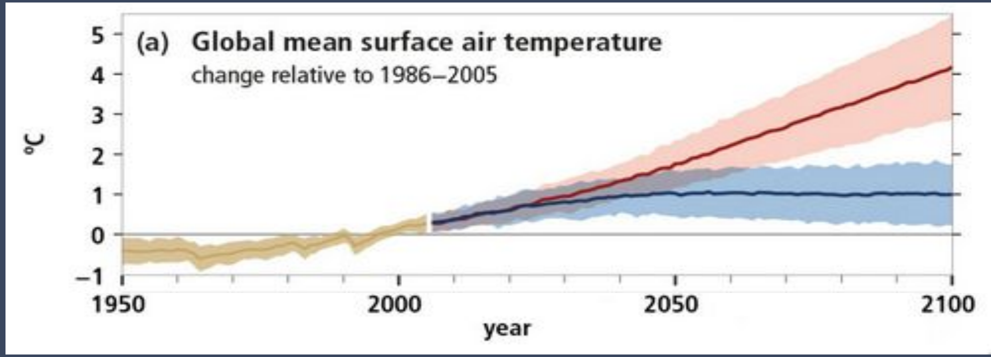

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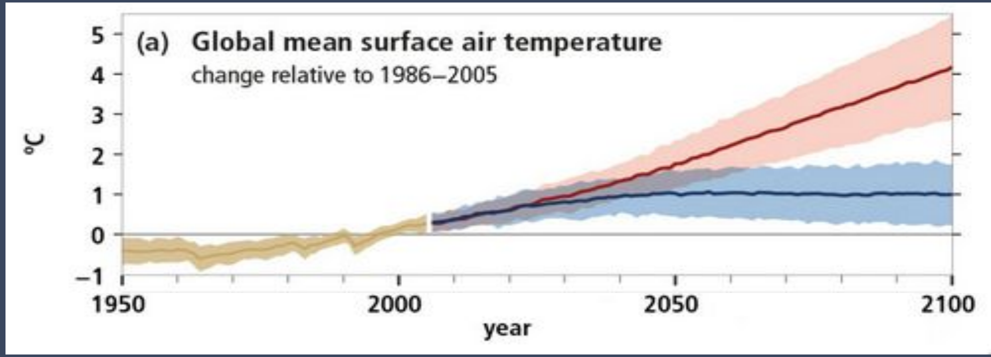

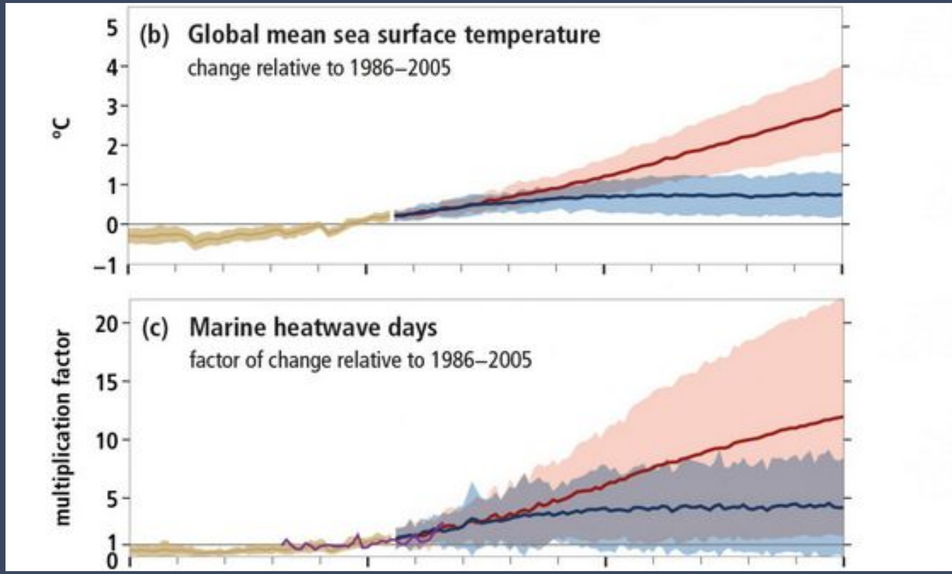

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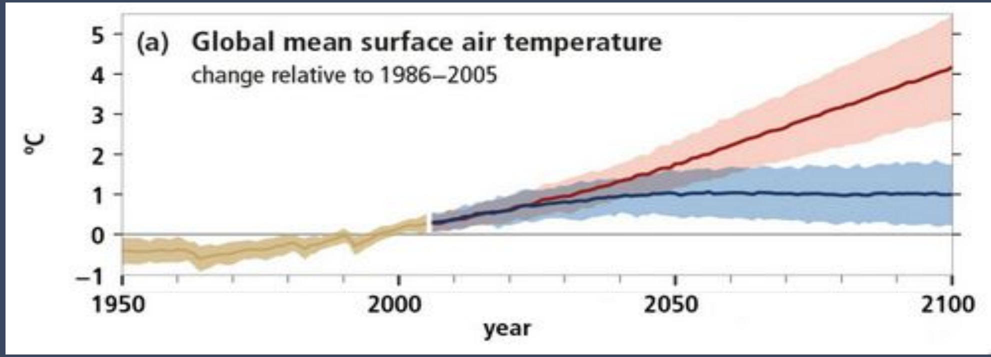

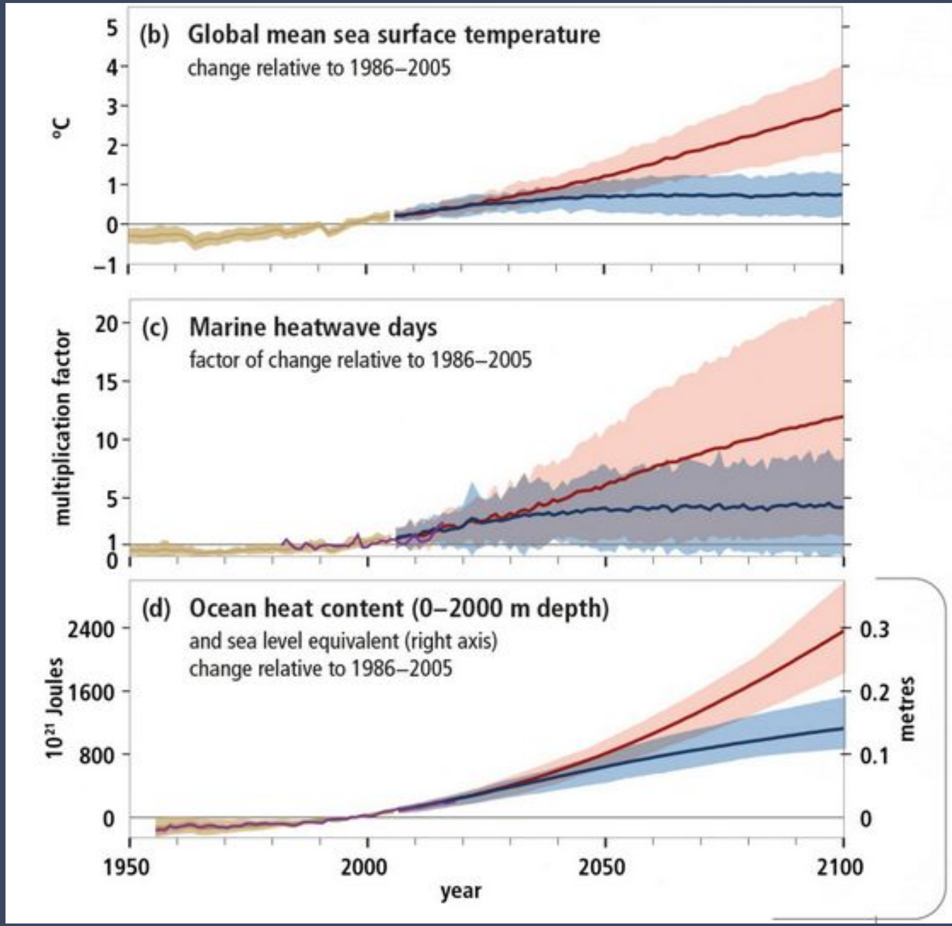

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MHWs can lead to mass oyster mortality

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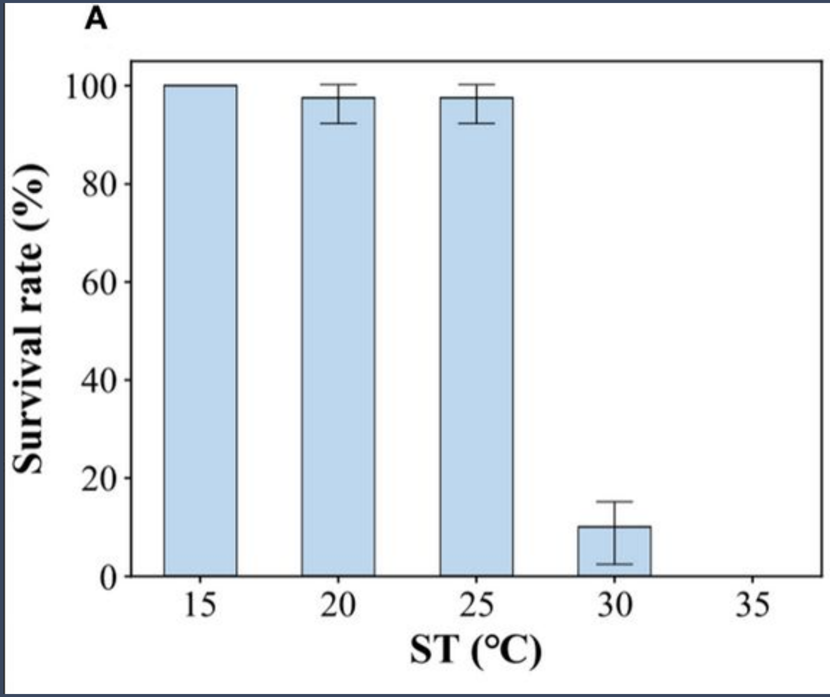

Heo et al., Frontiers in Marine Science 2023

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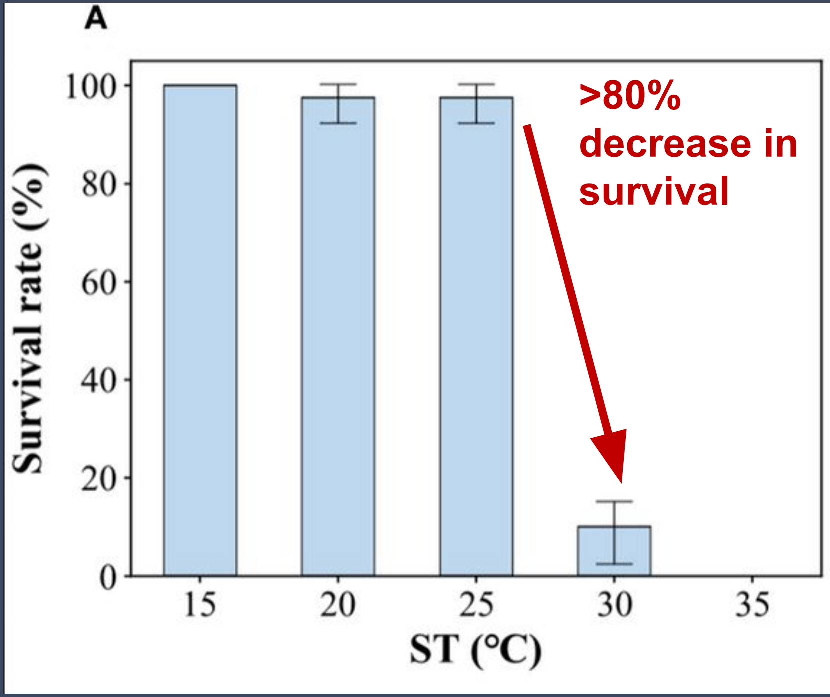

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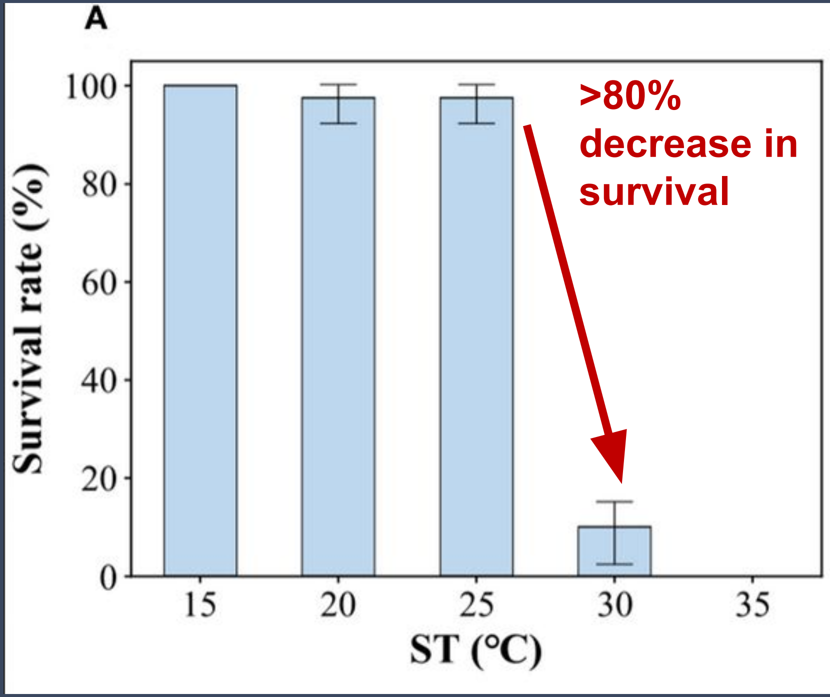

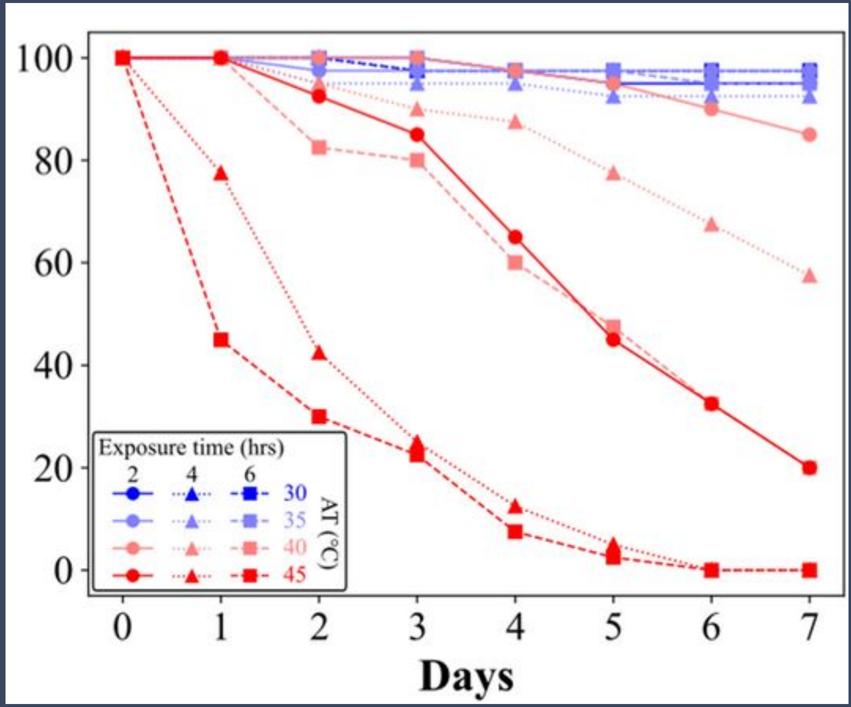

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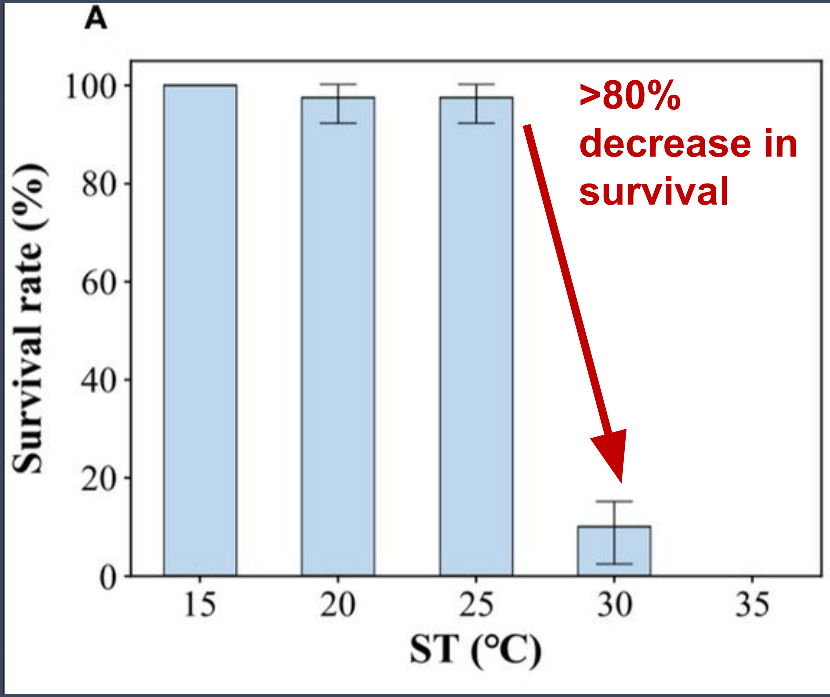

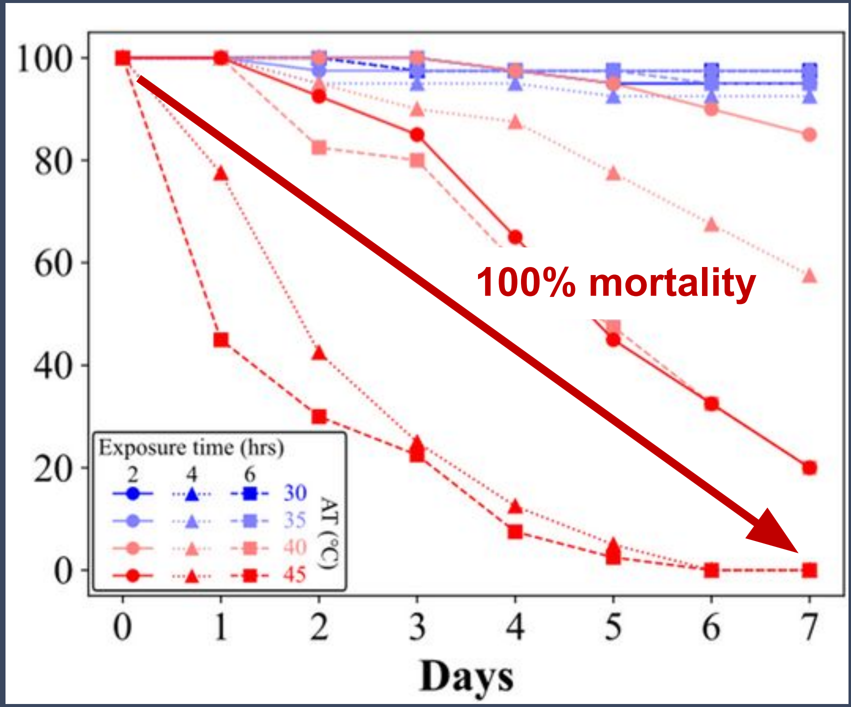

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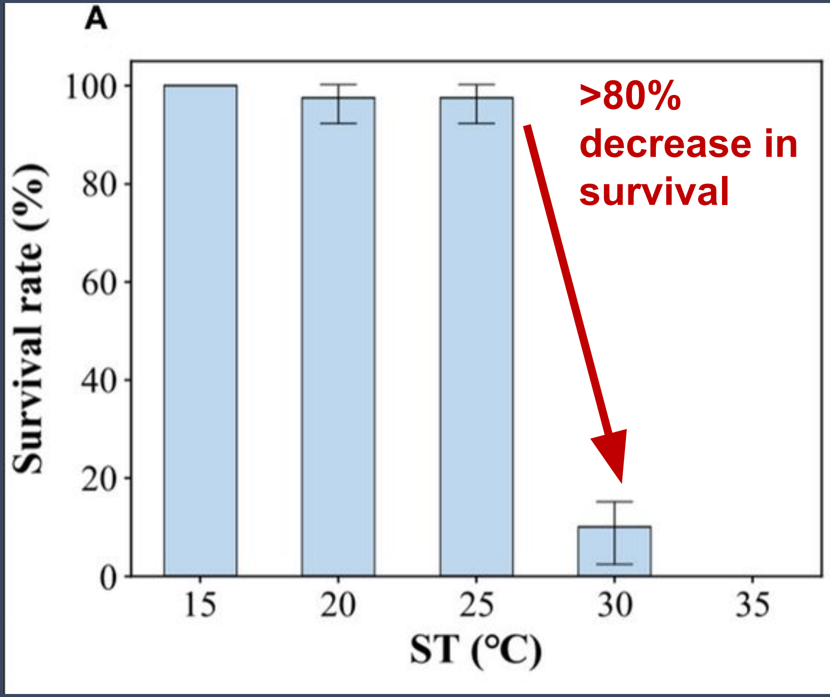

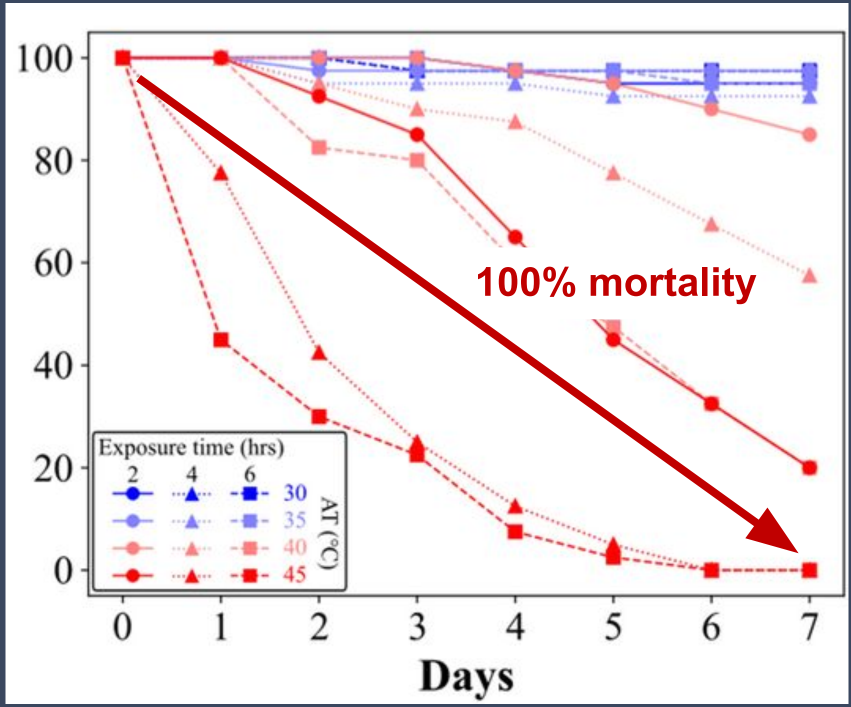

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Image credit: CNN

Oysters can buffer temperature stress until a critical point

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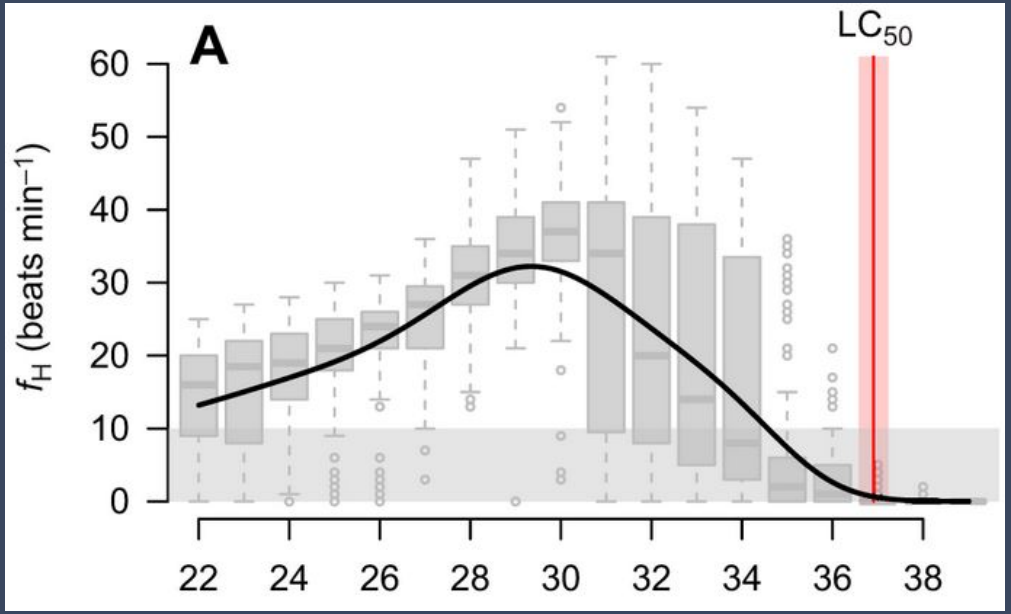
Heart rate



Götze et al., JEB 2025

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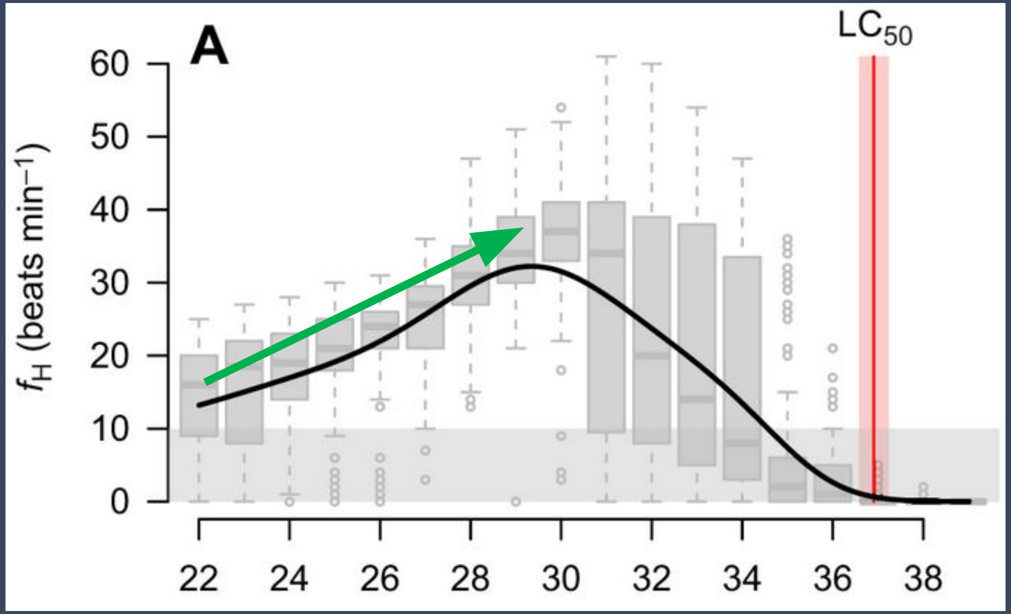

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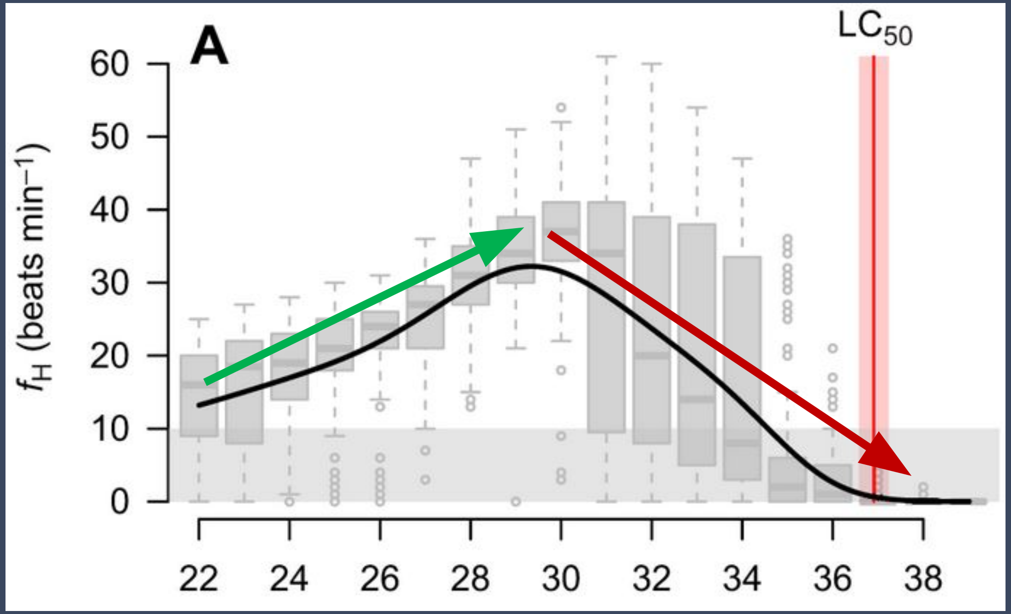

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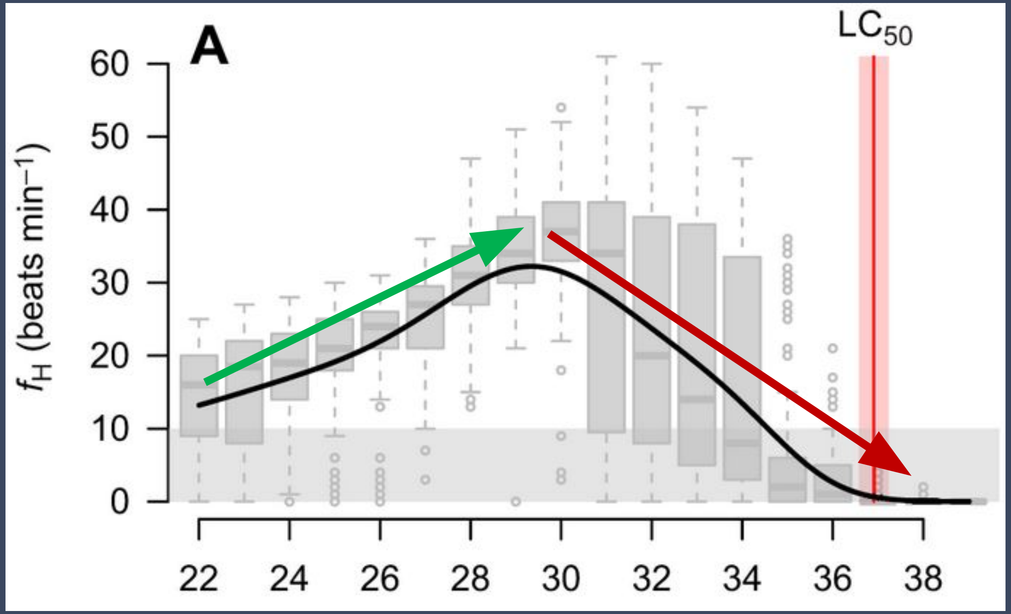
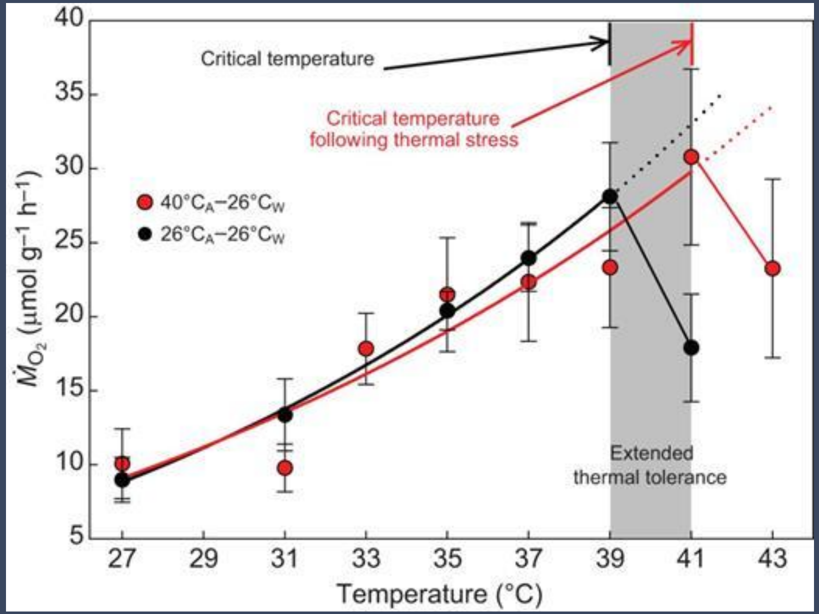


Respiration



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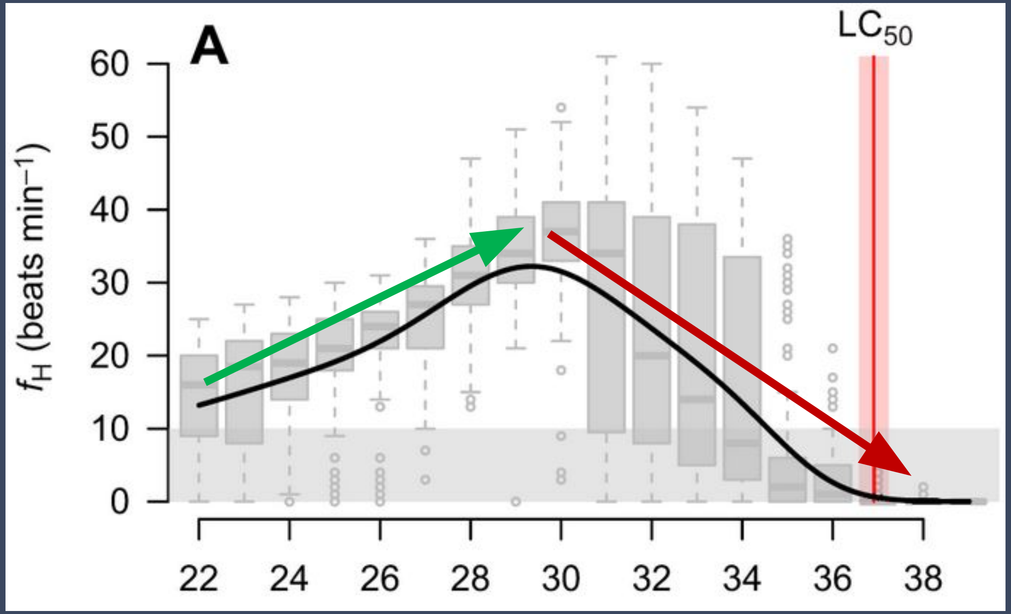

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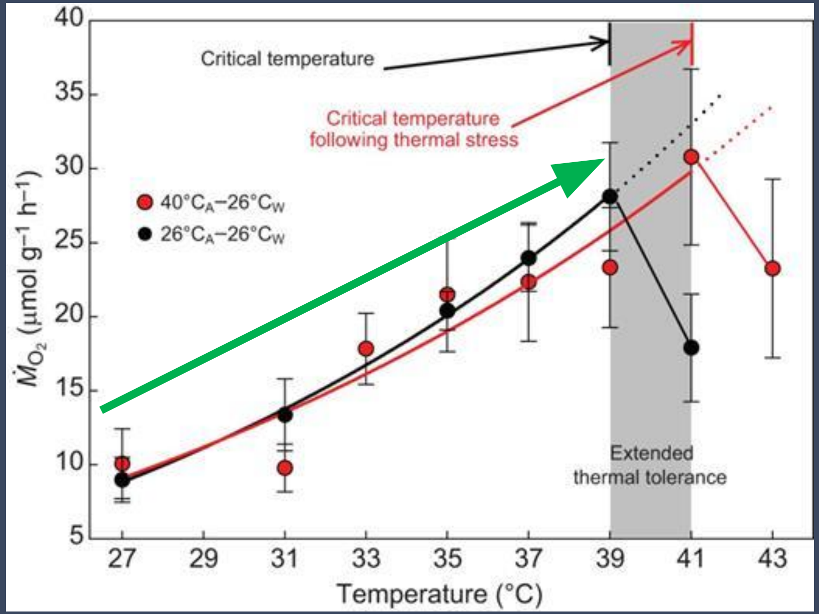

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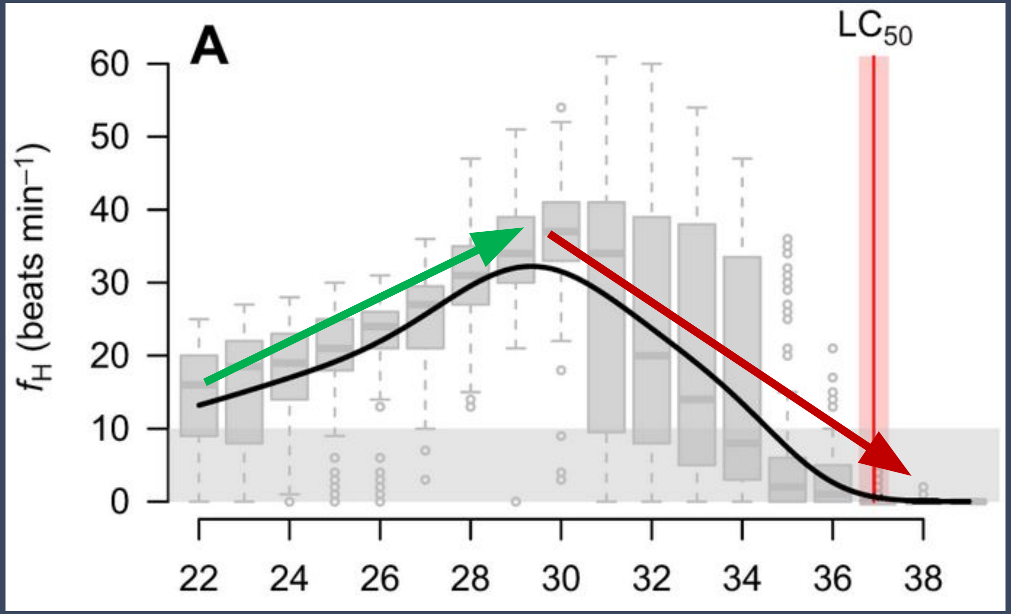

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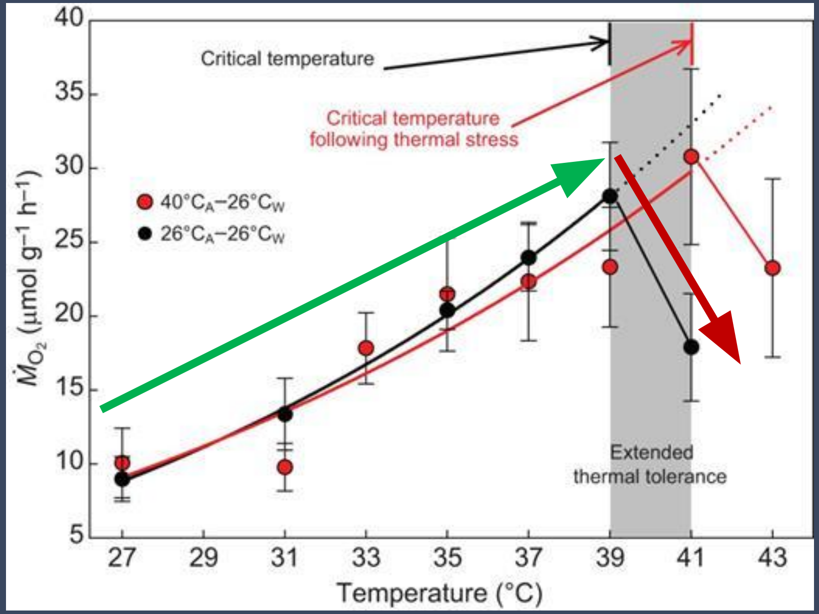

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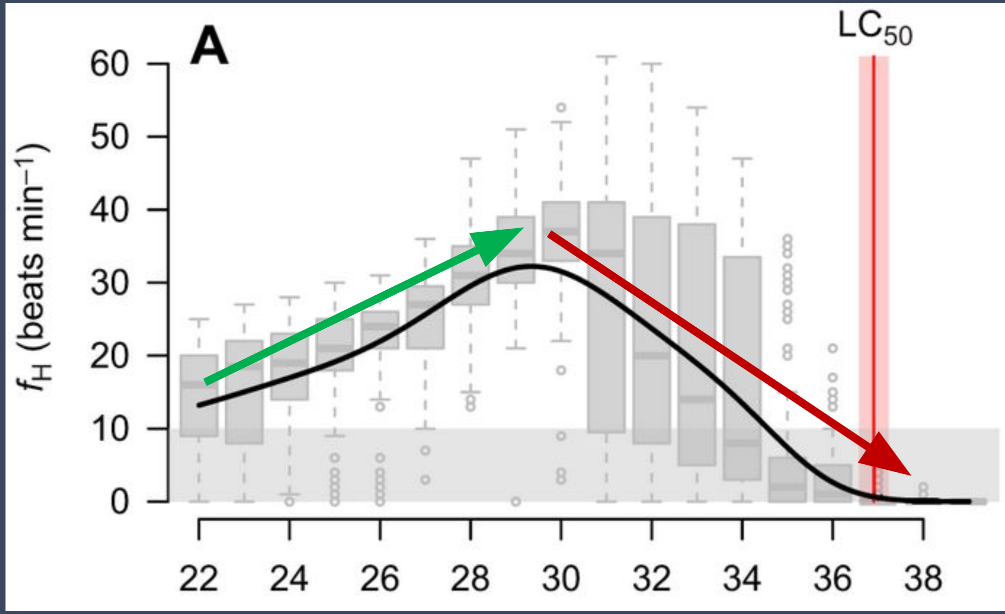

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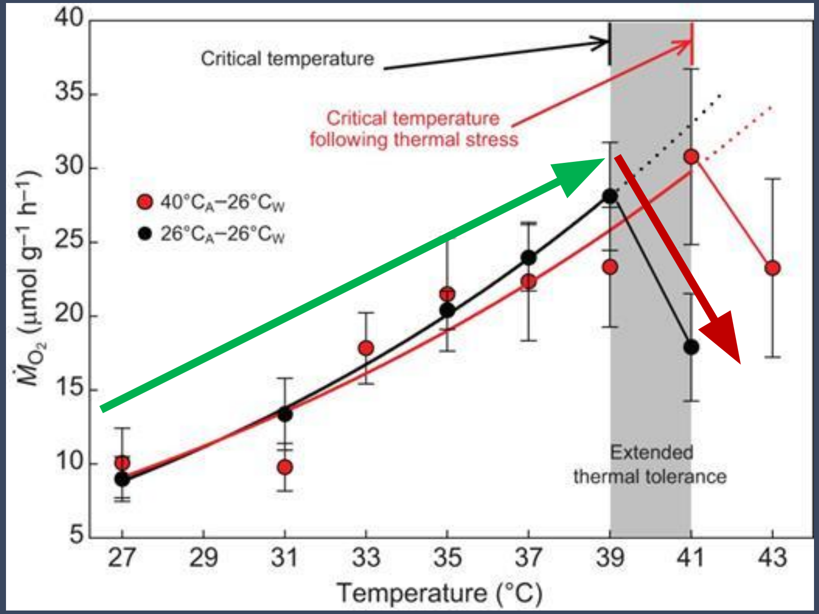
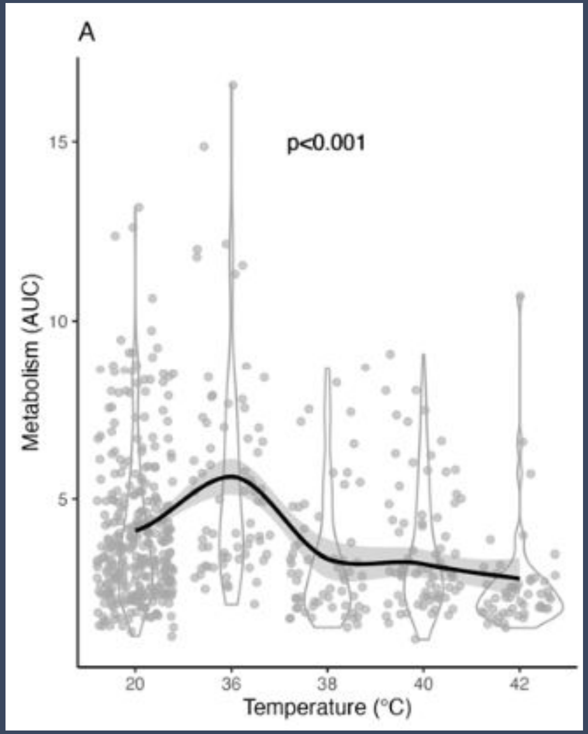


Metabolism



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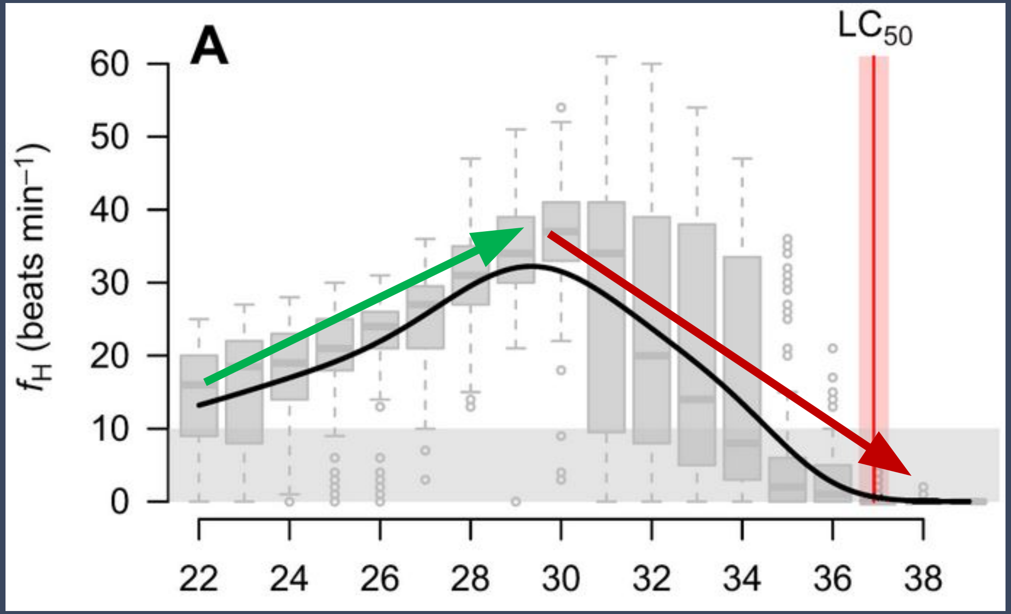

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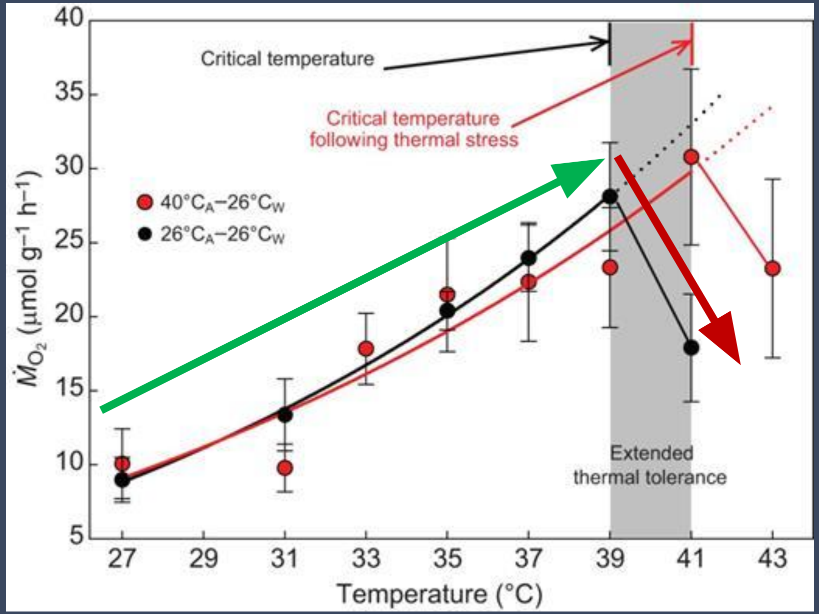

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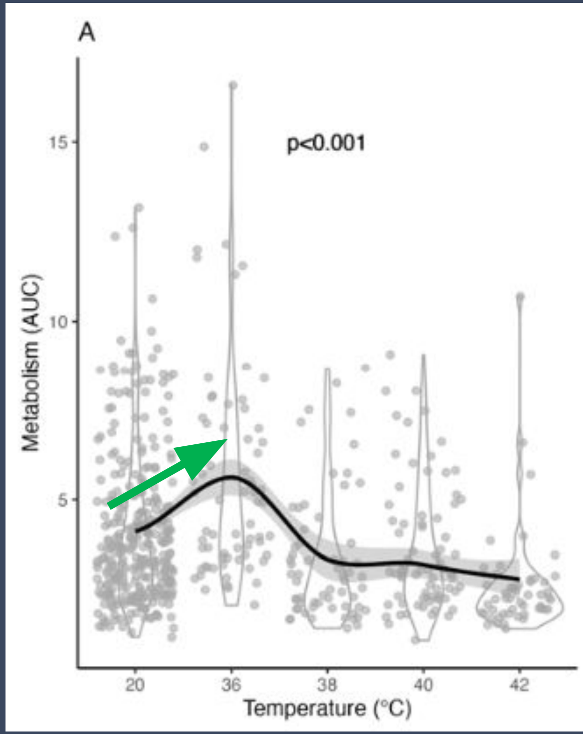

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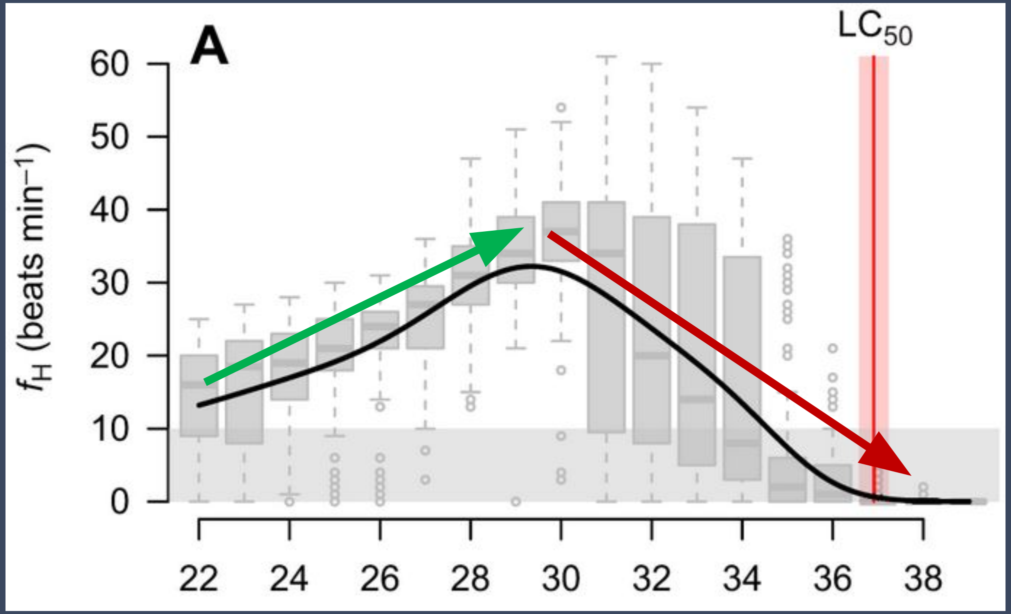

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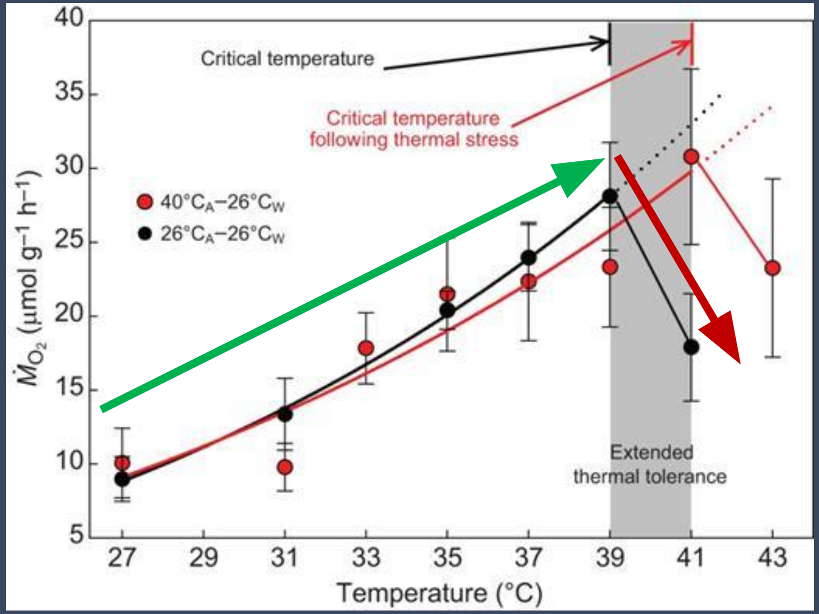

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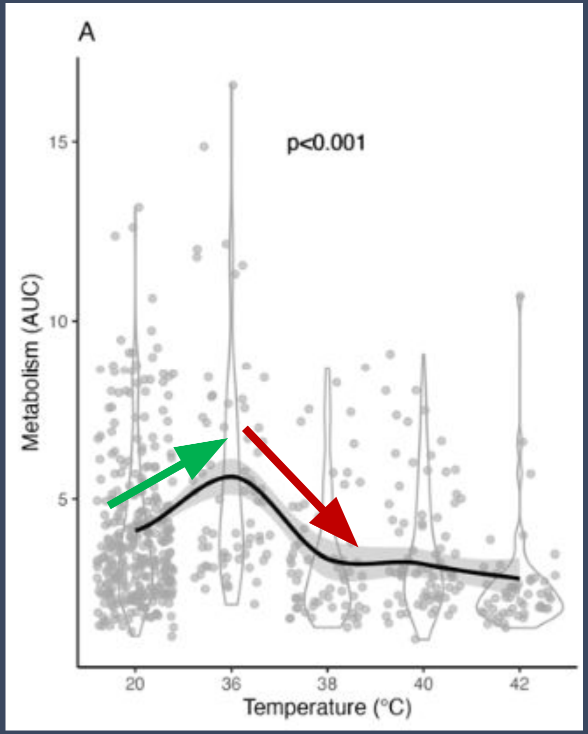

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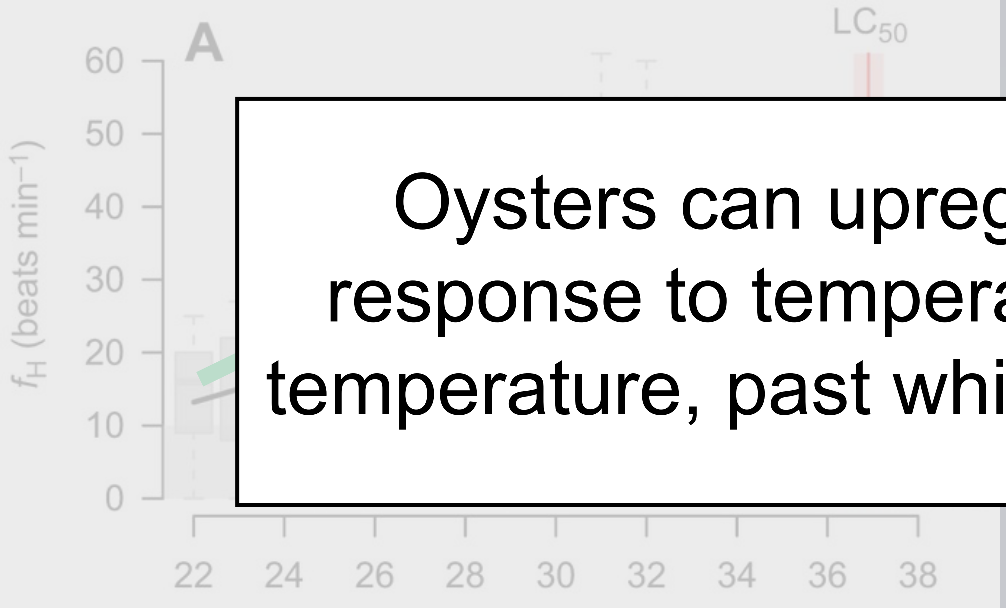

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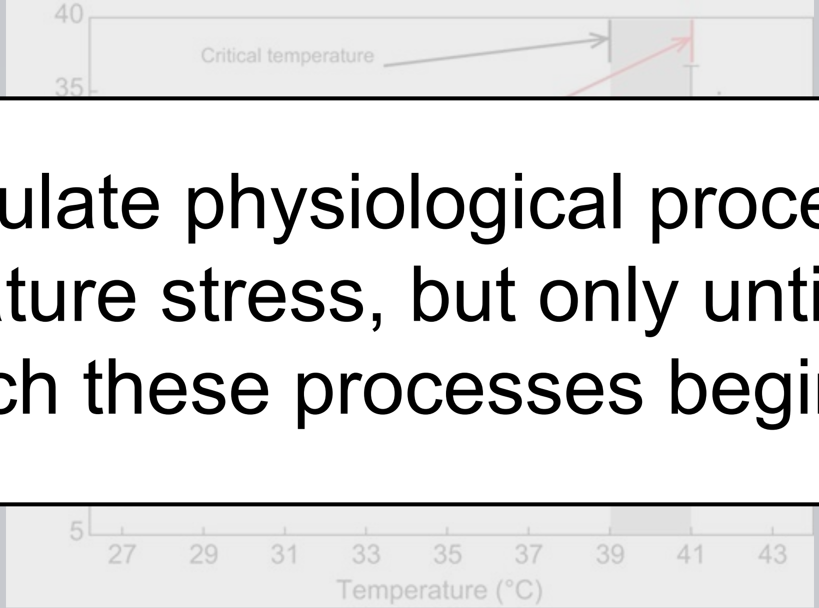

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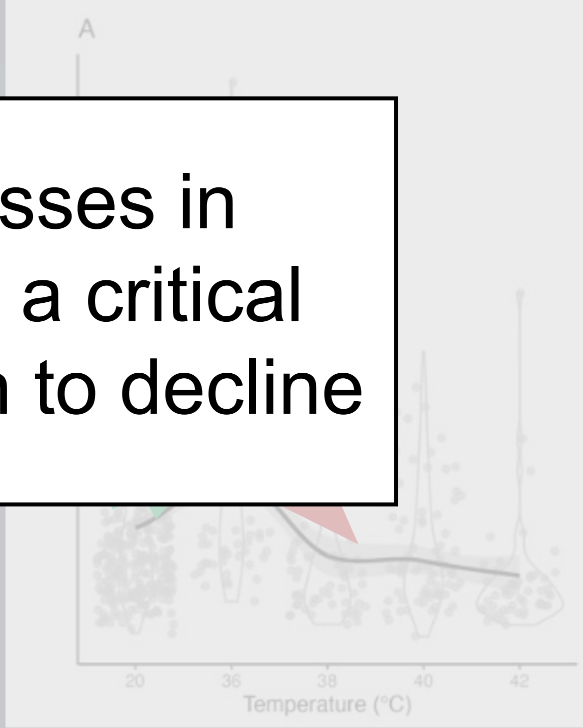

Oysters can upregulate physiological processes in response to temperature stress, but only until a critical temperature, past which these processes begin to decline

Götze et al., JEB 2025

Giomi et al., JEB 2016

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Storage form of glucose

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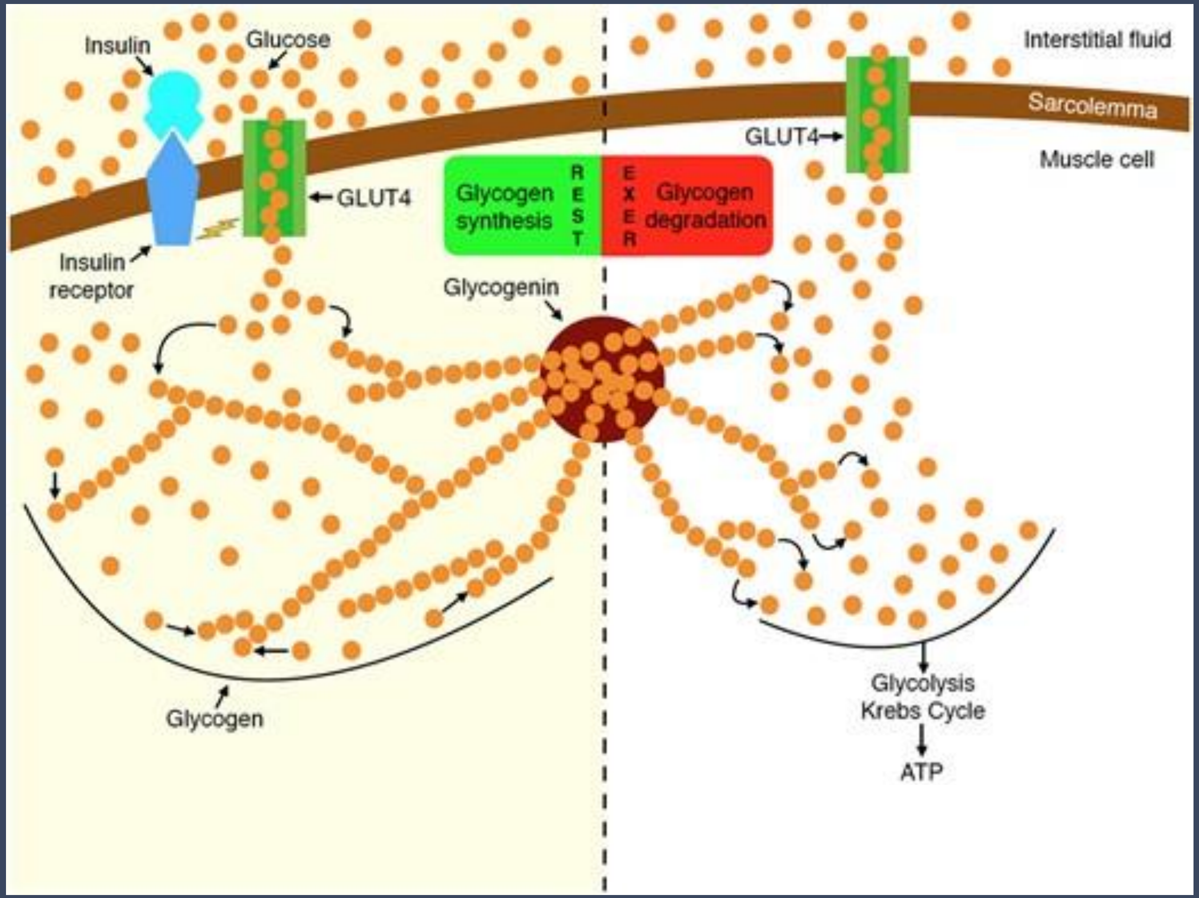

Murray and Rosenbloom, Nutrition Reviews 2018

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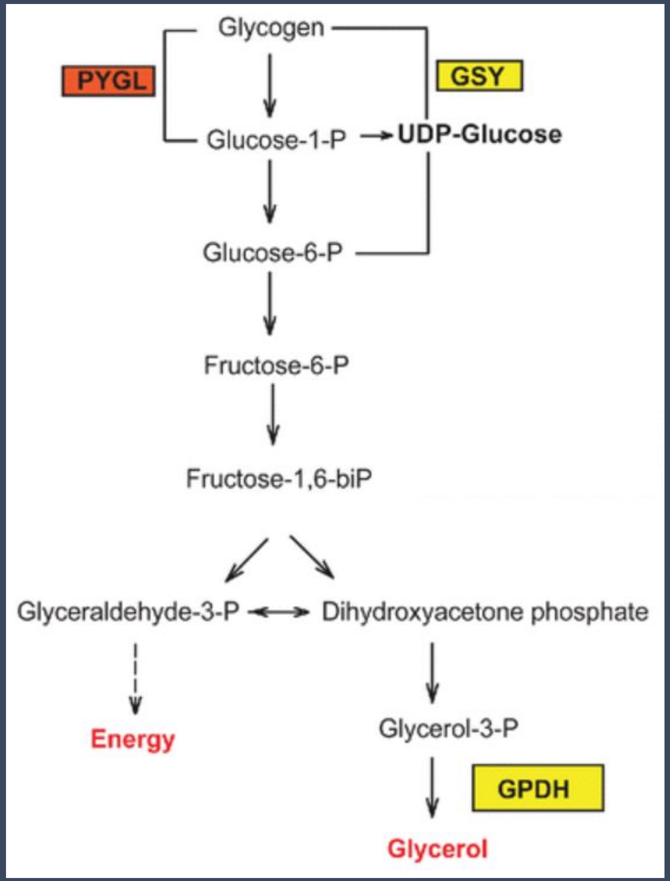

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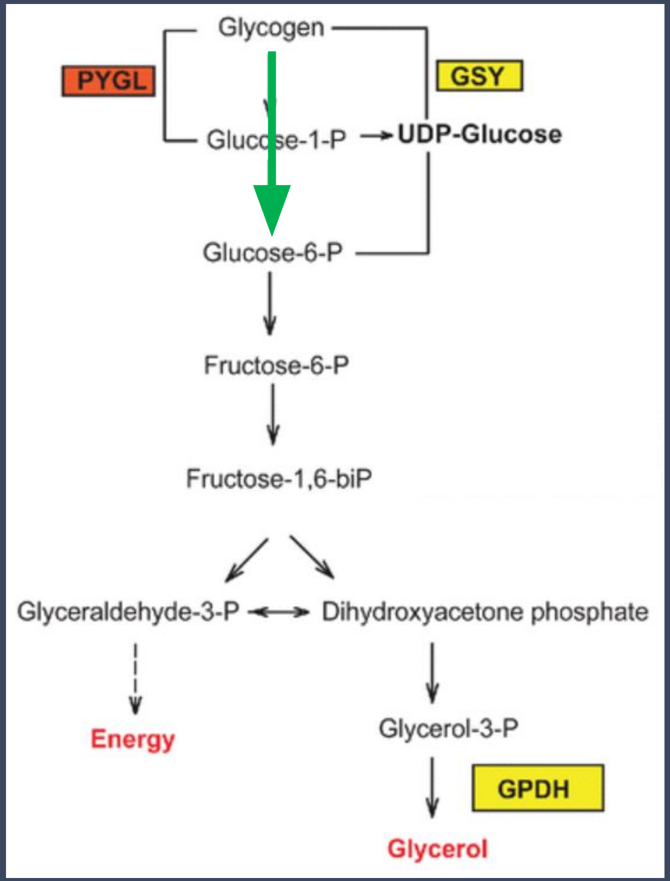

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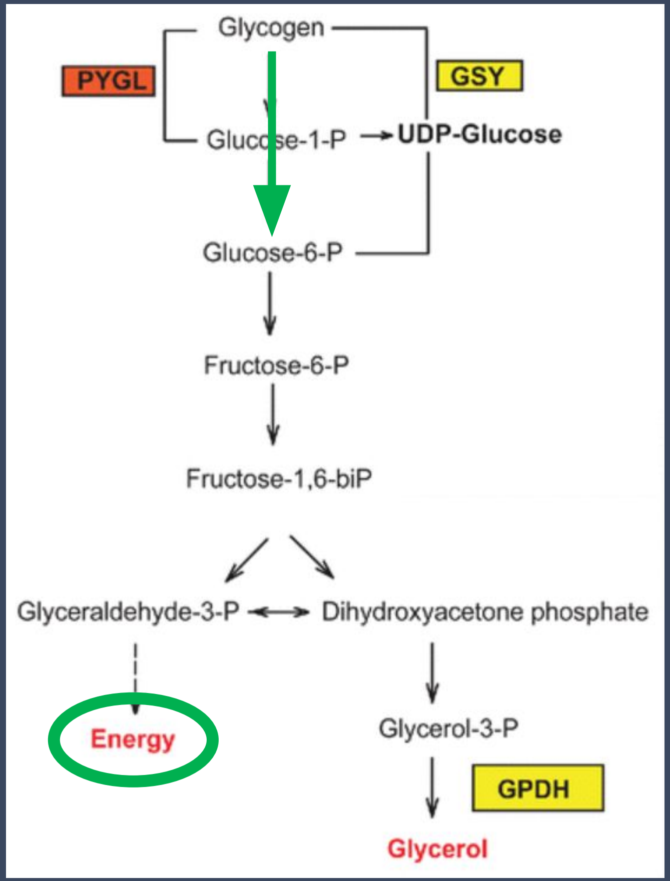

Possik and Prose, Worm 2016

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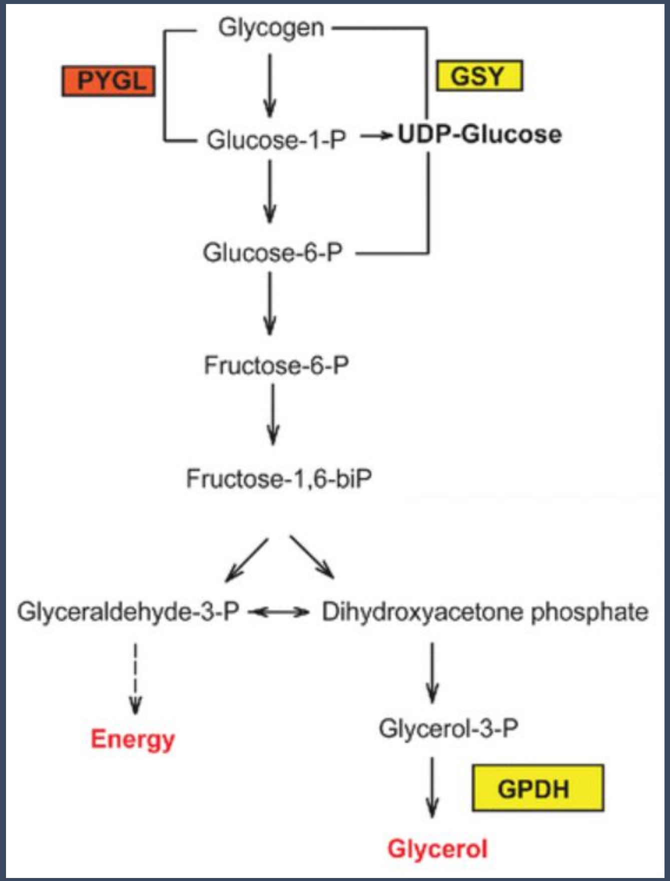

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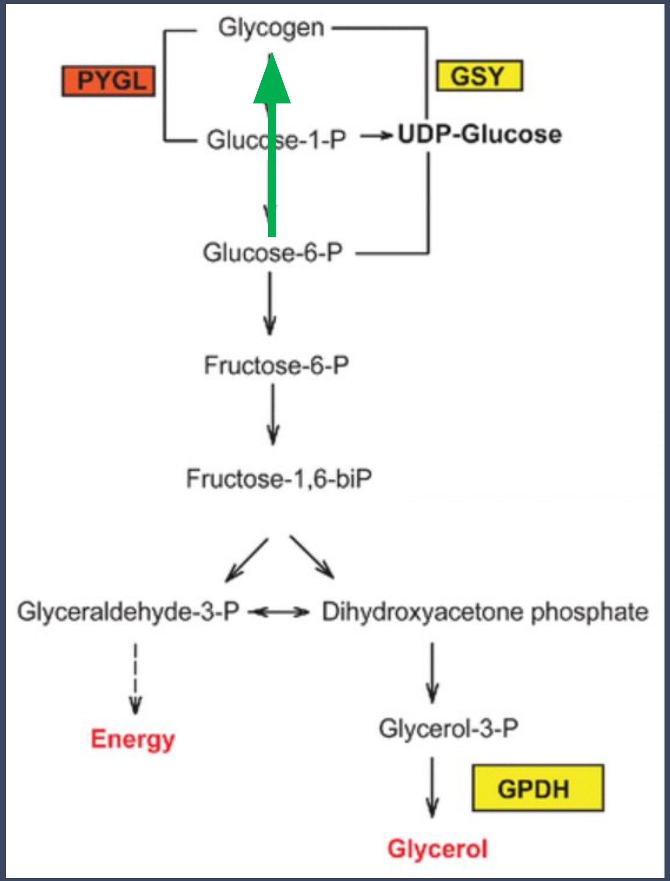

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Glycogen-Glo assay

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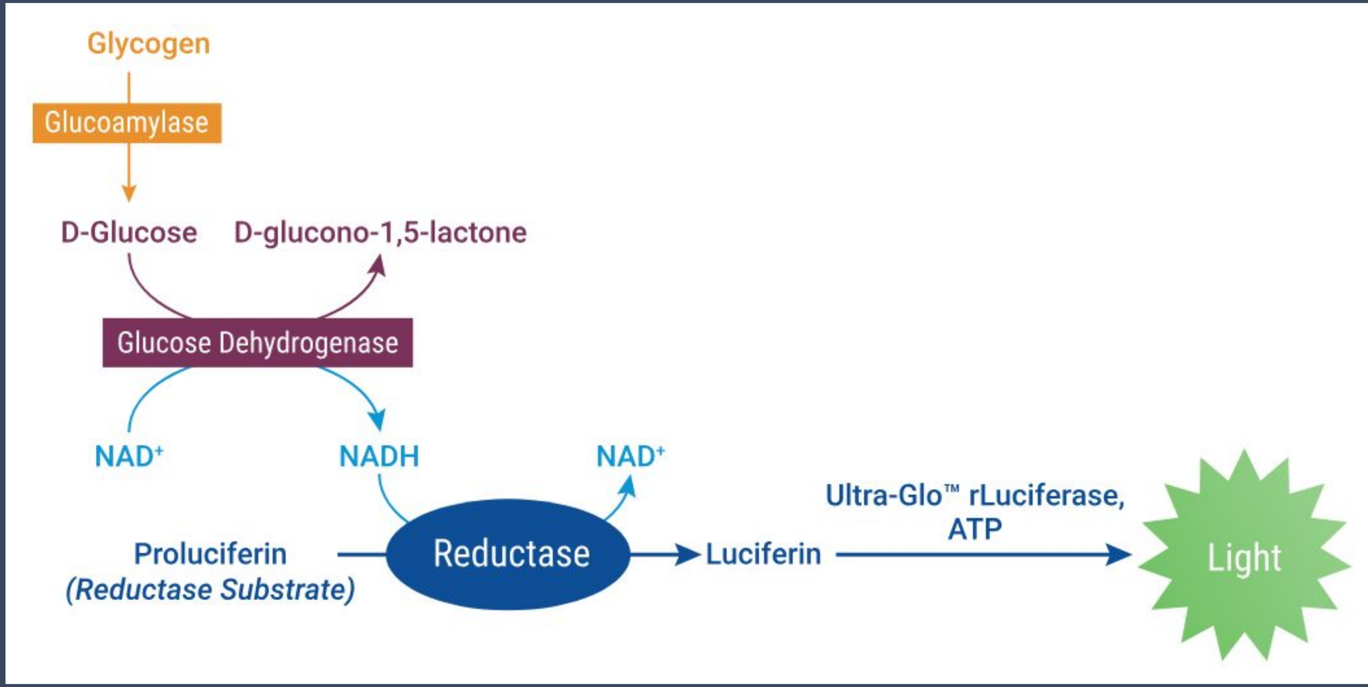

Image credit: Promega

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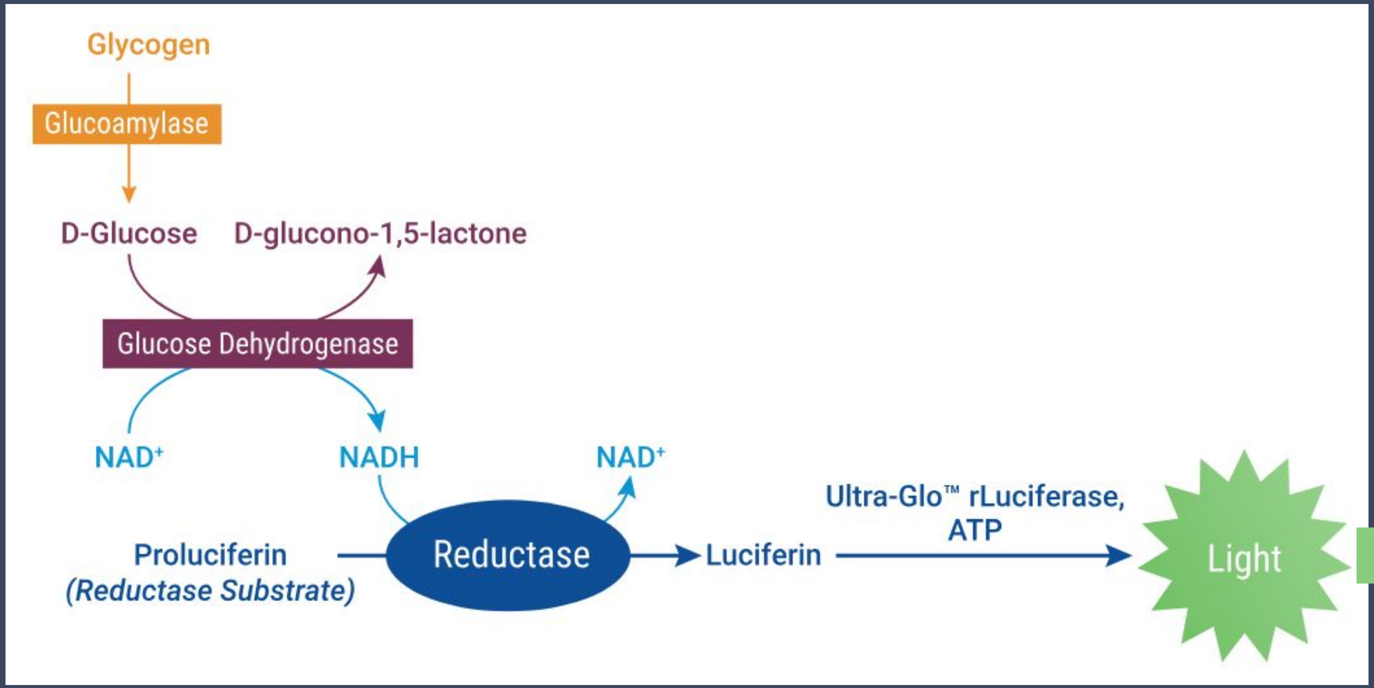

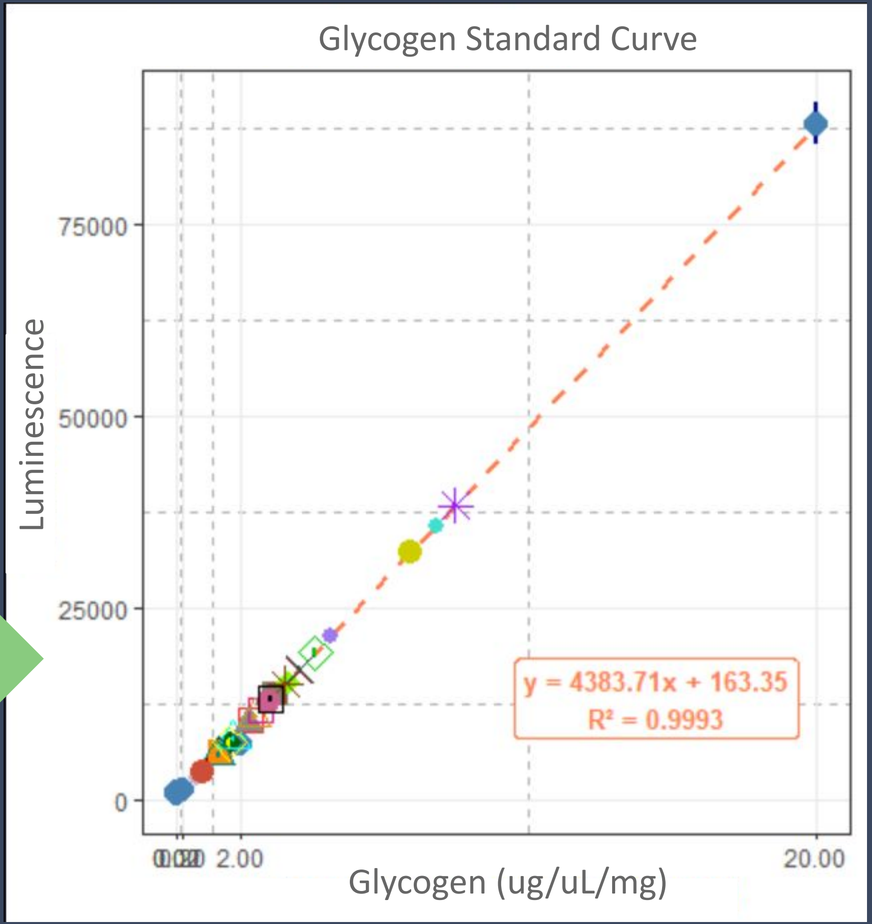

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Preliminary temperature stress experiment

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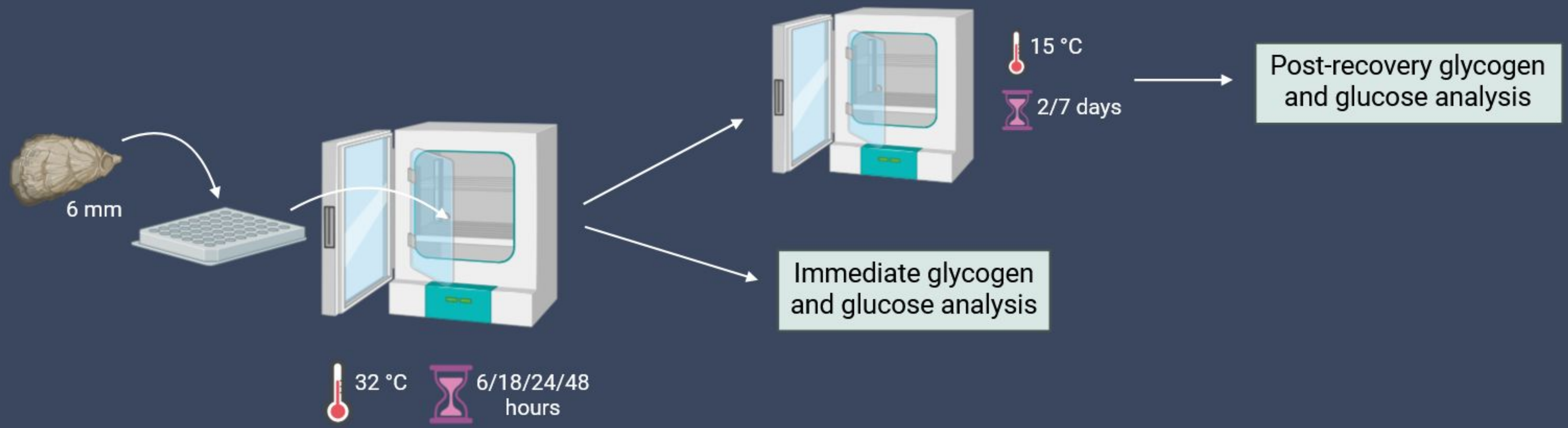

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Preliminary results – 48-hour exposure to 32 ^{0}C may lead to decreased glycogen levels

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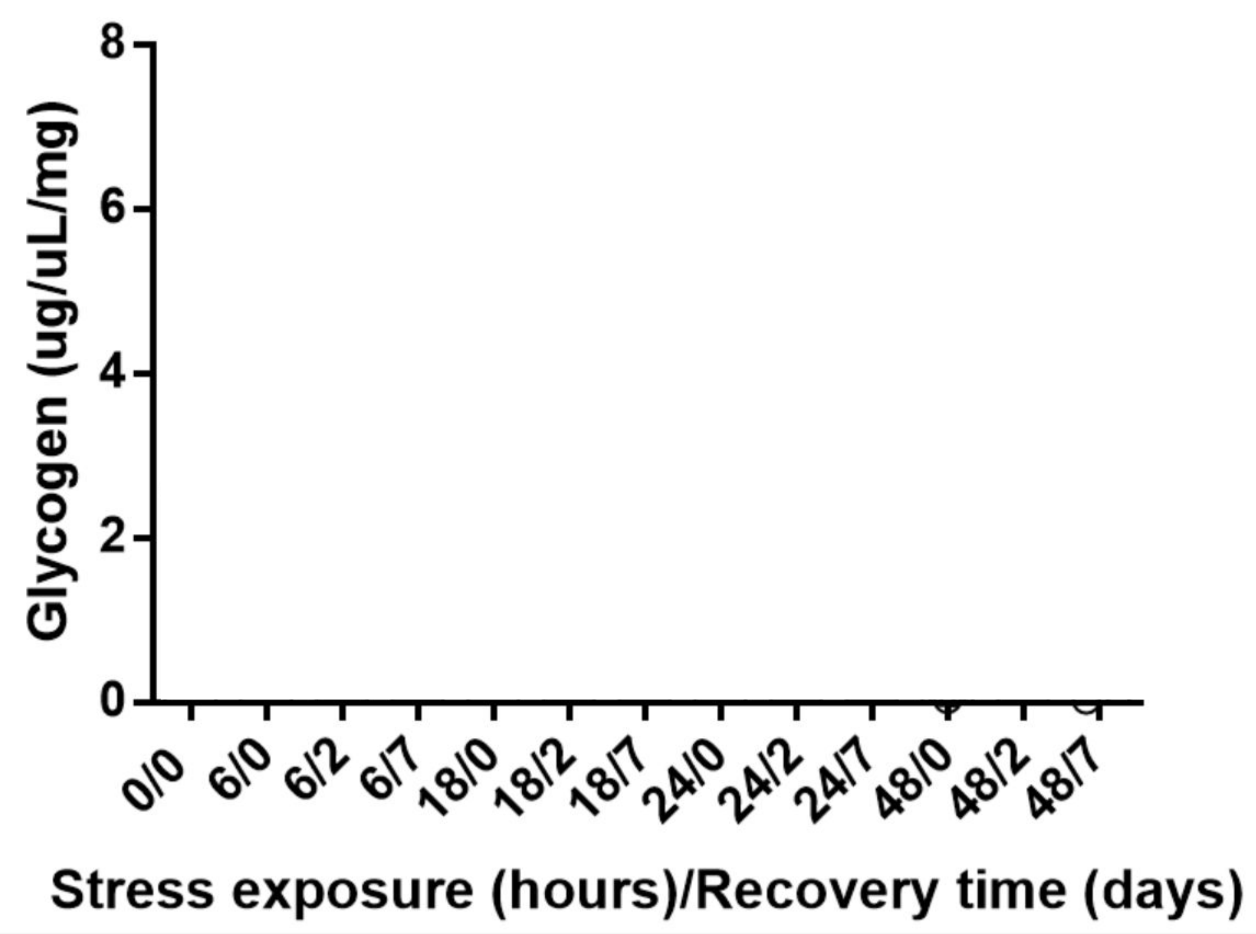

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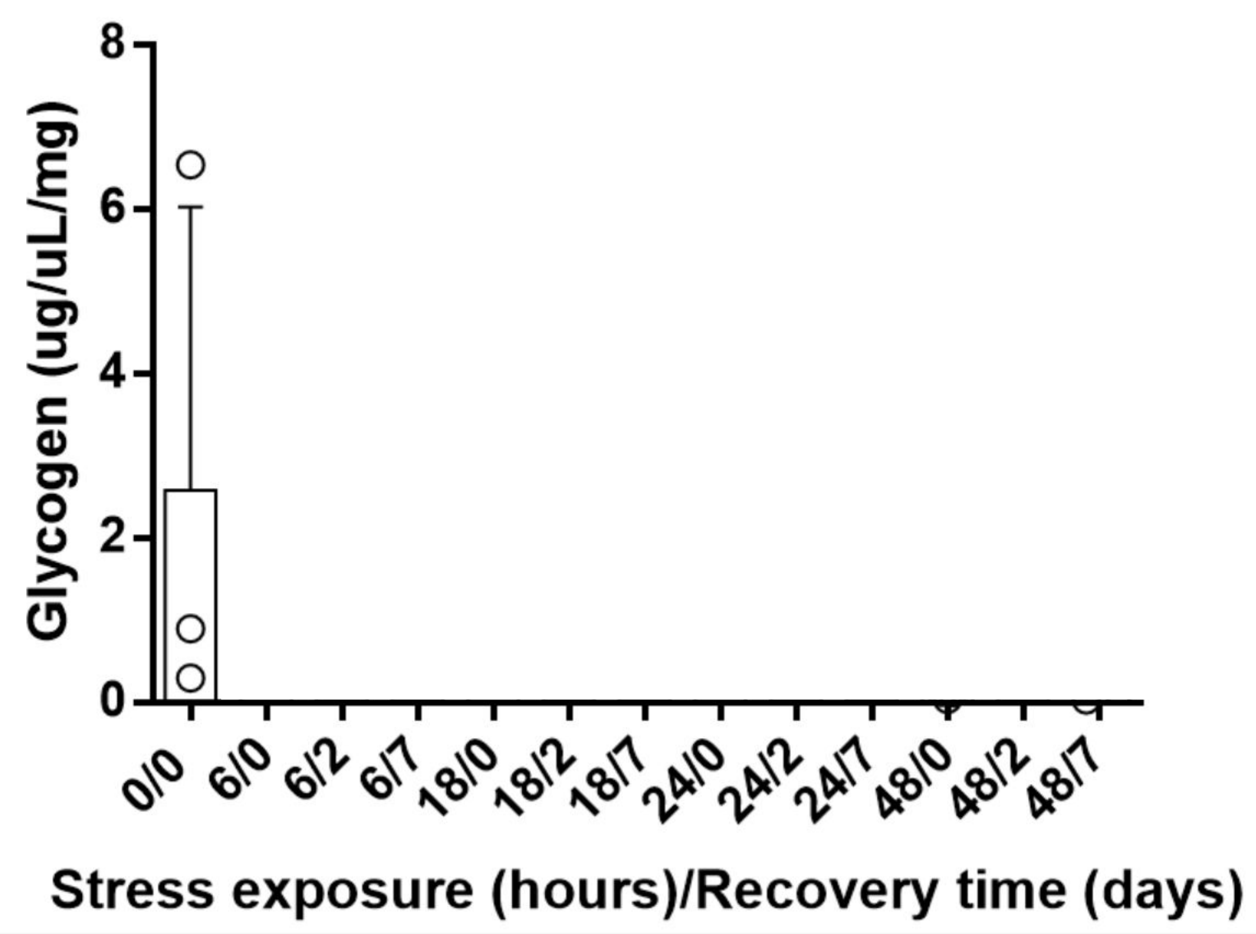

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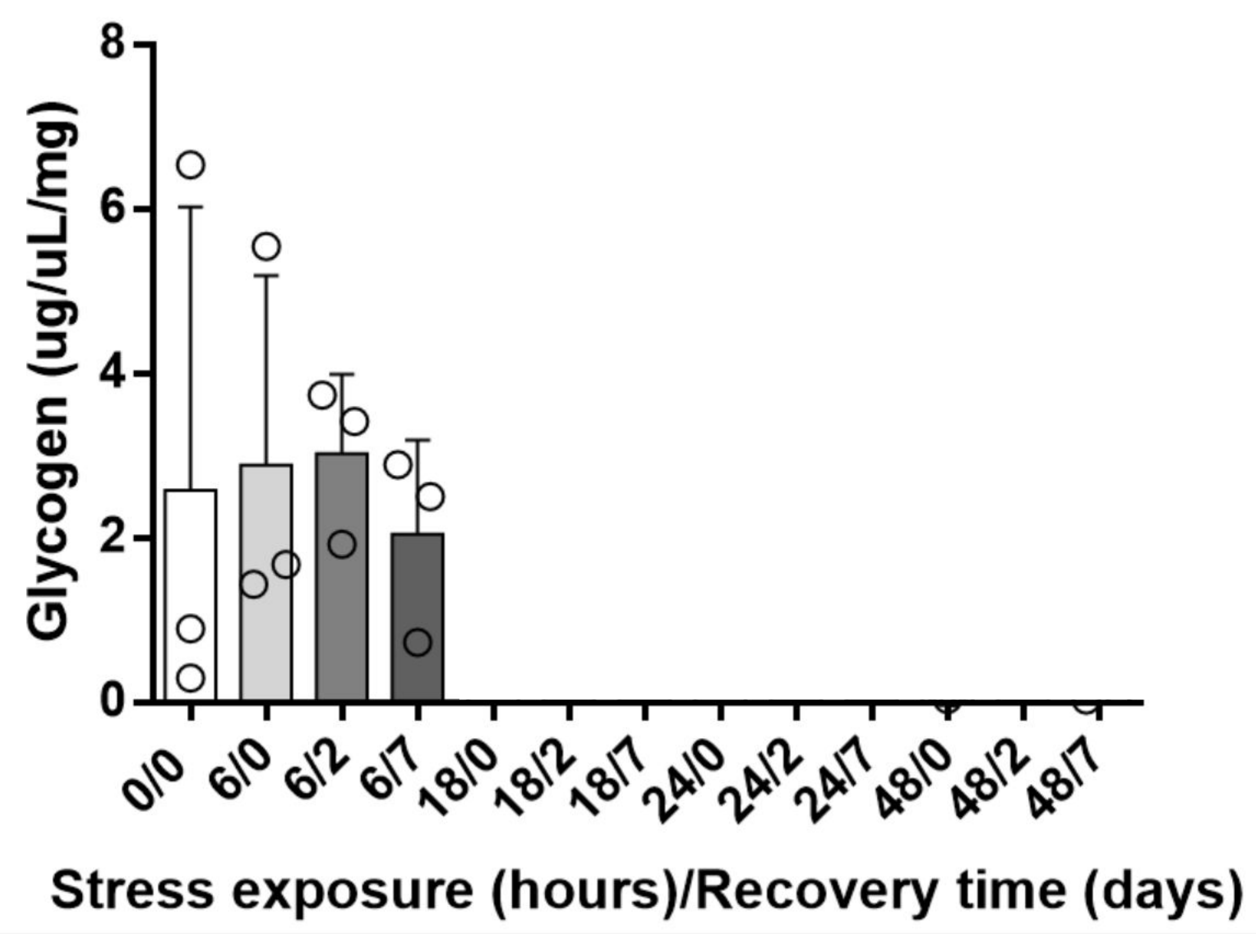

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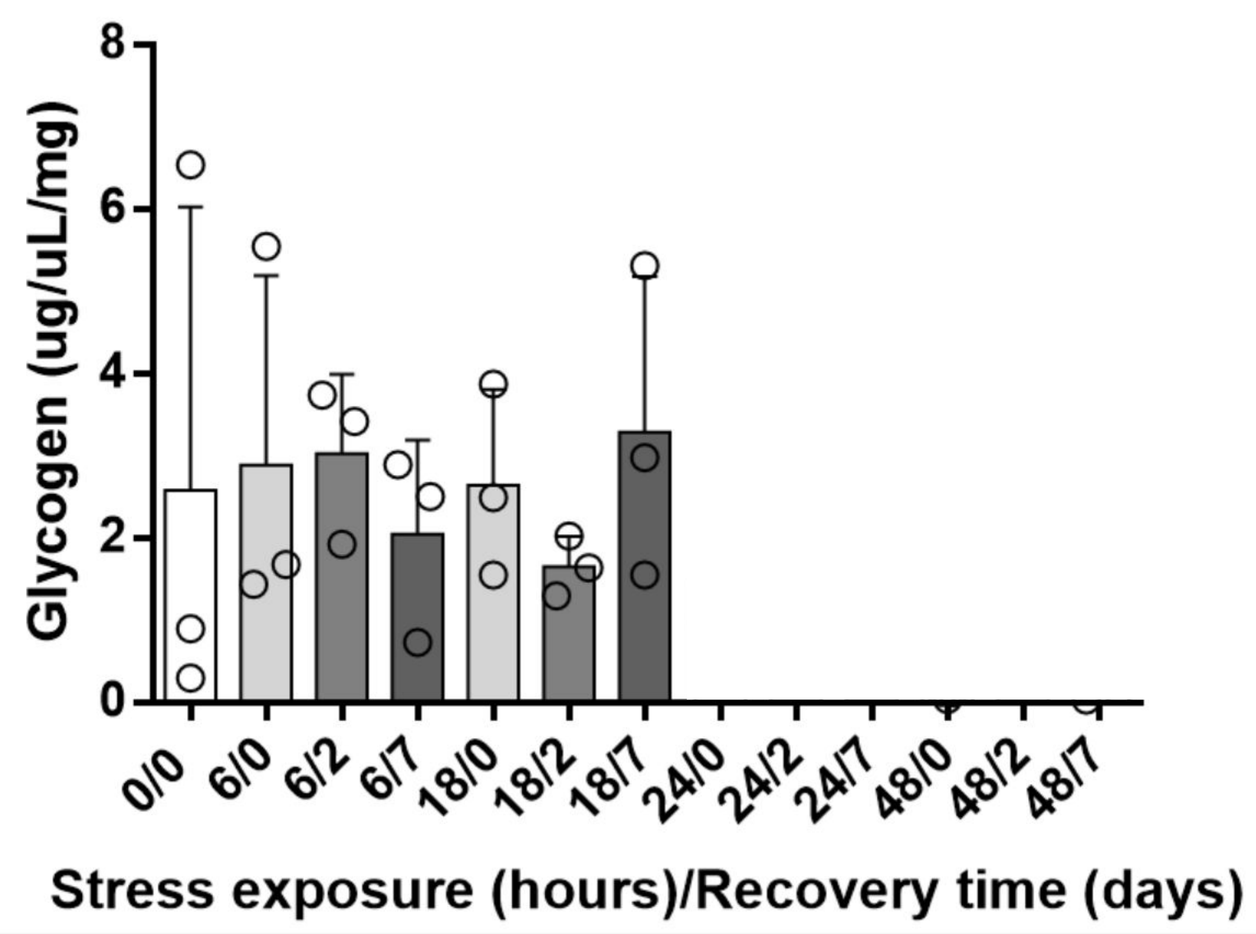

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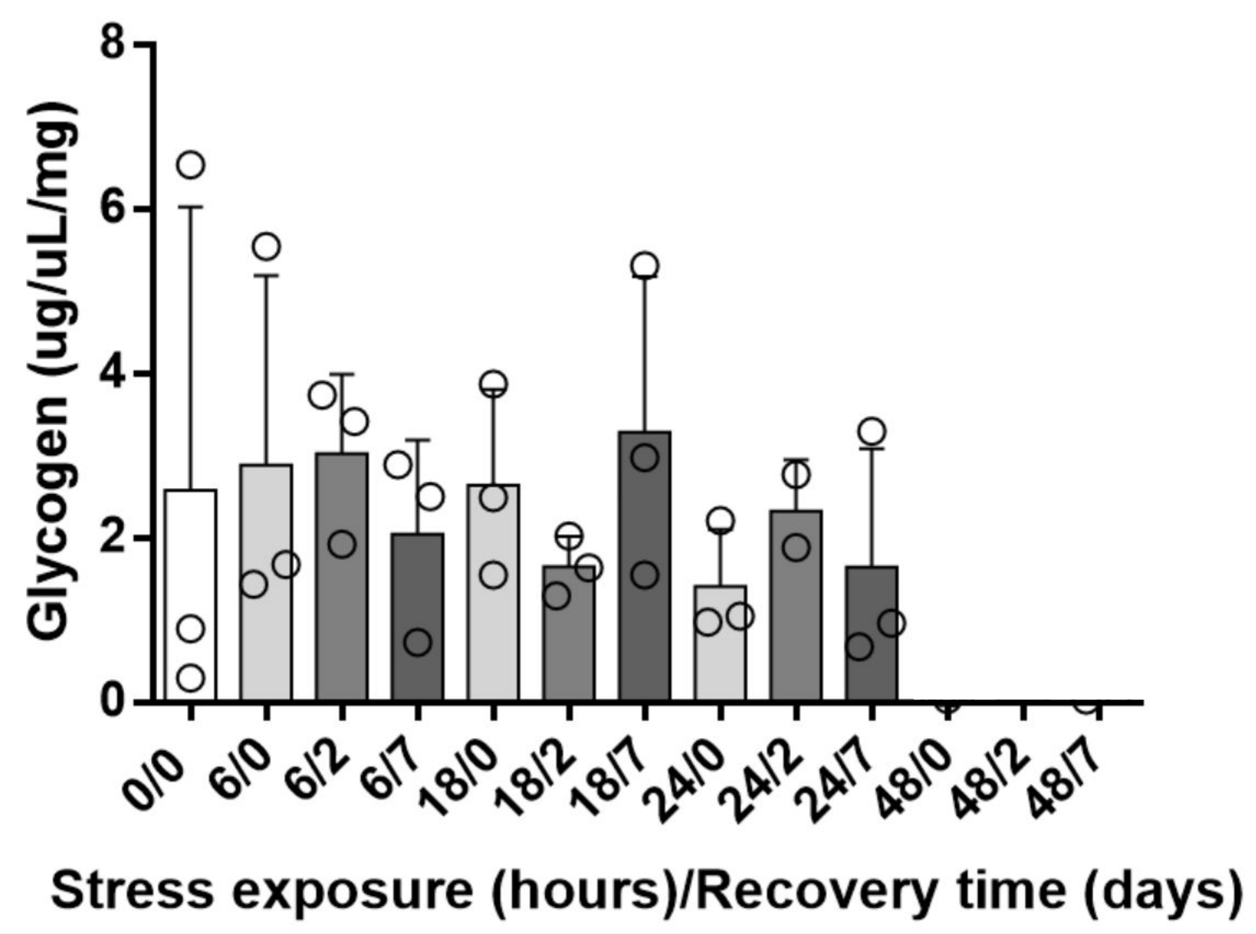

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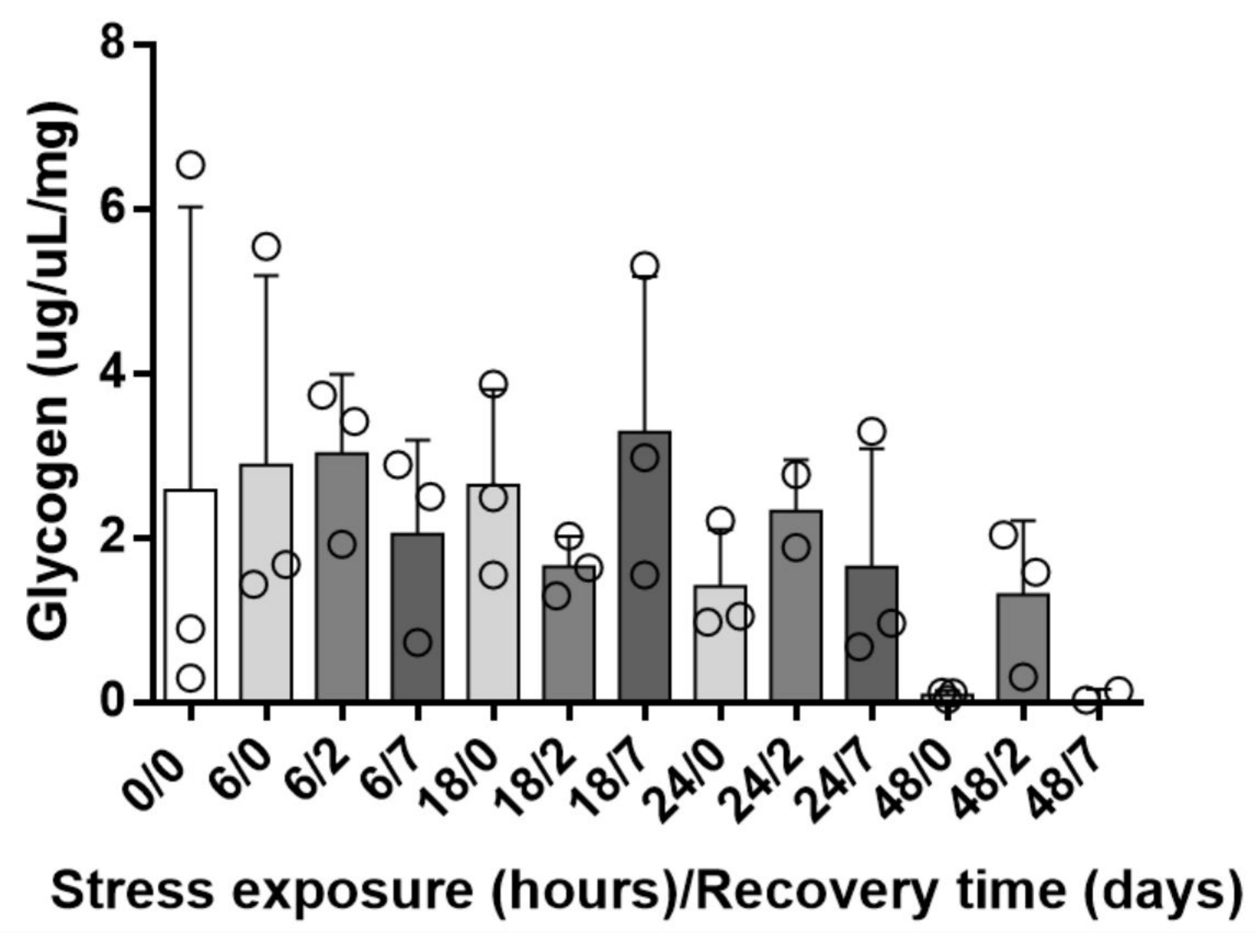

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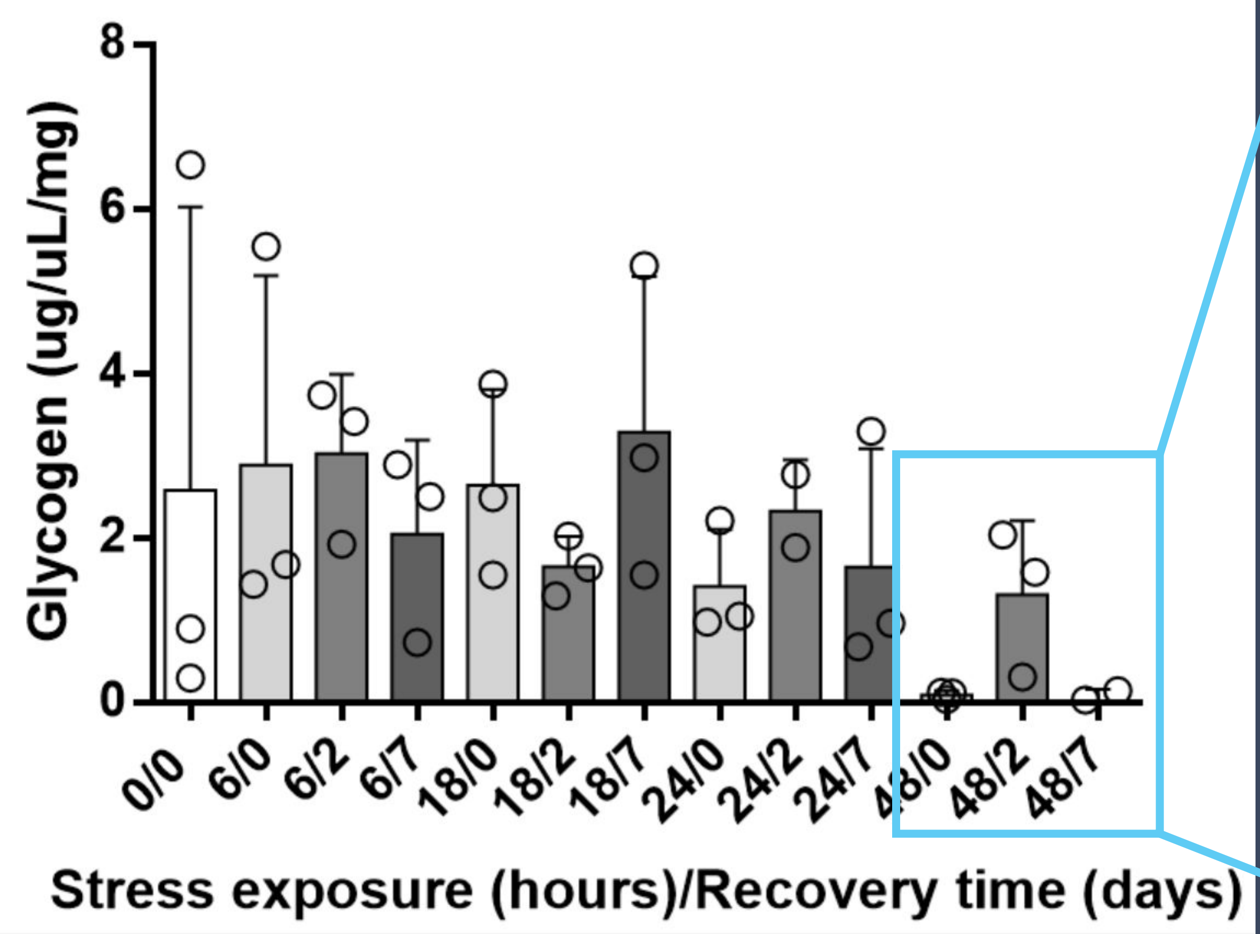

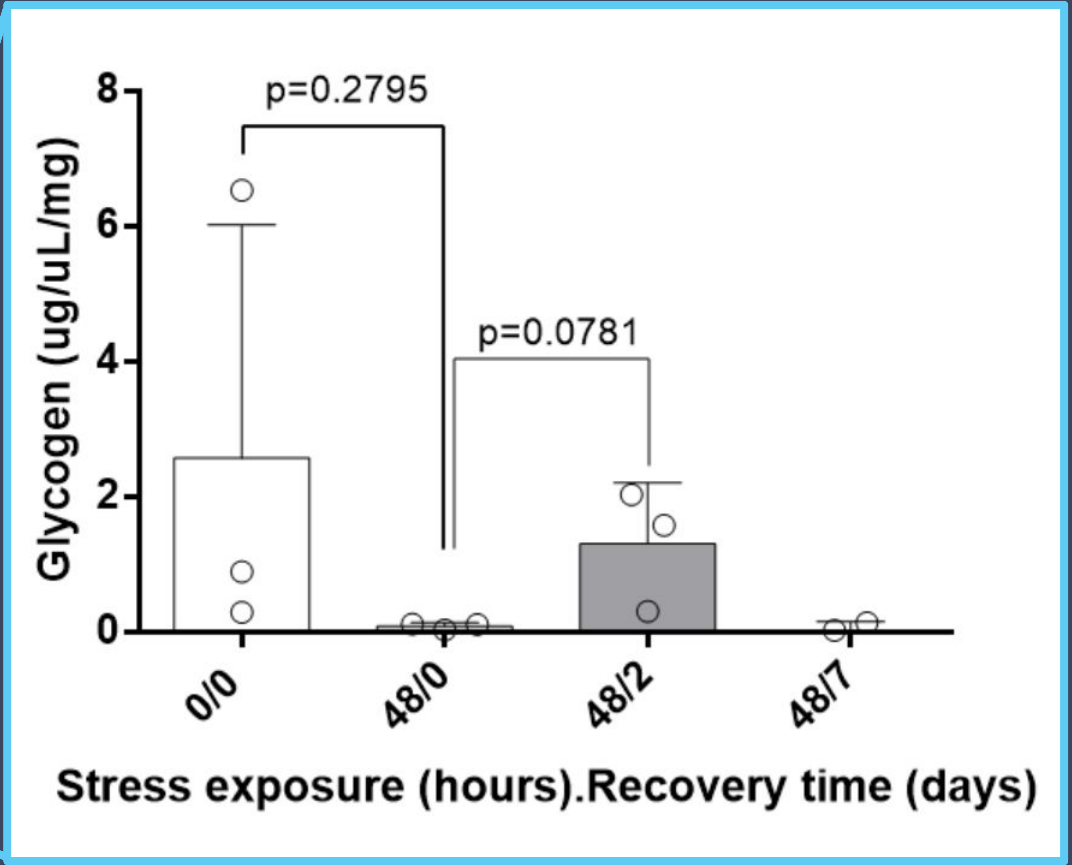

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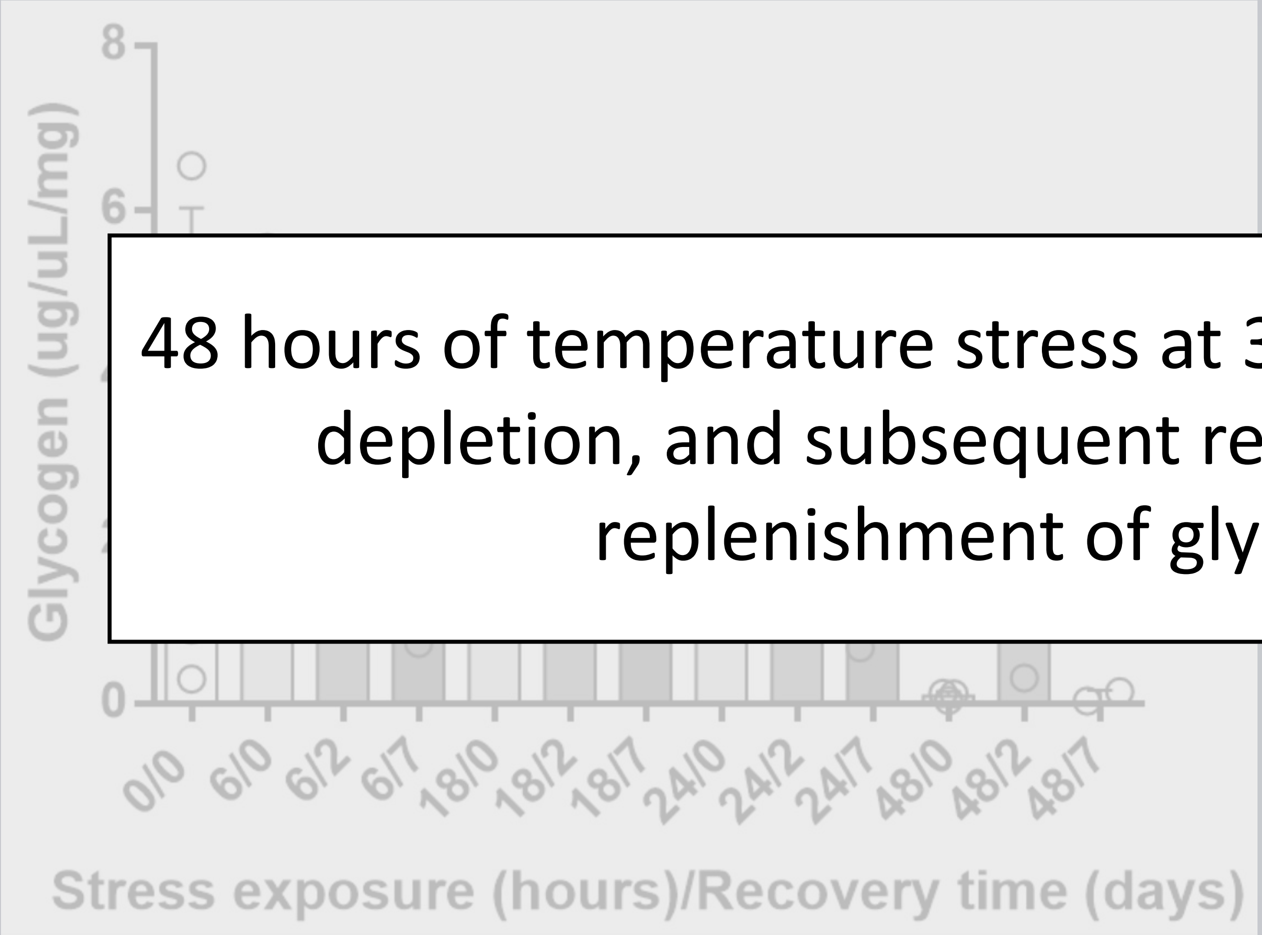

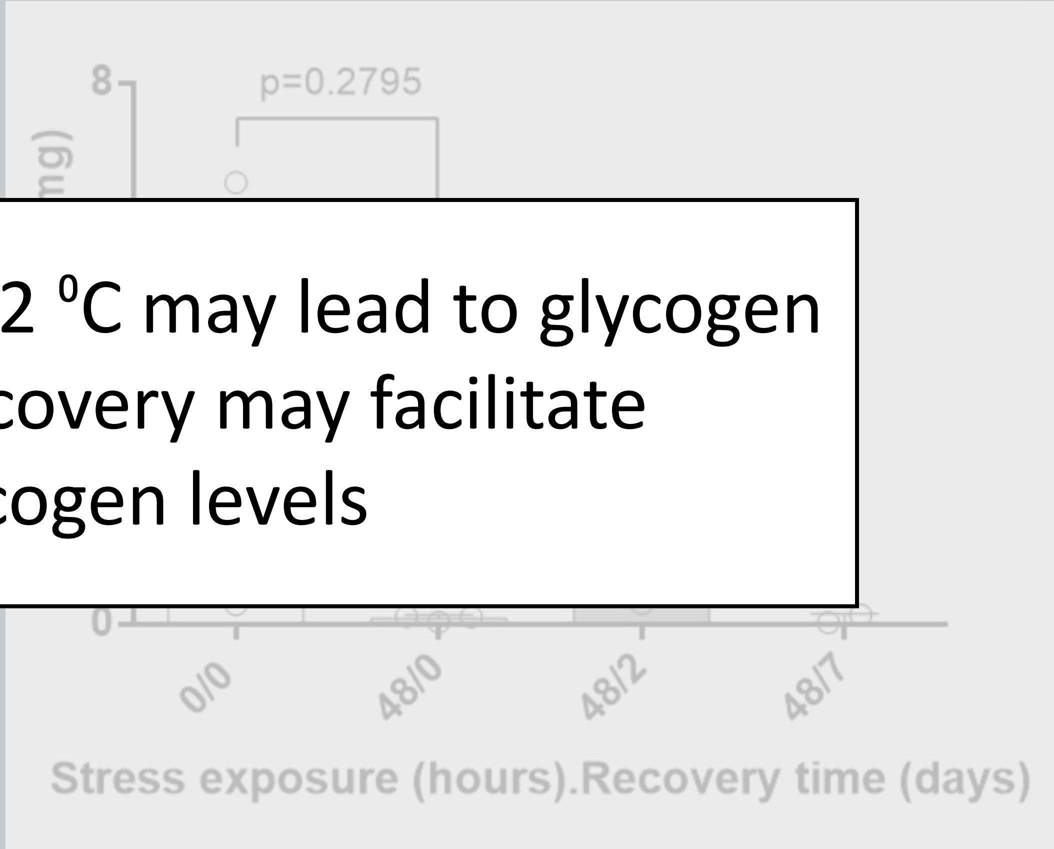

48 hours of temperature stress at 32 ^{0}C may lead to glycogen depletion, and subsequent recovery may facilitate replenishment of glycogen levels

48-hour heat stress leads to decreased glycogen levels, stores replenish during recovery

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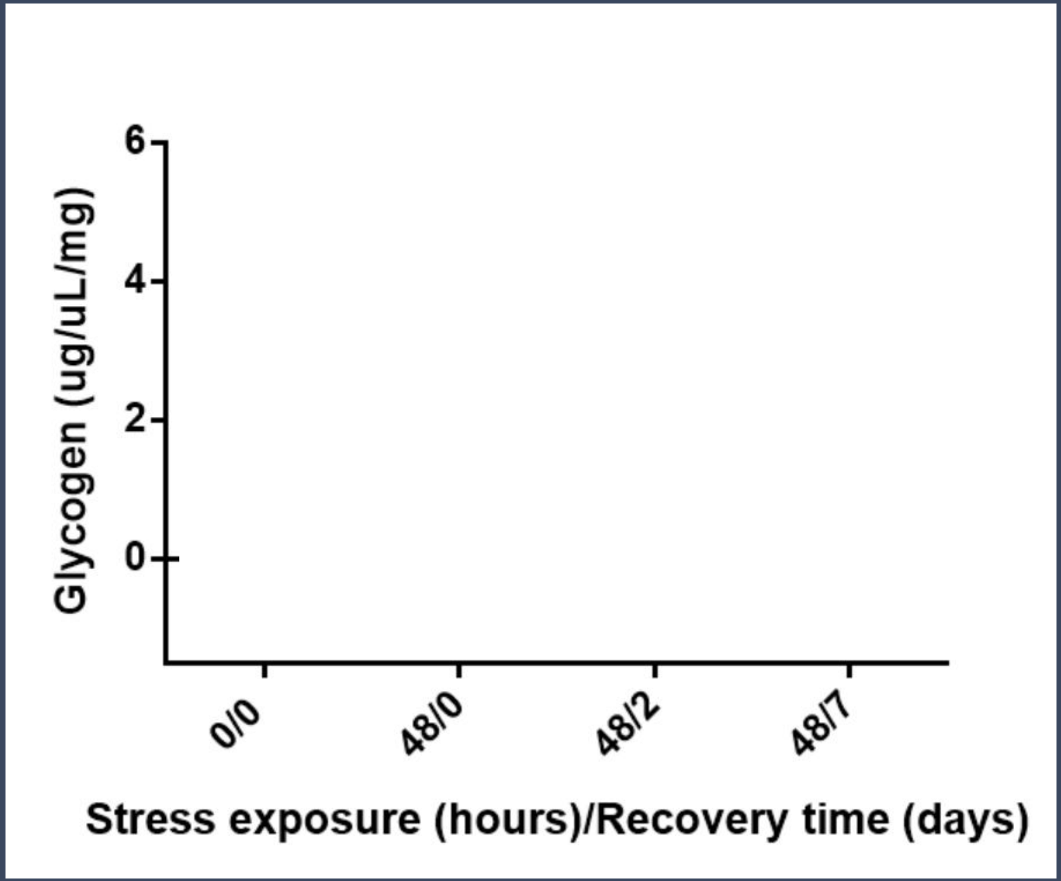

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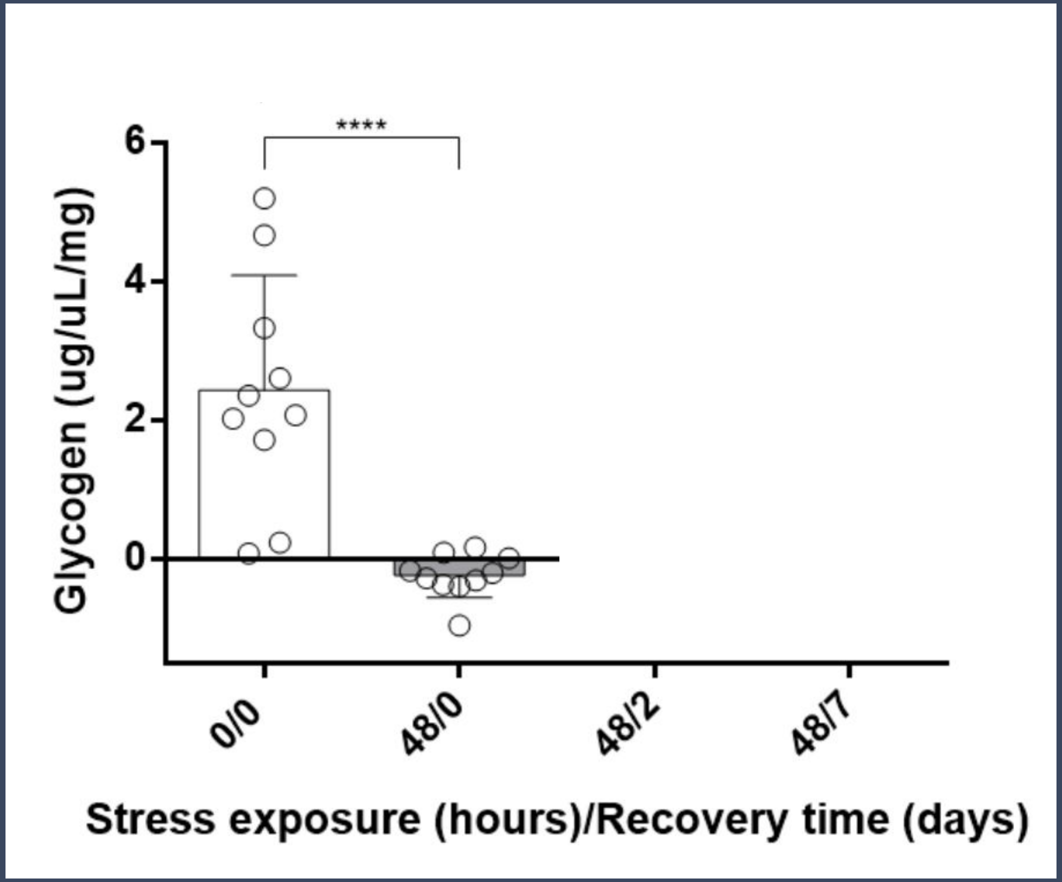

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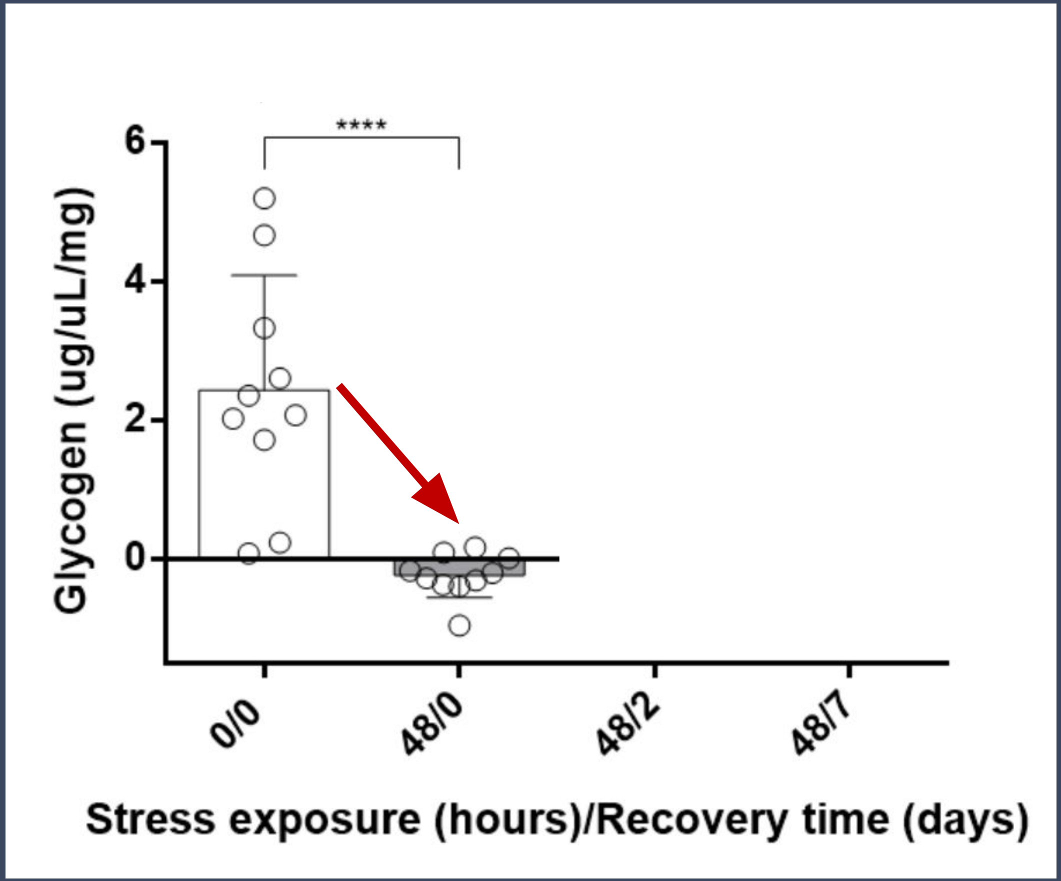

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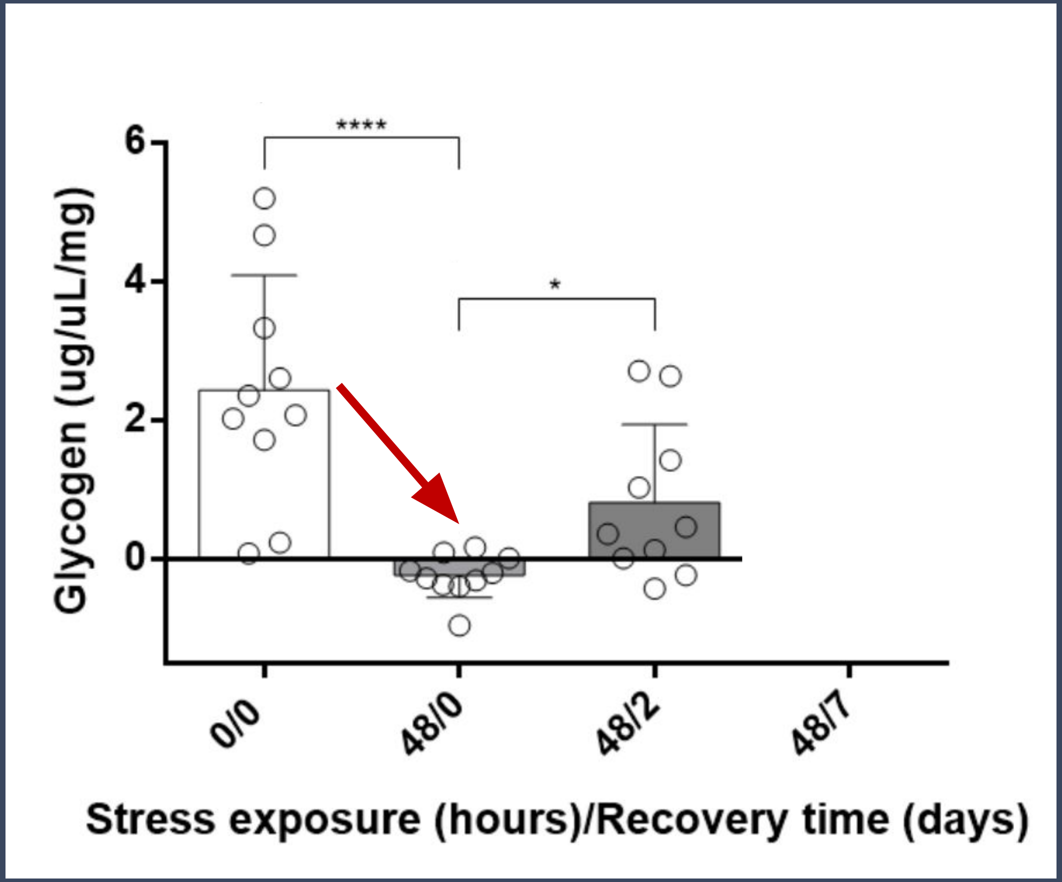

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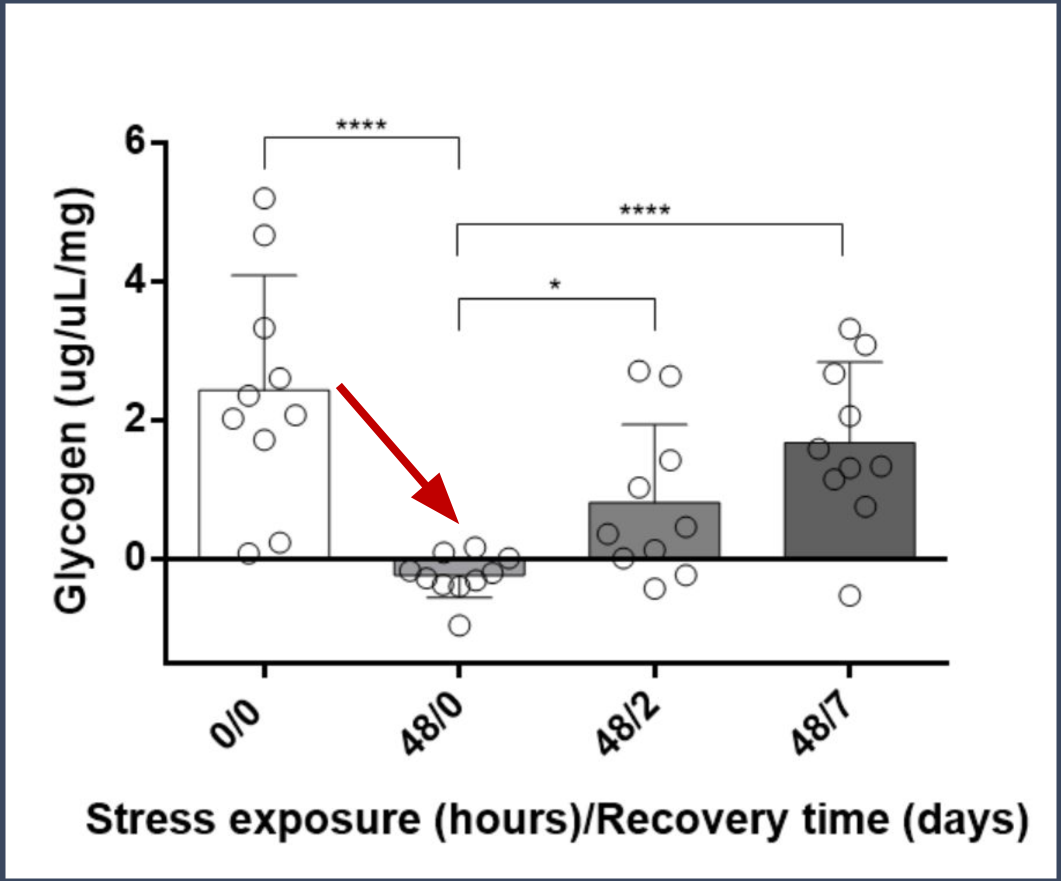

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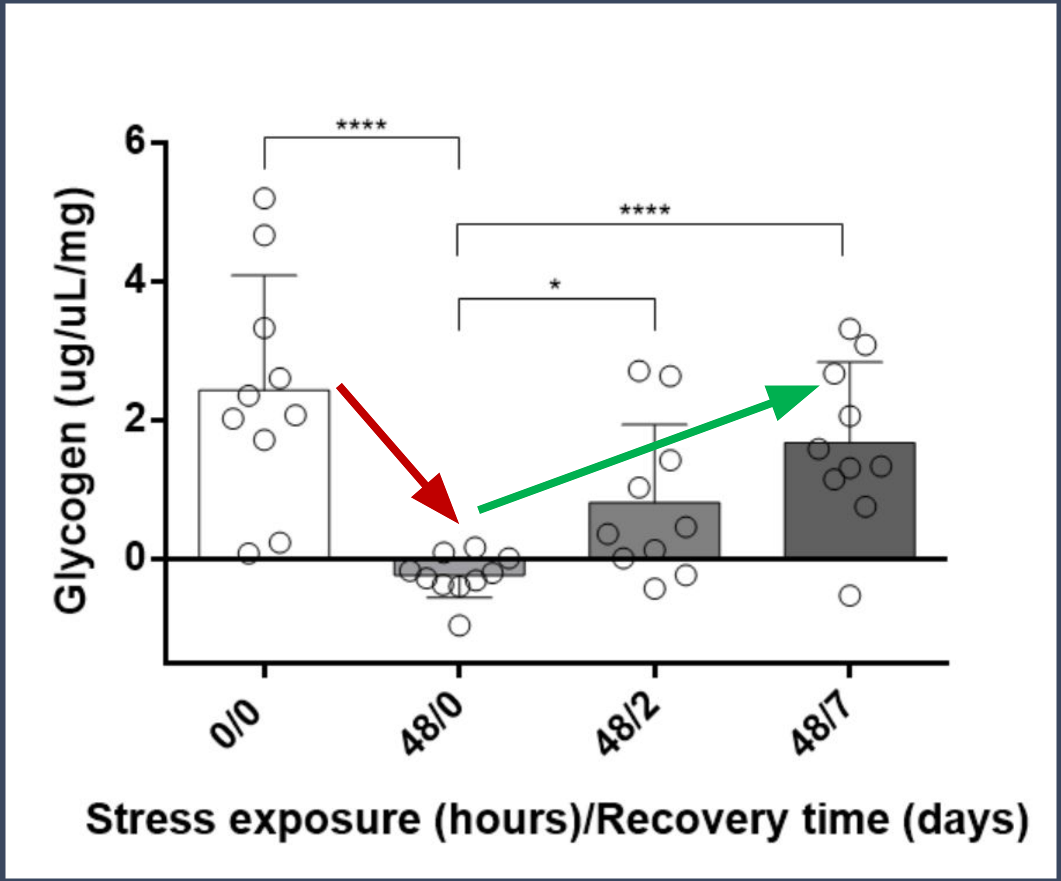

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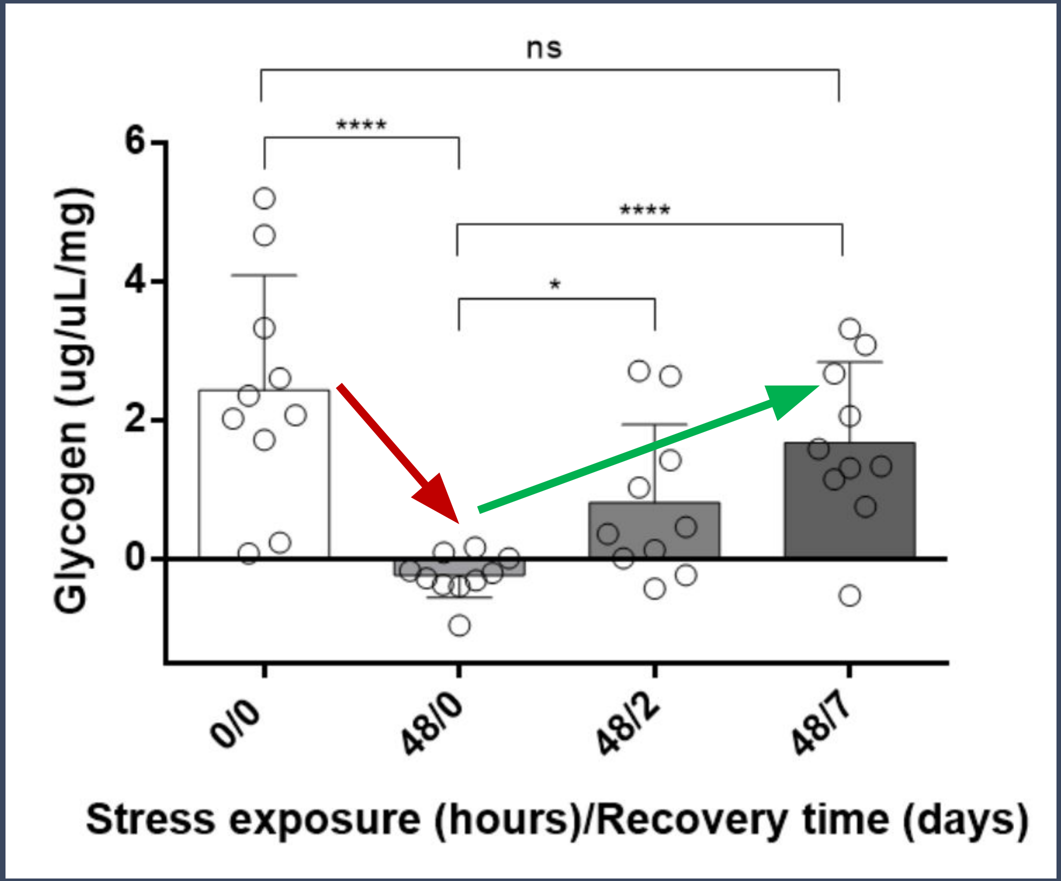

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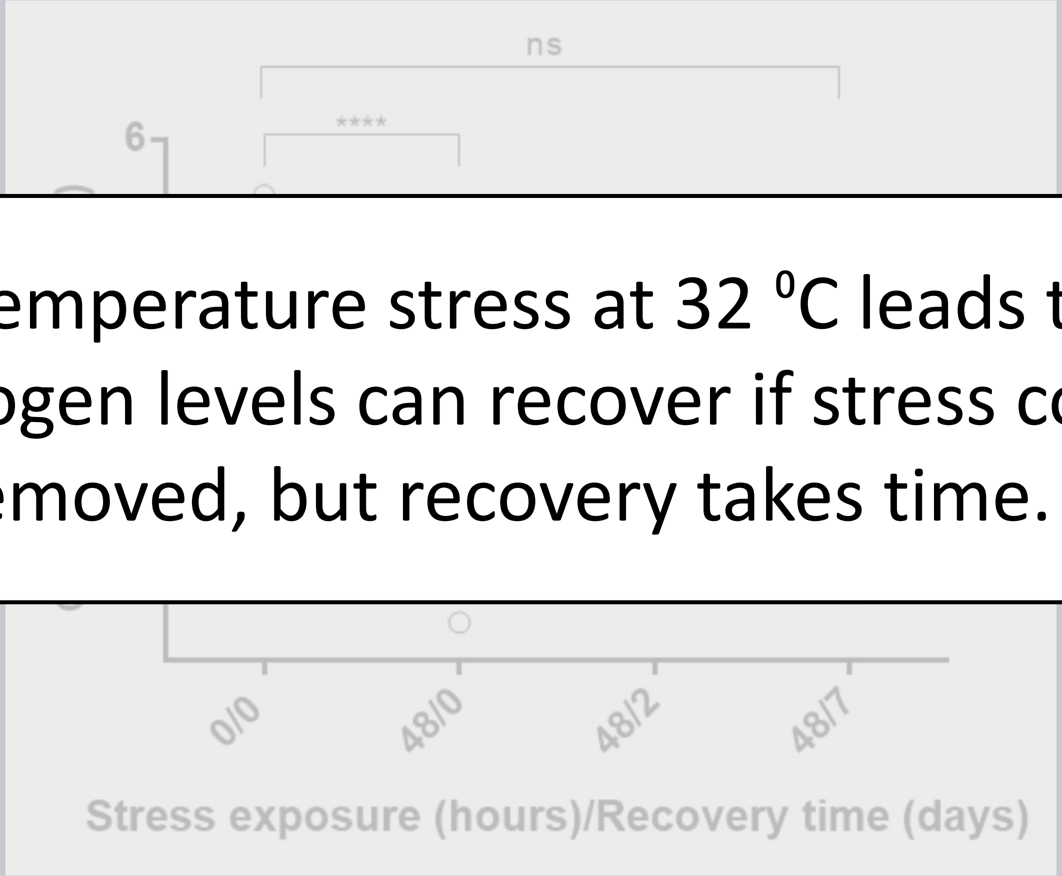


48 hours of temperature stress at 32 ^{0}C leads to depleted glycogen. Glycogen levels can recover if stress conditions are removed, but recovery takes time.

Future directions

Future directions

Tissue specificity (where?)

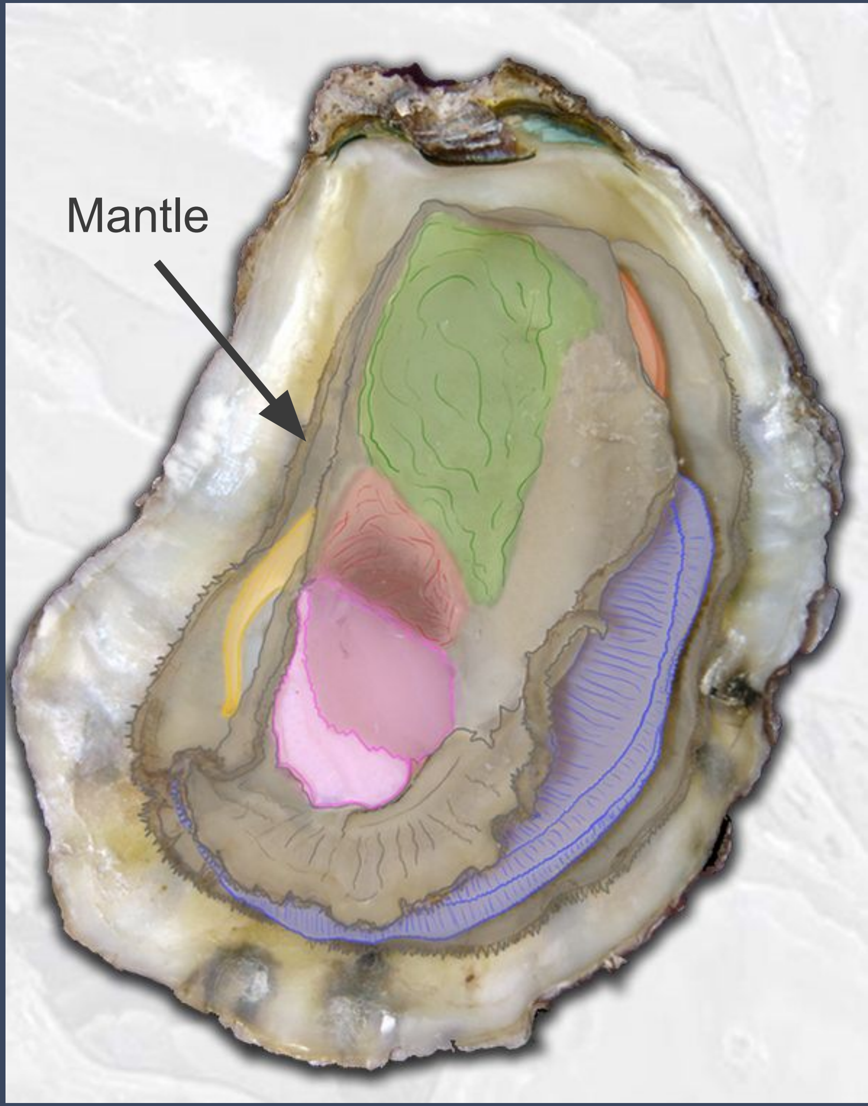
Future directions

Tissue specificity (where?)

Image credit: Maryland Sea Grant

Future directions

Tissue specificity (where?)



Liu et al., Aquaculture Research 2020

Image credit: Maryland Sea Grant

Future directions

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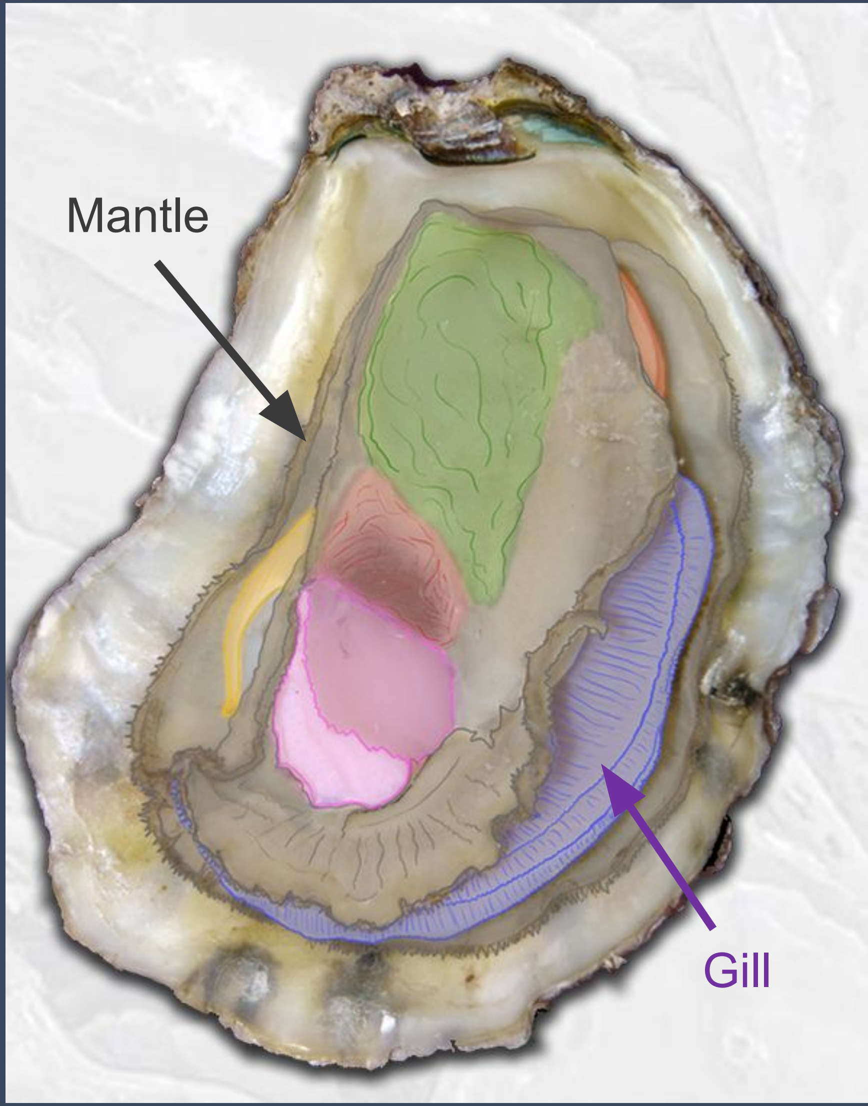


Liu et al., Aquaculture Research 2020

Image credit: Maryland Sea Grant

Future directions

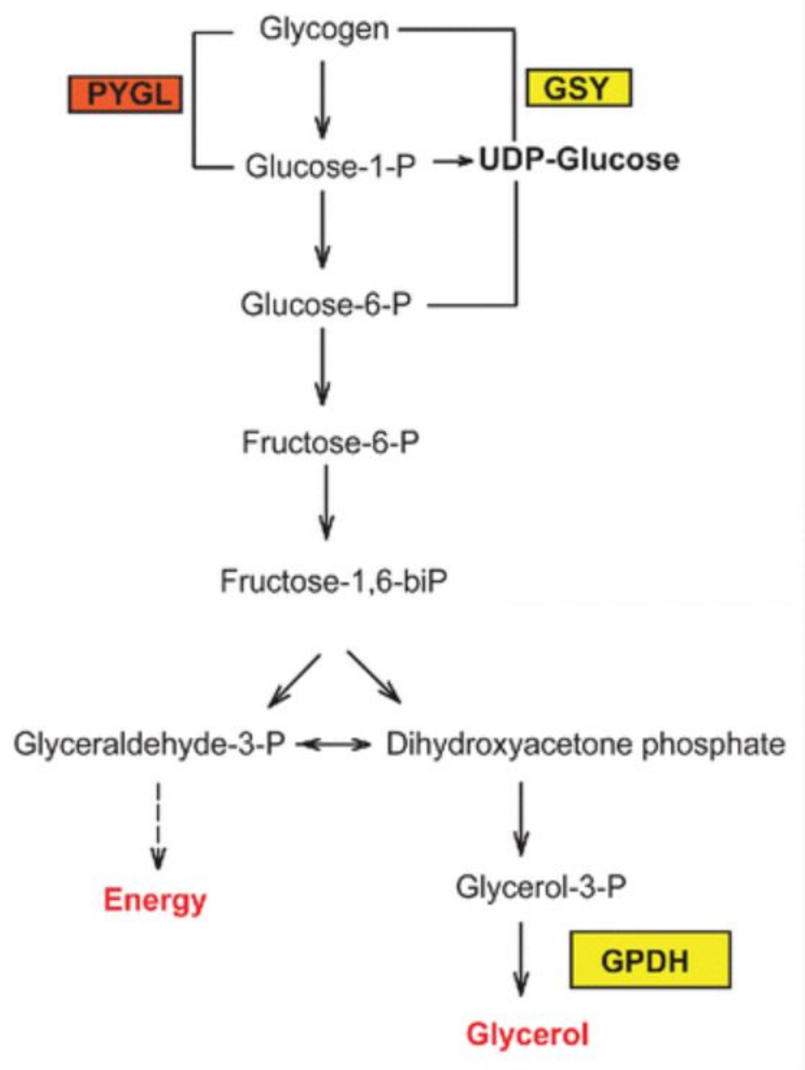
Tissue specificity (where?)

Enzyme regulation (how?)

Future directions

Tissue specificity (where?)

Enzyme regulation (how?)

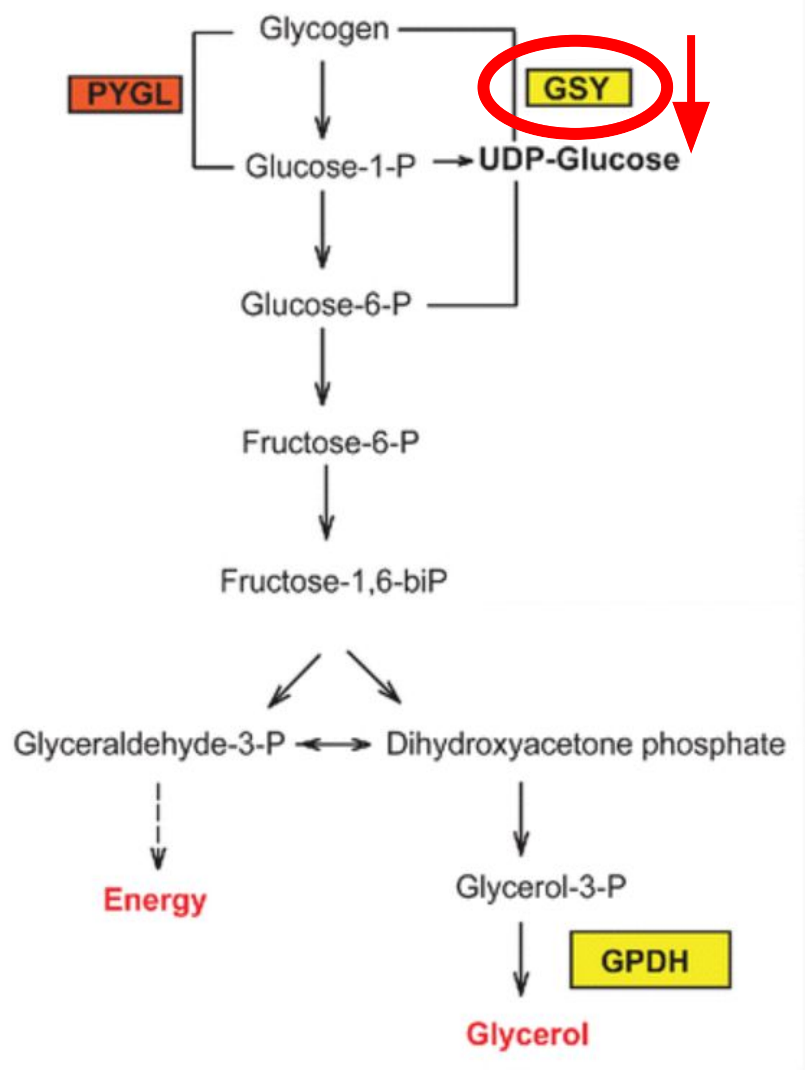


Possik and Prose, Worm 2016

Future directions

Tissue specificity (where?)

Enzyme regulation (how?)

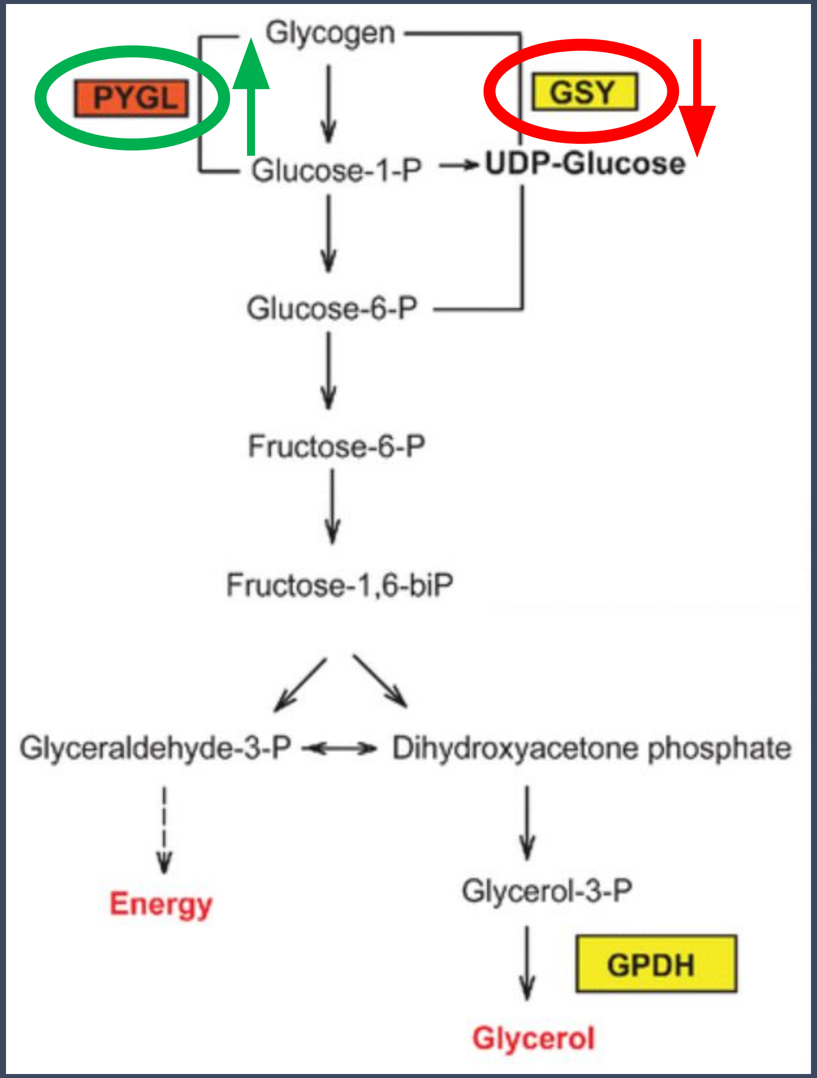


Possik and Prose, Worm 2016

Future directions

Tissue specificity (where?)

Enzyme regulation (how?)



Possik and Prose, Worm 2016

Future directions

Tissue specificity?

Enzyme regulation?

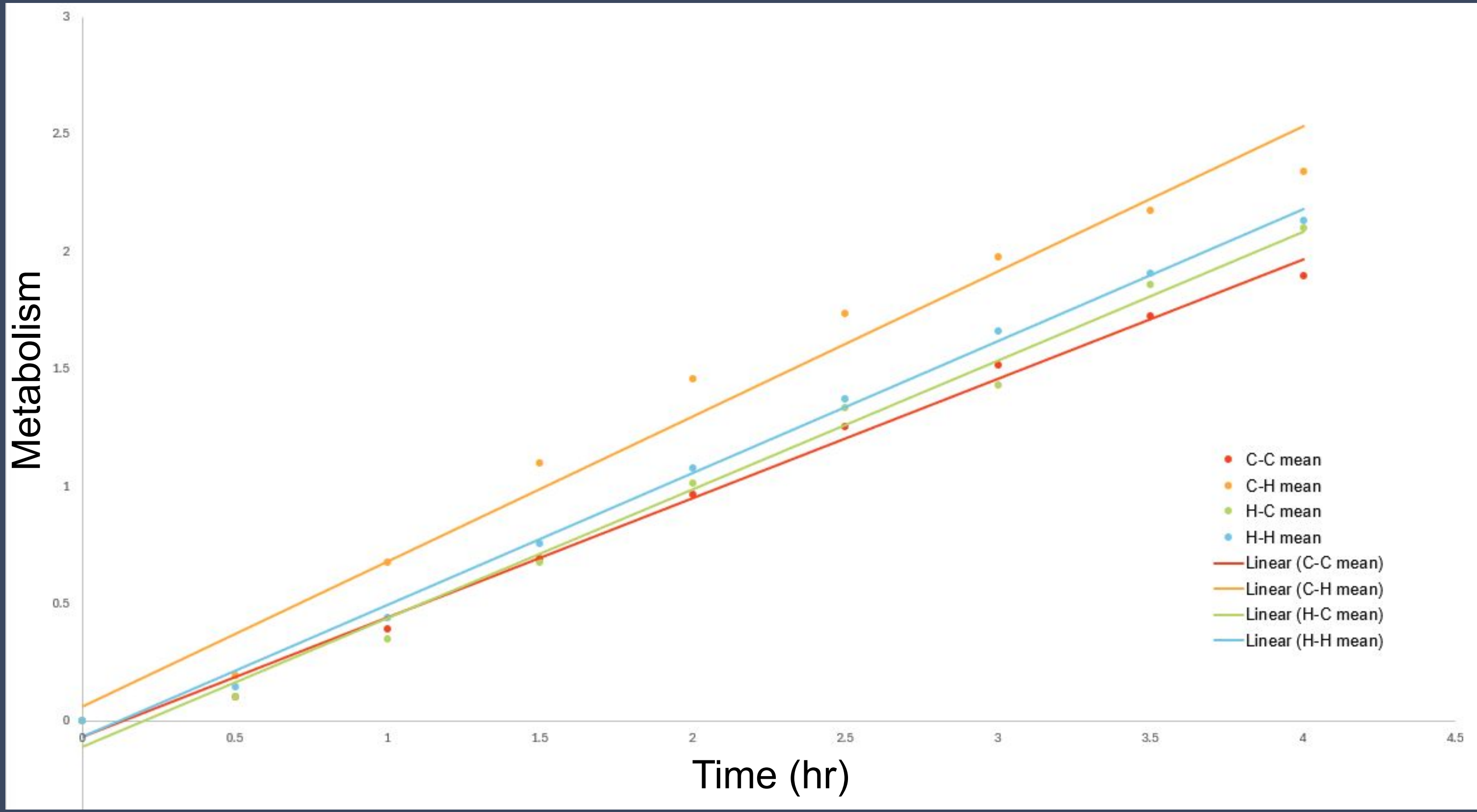
Resistance to
subsequent stress?

Future directions

Tissue specificity?

Enzyme regulation?

Resistance to subsequent stress?



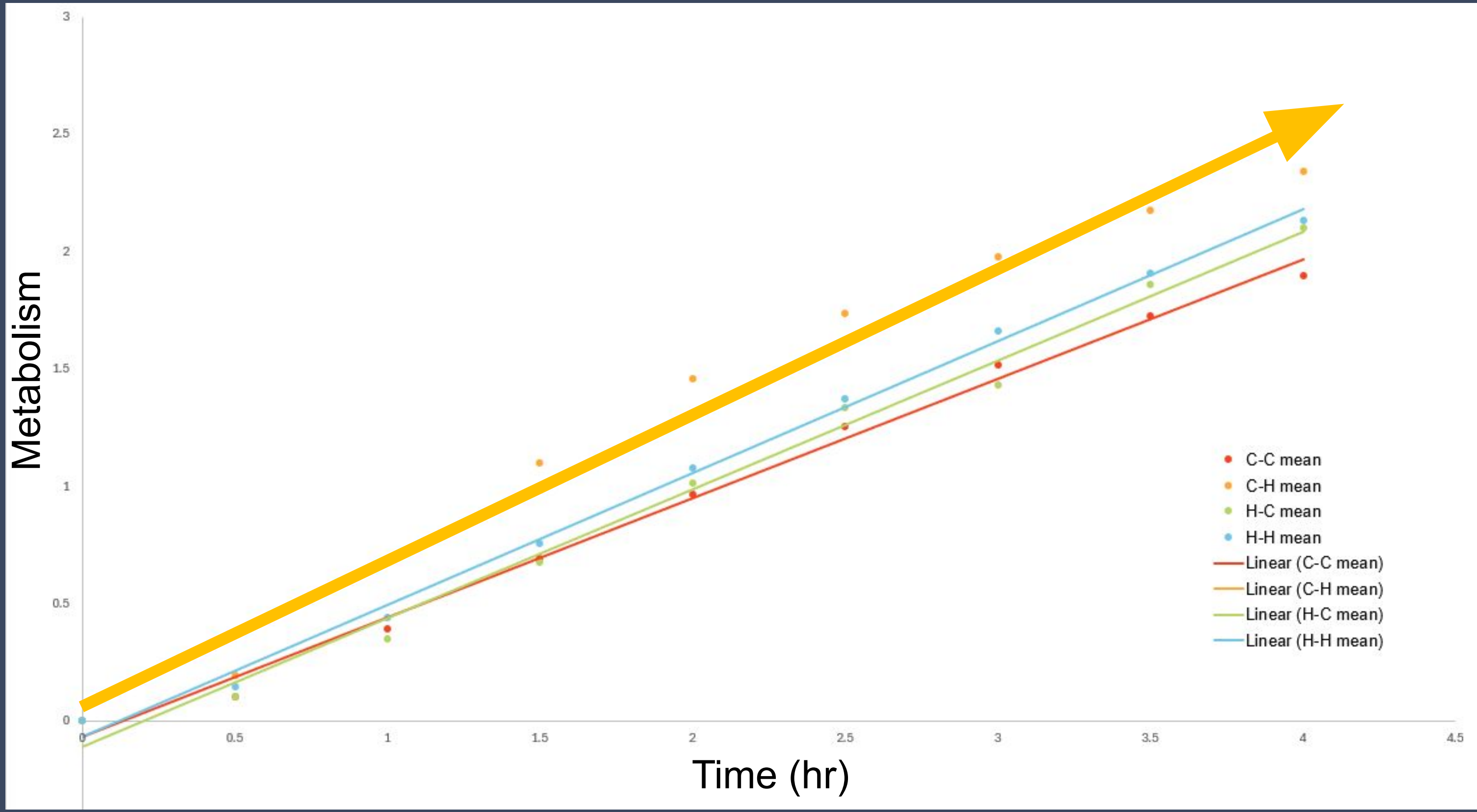
Credit: Christina Zhang

Future directions

Tissue specificity?

Enzyme regulation?

Resistance to subsequent stress?



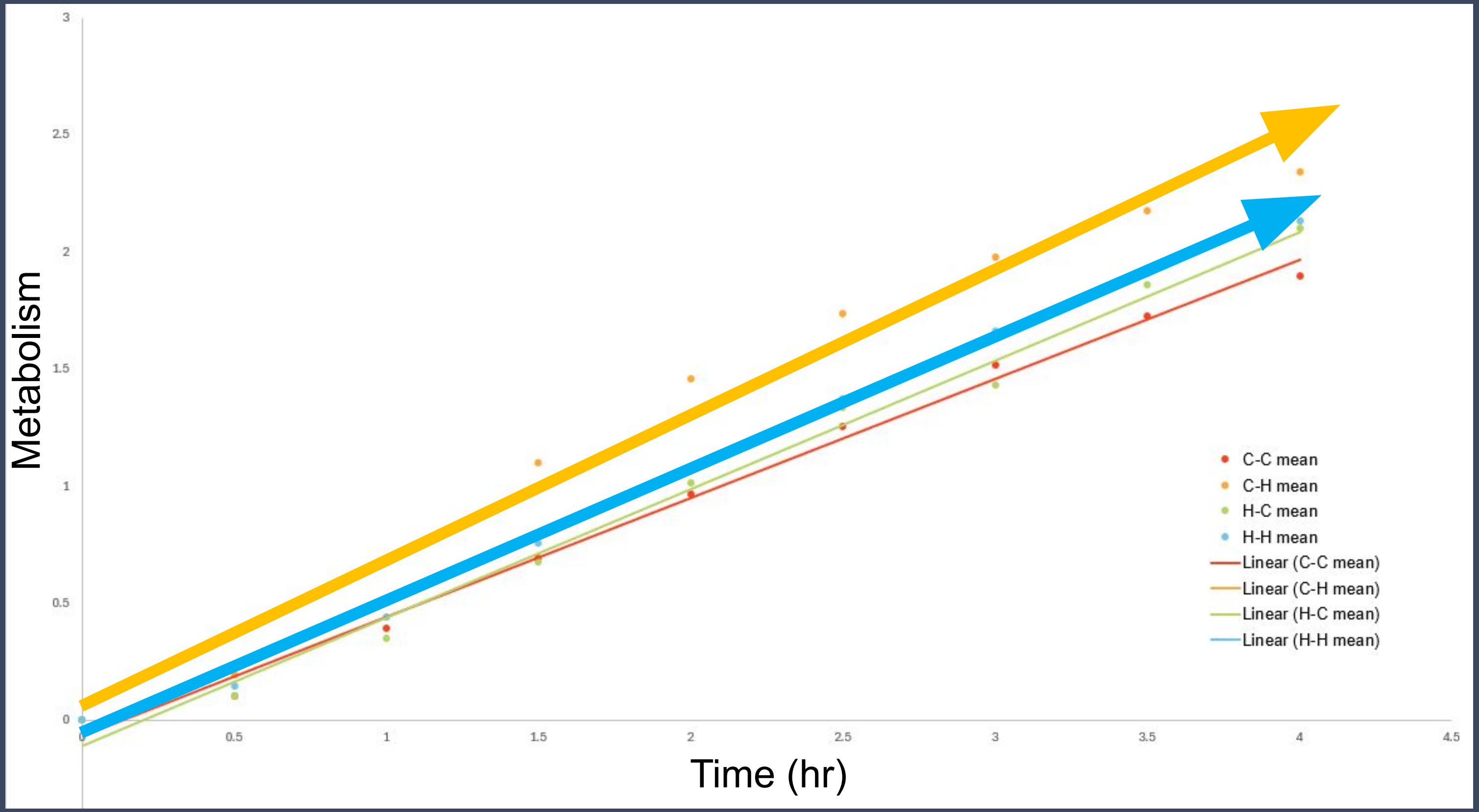
Credit: Christina Zhang

Future directions

Tissue specificity?

Enzyme regulation?

Resistance to subsequent stress?



Credit: Christina Zhang

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Thank you!

Sources

Open-source data

Sources

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