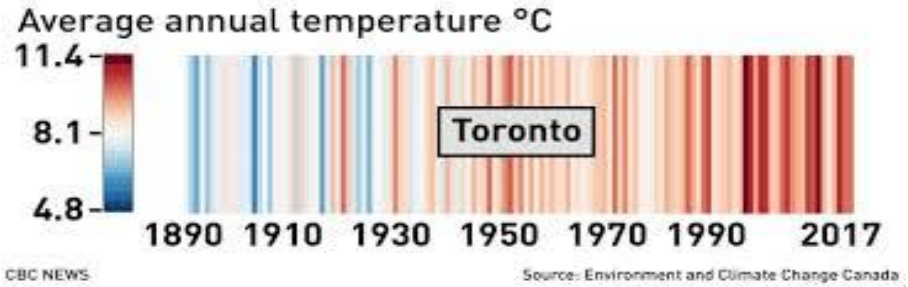
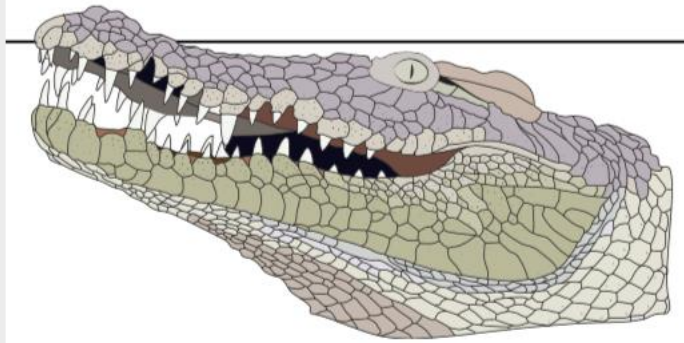
How do animals adapt to warming temperatures?



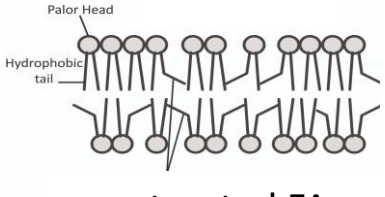


Metabolic acclimation

Metabolic thermogenesis

cold

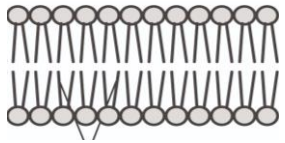
fluid



unsaturated FA

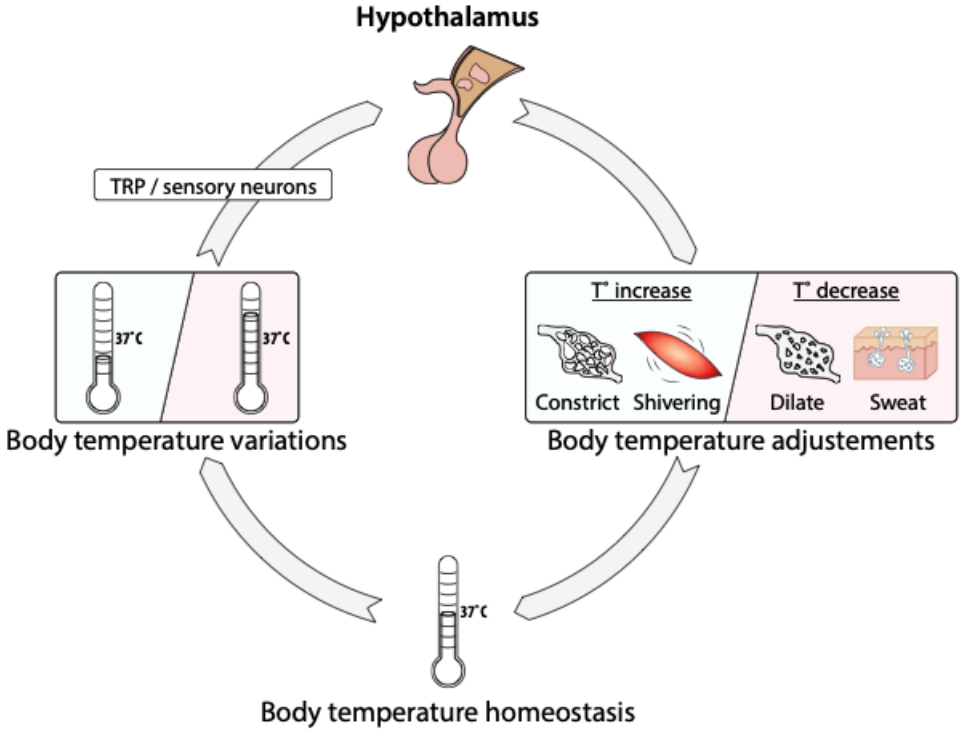
hot

viscous



saturated FA

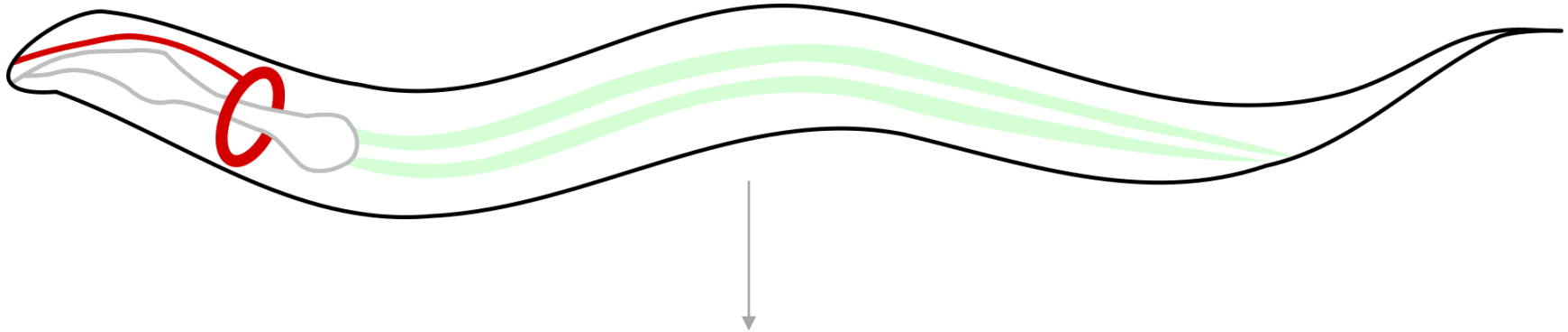
Homeoviscous adaptation



Membrane fluidity has to be adjusted within the cells

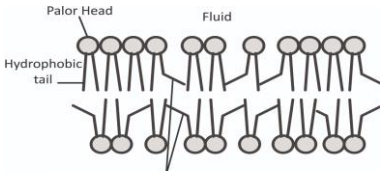
How are cells sourced with the right type of Fatty acid?

Soil nematodes are ectotherms

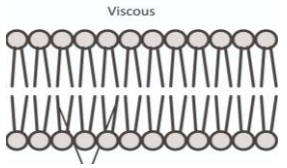


15ºC 20ºC 25ºC Heat-shock

Metabolic acclimation Metabolic acclimation



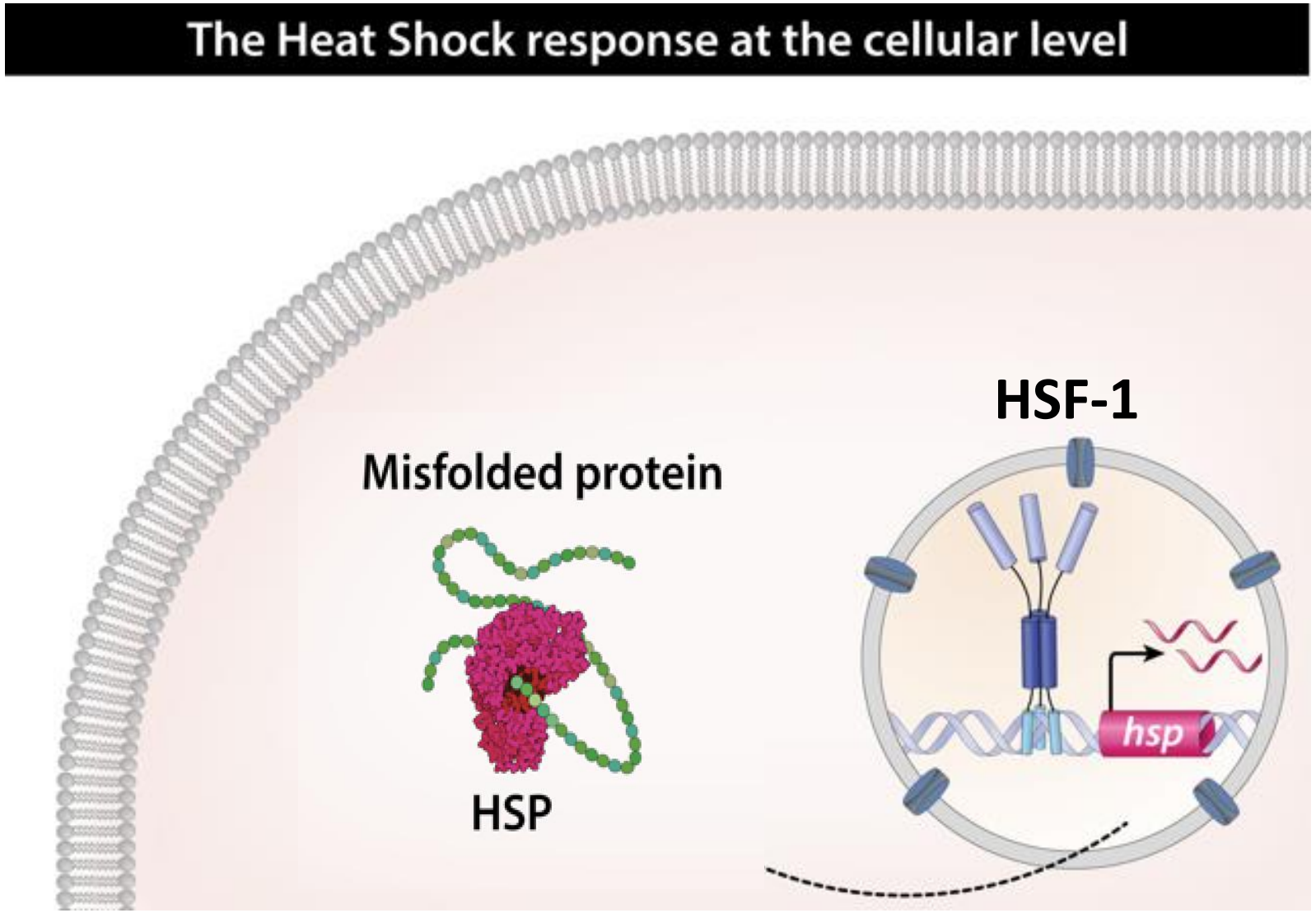
preferred temperature

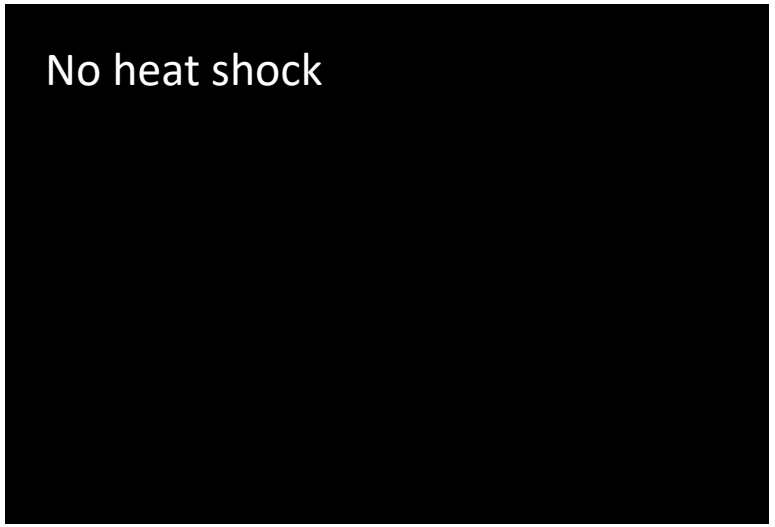


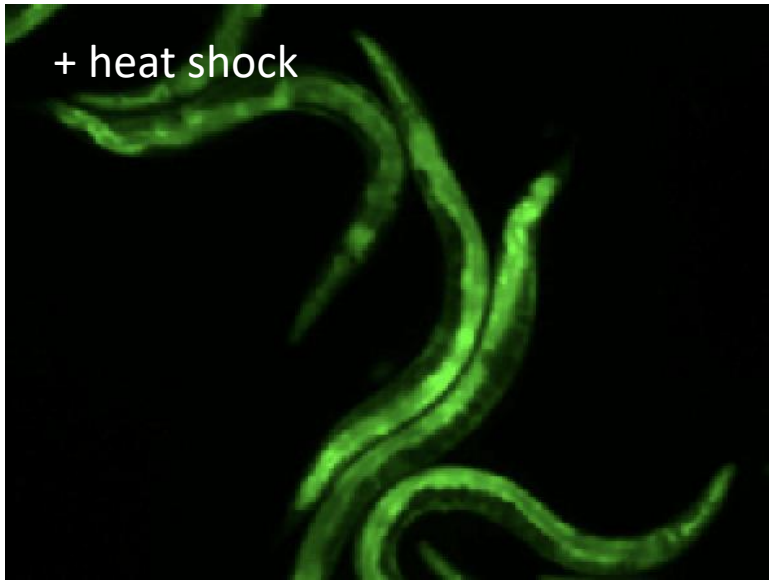
fluid **viscous**

No thermogenesis

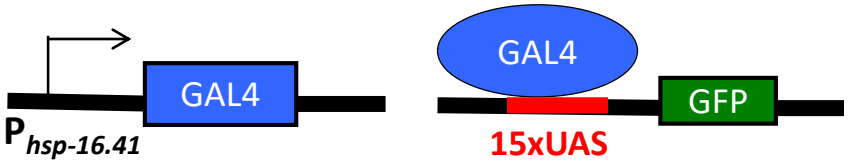
*hsp16.2*P:GFP

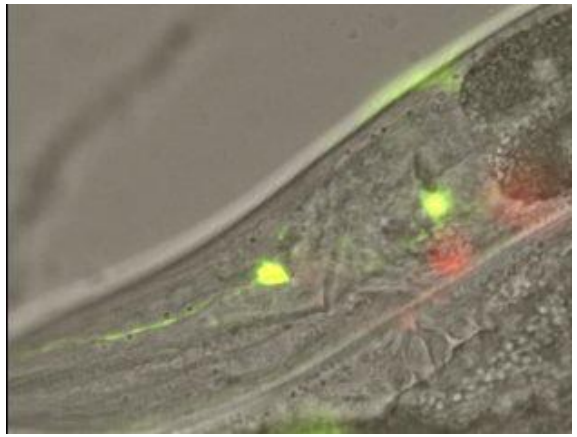

The Heat Shock response at the cellular level
HSF-1
Misfolded protein
HSP
hsp

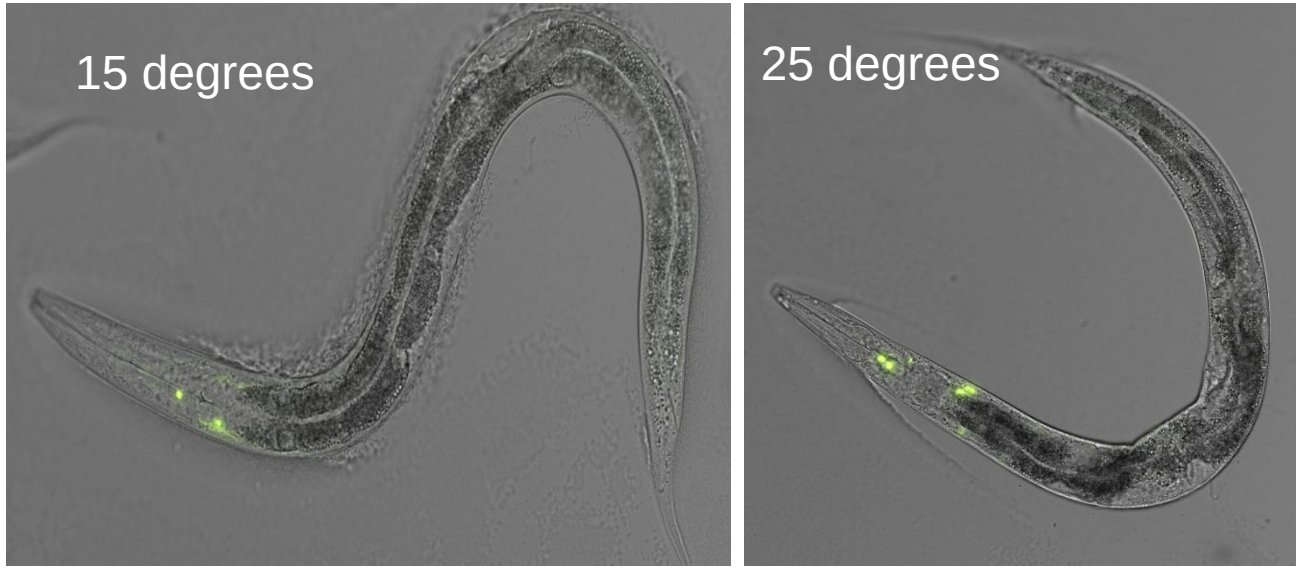

No heat shock

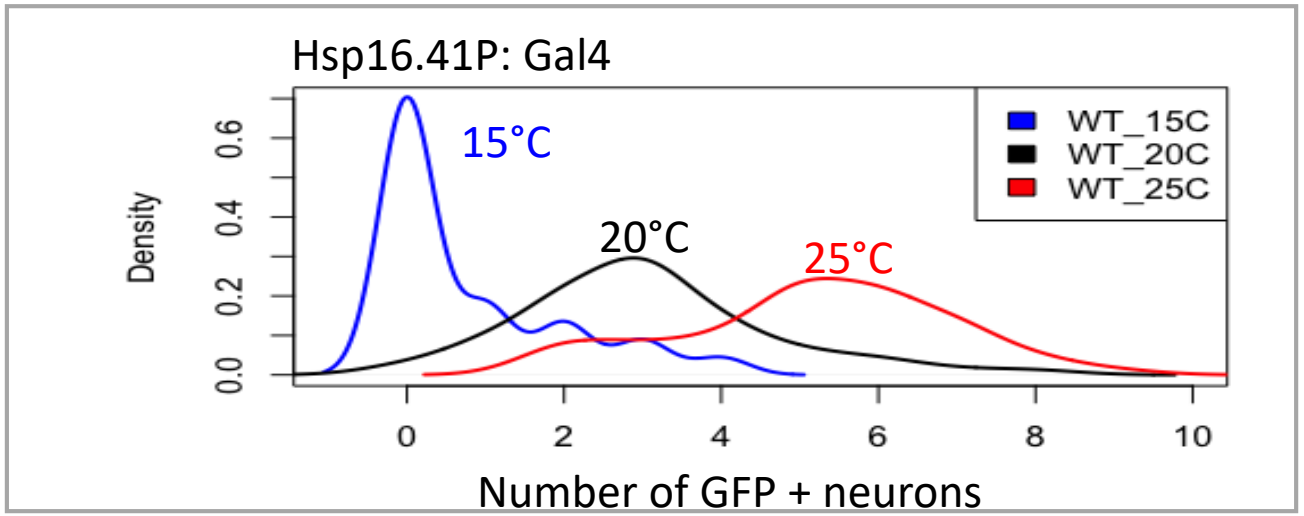

+ heat shock

Sensory neurons are very sensitive to temperature







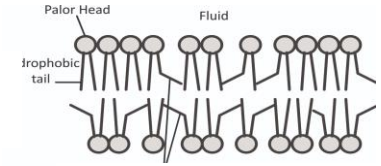


Laetitia Chauve

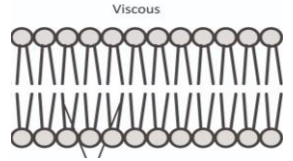
Neuronal stress and fat desaturases are opposite

cold **hot**

fluid



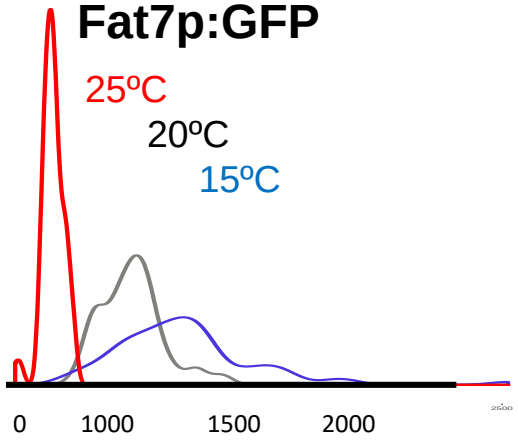
unsaturated FA



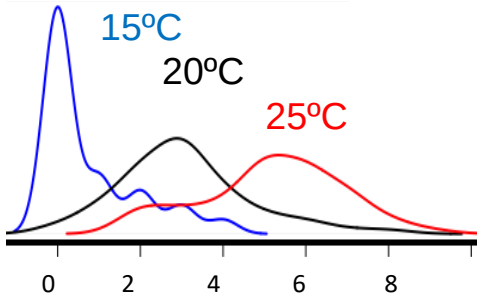
saturated FA

viscous

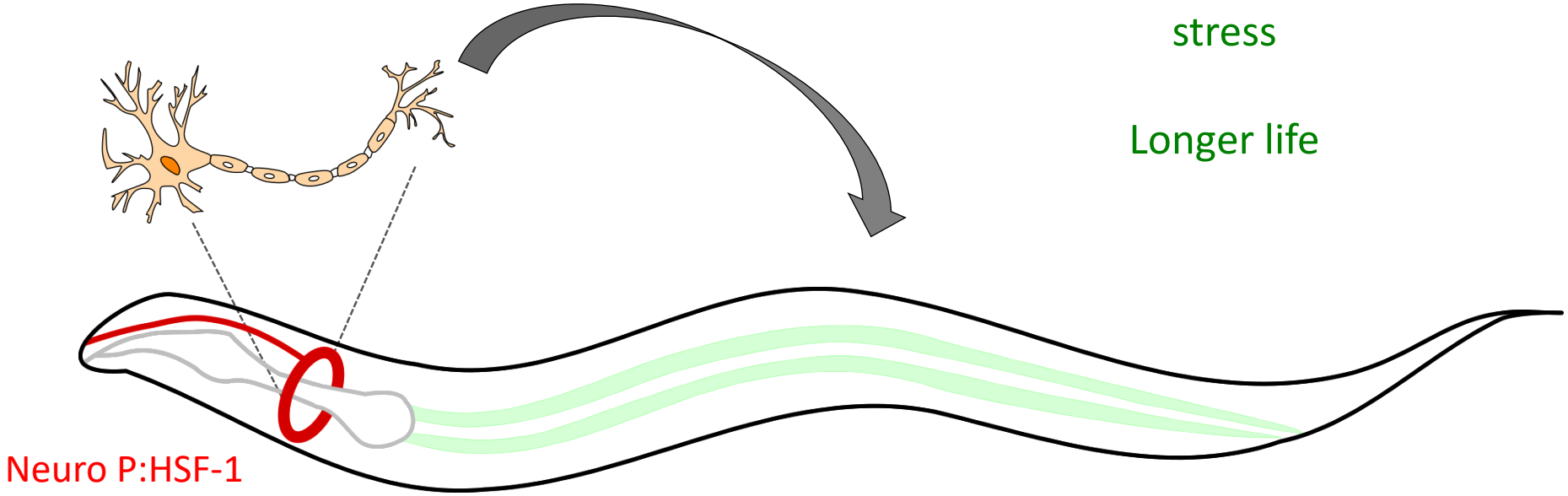
Fat7p:GFP



Stressed neurons



What is the function of neuronal stress?

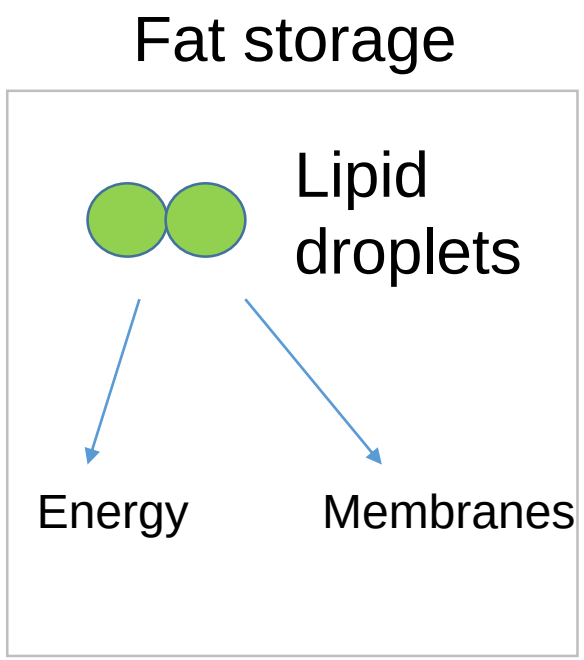


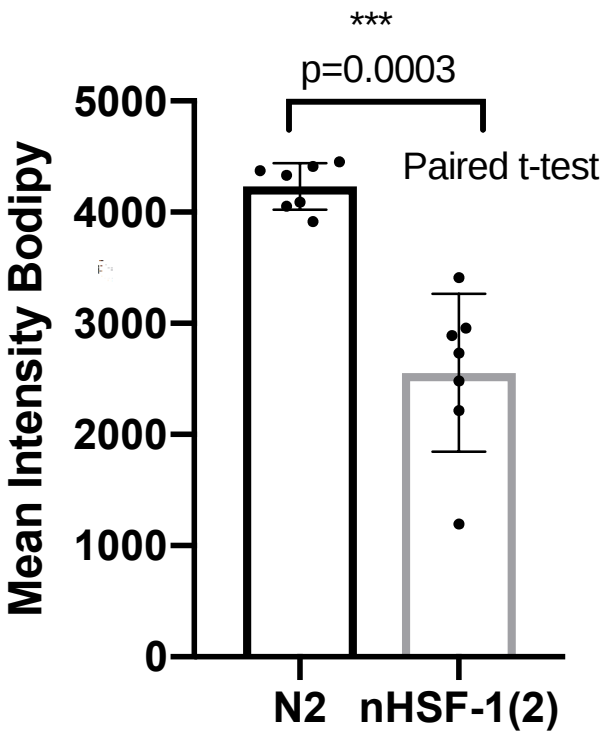
Increased robustness to stress

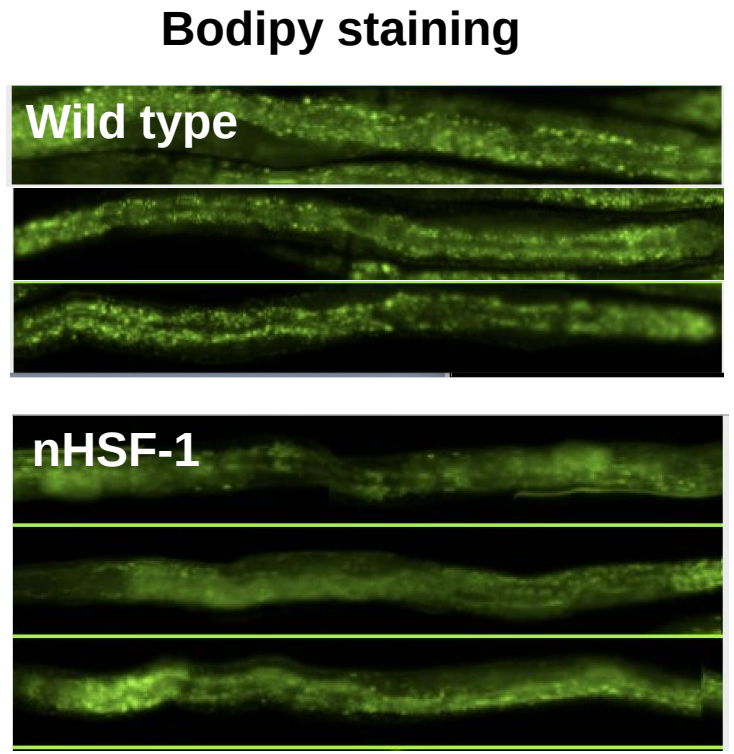
Longer life

Andy Dillin

nHSF-1 worms are leaner

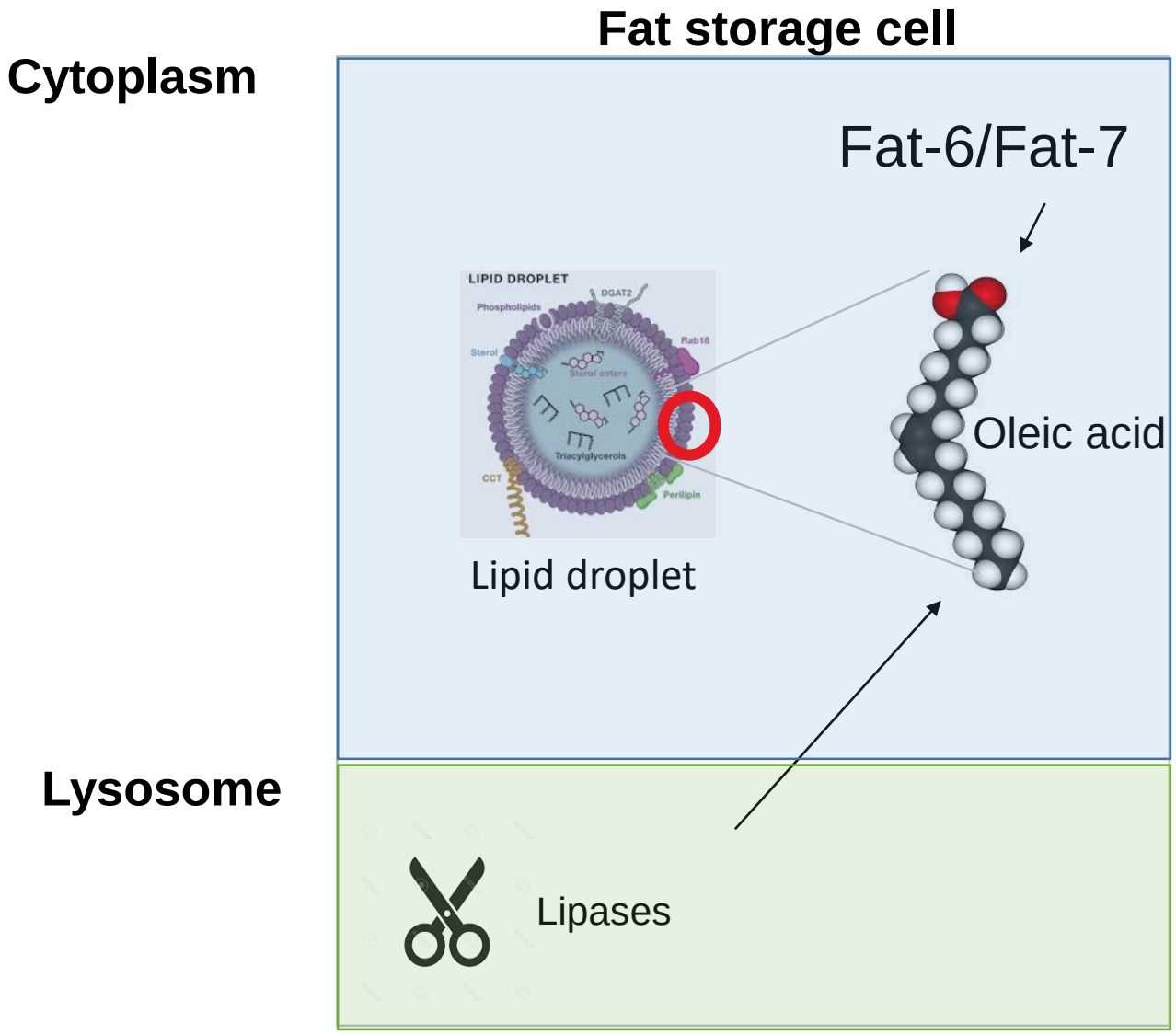






Mersede Masoudeh

Synthesis and degradation of lipids that coat Lipid droplets



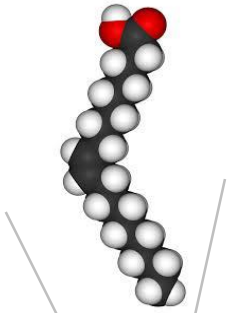
nHSF-1 has lower levels of unsaturated fatty acids

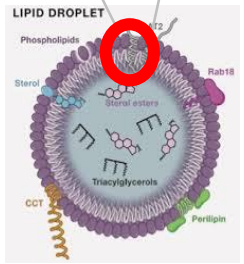
Stearoyl-CoA desaturase (SCD)

FAT6/7

↓

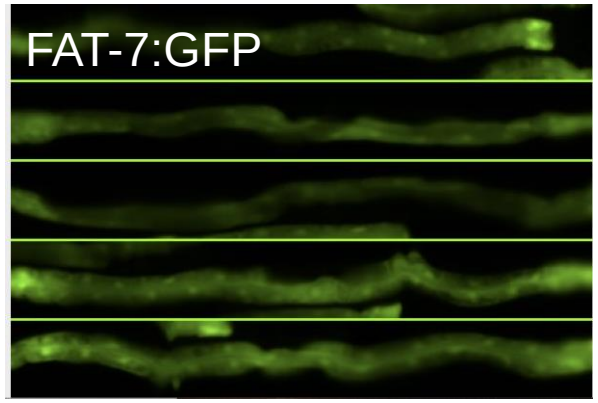
Oleic acid

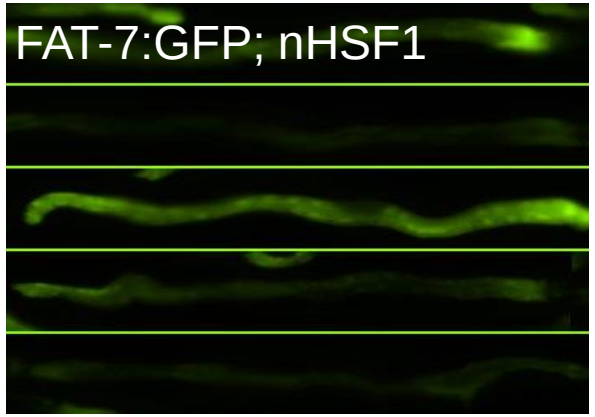


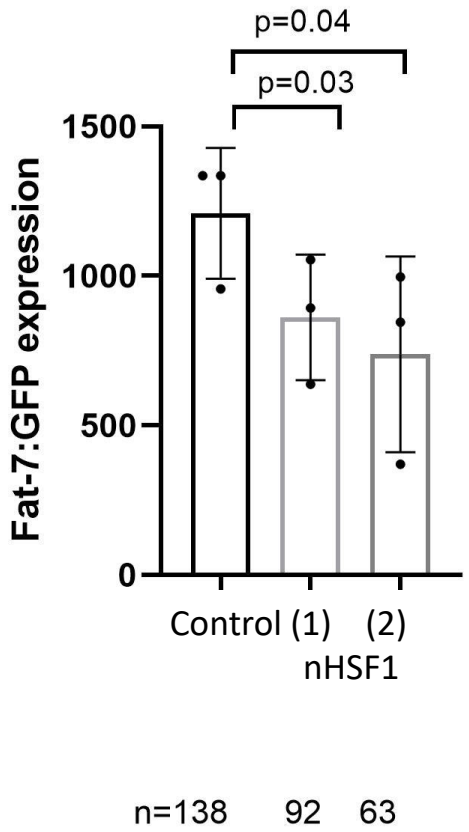


Lipid droplet

40 % reduction in the transcription of Fat-7

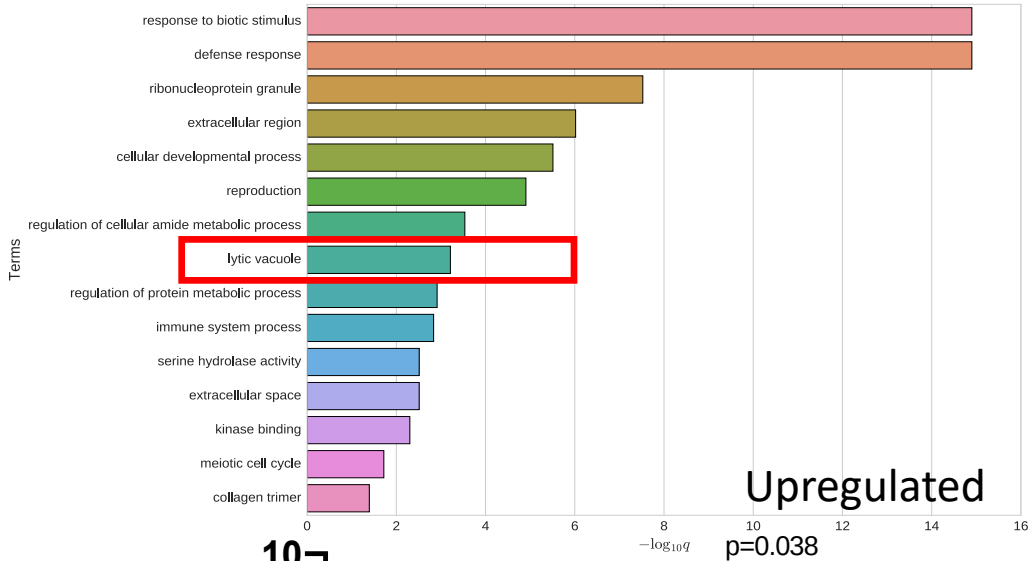




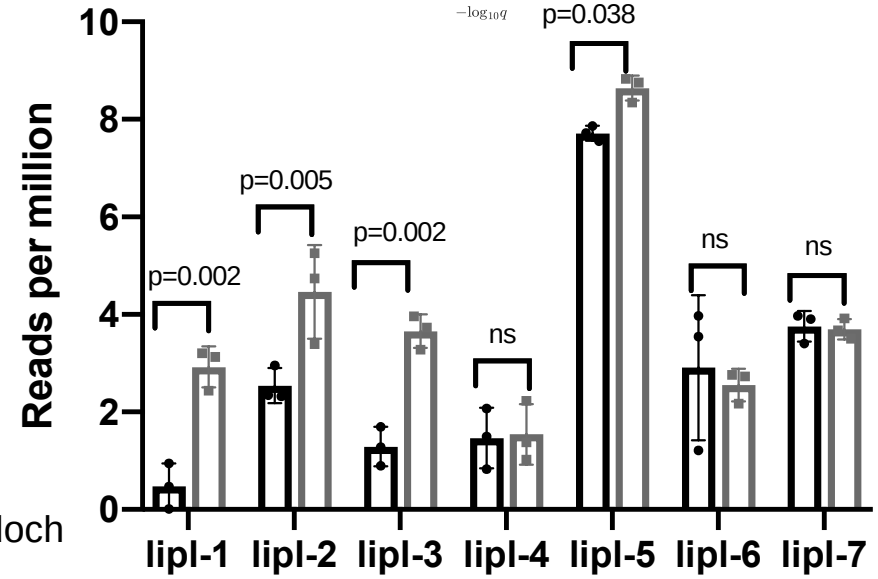


Mersede Masoudeh and Laetitia Chauve

RNA-seq reveals that Lysosomal lipases are upregulated in response to neuronal stress



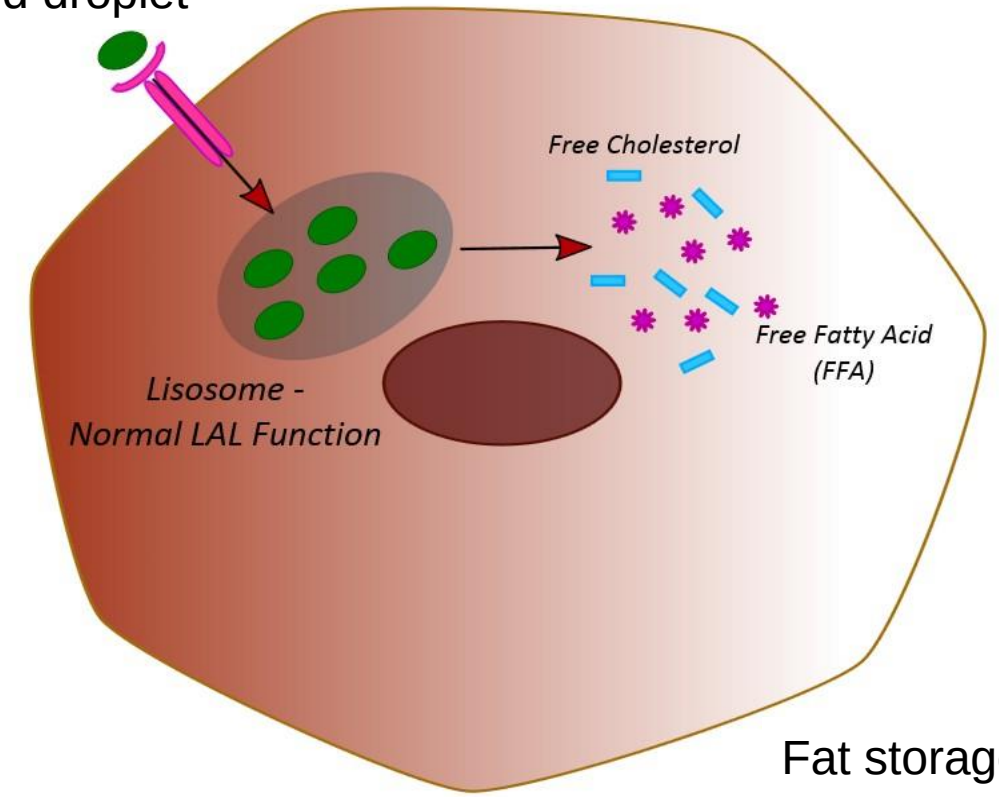
Upregulated



Sharlene Murdoch

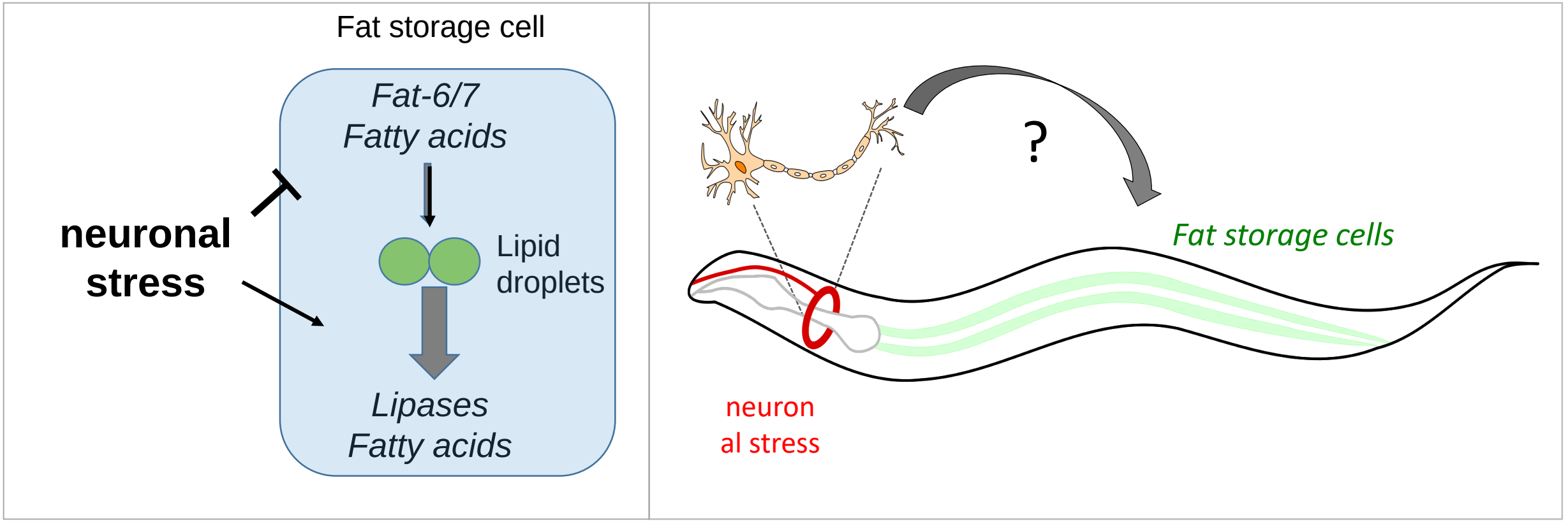
Physiological role of lysosomal acid lipase

Lipid droplet

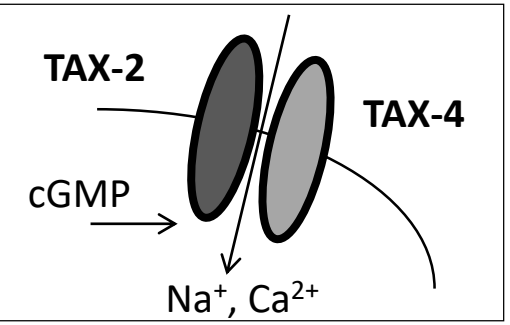


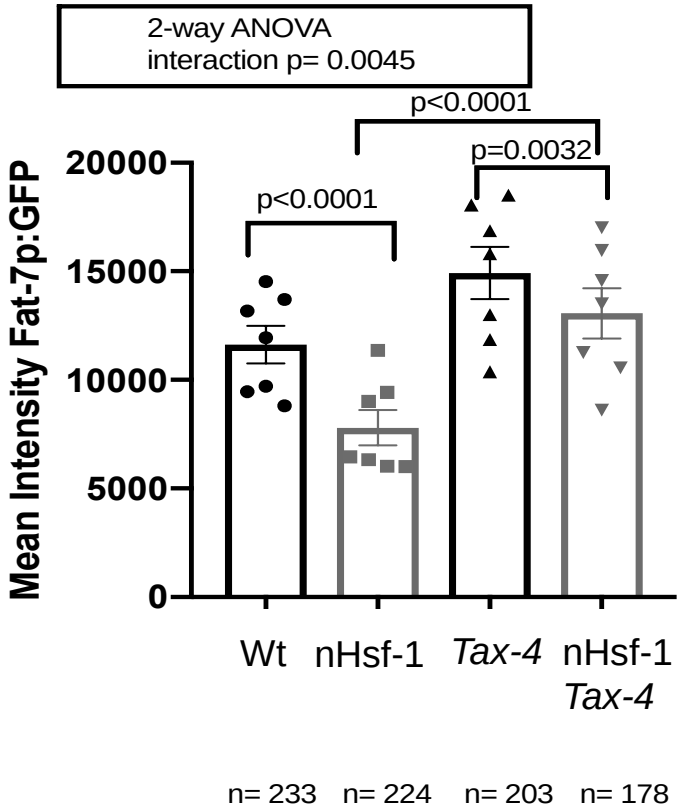
Fat storage cell

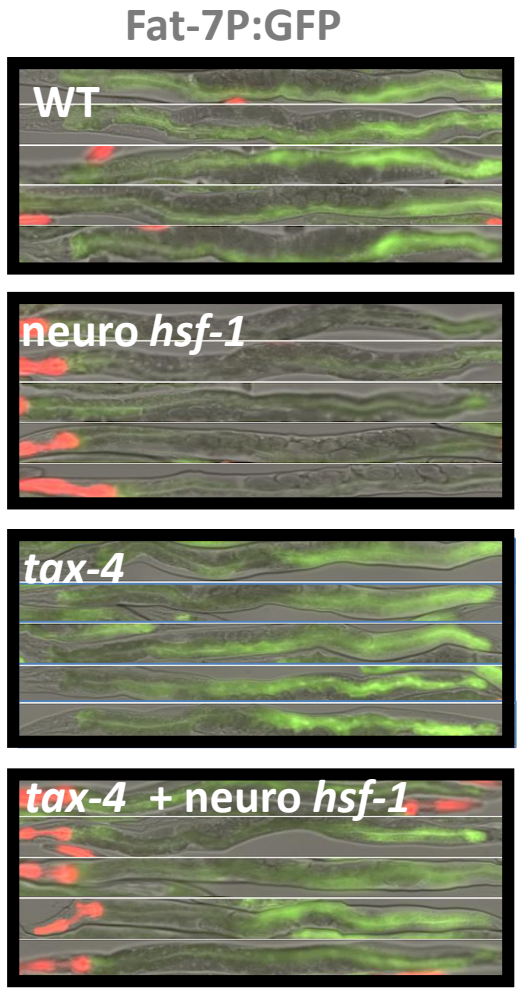
Neuronal circuits and signaling pathways involved?

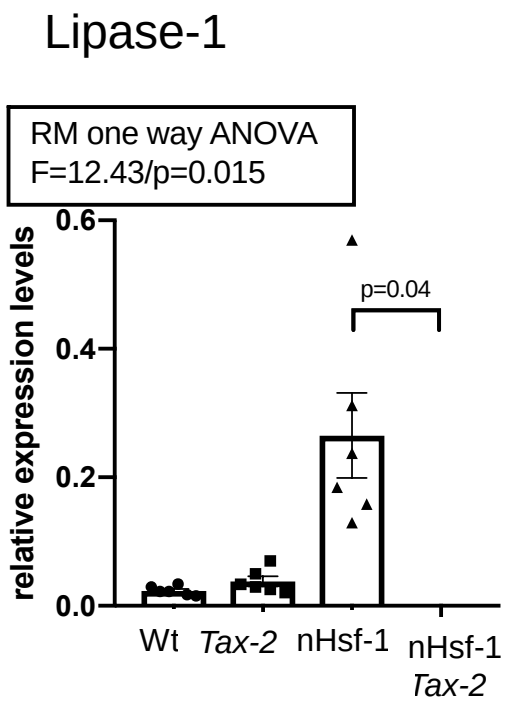


Tax2/Tax-4 cGMP gated channel is a regulator of fat deposits in nHSF1



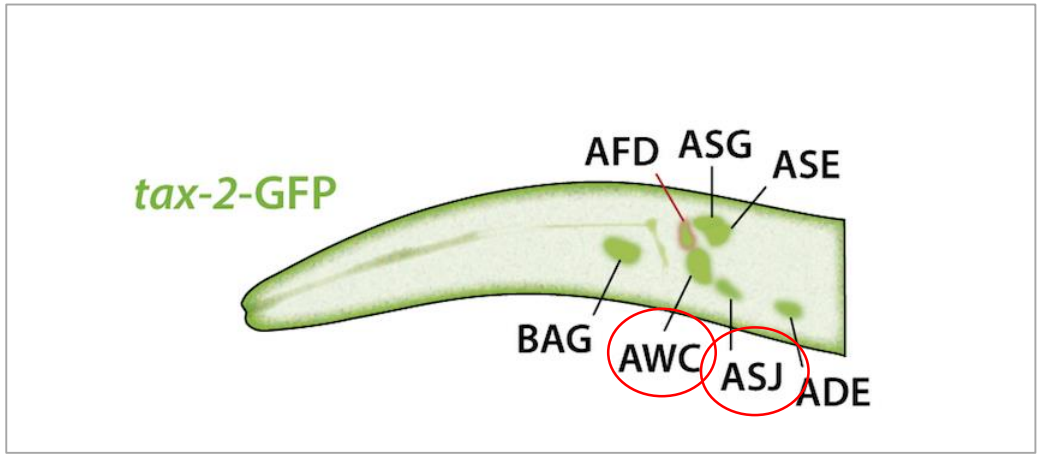


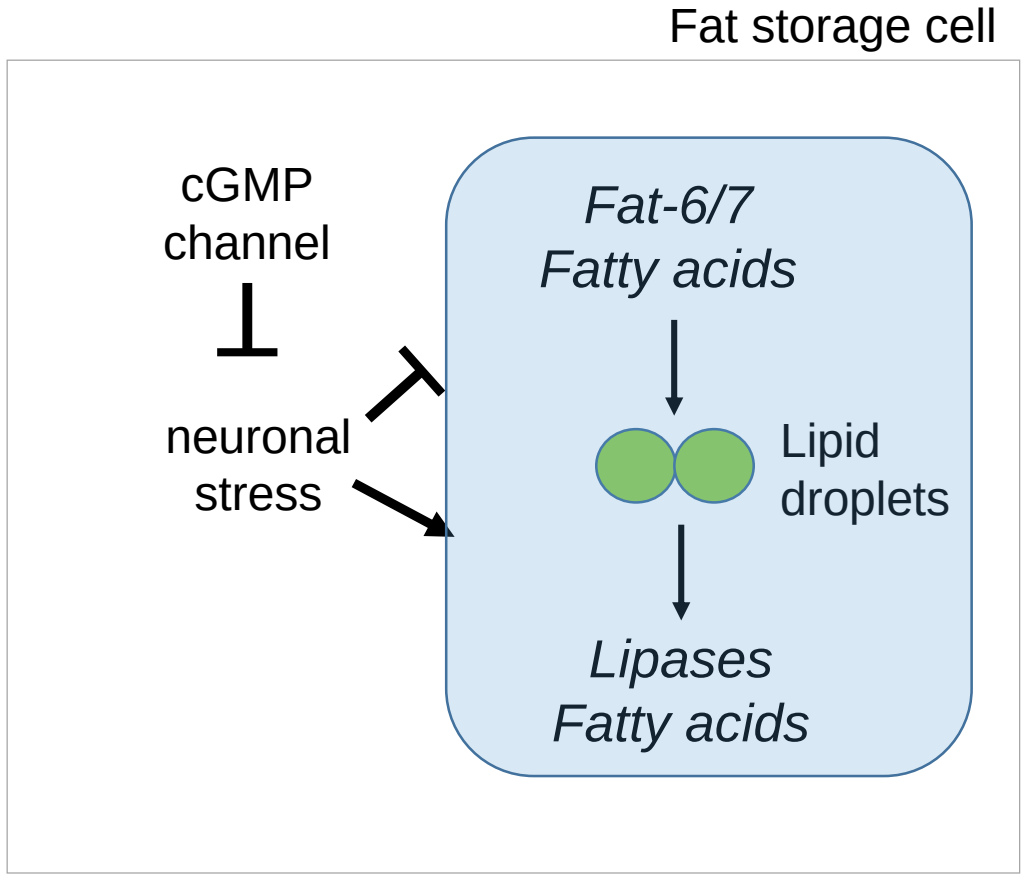




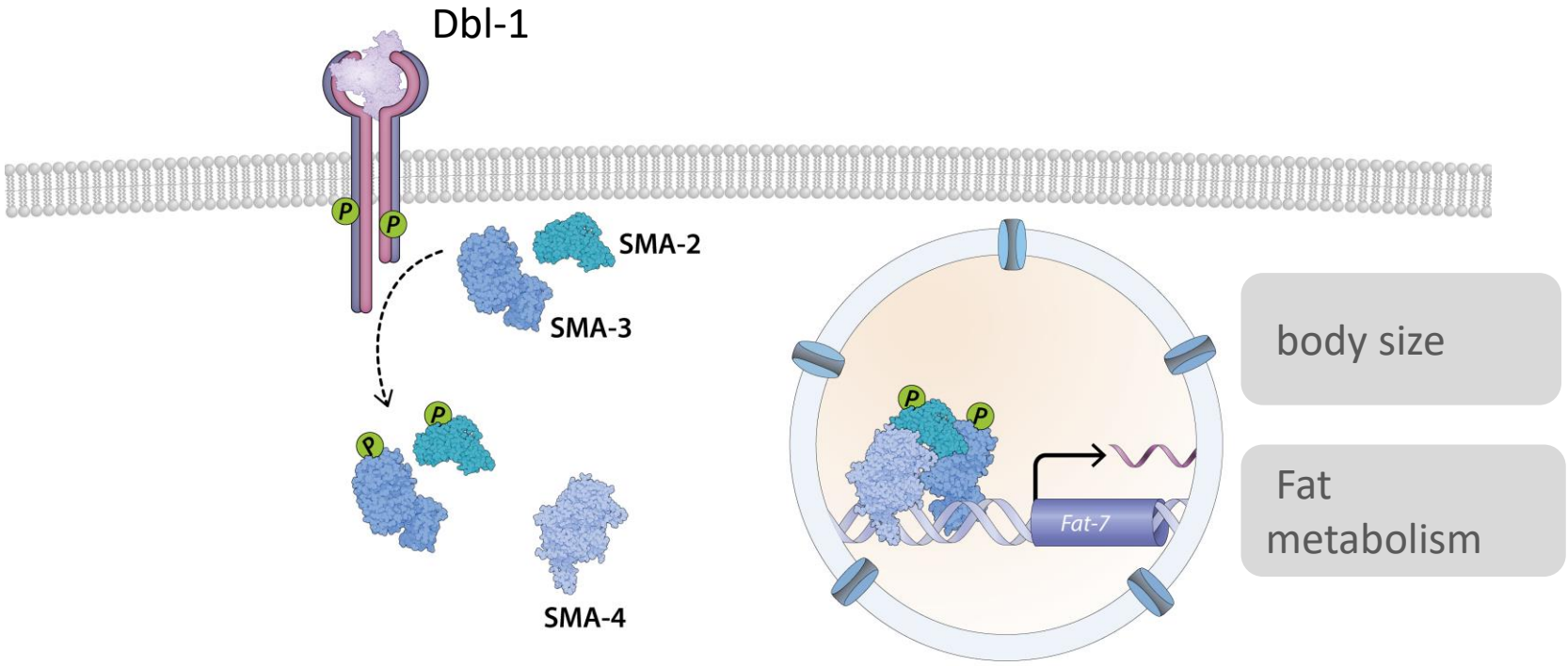
Laetitia Chauve, Sharlene Murdoch and Francesca Hodge

Tax2/Tax-4 cGMP gated channel is a regulator of fat deposits in nHSF1

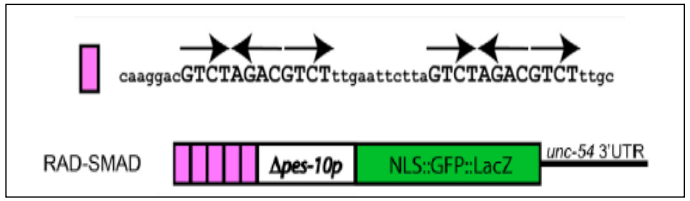




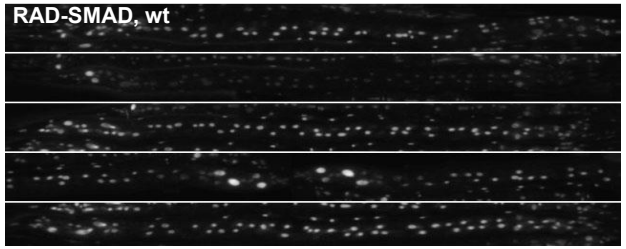
BMP signaling in *C.elegans*

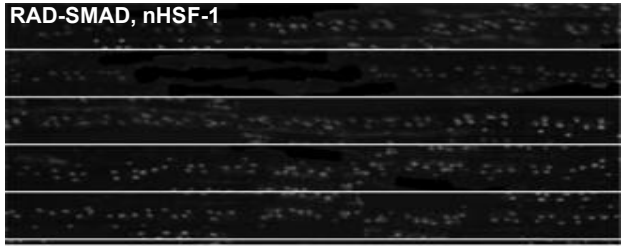


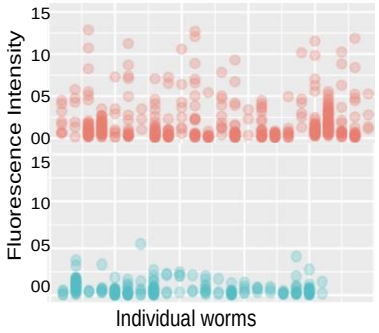
Neuronal stress causes a reduction in BMP activity

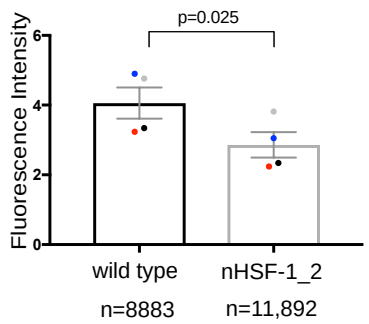


BMP sensor

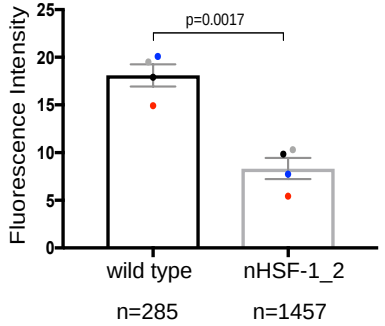








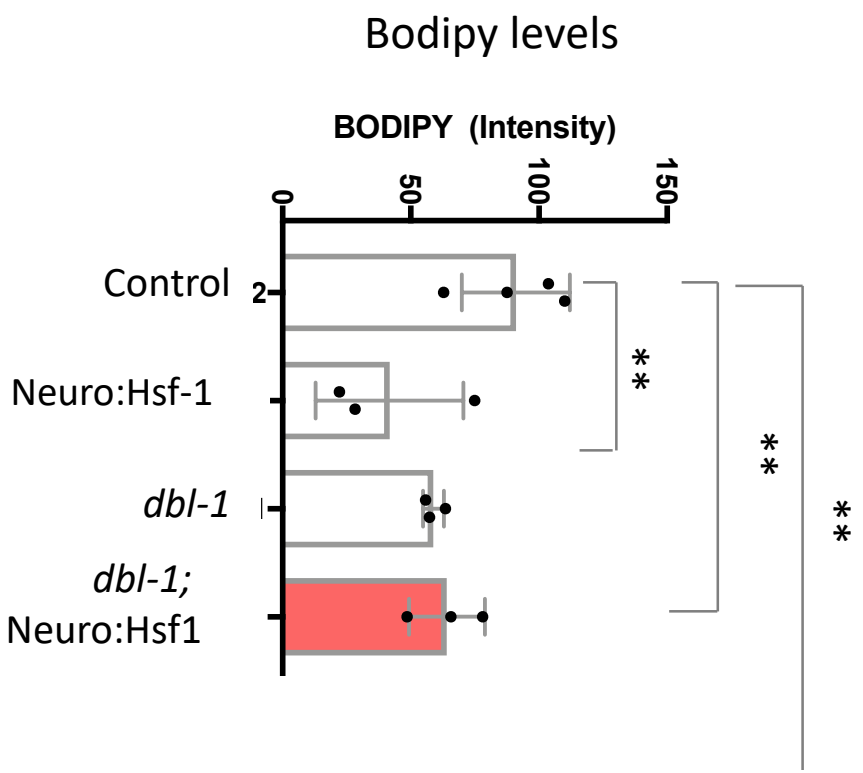
Intestine

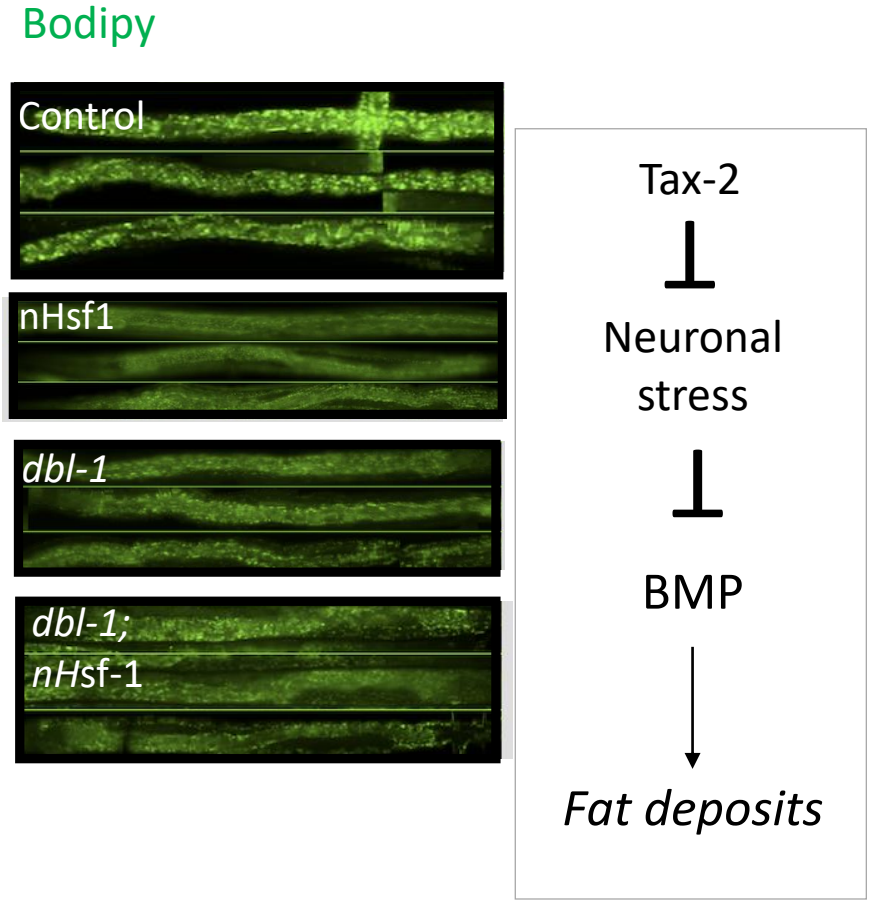


Epidermis

Laetitia Chauve and Hanneke Okkenhaug

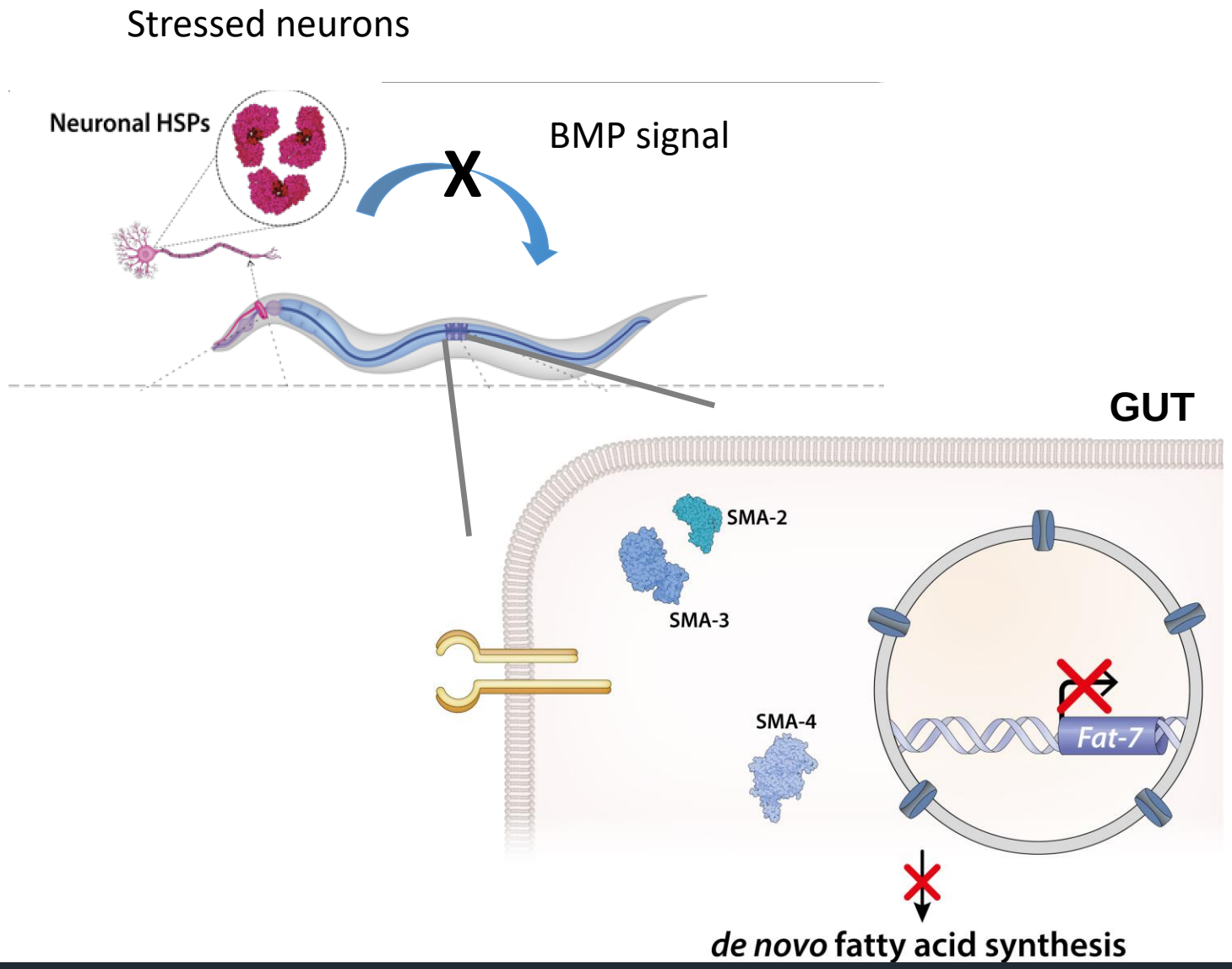
BMP signaling acts downstream of neuronal stress





Laetitia Chauve and Sharlene Murdoch

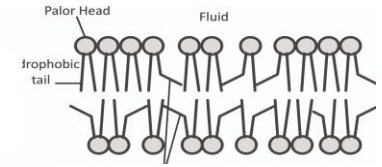
Model


Stressed neurons
Neuronal HSPs
BMP signal
X
GUT
SMA-2
SMA-3
SMA-4
Fat-7
de novo fatty acid synthesis

Neuronal stress as a thermostat

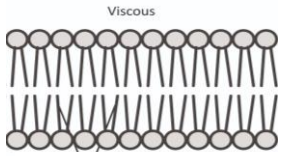
cold **hot**

fluid

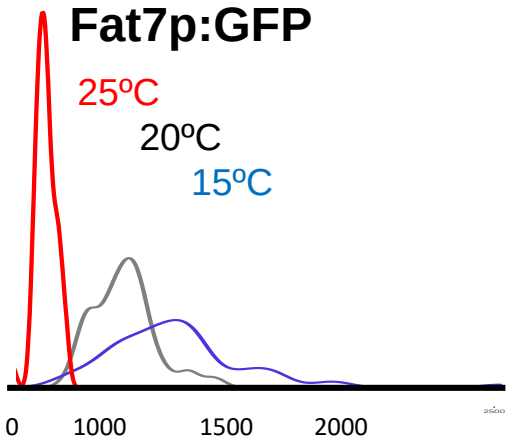


unsaturated FA

preferred temperature



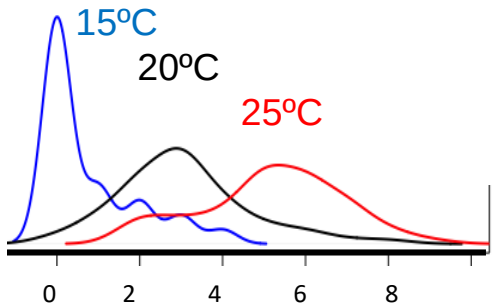
saturated FA **viscous**



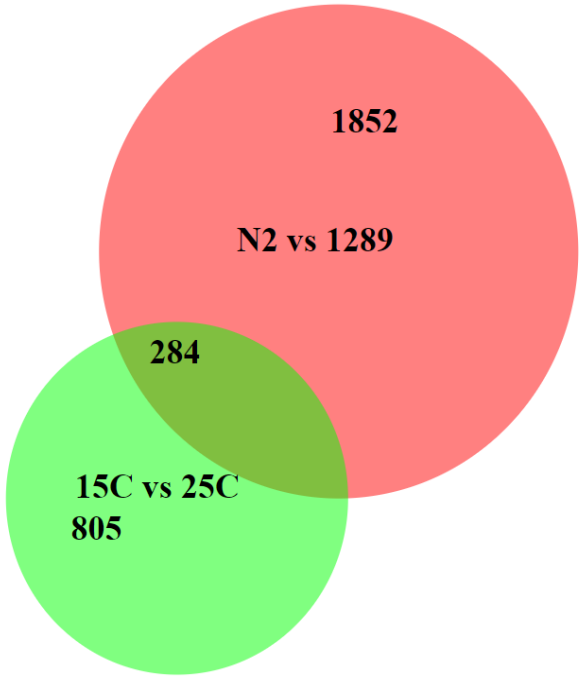
Neurons stressed

FAT-7

Stressed neurons



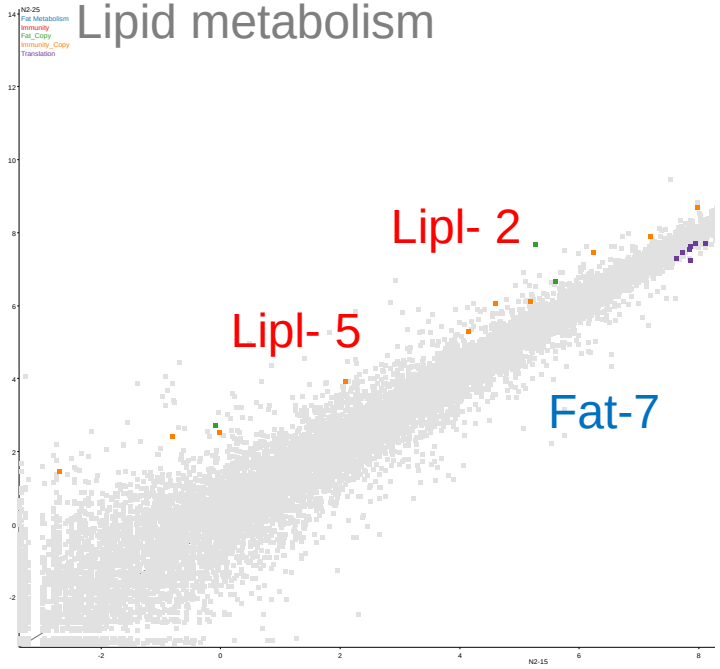
nHSF1 phenocopies high temperature with regards to lipid metabolism



Gomez Orte *et* al, 2017

Venn diagram
l2fc=0 (gene count)
P=2.7e-12

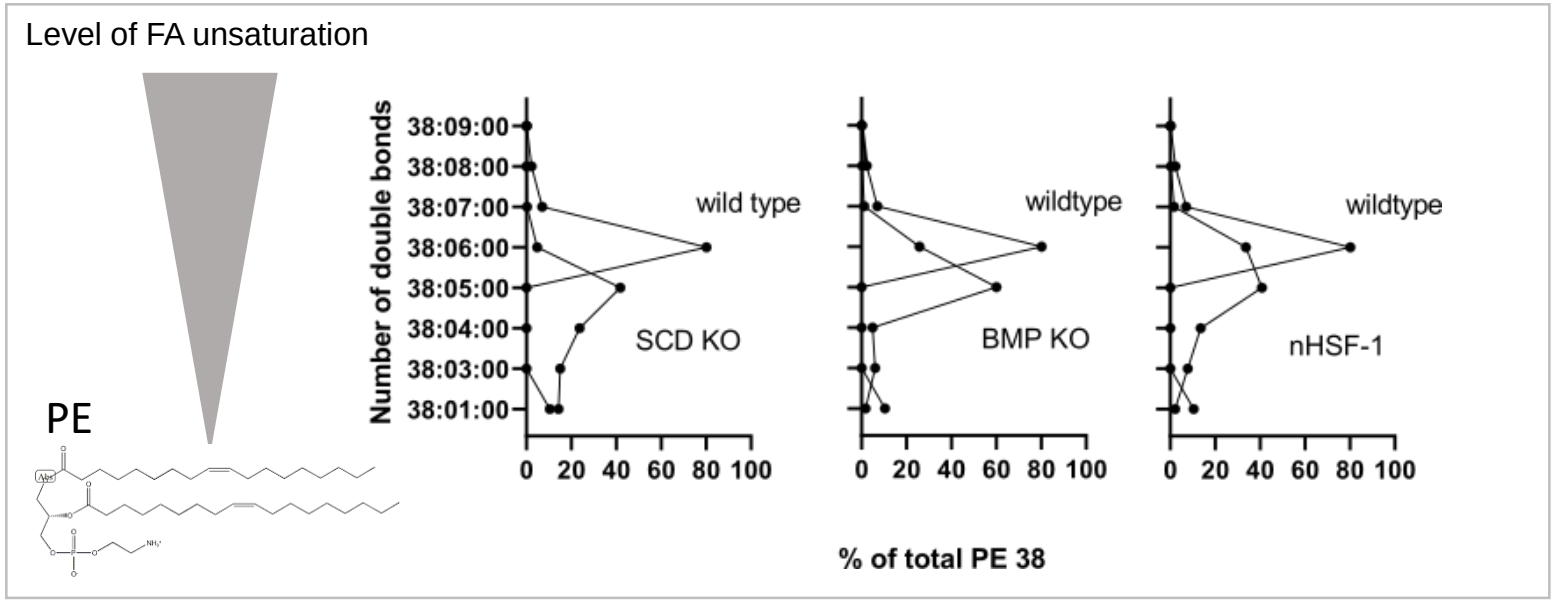
25ºC

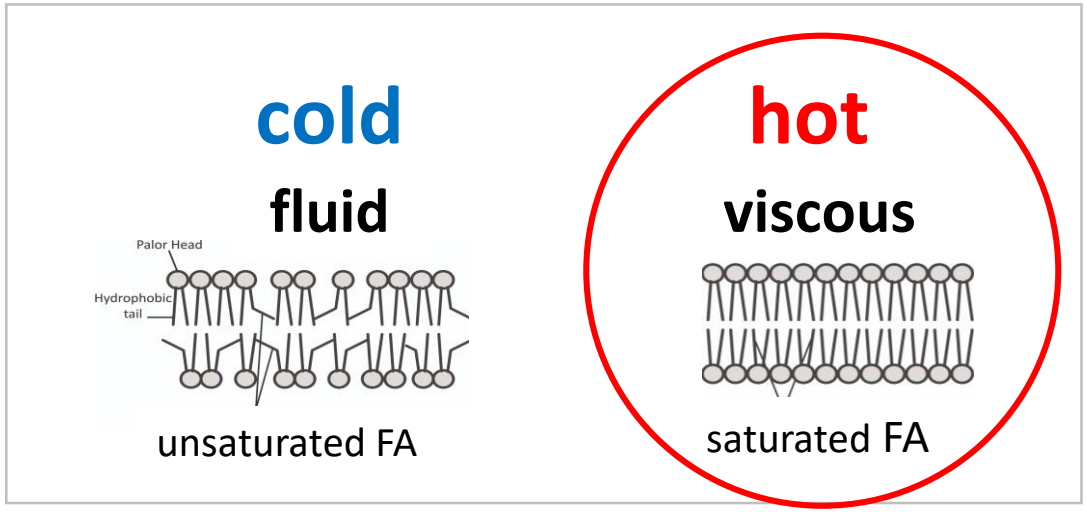


15ºC

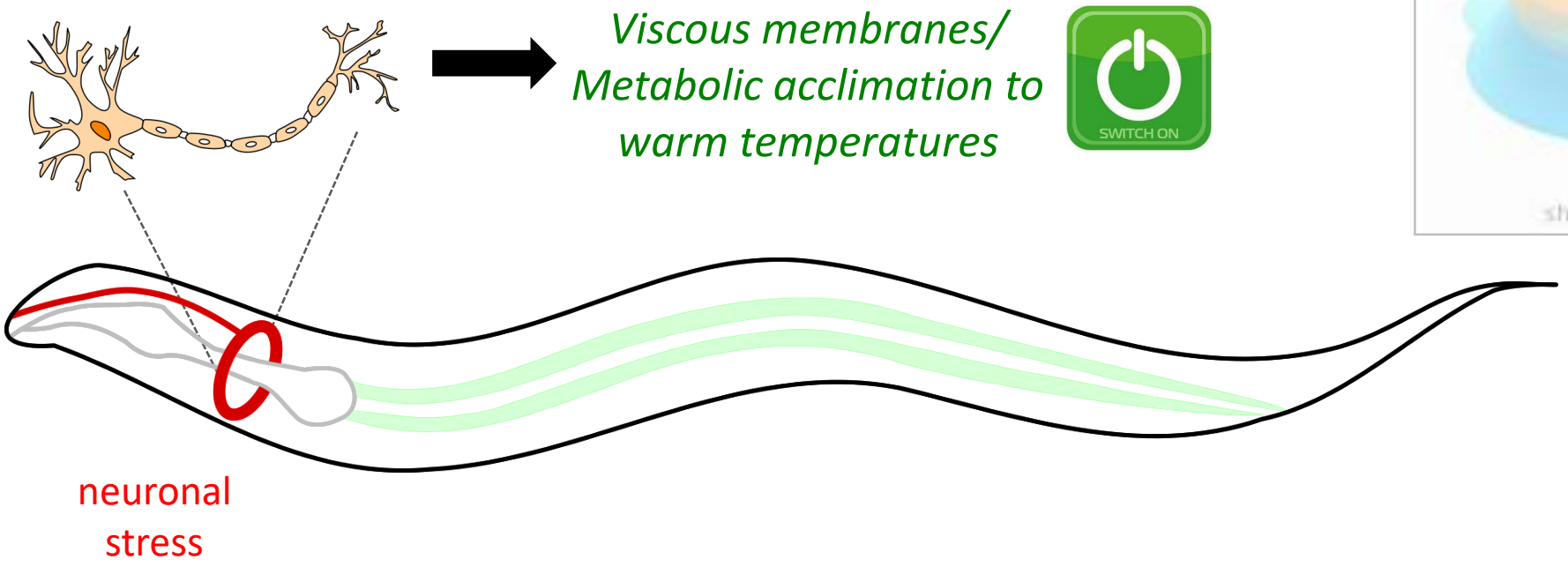
Steven Winglet

Neuronal stress increases membrane viscosity

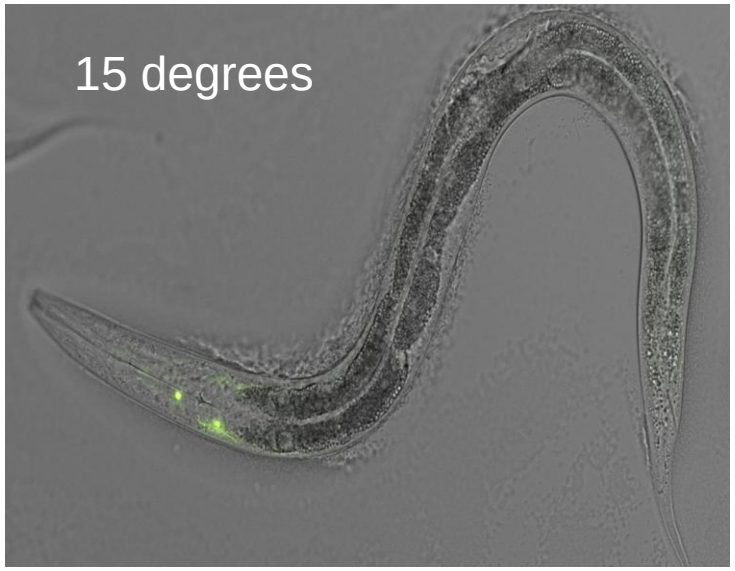


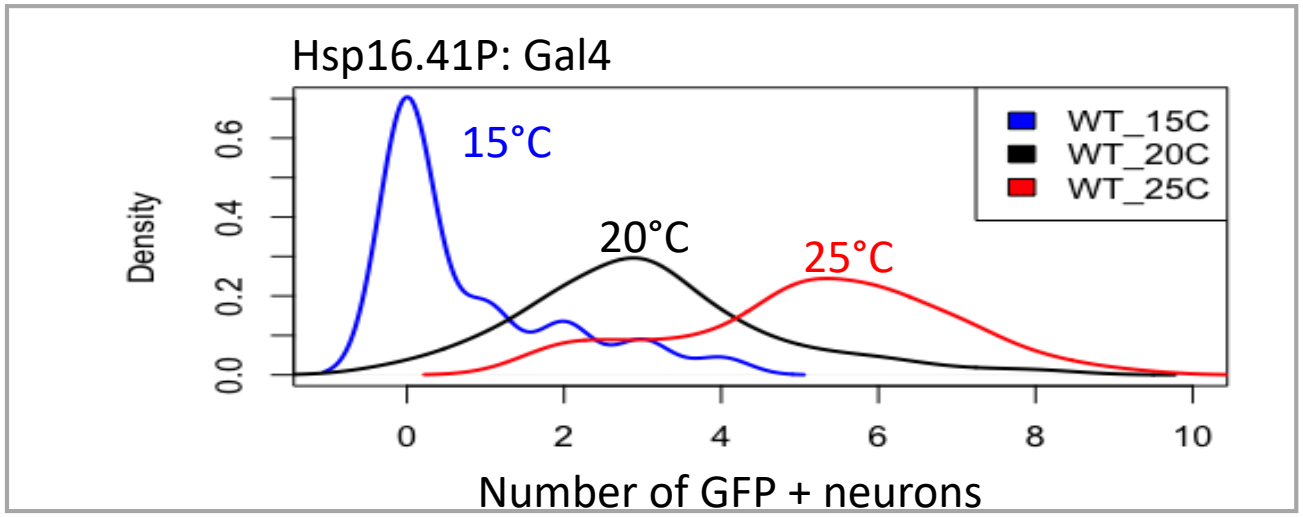


Worms get ready for the heat-wave



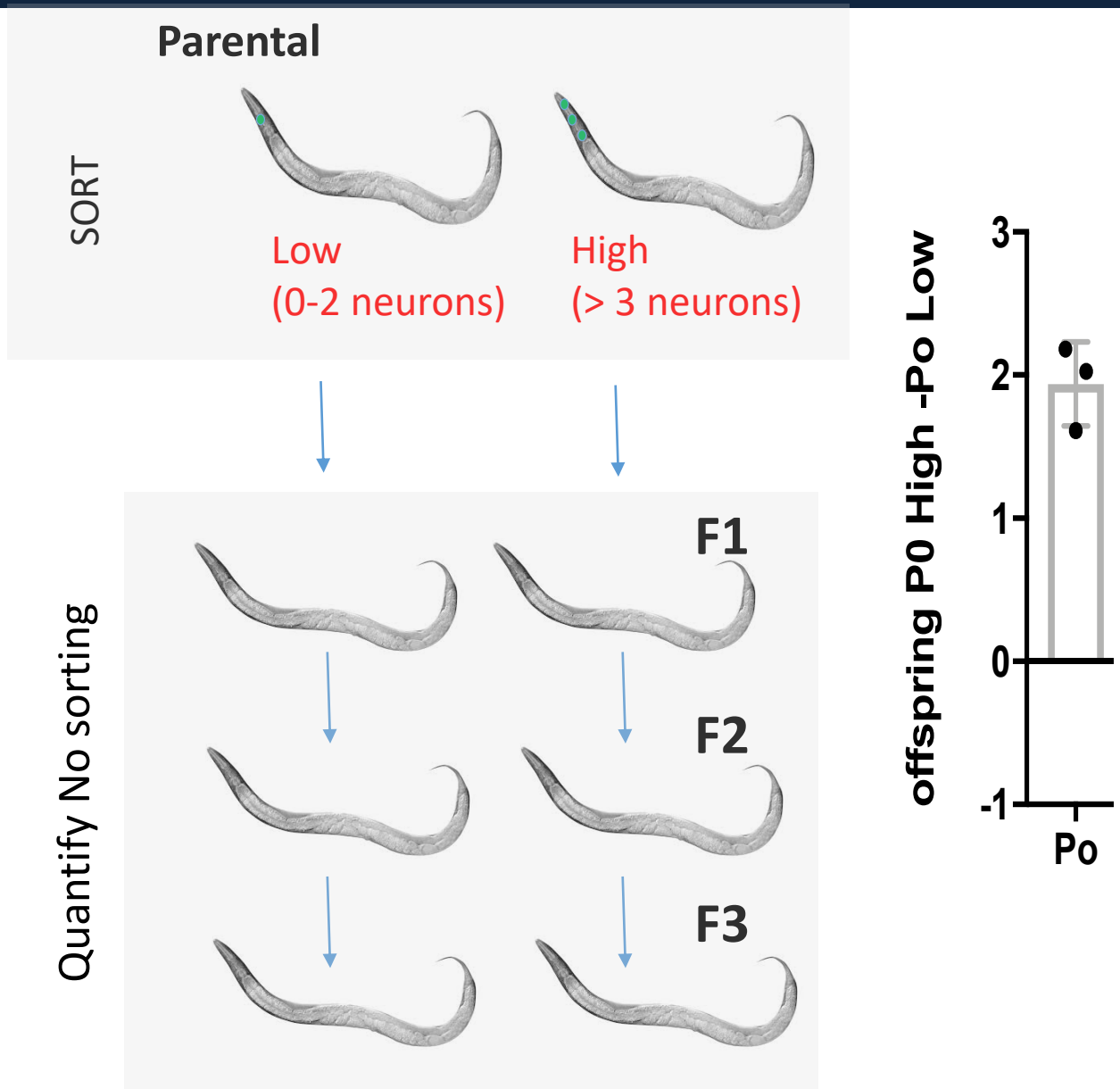
Why is the thermostat variable at constant temperatures?



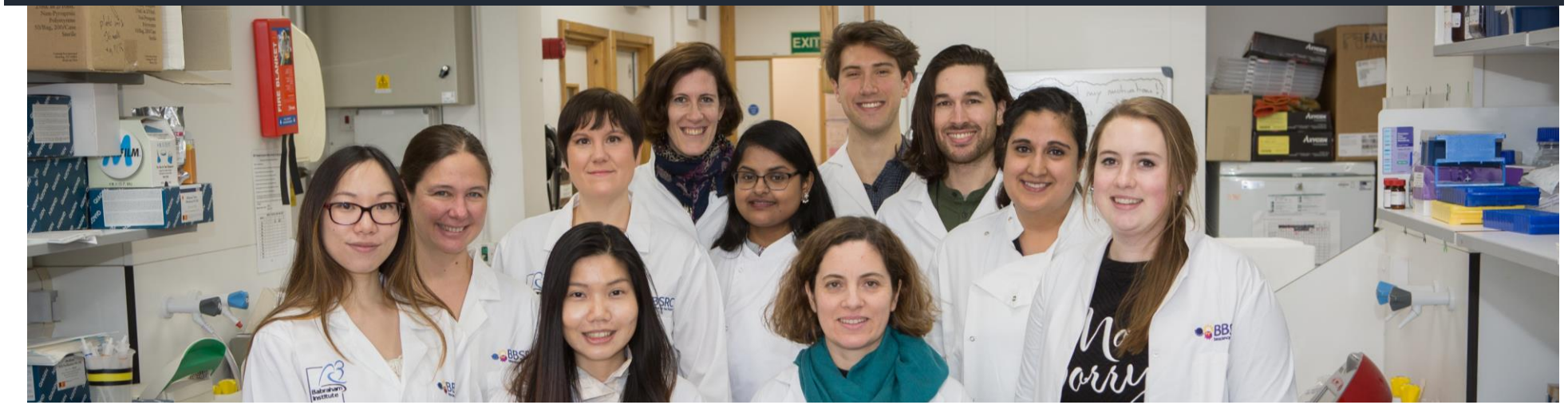


Laetitia Chauve

Is the level of neuronal stress remembered across generations?



Acknowledgements



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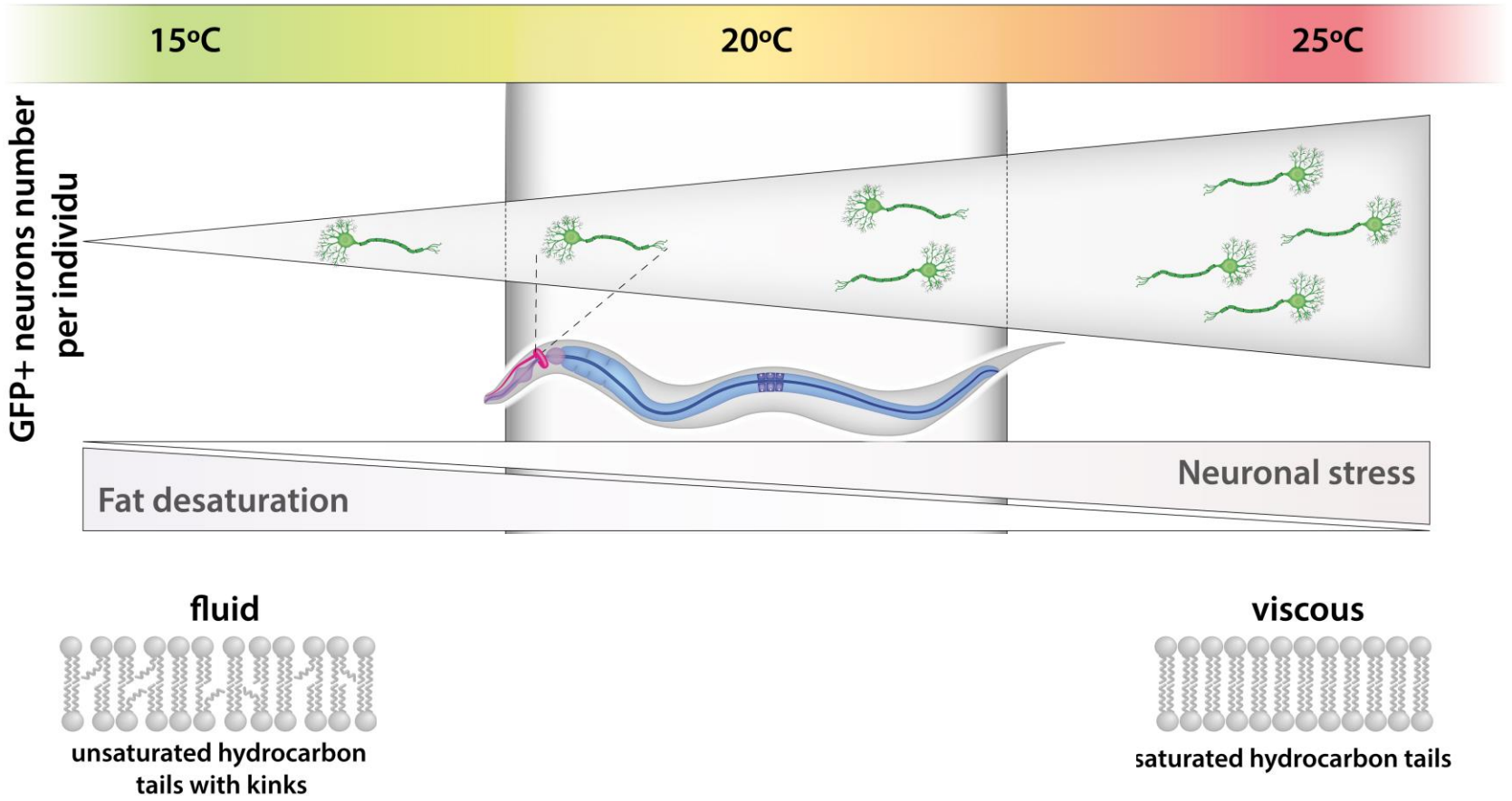
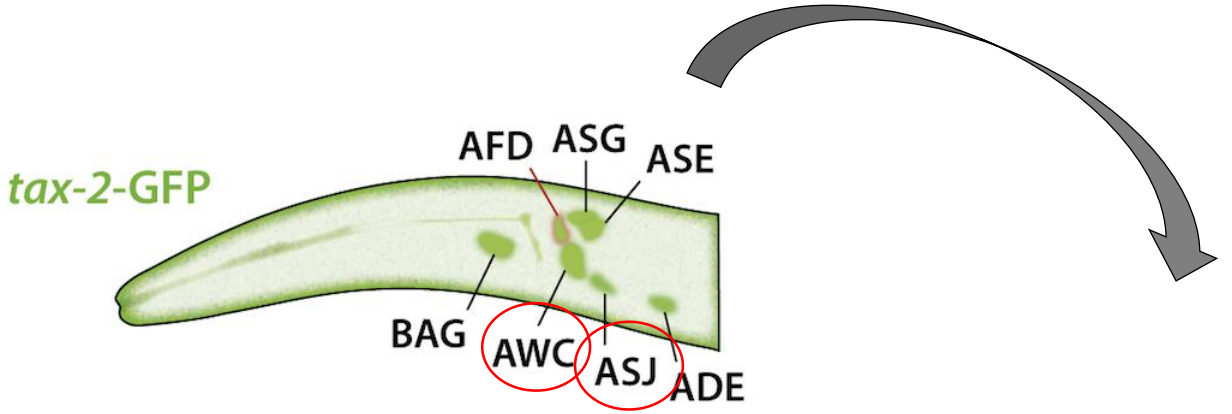
Neuronal stress as an adaptive thermostat



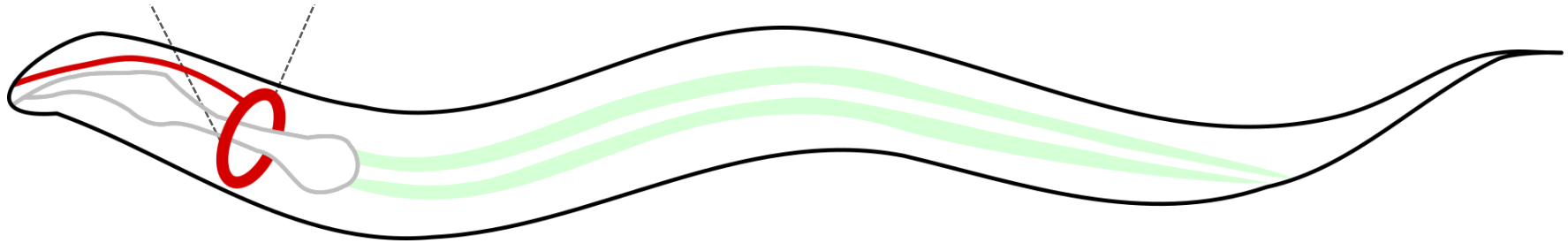
Prediction: nHSF1 worms have the thermostat switched on
Are they constitutively acclimated to warmer temperatures?

Subsets of tax2/tax-4 cGMP expressing neurons are key to fat remodeling

AWC and ASJ are both responsive to temperature



Fat remodeling

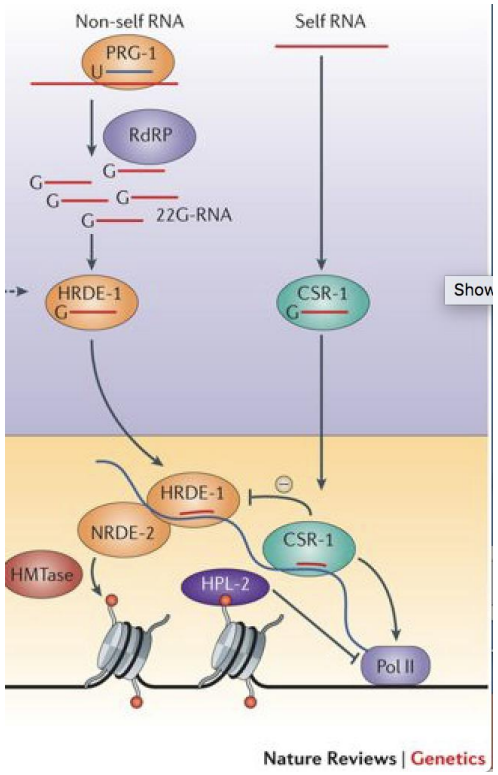


Key signals?

Does the thermostat remember across generations?

Natural RNA interference directs a heritable response to the environment

Daniel Schott, Itai Yanai* & Craig P. Hunter



Hsp transcripts can be subject to the Germline RNAi pathway

Neuronal stress causes a massive increase in membrane phospholipids

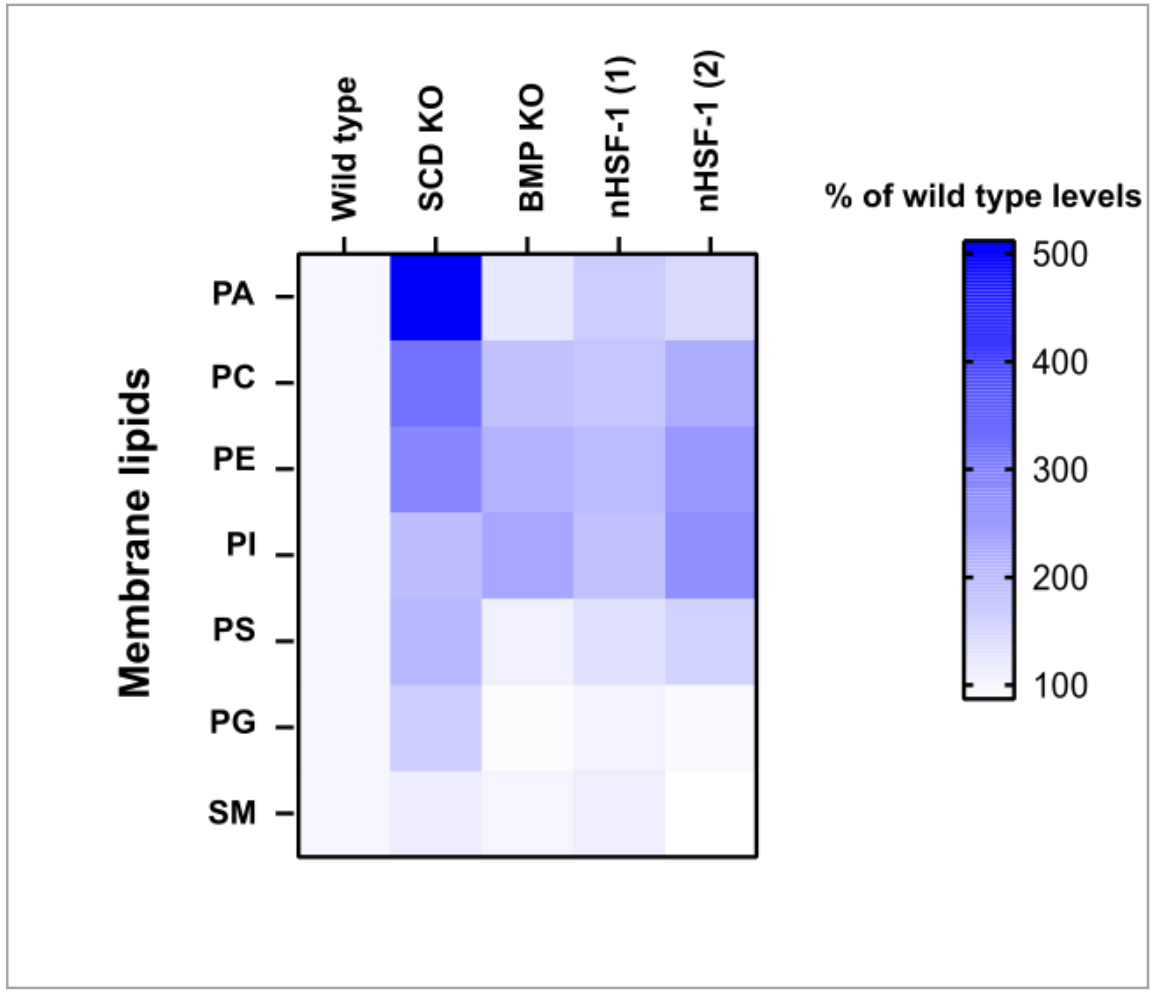
Neuronal stress

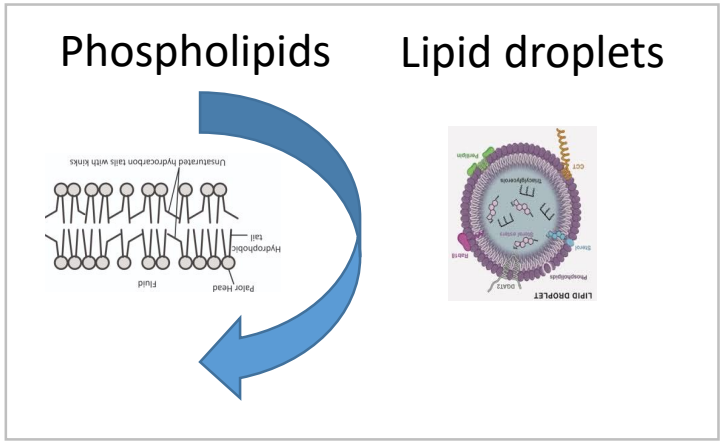
⊥

BMP

↓

SCD
Fat6/7





Greg West and Andrea Lopez