*Chapter 5*

# CONCLUSIONS

## 5.1 Concluding remarks

In working on my thesis, I have thought about how stress affects development and behavior. For example, chronic stress in mammals can affect the structure and function of the brain region associated with memory and emotion (1). Under stressful conditions, tardigrades can hibernate and even survive in the vacuum of space (2).

In the case of nematodes, I discovered that *Caenorhabditis elegans* use neuropeptides to respond to stress and to change their neural states (3). I also discovered around 8,000 other molecular correlates to stress, and used a selection as molecular markers to track and manipulate the dauer entry decision. Going outside of the lab, I discovered nematodes surviving in Mono Lake, and proposed an idea for how pre-adaptation to arsenic in the tide zone could lead to the genomic evolution needed to invade inner Mono Lake.

Here, I speculate that the *C. elegans* strategy of using FMRFamide neuropeptides to change their neural state during dauer is especially important for overcoming the constraints of their physically limited nervous system. That is, because *C. elegans* neurons are over-connected, the nervous system lacks compartmentalization, and does not contain an obvious region that could be specialized for dauer functions (4, 5). Instead, specialized connections between neurons could be created through the different combinations of neuropeptides and their particular receptors. Therefore, species with limited compartmentalization might rely on neuropeptides to allow them to switch neural states, potentially for responding to environmental stresses.

In the case of the human brain, which is compartmentalized into regions tasked with functions such as vision, learning, and memory, one might suspect neuropeptides to be less

important. In fact, even with compartmentalization, neuropeptides might help set up neural states within a region as well. For example, the dynamic visual information processing in mammalian retina requires the modulation of neuropeptdie NPY(6, 7).

On working on my thesis, I have also thought about the importance of field trip and look at biology in the nature. In-lab experiments are useful for precise quantitative measurements of complex and noisy animal development and behaviors. However, because lab condition is so controlled, we might lose our insight in studying biological relevant questions. That's why I think sufficient balance of in- and out-of-lab experiments is ideal.

From my perspective and experience, I believe there are several exciting directions the dauer field can go. Studying how tissues are coordinated in a way to execute the dauer decision appropriately, especially the mechanism for neuronal tissues to remodel and function properly for dauer-specific behaviors, would be fascinating. Moreover, studying dauer recovery decision, which requires the animal to constantly gauge the environmental changes and their internal energy storage, could provide a better understanding of how the interplay between external and internal states affects decision.

## 5.2 References


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