



Changes in telomere length throughout the lifespan of *Osmia lignaria*

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Introduction

- Telomeres are the specialized repetitive DNA sequences at the ends of the linear chromosomes that serve to maintain the integrity of the chromosomes, and protect the DNA from damage after each replication¹
- Telomeres play an important role in cell deterioration with advancing age, and is correlated to longevity²
- Although, in honey bees, there is no correlation between telomere length and aging²
- Solitary bees' telomeres show an inverse correlation between aging and telomere length. (fig. 1)
- *Osmia lignaria* is important agriculturally because they help pollinate various fruit trees³

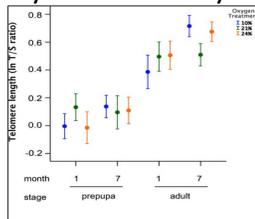
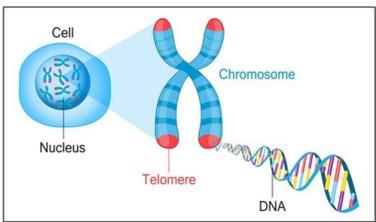


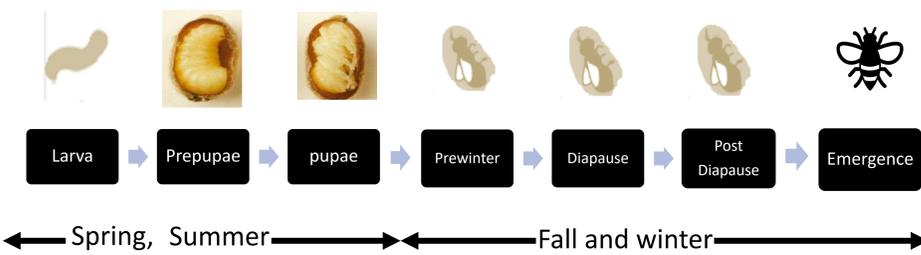
Fig 1. in *Megachile rotundata*, adults had longer telomeres than prepupa ($p < 0.0001$)

Predictions

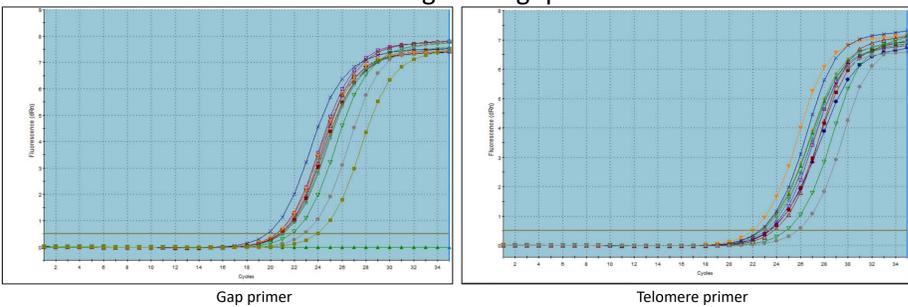
Based on the previous study in *M. rotundata*, we predict early adult stage bees in *O. lignaria* will have the longest telomere length, and telomere length will decline with adult age.

Methods

1. Extracted DNA from different life stages in *O. lignaria*



2. Measured relative telomere length using qPCR

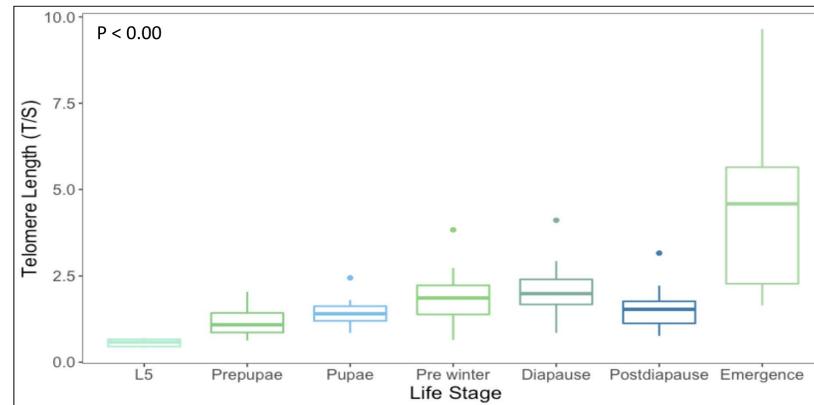


3. Calculated Telomere Ratio



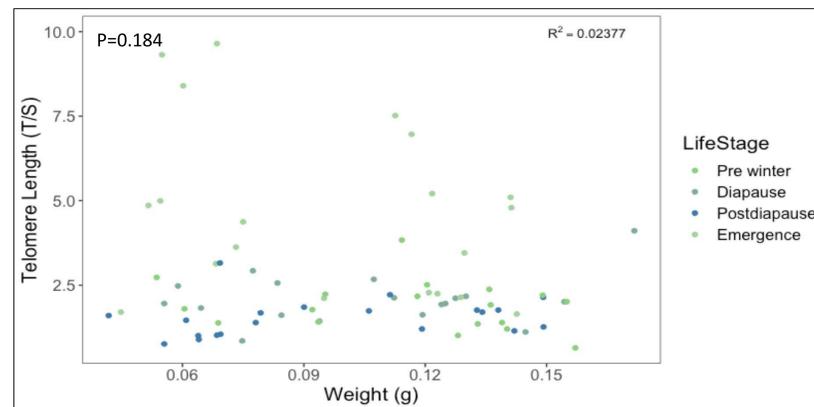
Results/Conclusions

Emerged bees have the longest telomeres



- Telomere length in the emerged bees is significantly longer than the other life stages.
- This is a similar pattern to the experiment conducted at NDSU (fig. 1) where the *Megachile* had an increase of telomere length in the adult life stage.
- Contrary to our predictions, telomere length appears to get longer in the latest life stage tested which is an unusual pattern.

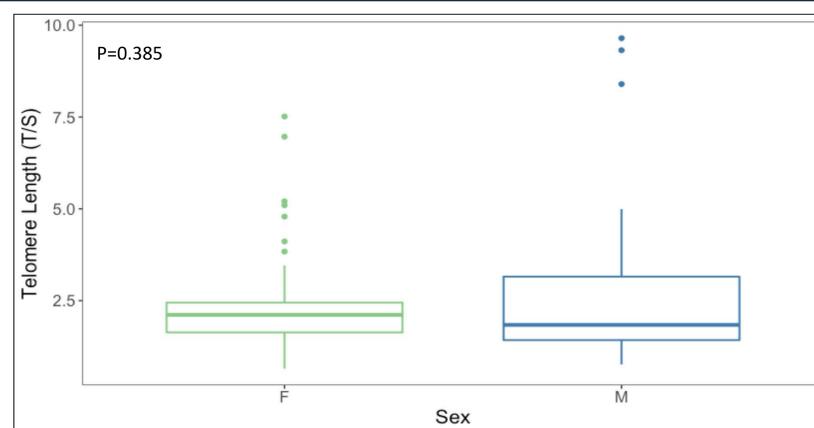
Mass has no correlation with telomere length



- There is no correlation between weight and telomere length
- Within a species it has been demonstrated that larger individuals have shorter telomeres than smaller individuals, we did not see this pattern



No difference in telomere length between males and females



- There was no significant difference in telomere length between males and females
- Females are known to have a longer life span than males



Future Experiment

- Study why the emergence life stage had the longest telomere length
- Study to see how telomerase effects the regeneration of telomeres in all life stages

References and Acknowledgments

DNA picture link: <https://www.news-medical.net/life-sciences/What-are-Telomeres.aspx>
Osmia lignaria life cycle image link: <http://bee-lifestyle.com/life-cycle-of-bees/>
 lignaria http://entnemdept.ufl.edu/creatures/NMSZ/BEES/blue_orchard_bee.htm
https://www.google.com/search?q=prepupae+osmia&source=images&sa=X&ved=0ahUKewj5yrvdvyAHVvU5DhKXCCQAAUIEgC&w=1520&bih=920imgdli-pyGTMRS5SD1PM:kmgrc-Ets-KBpd_ViUMK
 Horvath P. J. (2007). Telomerase and the aging process. *Experimental gerontology*, 42(7), 575-581. doi:10.1016/j.exger.2007.03.007
 Heidinger, B. J., Blount, J. D., Bones, W., Griffiths, K., Metzger, N. B., & Monaghan, P. (2012). Telomere length in early life predicts lifespan. *Proceedings of the National Academy of Sciences*, 109(5), 1743-1747.
 Bosch, J., & Kemp, W. P. (2002). How to manage the blue orchard bee. *Sustainable Agriculture Network*, Beltsville, Maryland, USA
 Rogers, L. J., Frazzini, E., & Vercosa, E. (2016). Lateralized antennal control of aggression and sex differences in red mason bees, *Osmia bicornis*. *Scientific reports*, 6, 29411

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