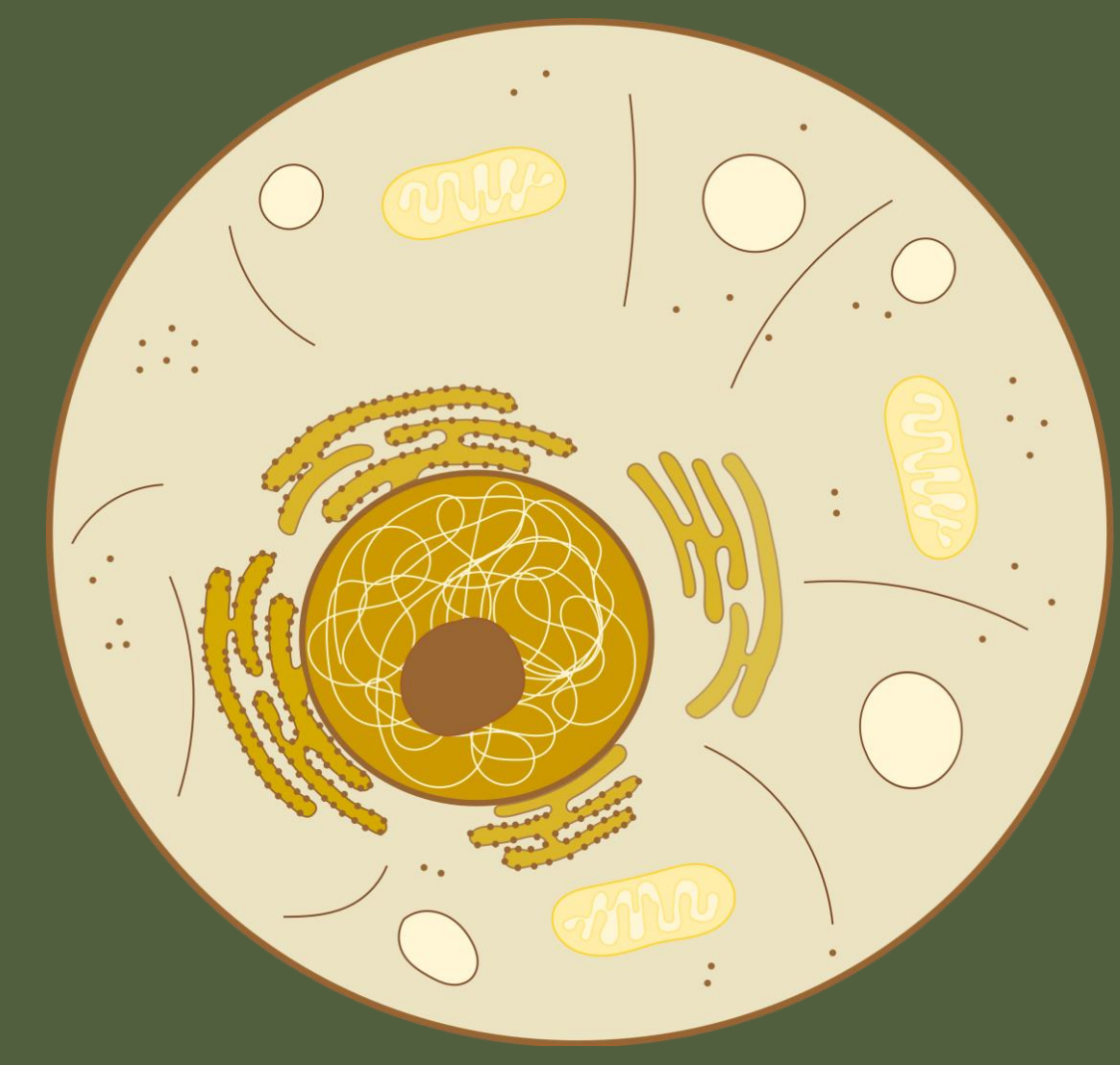


Systemic changes in cell size through the body and flight performance in *Drosophila melanogaster*: links to rapamycin-induced TOR downregulation

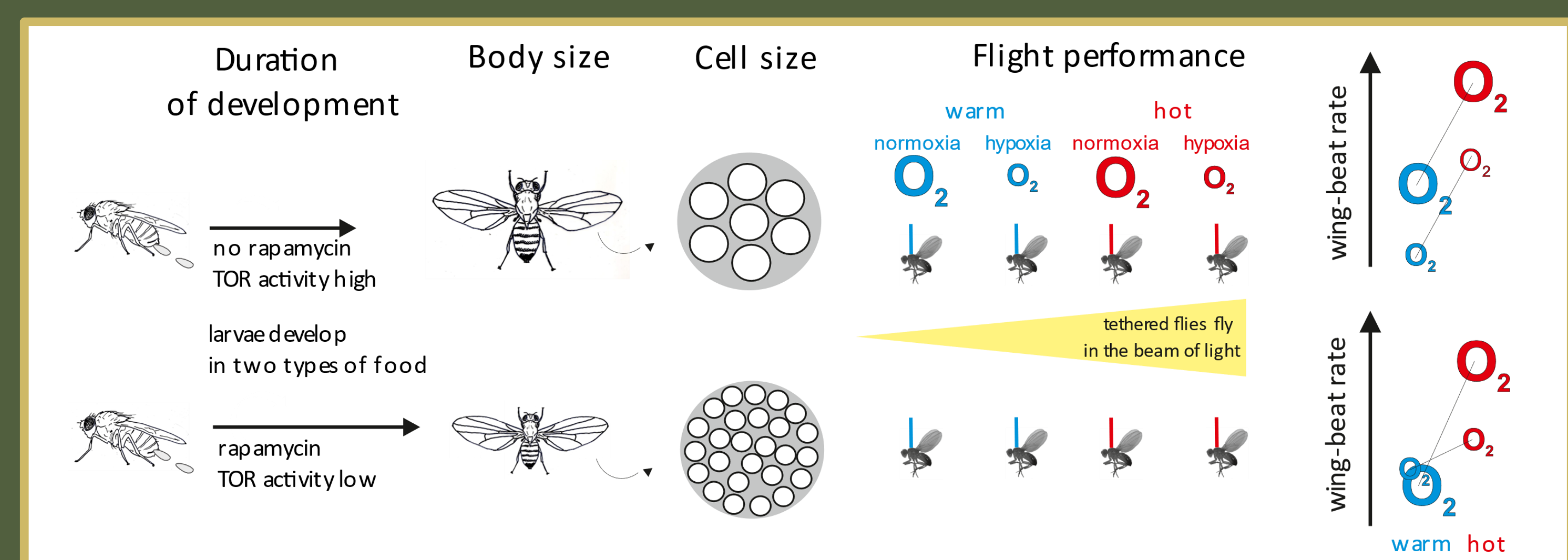
Ewa Szlachcic, Anna Maria Łabęcka, Valeriya Privalova, Anna Sikorska, Marcin Czarnołęski

Institute of Environmental Sciences, Jagiellonian University, Kraków, Poland



Does cell size matter?

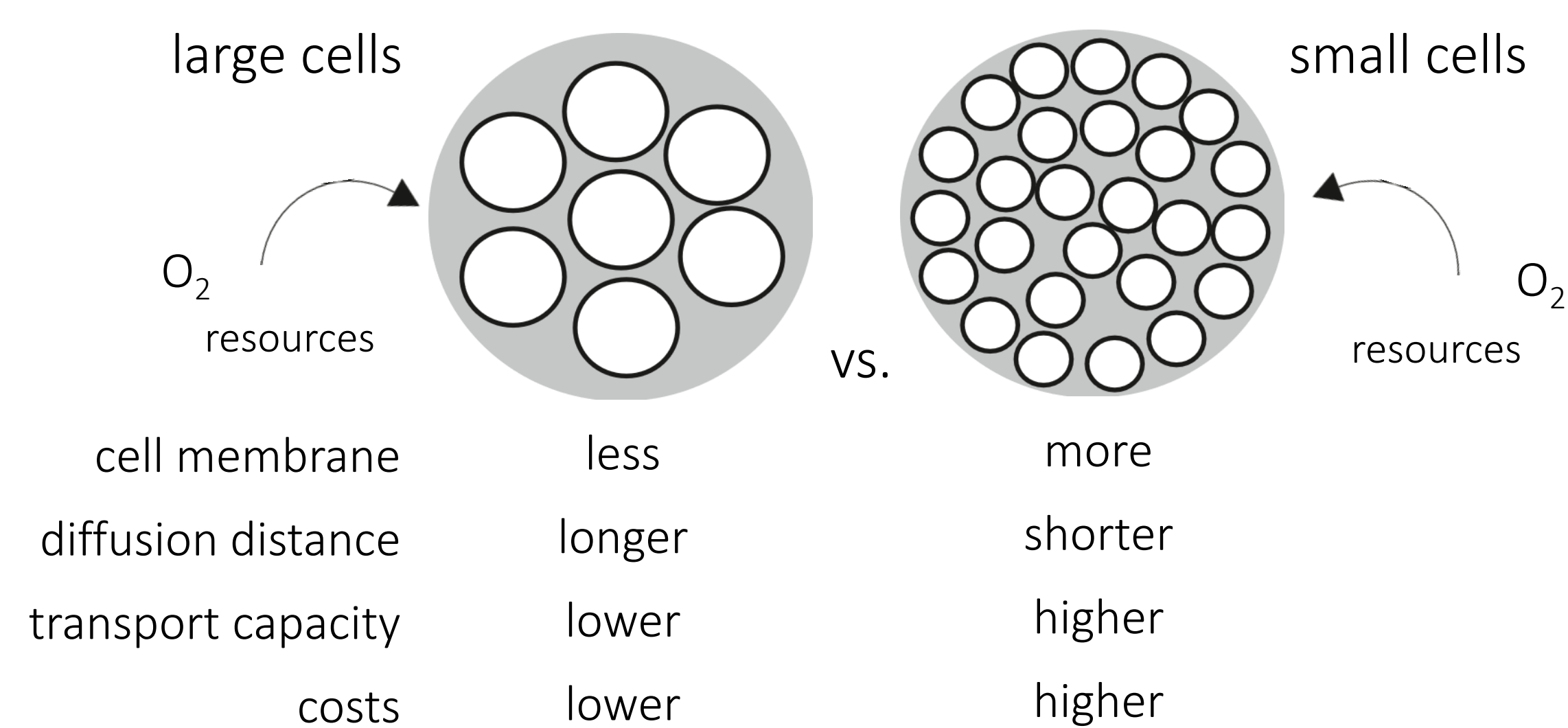
YES, cell size does play a role in how insects function, BUT the picture is complex.



1. INTRODUCTION

Cellularity is an apparent feature of organisms on Earth. Cell size differs between populations and species, but it remains unclear whether these changes occur synchronically or independently in different cell types and whether they have fitness consequences.

Theory of optimal cell size



Aim: to examine the role of cell size in insect functioning

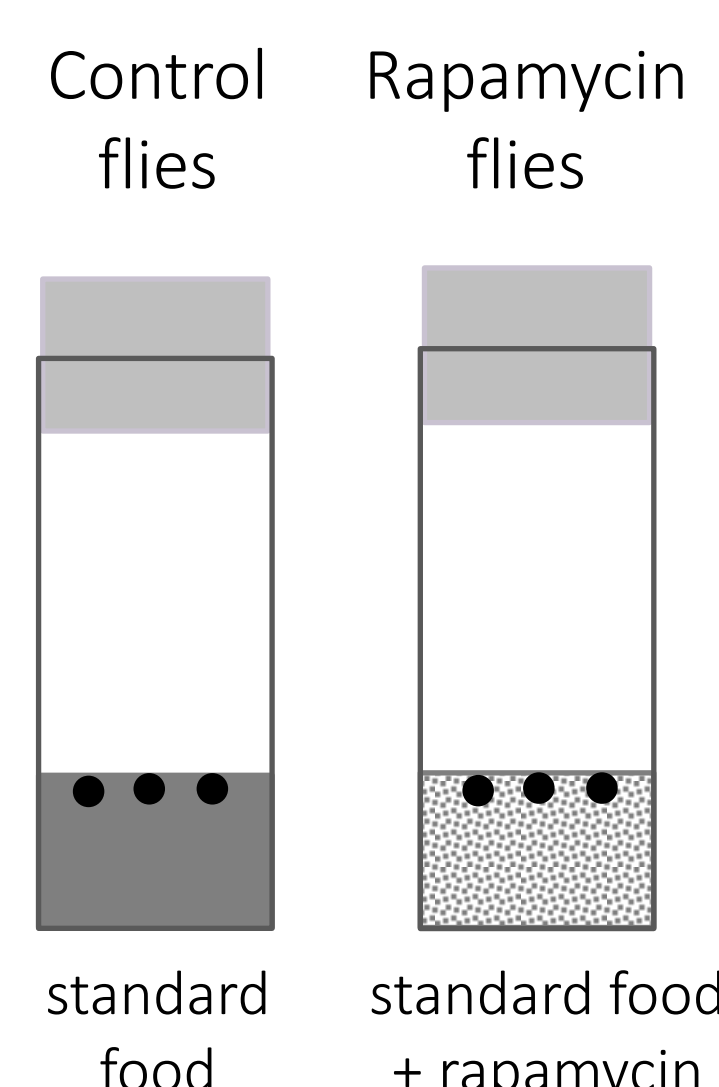
Research questions:

- Does cell size change consistently across organs in a body?
- Does cell size help organisms meet metabolic demands via resources supply during activity under different environmental conditions?

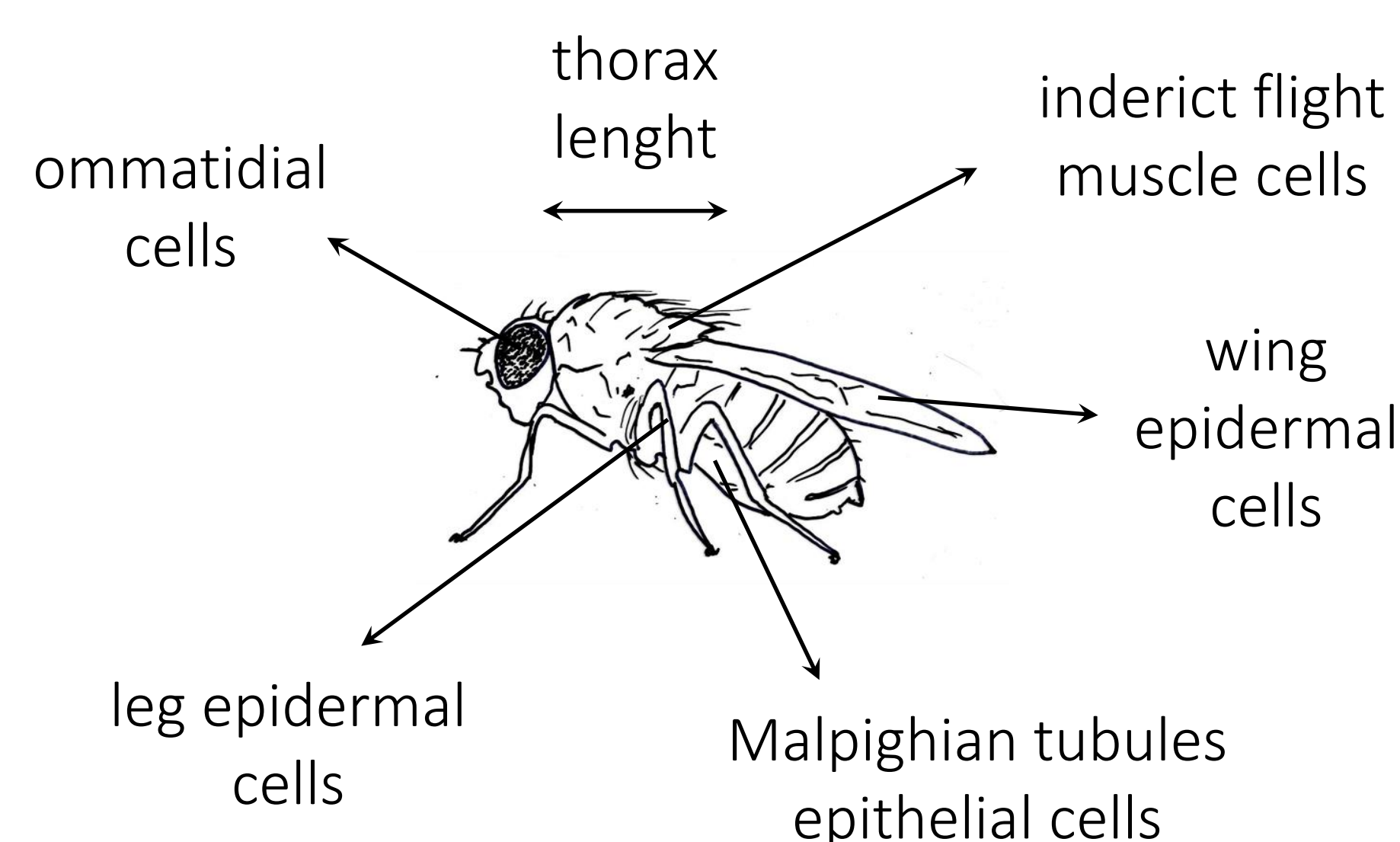
2. METHODS

Phenotypic induction

- Genetic lines of fruit flies originating from wild
- Manipulation of TOR activity by rapamycin to induce cell size changes
- Rapamycin, human drug, added to food during larval development



Body and cell size measurements



Flight performance

- Wing beat frequency in tethered males
- Four environmental conditions

24°C

normoxia
21% O₂

hypoxia
10% O₂

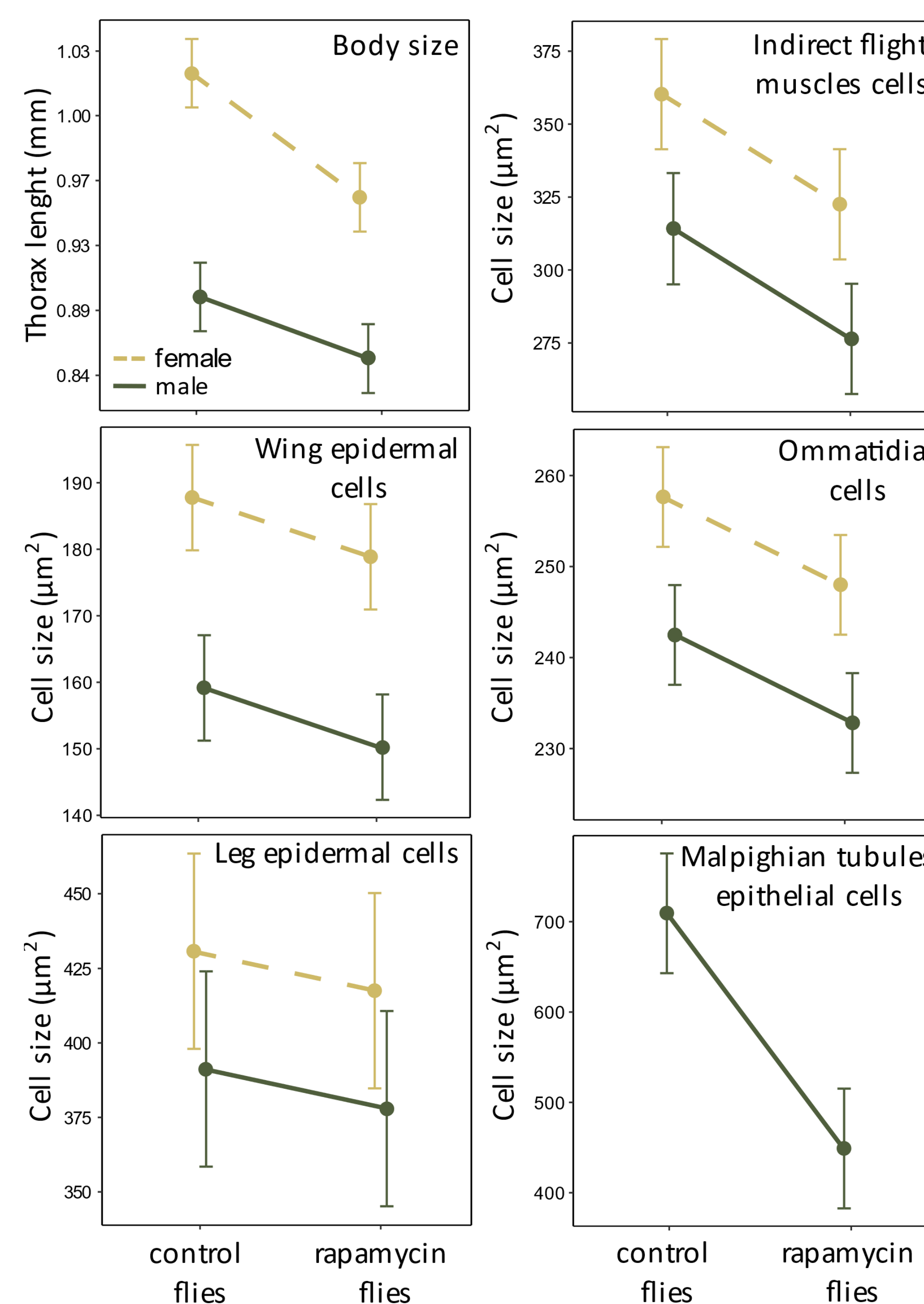
29°C

normoxia
21% O₂

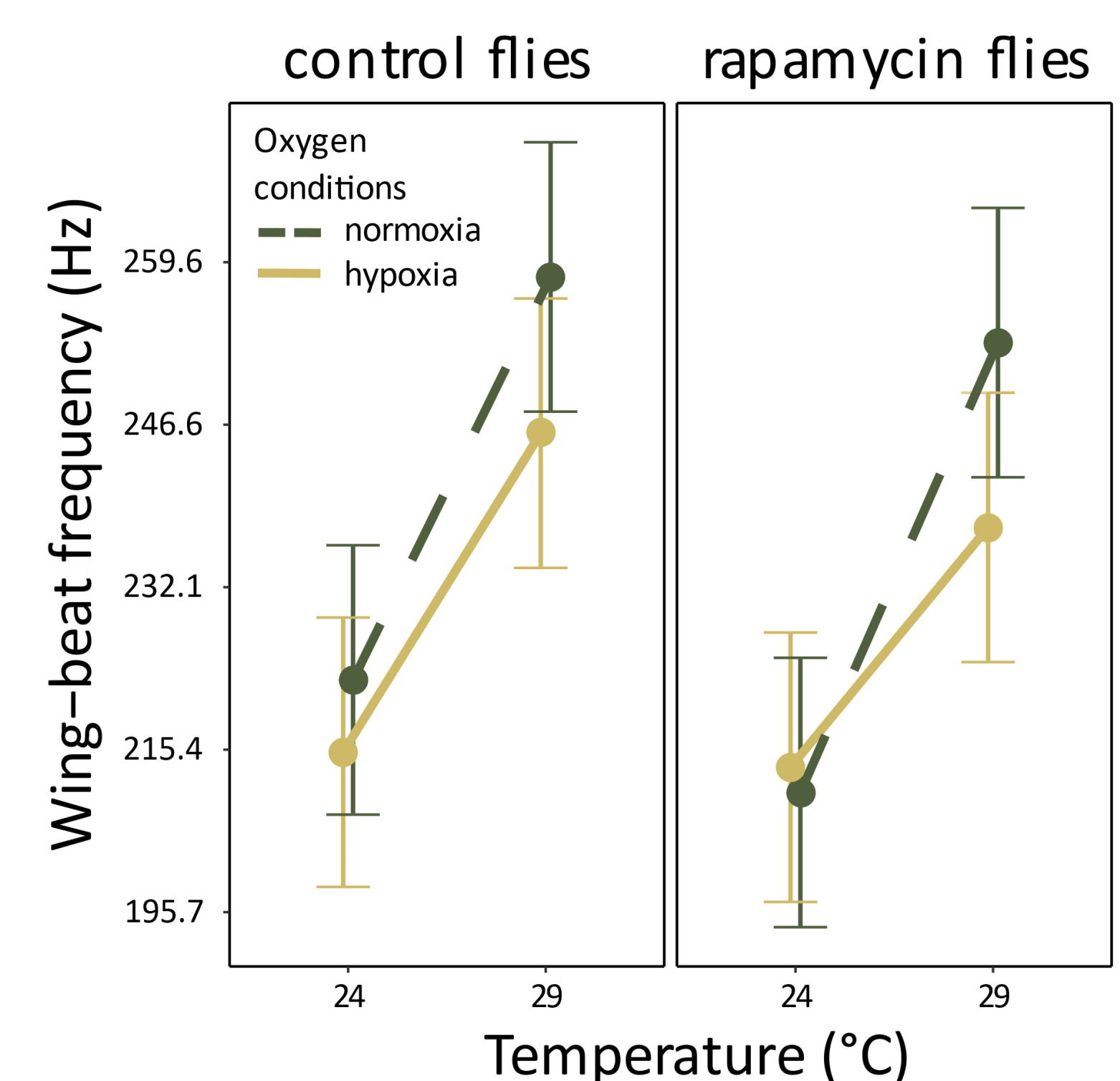
hypoxia
10% O₂

3. RESULTS

Body and cell size



Flight performance



- Rapamycin flies -> smaller bodies and smaller cells of each type
- Females -> larger with larger cells
- Wing beat rate -> slower under cooler and less-oxygenated conditions
- Small-celled flies -> no oxygen limitation under cooler conditions

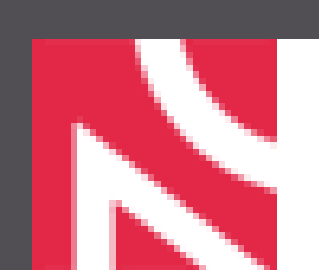
4. CONCLUSIONS

- Differences in TOR activity and sexes are manifested by different body size and orchestrated changes in cell size across the organism.
- Cellular composition of organisms should be considered more often when investigating performance of ectotherms in the changing world and the origin of ecological and evolutionary patterns in life histories.

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References:

Szlachcic, E., & Czarnołęski, M. 2021. Thermal and oxygen flight sensitivity in ageing *Drosophila melanogaster* flies: Links to rapamycin-induced cell size changes. *Biology*, 10, 861.
Szlachcic, E., Łabęcka, A. M., Privalova, V., Sikorska, A., Czarnołęski, M. 2023. Systemic orchestration of cell size throughout the body: Influence of sex and rapamycin exposure in *Drosophila melanogaster*. *Biol Lett*, 19:20220611.