Multivariate Meta-Analysis for Longevity and Reproduction

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# Multivariate meta-analysis and meta-regression

Reproductive traits were more strongly impacted by temperature changes than longevity when controlling for temperature (contrast = -1.04, 95% CI: -1.31 to -0.76, df = 396, *p*-value = < 0.0001). At 25C, longevity was reduced by -0.22 SD units relative to the control (95% CI: -0.41 to -0.04, df = 396, *p*-value = 0.02). In contrast, reproduction was significantly reduced by -1.26 SD units relative to the control (95% CI: -1.52 to -1, df = 396, *p*-value = < 0.0001). However, there was high heterogeneity in both traits with prediction intervals spanning -6.35 to 4.12 (**?@fig-fig1**).

Mean effects changed in complicated ways with changes in temperaure, with significant non-linear patterns that depended on the effect outcome (**?@tbl-tbl1**), with effect magnitude and direction changing non-linearly with temperature increases (FAY, MAYBE ADD FIG). Interestingly, studies that observed larger changes in reprodcution also observed correlated changes in longevity (between study correlation = 0.37), however, at the within study-level there was a much weaker correlation (within-study correlation = 0.17, [Figure 1](#fig-fig2)).

| Parameters | Est. | L 95% CI | U 95% CI | df | p-value |
| --- | --- | --- | --- | --- | --- |
| Longevity (mean) | -0.0903 | -0.3092 | 0.1286 | 392 | 0.42 |
| Reproduction (mean) | -0.4837 | -0.7943 | -0.1732 | 392 | < 0.01 |
| Linear Treatment Temperature (centered) - Longevity | -0.2581 | -0.2875 | -0.2288 | 1,576 | < 0.0001 |
| Linear Treatment Temperature (centered) - Reproduction | -0.0660 | -0.0978 | -0.0342 | 1,576 | < 0.0001 |
| Quadratic Treatment Temperature (centered) - Longevity | -0.0022 | -0.0042 | -0.0002 | 1,576 | 0.03 |
| Quadratic Treatment Temperature (centered) - Reproduction | -0.0123 | -0.0146 | -0.0099 | 1,576 | < 0.0001 |
| Cubic Treatment Temperature (centered) - Longevity | 0.0005 | 0.0003 | 0.0006 | 1,576 | < 0.0001 |
| Cubic Treatment Temperature (centered) - Reproduction | -0.0001 | -0.0002 | 0.0001 | 1,576 | 0.42 |

**?(caption)**

|  |
| --- |
| Figure 1- Between study correlation for reproduction and longevity |

# Sensitivity Analysis

This removes the smallest and largest 5% effect sizes (so 10% of the data in total). The plot above shows only the experiments that have outlying effect sizes not the specific effect size itself.

When removing the 5% largest and smallest effect sizes, the following effect sizes are removed.

[1] "HUM54A.-5" "TEMP1165\_B.6" "TEMP1313A.-7" "TEMP1361A.-3"   
 [5] "TEMP1506A.-10" "TEMP1567C.-5" "TEMP1964A.-5" "TEMP1964A.5"   
 [9] "TEMP1964A.7" "TEMP2035\_A.-15" "TEMP2035\_A.-20" "TEMP2281A.10"   
[13] "TEMP2313\_A.16" "TEMP2313\_A.19" "TEMP268\_A.-3" "TEMP268\_A.-7.7"  
[17] "TEMP419B.-5" "TEMP546\_A.-5" "TEMP546\_A.10" "TEMP559\_A.-10"   
[21] "TEMP559\_A.-5" "TEMP559\_A.10" "TEMP559\_A.15" "TEMP585\_A.-5"   
[25] "TEMP653A.-10" "TEMP850A.-3"