# Electronic supplementary materials for: Developmental plasticity of growth, genetic variation and maternal effects in response to temperature

*Heterogenous Variance*

Model with homogenous variance was best supported by WAIC values. As such, we did not explicitly model residuals in all subsequent models

**Table S1** Comparisons of WAIC values for homogenous and hetergenous residuals

|  |  |  |  |
| --- | --- | --- | --- |
| Model | WAIC value | ELPD Diff | SE Diff |
| Homogenous residuals | -3.61 | 0 | 0 |
| Heterogenous residuals | -2.09 | -0.76 | 2.08 |

*The Influence Of Developmental Temperature On The Thermal Reaction Norm Of Metabolic Rate*

**Table S2** Model coefficients of full model testing whether developmental temperature affects the elevation and slope of the thermal reaction norm of metabolic rate. This model used a complete case dataset, n = 3818. The intercept is the cold developmental temperature. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

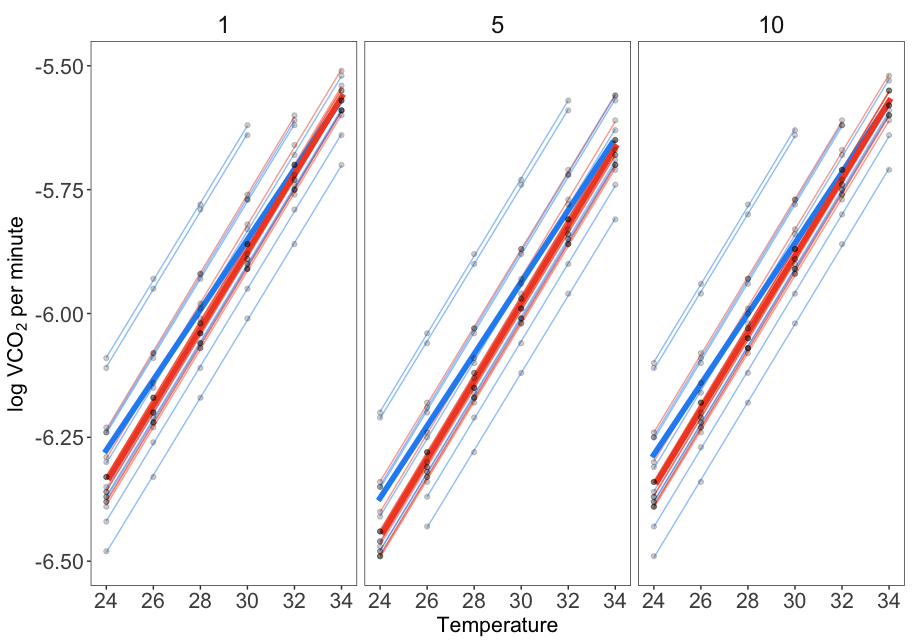
|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept | **-7.621** | **-7.843** | **-7.397** |
| Treatment 29 | 0.135 | -0.076 | 0.328 |
| Temperature | **0.077** | **0.072** | **0.081** |
| Mass | **0.622** | **0.51** | **0.739** |
| Age | -0.035 | -0.079 | 0.006 |
| Treatment 29 Temperature | -0.005 | -0.011 | 0.002 |
| VI, Intercept | **0.012** | **\*0** | **0.04** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vsession, Intercept | **0.01** | **0.003** | **0.028** |
| Vmeasurement error, Intercept | **0.044** | **0.04** | **0.049** |
| COVI, Intercept – I, Slope | -0.000123 | -0.000822 | 6.68e-05 |
| Residual | **0.041** | **0.038** | **0.044** |

**Table S3** Model coefficients of main effects model testing developmental temperature affects the elevation of the thermal reaction norm of metabolic rate. This model used an imputed dataset of n = 6000. The intercept is the cold developmental temperature. Note that the imputation model also estimates an intercept and residual variance for mass as it was also missing data. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero.

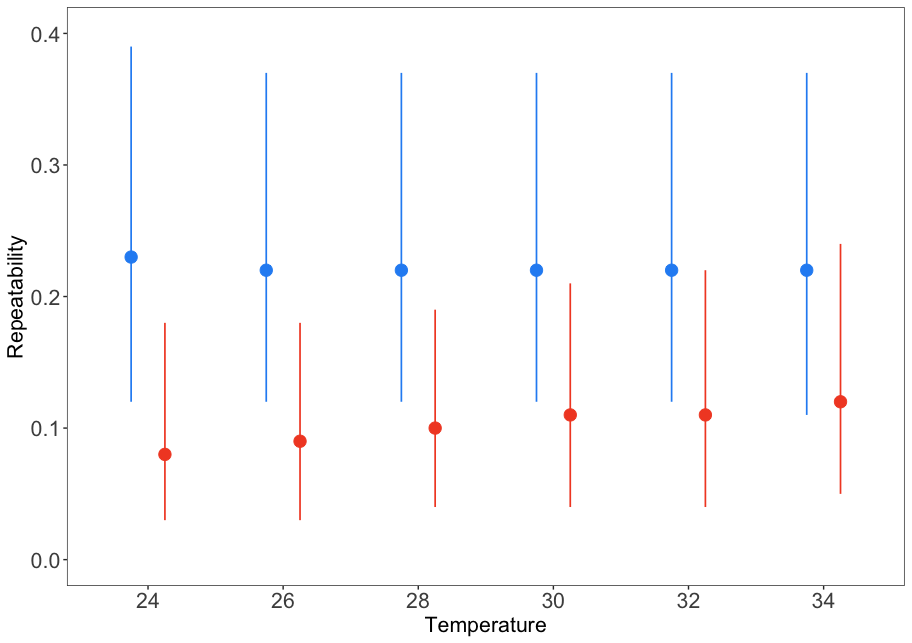
|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept MR | **-7.553** | **-7.758** | **-7.355** |
| Intercept Mass | **-1.442** | **-1.449** | **-1.436** |
| Treatment 29 | 0 | -0.06 | 0.059 |
| Temperature | **0.074** | **0.071** | **0.078** |
| Age | -0.035 | -0.081 | 0.007 |
| Mass | **0.622** | **0.509** | **0.734** |
| VI, Intercept | **0.013** | **0.001** | **0.042** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vsession, Intercept | **0.01** | **0.003** | **0.03** |
| Vmeasurement error, Intercept | **0.044** | **0.04** | **0.049** |
| COVI, Intercept – I, Slope | -0.000126 | -0.000869 | 6.38e-05 |
| Residual MR | **0.041** | **0.038** | **0.044** |
| Residual Mass | **0.043** | **0.041** | **0.045** |

**Table S4** Model coefficients of main effects model testing developmental temperature affects the elevation of the thermal reaction norm of metabolic rate. This model used a complete case dataset, n = 3818. The intercept is the cold developmental temperature. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept | **-7.556** | **-7.753** | **-7.356** |
| Treatment 29 | -0.001 | -0.059 | 0.062 |
| Temperature | **0.074** | **0.071** | **0.078** |
| Mass | **0.621** | **0.506** | **0.73** |
| Age | -0.035 | -0.076 | 0.01 |
| VI, Intercept | **0.013** | **0.001** | **0.041** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vsession, Intercept | **0.01** | **0.003** | **0.028** |
| Vmeasurement error, Intercept | **0.044** | **0.04** | **0.048** |
| COVI, Intercept – I, Slope | -0.000124 | -0.000921 | 7.09e-05 |
| Residual | **0.041** | **0.038** | **0.044** |

**Figure S1.** Predicted thermal reaction norms of metabolic rate for the ‘cold’ developmental temperature group (thick blue line, n = 26) and the ‘hot’ developmental temperature group (thick red line, n = 25). Predictions were made from an complete caste analysis. There were no significant difference among treatment in the elevation or slope of the reaction norm (see Table 2). Thin lines present individual reaction norms for a subset of 10 individuals from each treatment. Grey points represents model predictions for individual’s mean log metabolic rate. Each panel represents a distinct sampling sessions to illustrate the consistency of individual reaction norms. Note that a slight ‘jitter’ was added to each treatment’s reaction norms to highlight the presence of two reaction norms.

*The Influence Of Developmental Temperature On The Repeatability Of The Thermal Reaction Norm And Temperature Specific Repeatability Of Metabolic Rate*



**Figure S2.** Adjusted repeatability for average metabolic rate for the ‘cold’ developmental temperature group (blue) and the ‘hot’ developmental temperature group (red). Estimates were calculated from a complete case analysis. There were no significant differences among treatment in repeatability estimates (see Table S5). Repeatability did not change with acute temperature. Error bars represent 95% credible intervals.

**Table S5** Temeprature specific, adjusted repeatability estimates of log transformed metabolic rate for lizards from two developmental temperatures (nhot = 25, ncold = 26). These values were estimated from complete case dataset, nobs = 3818. Bolded values are significantly different from zero.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Cold development temperature  n = 26 | | | | Hot development temperature  n = 25 | | |
| Temperature | Repeatability | Lower | Upper | Repeatability | Lower | Upper |
| 24 | **0.23** | **0.12** | **0.39** | **0.08** | **0.03** | **0.18** |
| 26 | **0.22** | **0.12** | **0.37** | **0.09** | **0.03** | **0.18** |
| 28 | **0.22** | **0.12** | **0.37** | **0.1** | **0.04** | **0.19** |
| 30 | **0.22** | **0.12** | **0.37** | **0.11** | **0.04** | **0.21** |
| 32 | **0.22** | **0.12** | **0.37** | **0.11** | **0.04** | **0.22** |
| 34 | **0.22** | **0.11** | **0.37** | **0.12** | **0.05** | **0.24** |

**Table S6** Model coefficients of model whether body mass, temeperature and age predicts variation in metabolic rate. In this model, we fitted a ‘series’ as random intercept with temeperature as a random slope to estimate repeatability of the slope. See Statistical Analyses for details. This imputation model used an subset dataset of lizards in the cold developmental temperature only n = 26, nobs = 3000. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept MR | **-7.577** | **-7.882** | **-7.274** |
| Intercept Mass | **-1.453** | **-1.461** | **-1.444** |
| Temperature | **0.077** | **0.072** | **0.081** |
| Age | -0.011 | -0.052 | 0.03 |
| Mass | **0.647** | **0.469** | **0.823** |
| VI, Intercept | **0.024** | **0.001** | **0.08** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vseries, Intercept | **0.023** | **0** | **0.093** |
| Vseries, Slope | **\*0** | **\*0** | **\*0** |
| Vmeasurement error, Intercept | **0.037** | **0.03** | **0.044** |
| COVseries, Intercept – I, Slope | -0.000283 | -0.00171 | 9.75e-05 |
| COVseries, Intercept – I, Slope | -0.000305 | -0.00228 | 0.000107 |
| Residual MR | **0.045** | **0.041** | **0.049** |
| Residual Mass | **0.038** | **0.036** | **0.04** |

**Table S7** Model coefficients of model whether body mass, temeperature and age predicts variation in metabolic rate. In this model, we fitted a ‘series’ as random intercept with temeperature as a random slope to estimate repeatability of the slope. See Statistical Analyses for details. This imputation model used a subset dataset of lizards in the hot developmental temperature only n = 25, nobs = 3000. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept MR | **-7.527** | **-7.782** | **-7.277** |
| Intercept Mass | **-1.432** | **-1.441** | **-1.423** |
| Temperature | **0.072** | **0.067** | **0.076** |
| Age | -0.003 | -0.039 | 0.033 |
| Mass | **0.595** | **0.446** | **0.748** |
| VI, Intercept | **0.004** | **\*0** | **0.026** |
| VI, Slope | **0** | **\*0** | **\*0** |
| Vseries, Intercept | **0.034** | **0.003** | **0.123** |
| Vseries, Slope | **\*0** | **\*0** | **\*0** |
| Vmeasurement error, Intercept | **0.036** | **0.03** | **0.042** |
| COVseries, Intercept – I, Slope | -0.000114 | -0.000927 | 3.17e-05 |
| COVseries, Intercept – I, Slope | -0.000578 | -0.00311 | 7.6e-05 |
| Residual MR | **0.037** | **0.034** | **0.04** |
| Residual Mass | **0.048** | **0.045** | **0.051** |

**Table S8** Model coefficients of model whether body mass, temeperature and age predicts variation in metabolic rate. In this model, we fitted a ‘series’ as random intercept with temeperature as a random slope to estimate repeatability of the slope. See Statistical Analyses for details. This model used a complete case dataset of lizards in the cold developmental temperature only n = 26, nobs = 1897. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept | **-7.562** | **-7.862** | **-7.272** |
| Temperature | **0.076** | **0.072** | **0.081** |
| Mass | **0.654** | **0.471** | **0.831** |
| Age | -0.012 | -0.052 | 0.029 |
| VI, Intercept | **0.024** | **0.002** | **0.083** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vseries, Intercept | **0.022** | **\*0** | **0.085** |
| Vseries, Slope | **\*0** | **\*0** | **\*0** |
| Vmeasurement error, Intercept | **0.037** | **0.031** | **0.044** |
| COVseries, Intercept – I, Slope | -0.00027 | -0.00166 | 0.000101 |
| COVseries, Intercept – I, Slope | -0.000296 | -0.00205 | 0.000106 |
| Residual | **0.045** | **0.041** | **0.049** |

**Table S9** Model coefficients of model whether body mass, temeperature and age predicts variation in metabolic rate. In this model, we fitted a ‘series’ as random intercept with temeperature as a random slope to estimate repeatability of the slope. See Statistical Analyses for details. This model used a complete case dataset of lizards in the cold developmental temperature only n = 26, nobs = 1921. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept | **-7.513** | **-7.769** | **-7.255** |
| Temperature | **0.072** | **0.067** | **0.076** |
| Mass | **0.6** | **0.453** | **0.751** |
| Age | -0.004 | -0.037 | 0.032 |
| VI, Intercept | **0.005** | **\*0** | **0.027** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vseries, Intercept | **0.035** | **0.002** | **0.135** |
| Vseries, Slope | **\*0** | **\*0** | **\*0** |
| Vmeasurement error, Intercept | **0.036** | **0.03** | **0.042** |
| COVseries, Intercept – I, Slope | -0.000117 | -0.000878 | 2.8e-05 |
| COVseries, Intercept – I, Slope | -0.00064 | -0.00335 | 7.19e-05 |
| Residual | **0.037** | **0.034** | **0.04** |

**Table S10** Model coefficients of model whether body mass, temperature and age predicts variation in metabolic rate. This imputation model used an subset dataset of lizards in the cold developmental temperature only n = 26, nobs = 3000*.* Note that the imputation model also estimates an intercept and residual variance for mass as it was also missing data. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero.

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept MR | **-7.706** | **-8.004** | **-7.392** |
| Intercept Mass | **-1.453** | **-1.461** | **-1.444** |
| Temperature | **0.077** | **0.071** | **0.082** |
| Age | -0.023 | -0.092 | 0.038 |
| Mass | **0.56** | **0.395** | **0.733** |
| VI, Intercept | **0.024** | **0.002** | **0.085** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vsession, Intercept | **0.01** | **0.003** | **0.03** |
| Vmeasurement error, Intercept | **0.046** | **0.04** | **0.053** |
| COVI, Intercept – I, Slope | -0.000273 | -0.00184 | 0.000109 |
| Residual MR | **0.045** | **0.041** | **0.049** |
| Residual Mass | **0.038** | **0.036** | **0.04** |

**Table S11** Model coefficients of model whether body mass, temperature and age predicts variation in metabolic rate. This imputation model used an subset dataset of lizards in the hot developmental temperature only n = 25, n*o*bs = 3000*.* Note that the imputation model also estimates an intercept and residual variance for mass as it was also missing data. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero.

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept MR | **-7.452** | **-7.706** | **-7.185** |
| Intercept Mass | **-1.432** | **-1.442** | **-1.422** |
| Temperature | **0.072** | **0.067** | **0.077** |
| Age | -0.025 | -0.069 | 0.02 |
| Mass | **0.643** | **0.502** | **0.787** |
| VI, Intercept | **0.006** | **\*0** | **0.029** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vsession, Intercept | **0.008** | **0.002** | **0.023** |
| Vmeasurement error, Intercept | **0.043** | **0.037** | **0.049** |
| COVI, Intercept – I, Slope | -0.000127 | -0.000961 | 4.63e-05 |
| Residual MR | **0.037** | **0.034** | **0.041** |
| Residual Mass | **0.048** | **0.045** | **0.051** |

**Table S12** Model coefficients of model testing whether body mass, temperature and age predicts variation in metabolic rate. This model used a complete case dataset of lizards in the cold developmental temperature only n = 26, nobs = 1897. The intercept is the cold developmental temperature. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept | **-7.705** | **-8.01** | **-7.413** |
| Temperature | **0.077** | **0.072** | **0.082** |
| Mass | **0.564** | **0.395** | **0.732** |
| Age | -0.026 | -0.096 | 0.037 |
| VI, Intercept | **0.026** | **0.002** | **0.093** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vsession, Intercept | **0.011** | **0.003** | **0.036** |
| Vmeasurement error, Intercept | **0.046** | **0.039** | **0.053** |
| COVI, Intercept – I, Slope | -3e-04 | -0.00202 | 0.000105 |
| Residual | **0.045** | **0.041** | **0.049** |

**Table S13** Model coefficients of model testing whether body mass, temperature and age predicts variation in metabolic rate. This imputation model used a complete case dataset of lizards in the hot developmental temperature only n = 25, nobs = 1921. The intercept is the cold developmental temperature. Mass and MR was log transformed and Age was z-transformed. Bolded estimates are significantly different from zero. Values with \* indicate very small values that are still greater than zero

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Estimate | Lower | Upper |
| Intercept | **-7.449** | **-7.703** | **-7.193** |
| Temperature | **0.072** | **0.067** | **0.076** |
| Mass | **0.646** | **0.503** | **0.791** |
| Age | -0.026 | -0.072 | 0.02 |
| VI, Intercept | **0.006** | **\*0** | **0.03** |
| VI, Slope | **\*0** | **\*0** | **\*0** |
| Vsession, Intercept | **0.009** | **0.002** | **0.023** |
| Vmeasurement error, Intercept | **0.043** | **0.037** | **0.049** |
| COVI, Intercept – I, Slope | -0.000125 | -0.000967 | 4.22e-05 |
| Residual | **0.037** | **0.034** | **0.041** |