

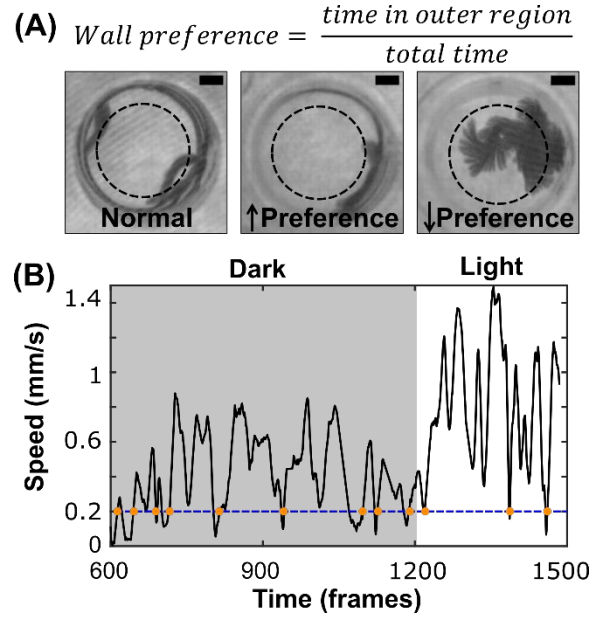
Supplementary Material

1 **Supplementary Tables**

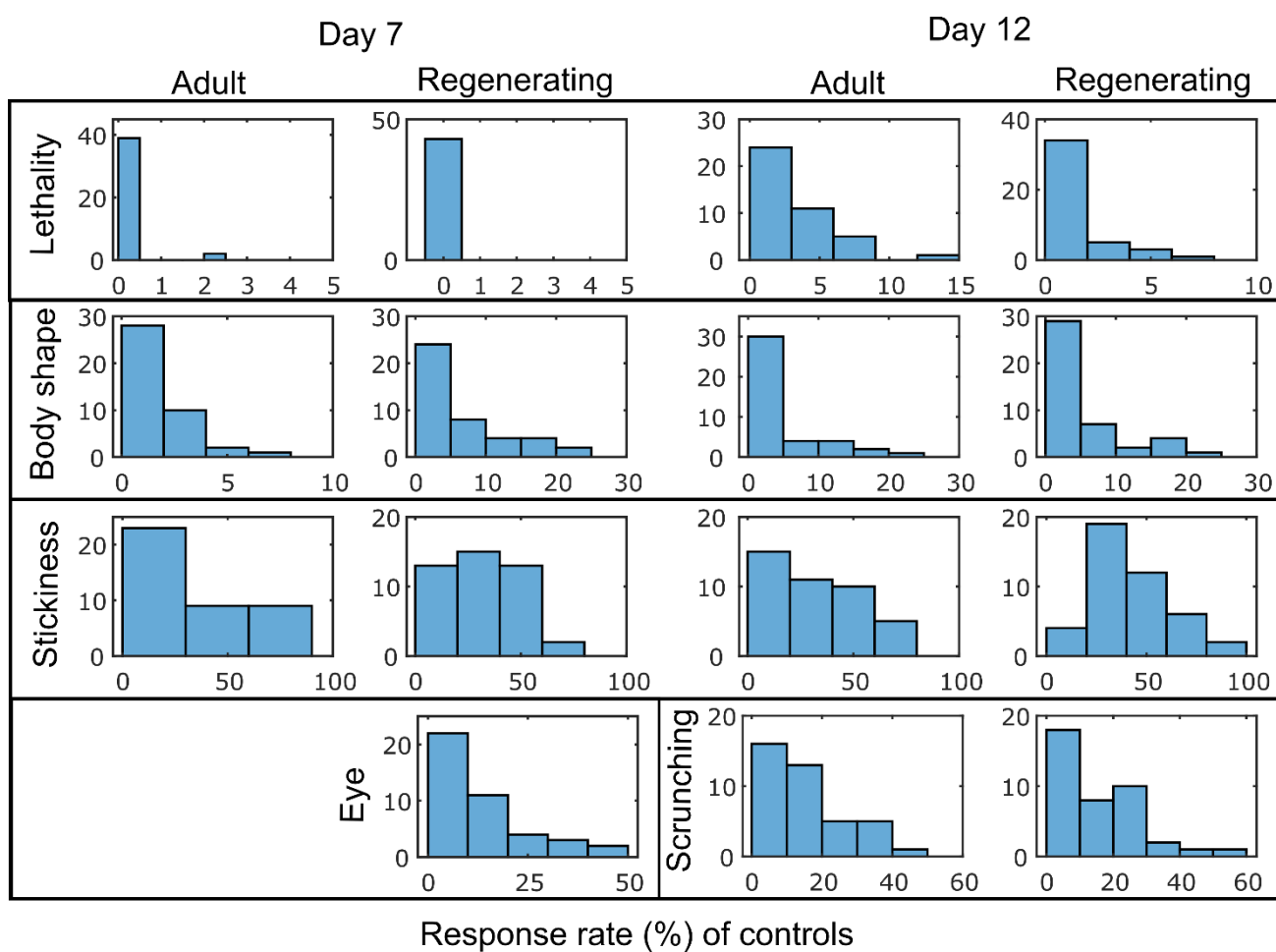
Supplementary Table 1. Comparison of potency ranking of OPs between adult and regenerating planarians. The most sensitive BMC (μM) for each OP in either adult or regenerating planarians is listed along with the associated relative rank, with 1 being the most potent.

OP	BMC _{adult}	Rank	BMC _{regenerating}	Rank
Acephate	229	7	302	7
Chlorpyrifos	1.7	4	1.7	2
Diazinon	0.22	2	9.2	4
Dichlorvos	0.09	1	0.10	1
Malathion	14	6	43	6
Parathion	5	5	17	5
Profenofos	0.29	3	4.6	3

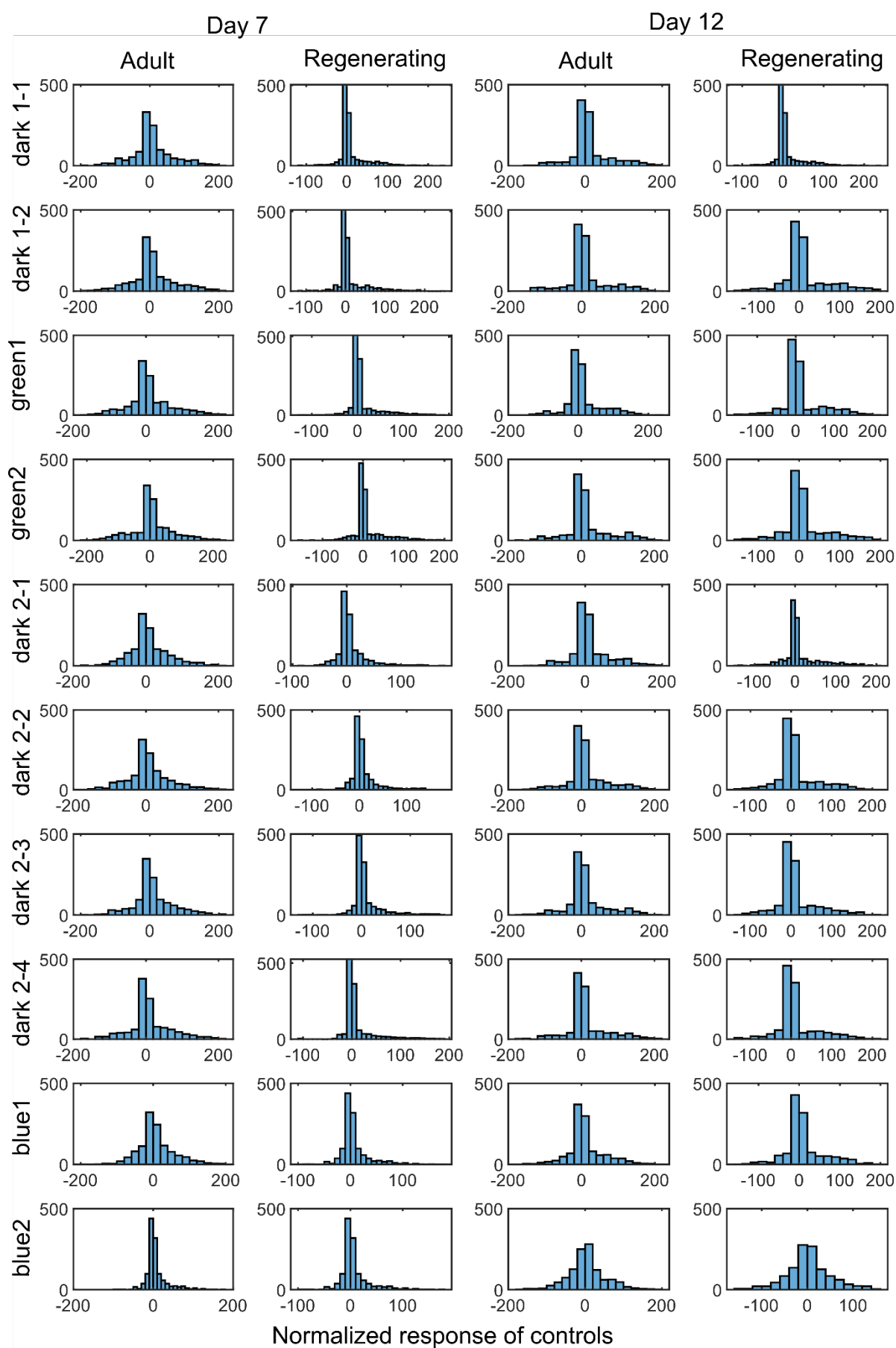
2 Supplementary Figures



Supplementary Figure 1. Examples of new endpoints. (A) Wall preference is measured as the fraction of time a planarian spends in the outer 2/3 of the well (outside the dotted circle). Increased wall preference is associated with less exploration of the well. Scale bar: 2 mm. (B) Locomotor bursts (orange dots) are instances where the planarian goes from resting (speed <0.2 mm/s) to not resting (speed >0.2 mm/s). The total cumulative number of locomotor bursts and the ratio of bursts during the blue and 2nd dark phases of the phototaxis assay are quantified.

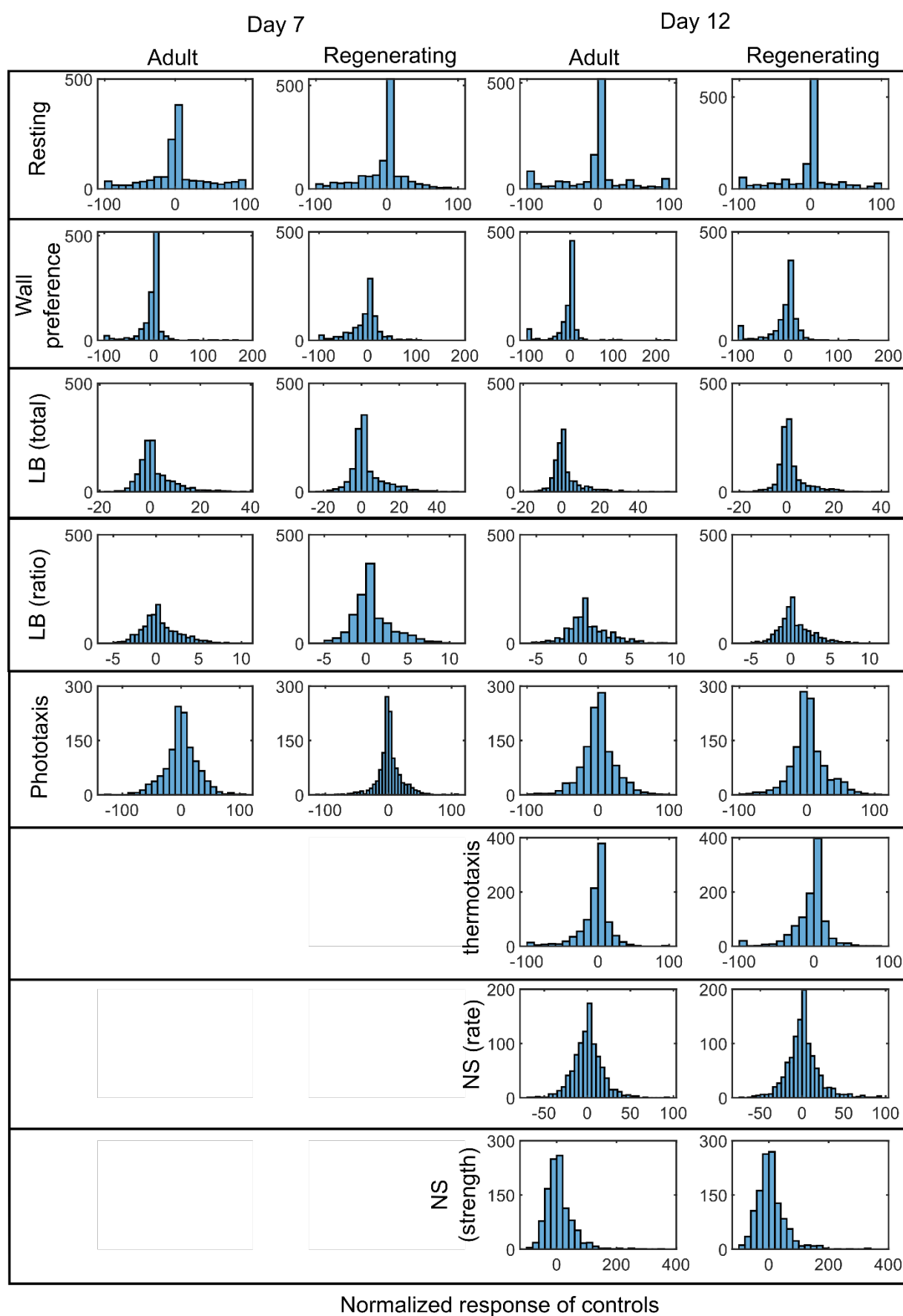


Supplementary Figure 2. Response rate of vehicle controls in the binary endpoints. Plots show the distribution of response rates in the vehicle controls for all binary outcome measures.

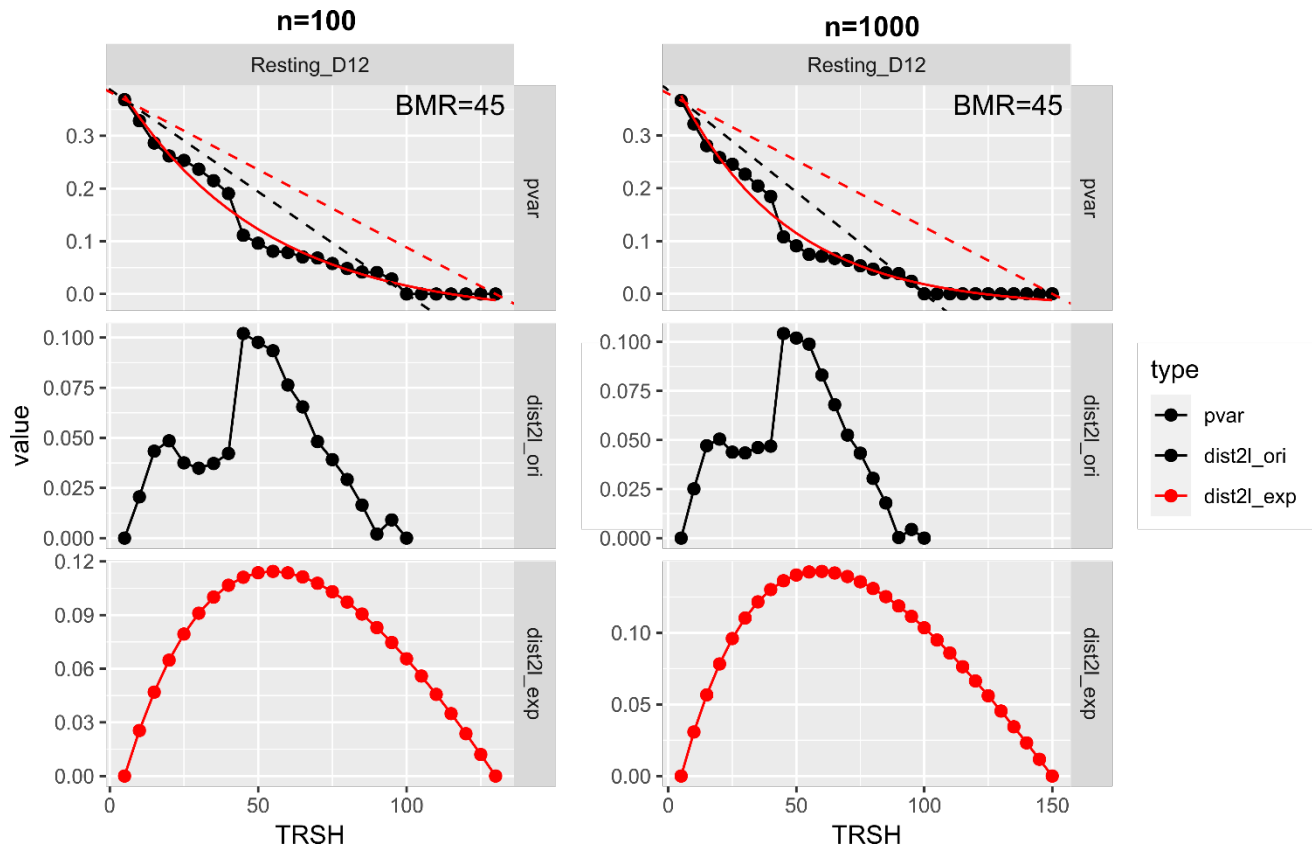


Supplementary Figure 3. Normalized responses of the vehicle controls in the speed endpoints.

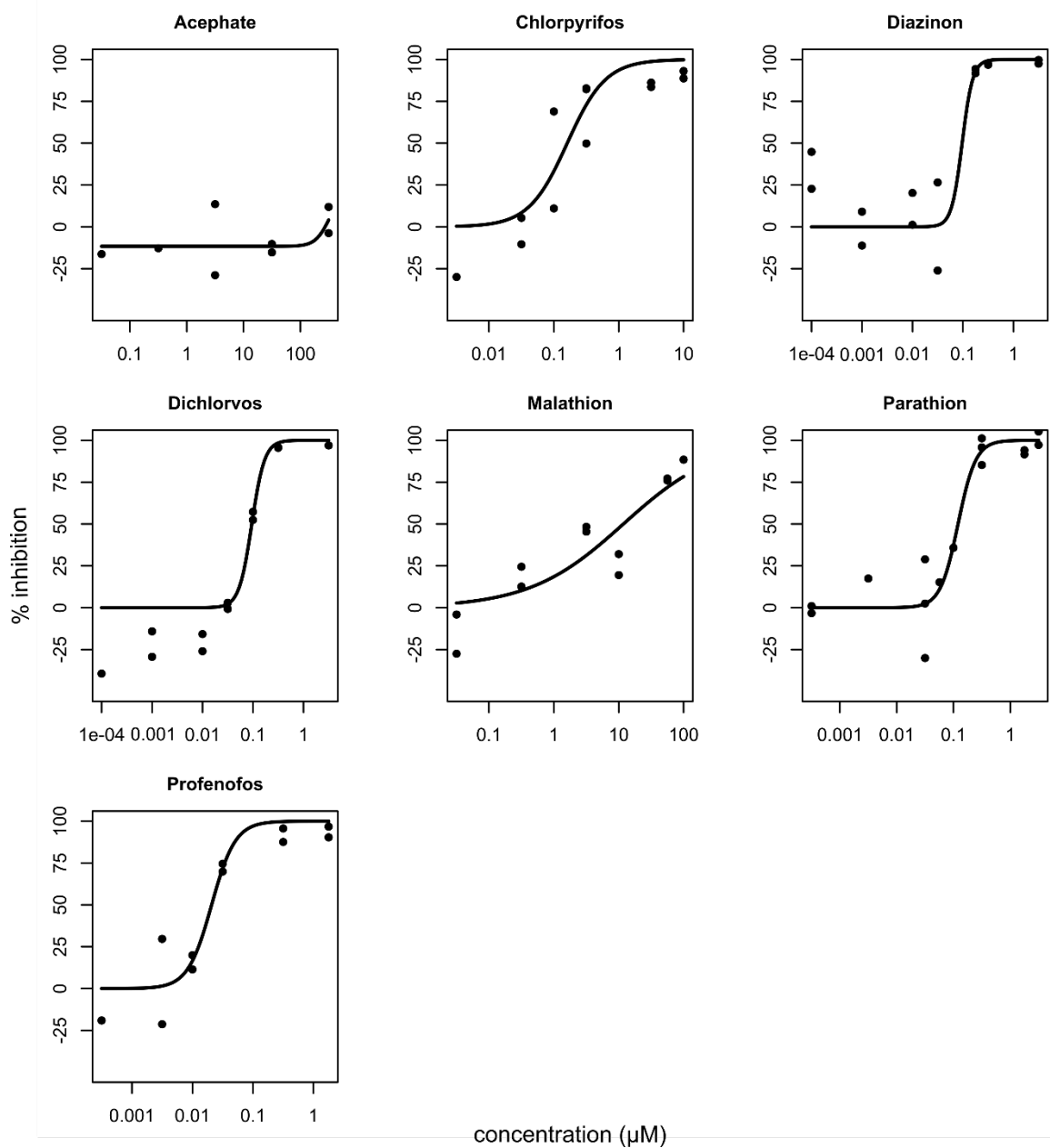
Plots show the distribution of normalized responses for each individual vehicle control when normalized by the median of the control population of the respective plate.



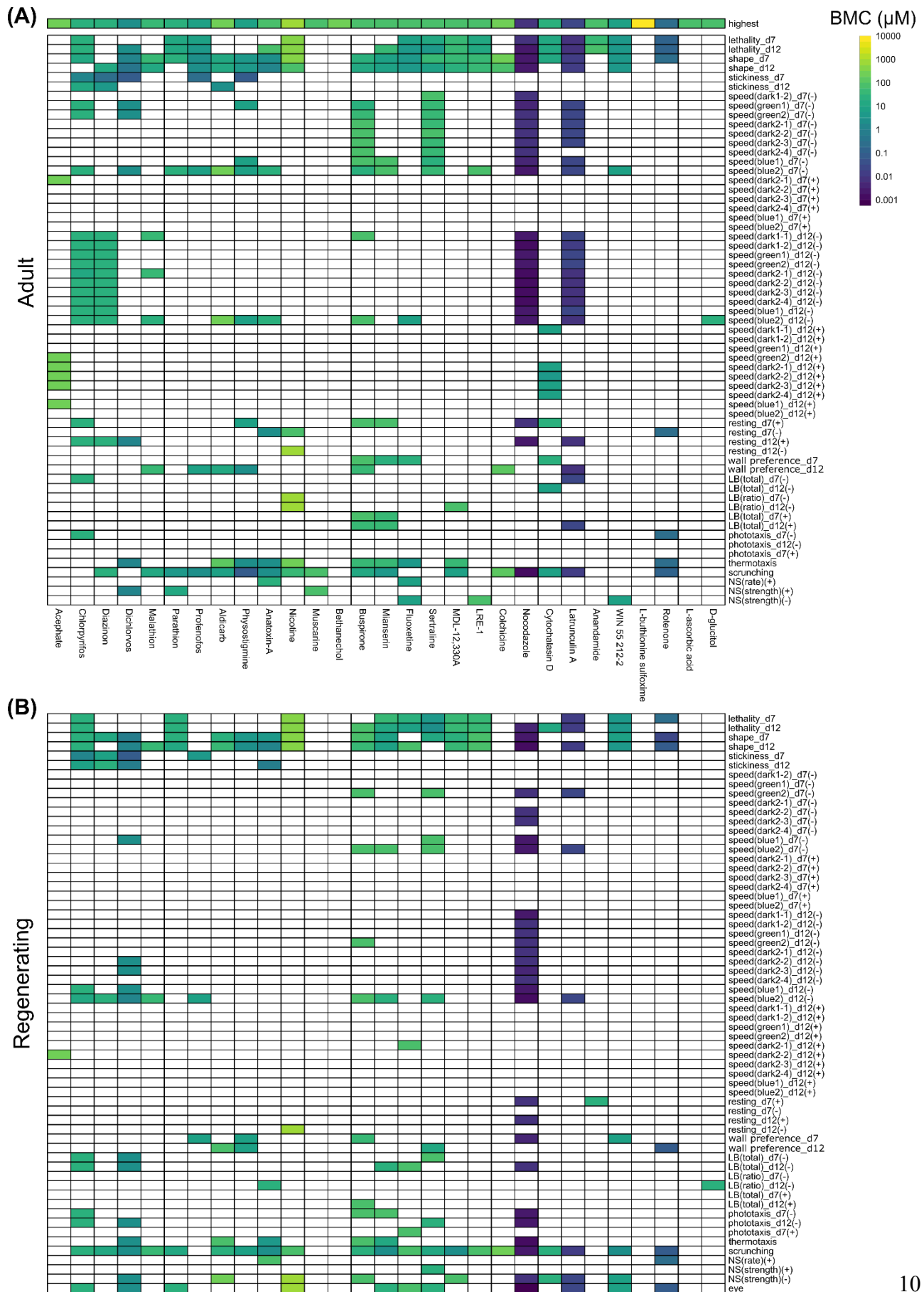
Supplementary Figure 4. Normalized responses of the vehicle controls in the remaining continuous endpoints. Plots show the distribution of normalized responses for each individual vehicle control when normalized by the median of the control population of the respective plate. LB: locomotor bursts; NS: noxious stimuli.



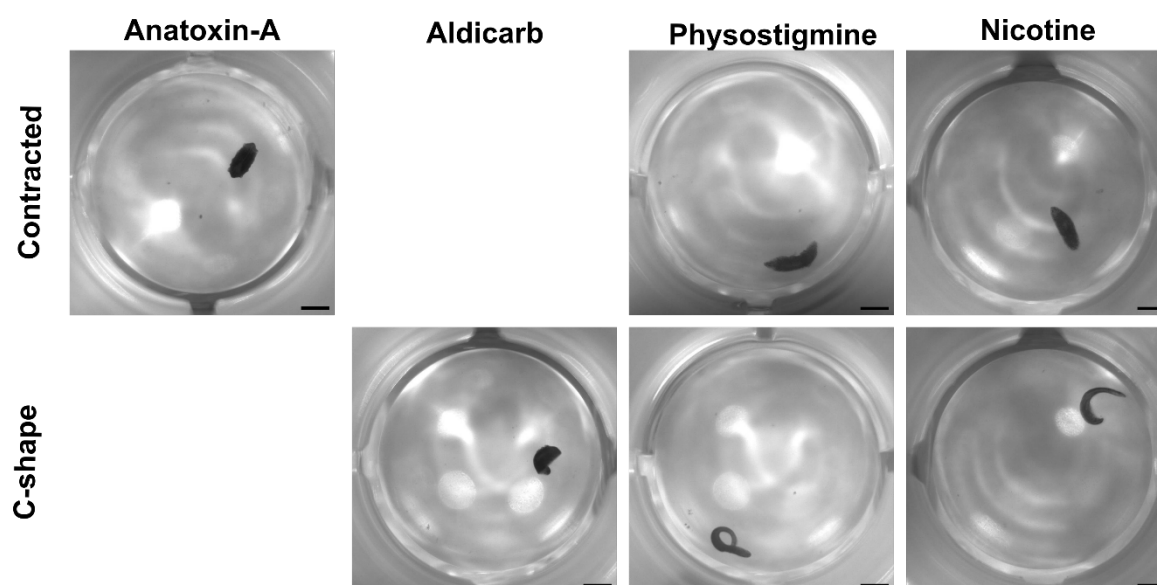
Supplementary Figure 5. Bootstrapping with $n=100$ samples gives similar results as $n=1000$. Benchmark response (BMR) diagnostic plots were compared when setting the “n_samples” parameter to either 100 or 1000 using the data from the day 12 resting endpoint in adults. The same BMRs were suggested using either number of samples.



Supplementary Figure 6. AChE inhibition in adult planarians. Ellman assays were performed on adult planarians exposed for 12 days to different concentrations of the OPs. Dose response curves were fit with a Hill equation (setting the lower limit to 0 and the upper limit to 100) using the R package drc.



Supplementary Figure 7. Heatmaps comparing the benchmark concentrations (BMCs) for tested chemicals in adult (A) and regenerating (B) planarians. The first row shows the highest tested concentration. For endpoints that can have effects in both directions, the BMCs are separated by either the positive (+) or (-) direction.



Supplementary Figure 8. Examples of contracted and c-shape body shapes in cholinergic drugs. Examples are of adult planarians exposed to the highest test concentration of the specified chemicals. Scale bar: 1 mm.