

Description of Additional Supplementary Files

Supplementary Data 1. Trait list and DGRP strains with missing values. List of metabolite and phenotype traits and their descriptions on the first sheet. The second sheet contains a list of DGRP strains with missing phenotype values that were imputed with the mean of all other strains for that trait.

Supplementary Data 2. DGRP datasets. Raw DGRP data on each diet used for correlation and modeling analysis.

Supplementary Data 3. Random Forest response model traits. Order of traits used to build each random forest response model by the proportion of trees/estimators that trait was included in out of the 10,000 trees/estimators run for each model. Overlap of trait importance was calculated using the hypergeometric

Supplementary Data 4. Mendelian randomization Results.

Full Mendelian randomization results for all primary and sensitivity analyses shown in Figure 5 and 6.

Supplementary Data 5. Model trait selection and validation determination.

Supplementary Data 6. Lifespan Summary Stats and Statistics. Cox proportional hazards analysis statistics using survival package in Python. Sheets contain statistics for specified experiments. Deaths for each group are at the top of each sheet, with comparisons in the rows below. The last two columns of each sheet contain the comparison statistics and means for that row's comparison.