

Fig. S1: Changes in the diversity, richness, and composition of the gut microbiota in mice.

a Body weights and total distances in the open field tests for mice with different ranks (Rank1, $n = 7$; Rank2, $n = 7$; Rank3, $n = 6$; Rank4, $n = 6$; Rank1 vs Rank2 vs Rank3 vs Rank4, no statistical difference in p values; data are mean \pm SEM; Kruskal-Wallis test, two-tailed)

b Alpha diversity indices of gut microbiota in mice with different ranks (Rank1, $n = 6$; Rank2, $n = 7$; Rank3, $n = 6$; Rank4, $n = 6$; Rank1 vs Rank2 vs Rank3 vs Rank4, no statistical difference in p values; data are mean \pm SEM; Wilcoxon rank-sum test, two-tailed).

c The overall characteristics of gut microbiota displayed using PCoA based on the abund_jaccard distance, with internal differences analyzed by PERMANOVA test (permutations = 999, $p = 0.275$).

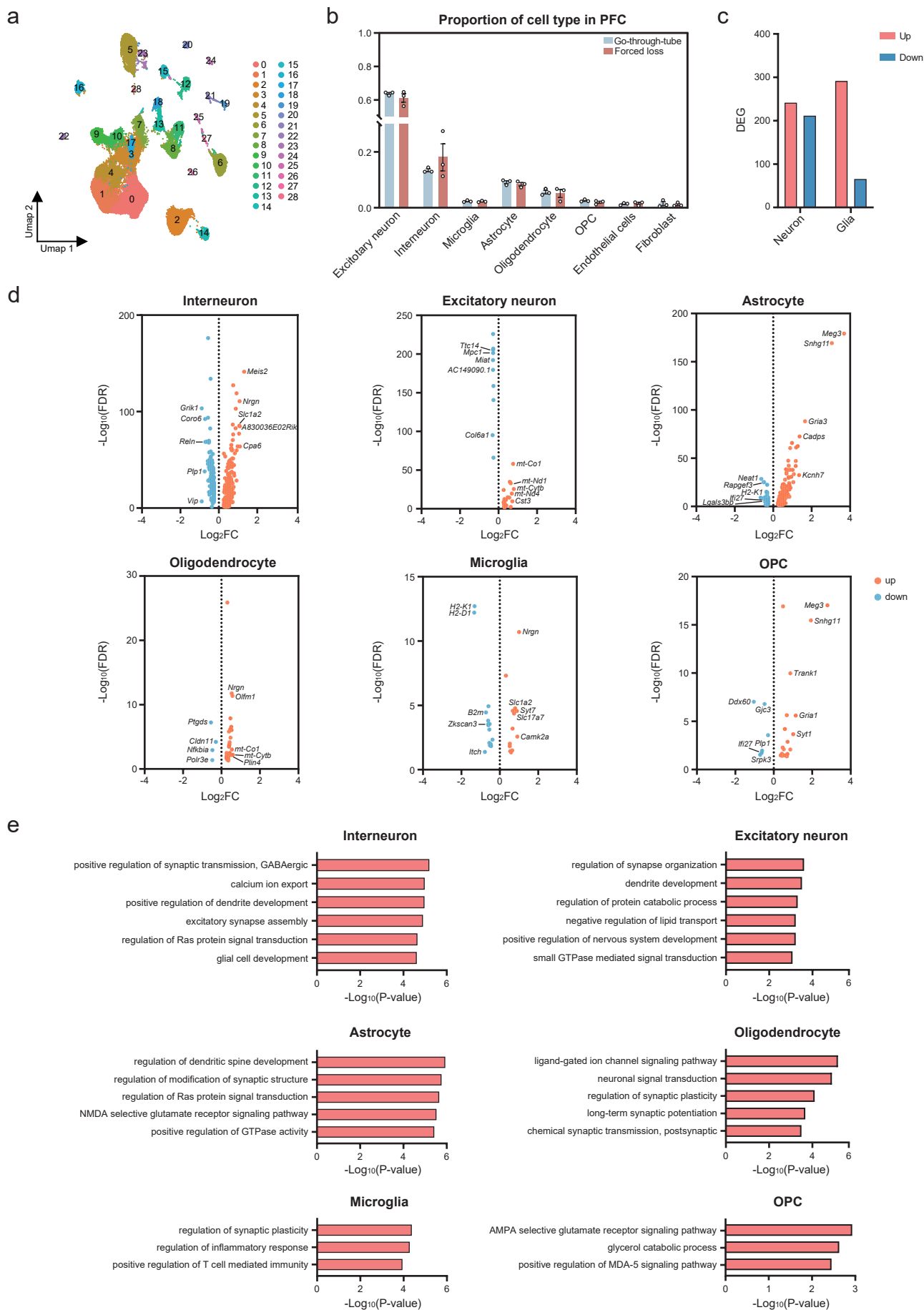
d Body weights and total distances in the open field tests for mice in the go-through-tube and forced loss groups (Go-through-tube, $n = 7$; Forced loss, $n = 7$; Go-through-tube vs. Forced loss, no statistical difference in p values; data are mean \pm SEM; T test, two-tailed).

e Alpha diversity indices of the gut microbiota in go-through-tube mice and forced loss mice (Go-through-tube, $n = 6$; Forced loss, $n = 6$; Go-through-tube vs. Forced loss, no statistical difference in p values; data are mean \pm SEM; Wilcoxon rank-sum test, two-tailed).

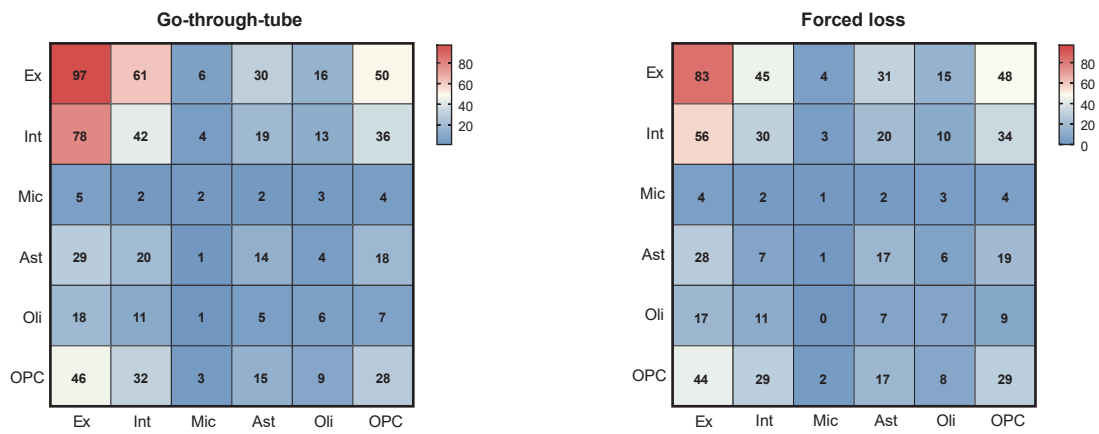
f DNA expression of gut microbiota genes in the control and ABX groups (Con, $n = 8$; ABX, $n = 14$; Con vs. ABX, **** $p < 0.0001$; data are mean \pm SEM; T test, two-tailed).

g Time percentages of pushing, voluntary retreating, resistance (when pushed by an opponent), and passive retreating (when pushed by an opponent) during tube test for microbiota-depleted mice before and after go-through-tube or forced loss procedure (Go-through-tube + ABX, $n = 6$ mice, 18 trials; forced loss + ABX, $n = 7$ mice, 21 trials. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$, ns, not significant; data are mean \pm SEM; Mann-Whitney test, two-tailed).

Supplementary Figure 2



a



b

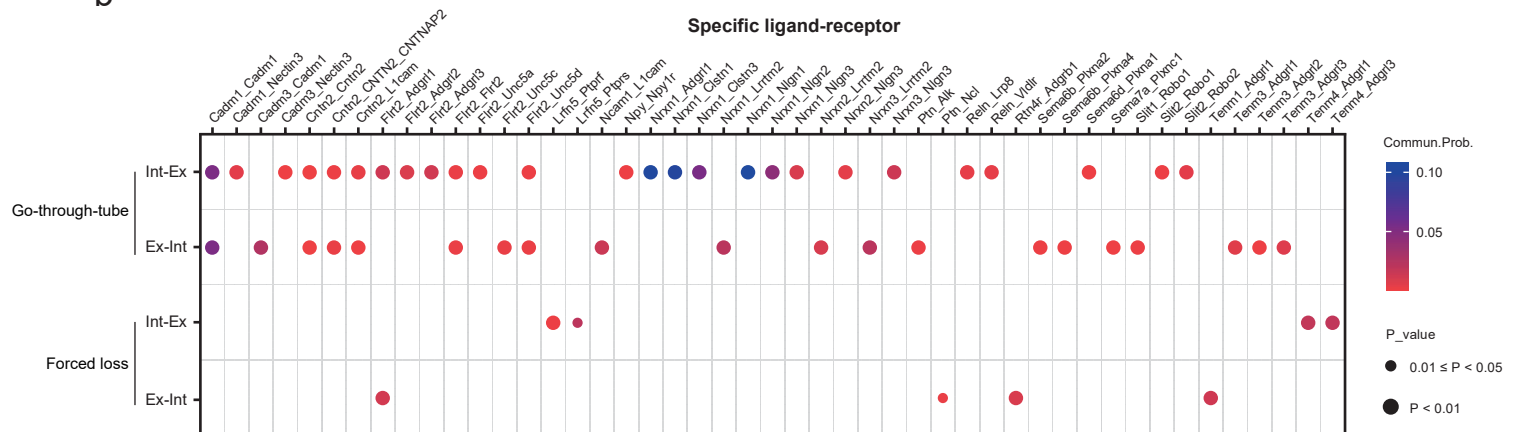


Fig. S3: The number and specific function of ligand-receptor pairs in the go-through-tube and forced loss groups.
a The number of all activated ligand-receptor pairs in the go-through-tube and forced loss groups (Go-through-tube, $n = 3$; Forced loss, $n = 3$).
b Functions of specific connections in the ligand-receptor relationships between interneurons and excitatory neurons ($p < 0.05$).

Supplementary Figure 4

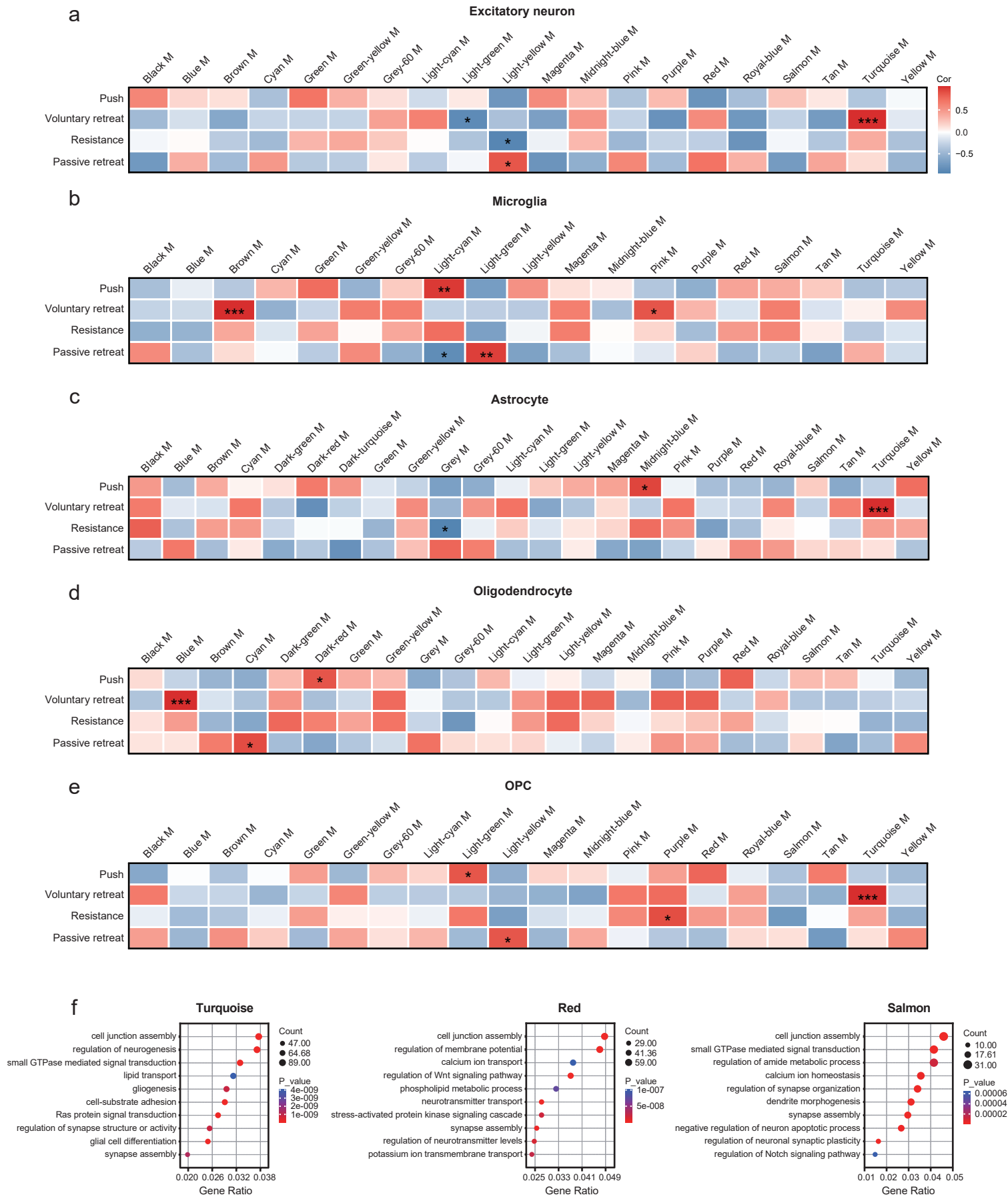


Fig. S4: Correlation between gene modules of differential cell types and forced loss related behaviors.
a-e The heatmap showed gene modules associated with four behaviors (push, voluntary retreat, resistance, passive retreat) in excitatory neurons, microglia, astrocytes, oligodendrocytes and OPC ($r > 0.6$ or < -0.6 , $*p < 0.05$, $**p < 0.01$, $***p < 0.001$, two-tailed Pearson correlation).
f GO enrichment analysis showed the functions and pathways of genes enrichment in three modules (turquoise, red, salmon) associated with voluntary retreat in interneurons ($p < 0.05$).