Supplemental Figure Legends

Figure S1: . Performance of control female siblings of males shown in Figure 3. The performance index for each genotype [rut^{2080}/+; UAS-rut/+], [rut^{2080}/+; 247/UAS-rut], [rut^{2080}/+; C309/+; UAS-rut/+],[rut^{2080}/+; UAS-rut/+; OK107/+] and [rut^{2080}/Y; UAS-rut/+] is shown for immediate memory (a) and 3 hour memory (b) after a single training session, and 24 hour memory after massed (c) and spaced training (d). In each case, the addition of a single Gal4 Driver does significantly improve performance of [rut^{2080}/+; UAS-rut/+] control heterozygous females. All groups in this figure were trained and tested in parallel with the male siblings in Fig 3, a-d respectively.

Figure S2: . STM Performance of female *rut*^{2080};UAS-rut heterozygous animals and females heterozygous for *rut*^{2080}, lobe specific MB Gal4 drivers, and the UAS-rut+ transgene. The performance index for each genotype [rut^{2080}/+; UAS-rut/+], [rut^{2080}/+; C305a/+; UAS-rut/+], [rut^{2080}/+; 201Y/+; UAS-rut/+],[rut^{2080}/+; GH146/+; UAS-rut/+] [rut^{2080}/+; C739/+; UAS-rut/+], and [rut^{2080}/Y; UAS-rut/+] is shown for immediate memory and 3 hour memory after a single training session. In each case, the addition of a single Gal4 Driver does significantly improve performance of [rut^{2080}/+; UAS-rut/+] control heterozygous females.

Figure S3: . 24 Hour memory Performance of female *rut*^{2080};UAS-rut heterozygous animals and females heterozygous for *rut*^{2080}, lobe specific MB Gal4 drivers, and the UAS-rut+ transgene. The performance index for each genotype [rut^{2080}/+; UAS-rut/+], [rut^{2080}/+; C305a/+; UAS-rut/+], [rut^{2080}/+; 201Y/+; UAS-rut/+],[rut^{2080}/+; GH146/+; UAS-rut/+] [rut^{2080}/+; C739/+; UAS-rut/+], and [rut^{2080}/Y; UAS-rut/+] is shown for

memory 24 hour memory after massed (a,b) and spaced training (c,d). In each case, the addition of a single Gal4 Driver does significantly improve performance of [rut^{2080}/+; UAS-rut/+] control heterozygous females.

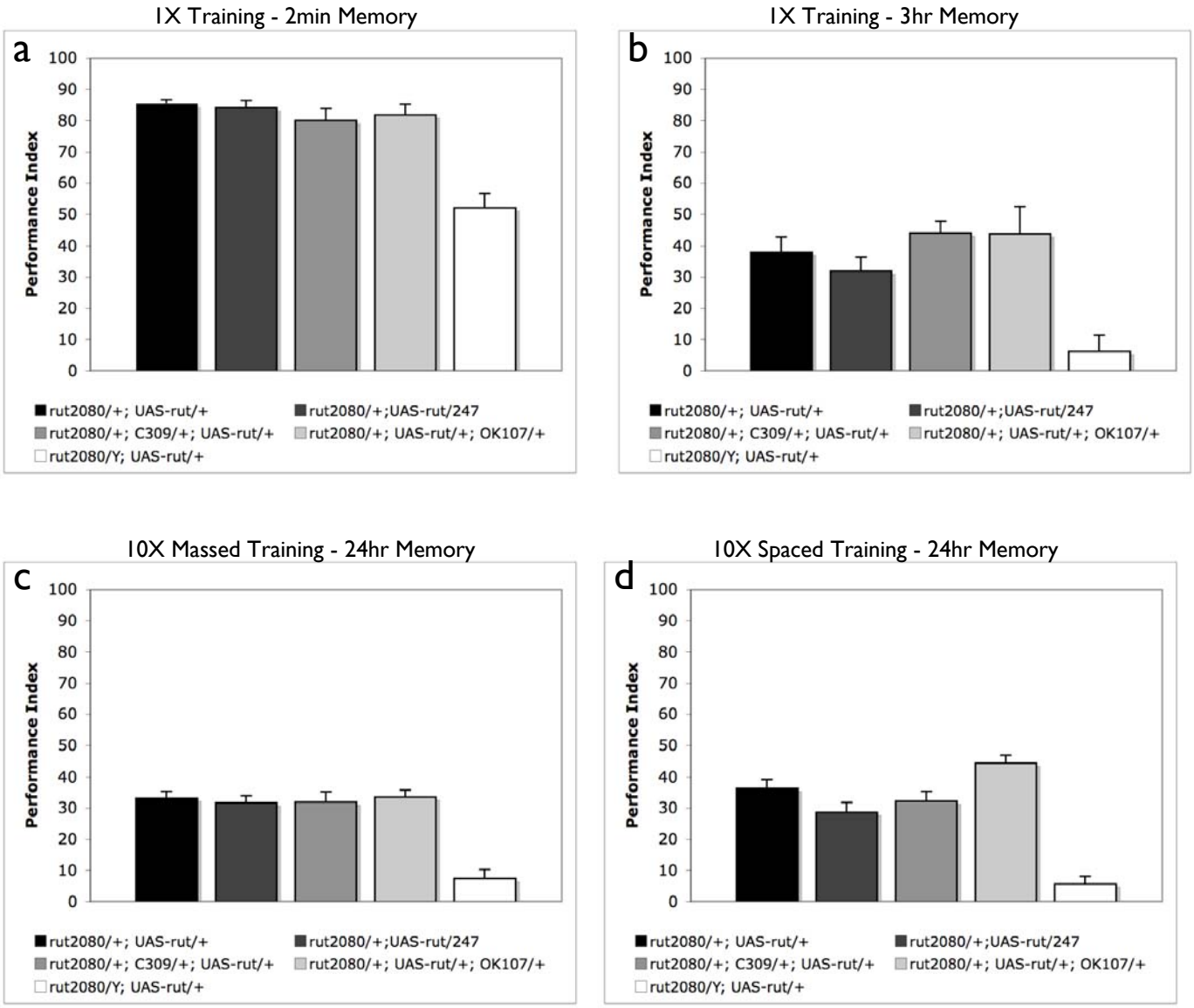
Figure S4: Performance of female rut^{2080};UAS-rut heterozygous animals and females heterozygous for rut^{2080}, the UAS-rut+ transgene, and Gal4 drivers 201Y and C739 alone or in combination. The performance index for each genotype [rut^{2080}/+; UAS-rut/+], [rut^{2080}/+; C739/+; UAS-rut/+], [rut^{2080}/+; 201Y/+; UAS-rut/+], [rut^{2080}/+; C739/201Y; UAS-rut/+], and [rut^{2080}/Y; UAS-rut/+] is shown for immediate memory (a) and 3 hour memory (b) after a single training session, and 24 hour memory after massed (c) and spaced training (d). For immediate, 3 hour, and 24 hour memory after massed training, females heterozygous for both rut^{2080} and either one or both Gal4 drivers show no significant increases in performance relative to female rut^{2080} heterozygous controls. However, in the case of 24 hour memory after spaced training, females heterozygous for rut^{2080} and both 201Y and c739 Gal4 drivers show significantly higher performance compared to female rut^{2080} heterozygous controls. $P < 0.05$.

Figure S5: Immediate Memory after spaced training in *rut* mutant animals. The performance index for each genotype [rut^{2080}/+; UAS-rut/+] and [rut^{2080}/Y; UAS-rut/+] is shown for immediate memory after spaced training. While displaying significantly lower performance compared to female rut^{2080} heterozygous controls, [rut^{2080}/Y; UAS-rut/+] animals still show residual *rut* independent memory.

Figure S6: Performance of female *rut*^{2080};UAS-rut heterozygous animals and females heterozygous for *rut*^{2080}, the UAS-rut+ transgene, and Gal4 drivers 201Y alone or 201Y and C305a or 201Y and C739 in combination. The performance index for each genotype [*rut*^{2080}/+; UAS-rut/+], [*rut*^{2080}/+; 201Y/+; UAS-rut/+], [*rut*^{2080}/+; C305a/201Y; UAS-rut/+] [*rut*^{2080}/+; C739/201Y; UAS-rut/+], and [*rut*^{2080}/Y; UAS-rut/+] is shown for 24 hour memory after spaced training. In each case, the addition of a single Gal4 Driver, or two Gal4 drivers does significantly improve performance of [*rut*^{2080}/+; UAS-rut/+] control heterozygous females.

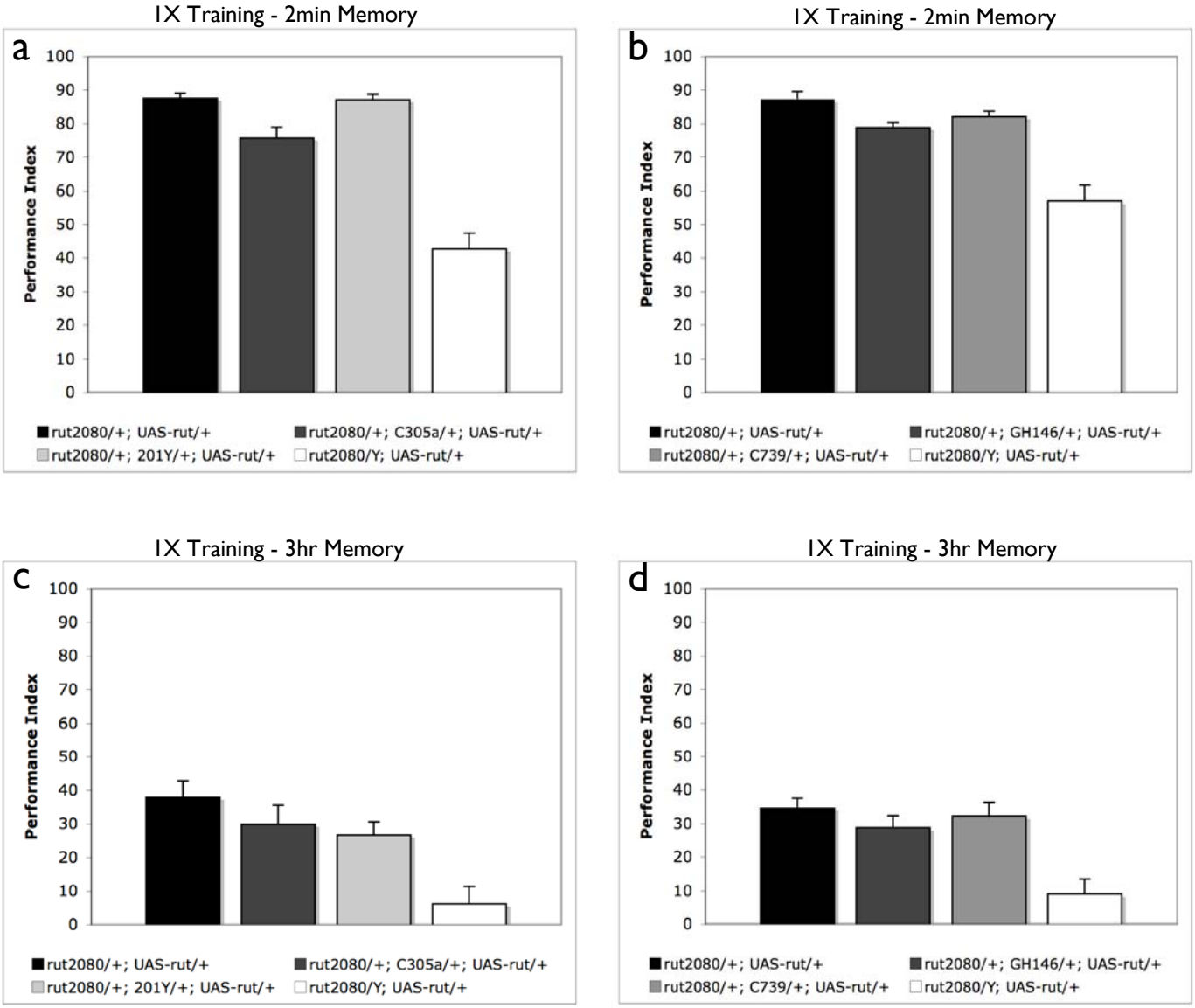
Supplemental Figure 1

Figure S1



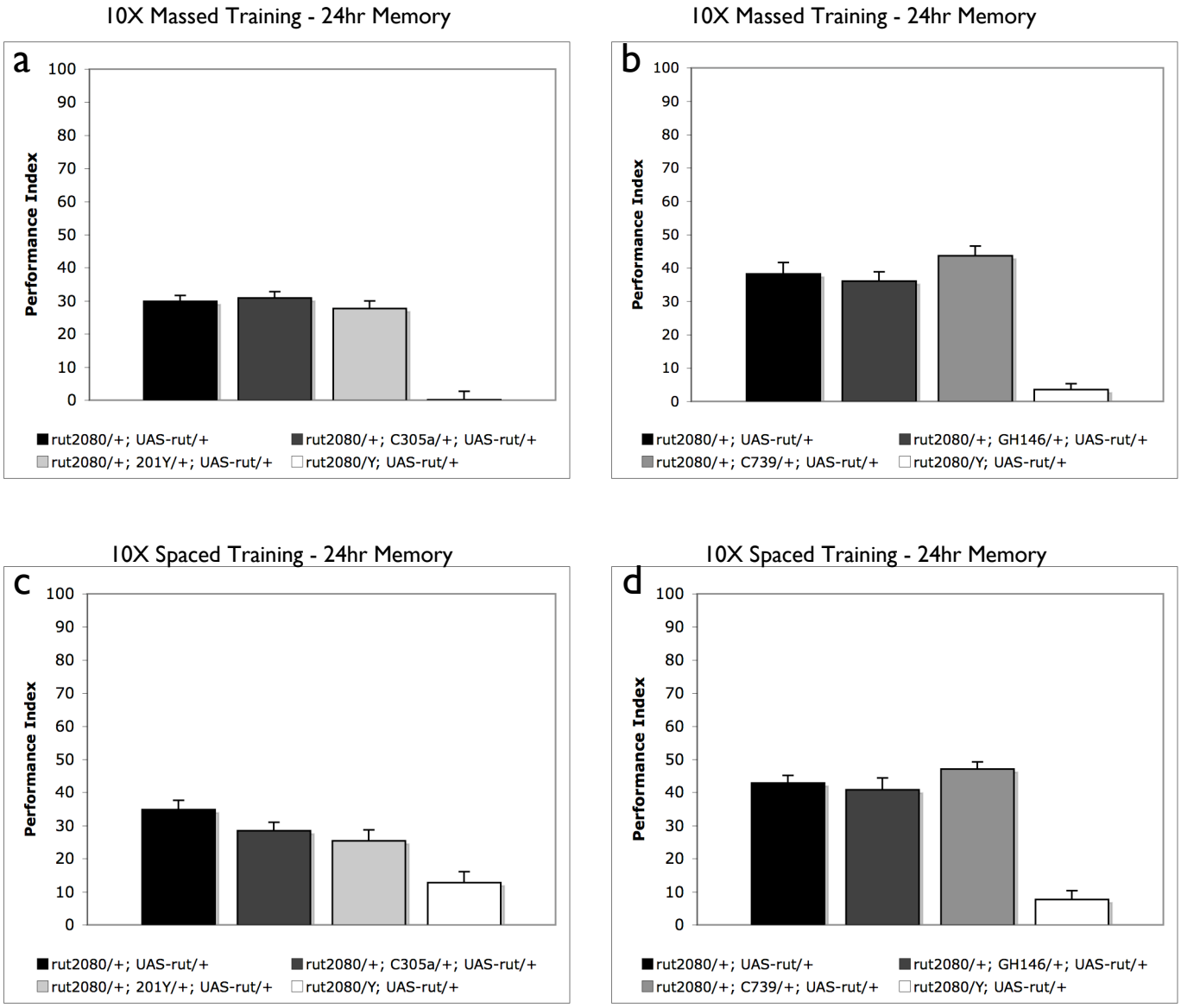
Supplemental Figure 2

Figure S2



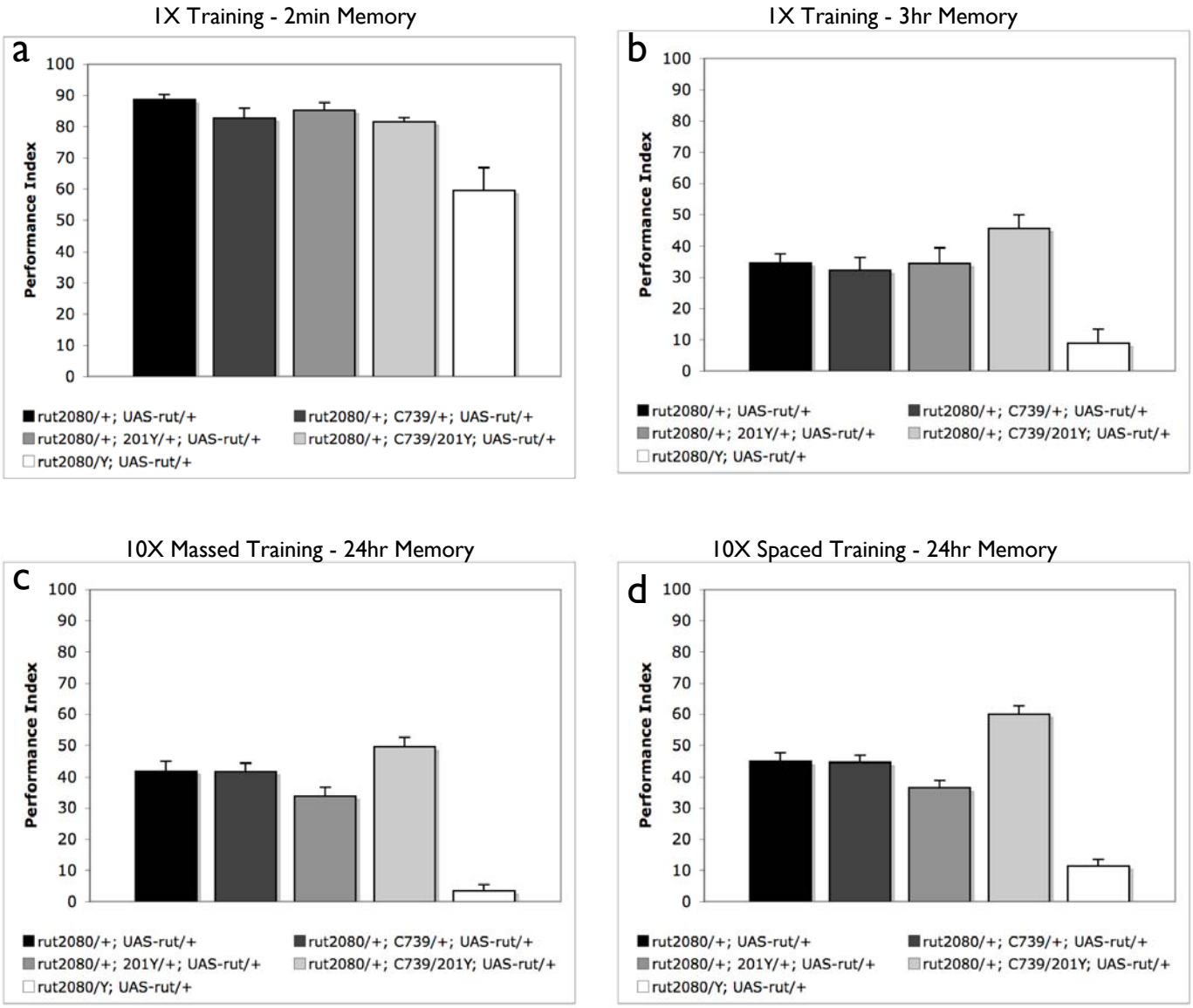
Supplemental Figure 3

Figure S3



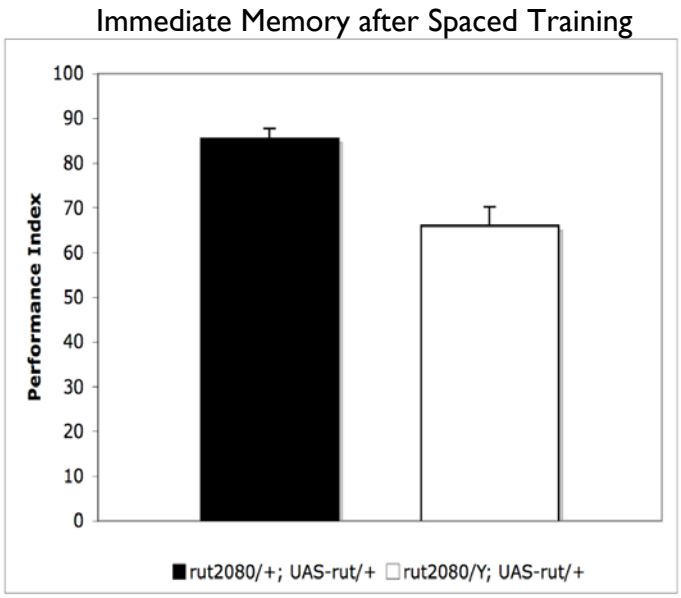
Supplemental Figure 4

Figure S4



Supplemental Figure 5

Figure S5



Supplemental Figure 6

Figure S6