



**Figure S3.**

**(a)** Effects of co-housing on the time out of  $10^4$  seconds taken to achieve 80% success in a test to evaluate the discrimination learning abilities of WT, co-housed WT and 5XFAD transgenic (Tg) mice at 7-month-old ( $n = 5-8$ ). Time spent means the time to reach the 80% performance level (seconds); the higher the time spent, the more severe the cognitive impairment is (see Methods).

**(b)** Effects of faecal microbiota transplantation (FMT) on the frequency of brain immune cells (Th1 and Th2) in 12-month-old C57 recipient mice injected with A $\beta$  (see Methods) using feces of either 9-month-old WT or 5XFAD transgenic (Tg) mice. Th1 cells (CD45<sup>high</sup>CD4<sup>+</sup>CXCR3<sup>+</sup>) and Th2 cells (CD45<sup>high</sup>CD4<sup>+</sup>CCR4<sup>+</sup>) are presented relative to CD45<sup>high</sup>CD4<sup>+</sup>T cells ( $n = 6-8$ ); the data are presented as the mean  $\pm$  standard error of the mean (mean  $\pm$  sem). \* $P = 0.041$  (Th1), \* $P = 0.020$  (Th2) by Student's t-test. C57, the C57BL/6 wild type (WT) mice.

**(c)** Effects of faecal microbiota transplantation (FMT) on the frequency of brain Th1 cells in 7-month-old 5XFAD (Tg) recipient mice injected with A $\beta$  (see Methods) using feces of 2-month-old WT mice ( $n = 6-7$ ). The data are presented as the mean  $\pm$  standard error of the mean (mean  $\pm$  sem). \* $P = 0.035$  by Student's t-test.