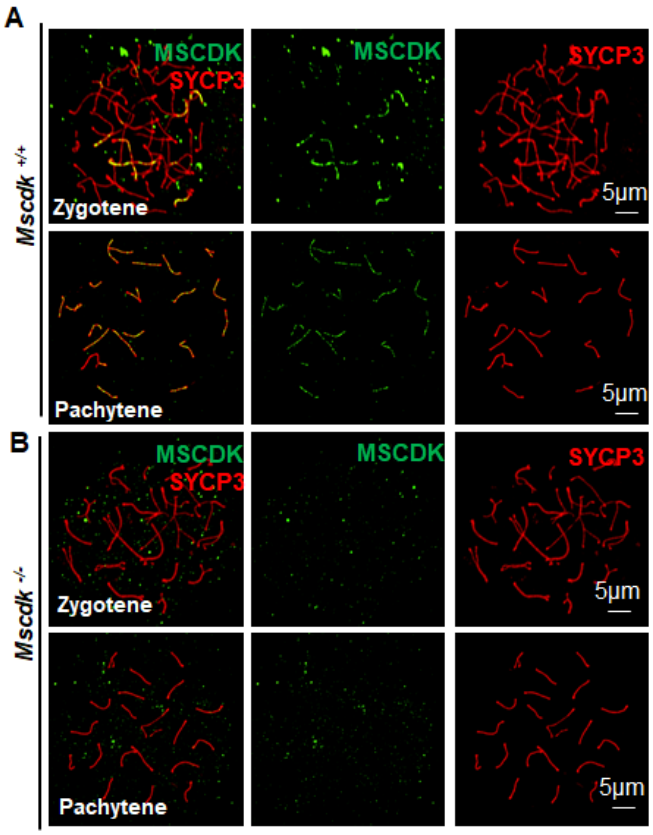
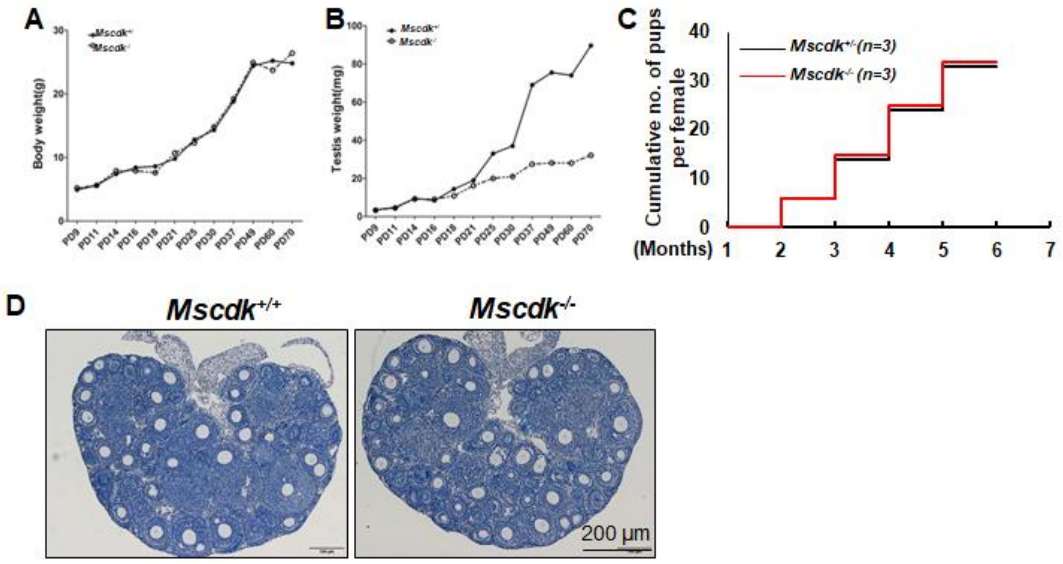
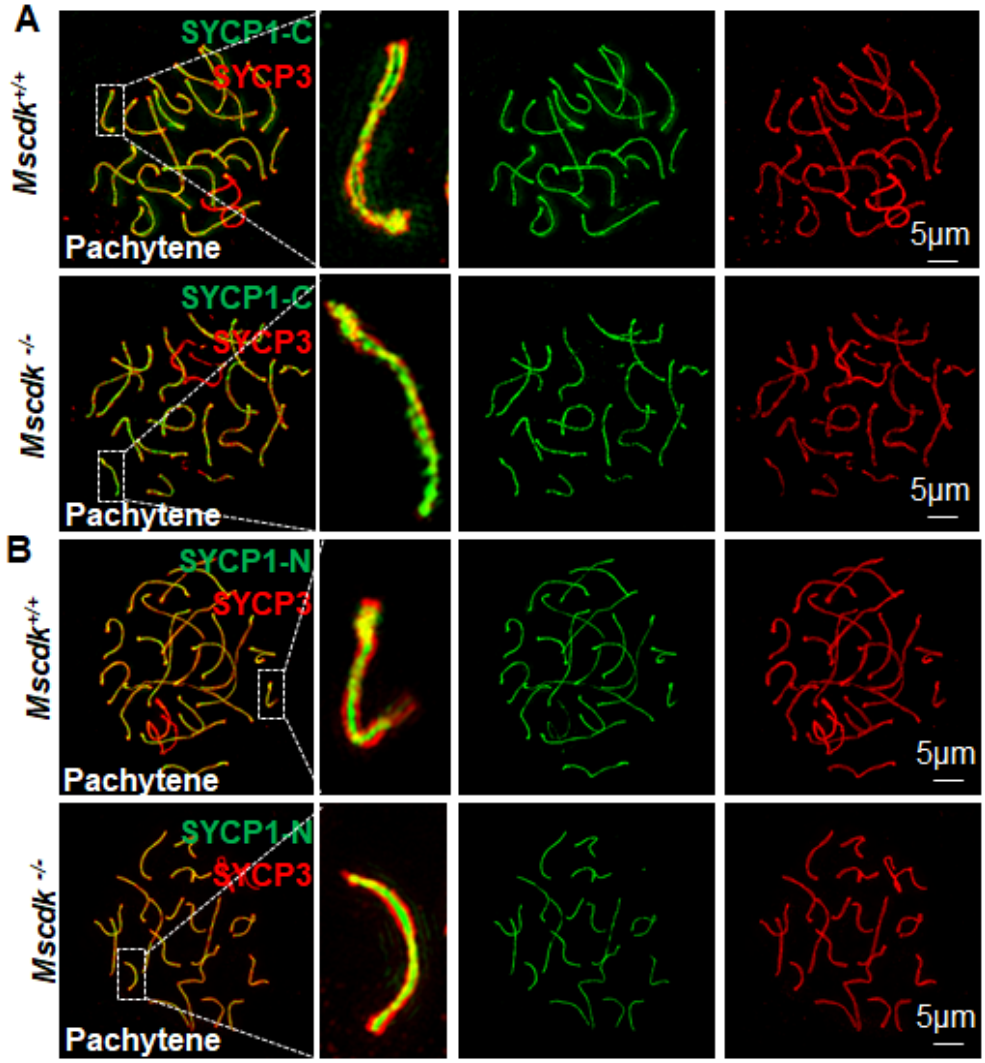


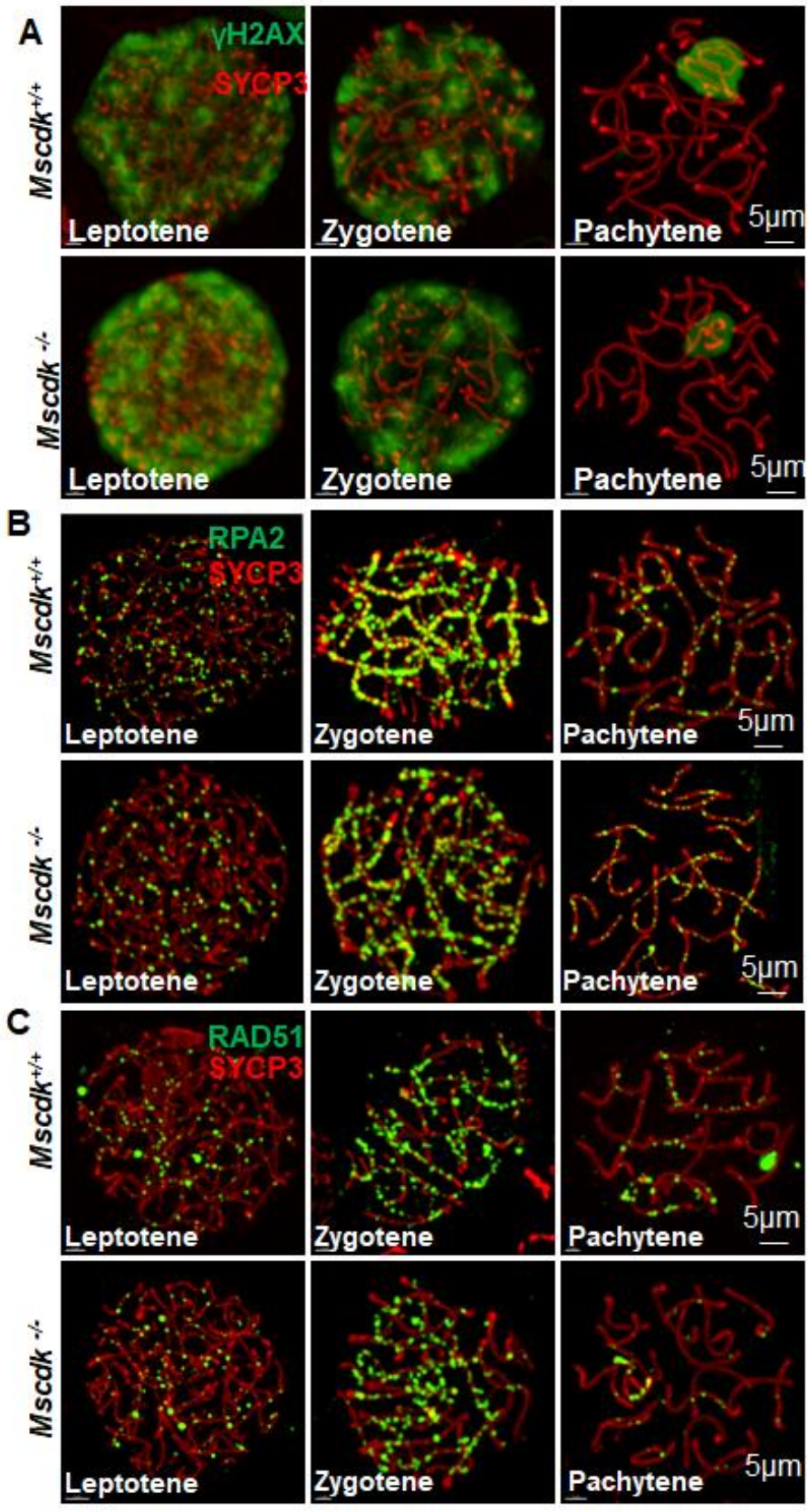
Supplemental figure1. Verification of the MSCDK antibody efficiency. (A) Spermatocyte nuclei from a *Mscdk*$^{+/+}$ mouse immunolabeled for MSCDK and SYCP3. **(B)** Spermatocyte nuclei from a *Mscdk*$^{-/-}$ mutant mouse immunolabeled for MSCDK and SYCP3.



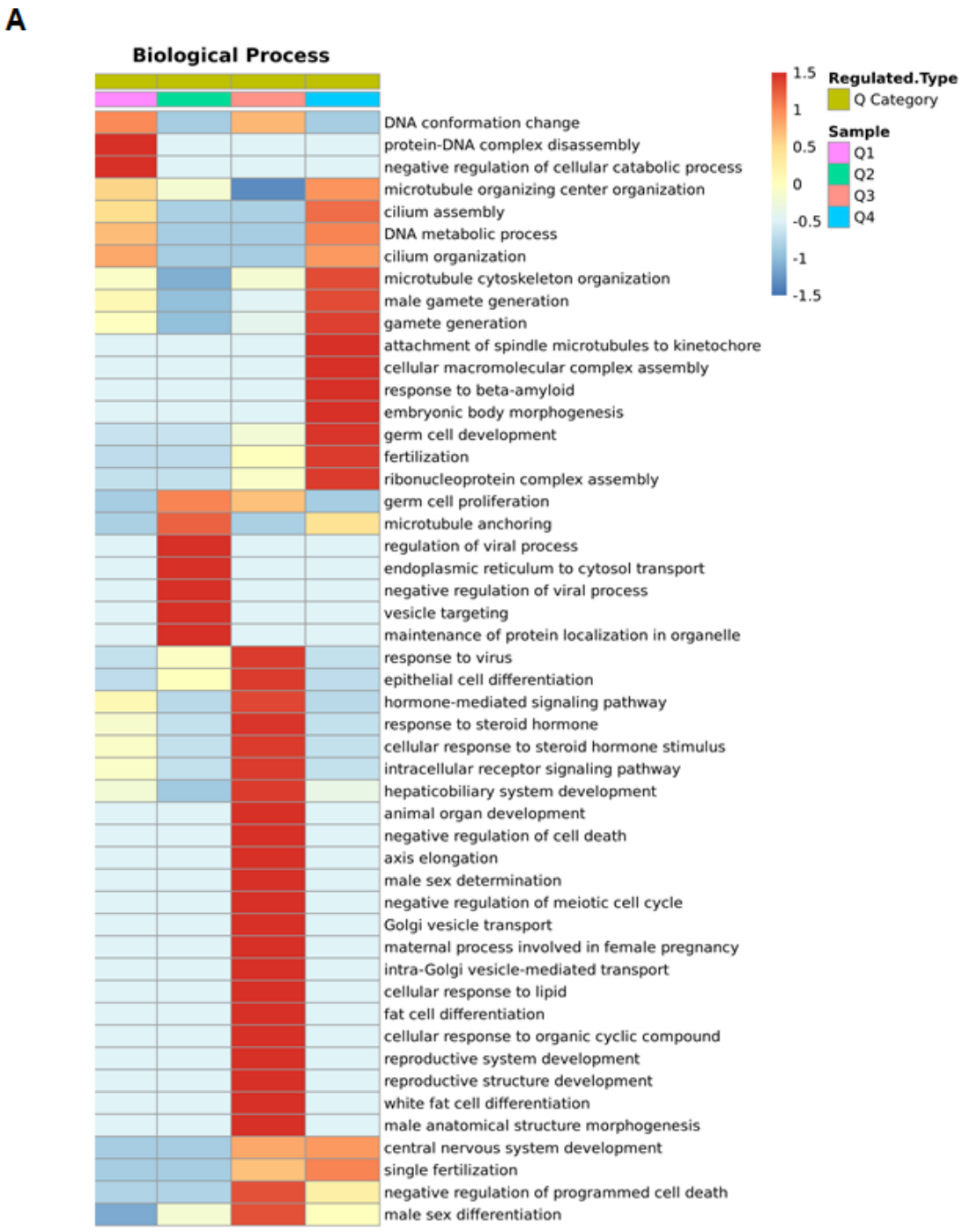
Supplemental figure2. (A) Body weight of *Mscdk*$^{+/+}$ and *Mscdk*$^{-/-}$ mice **(B)** Weights of testes derived from *Mscdk*$^{+/+}$ and *Mscdk*$^{-/-}$ males at indicated ages. **(C)** Cumulative numbers of pups per female during the defined time period. n = 3 mice for each genotype. **(D)** Hematoxylin staining of ovary sections from PD19 *Mscdk*$^{+/+}$ and *Mscdk*$^{-/-}$ mice.



Supplemental figure3. (A) SIM images of spermatocyte chromosome spreads immunostained for SYCP3 (red) and SYCP1 C-terminal (green) from PD35 testes. **(B)** SIM images of spermatocyte chromosome spreads immunostained for SYCP3 (red) and SYCP1 N-terminal (green) from PD35 testes.



Supplemental figure4. Representative images of spermatocytes from the leptotene to pachytene stages are shown as merged images. **(A)** γ-H2AX. **(B)**RPA2 foci. **(C)**RAD51 foci.



Supplemental figure5. (A) Gene ontology and KEGG analyses identified "germ cell development related pathway" as the most enriched pathway.

Supplemental Table 1.

Phospho-proteomics quantified of *Mscdk*$^{-/-}$ and wild type testes from PD19 mice.