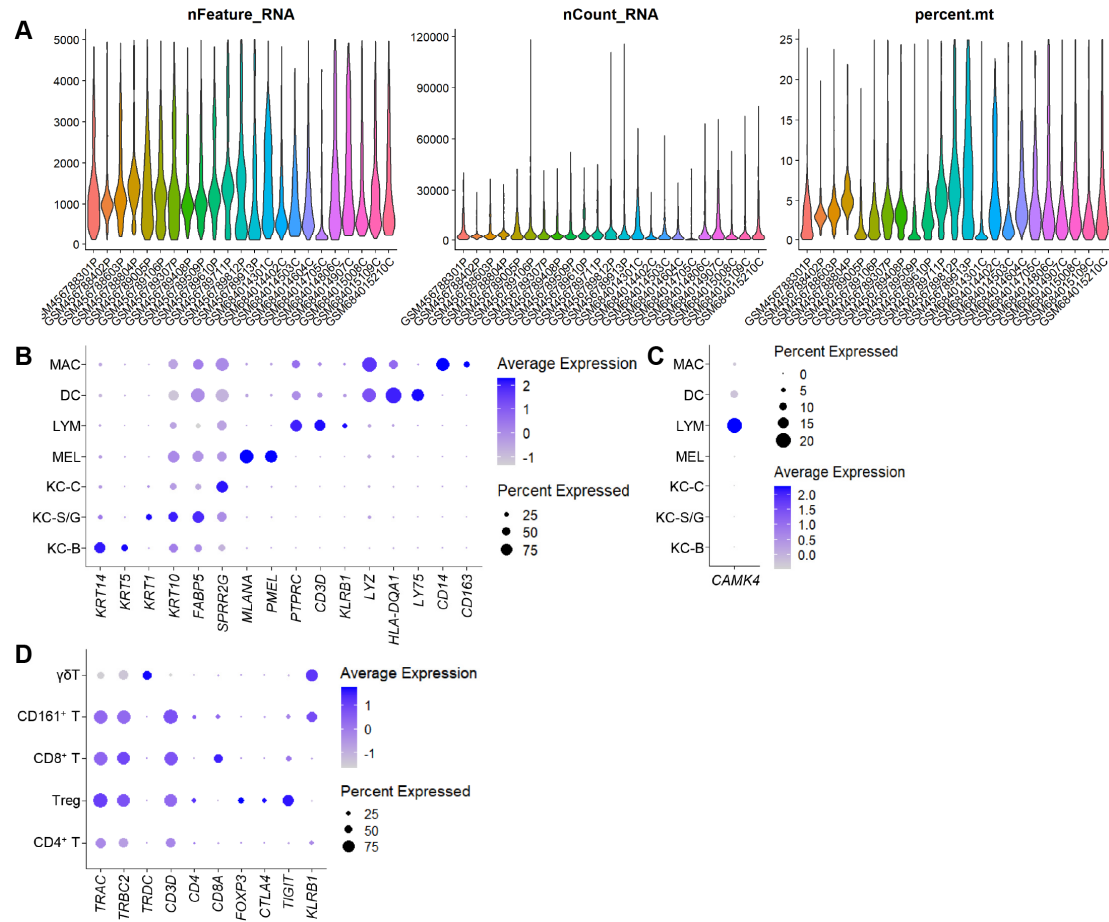
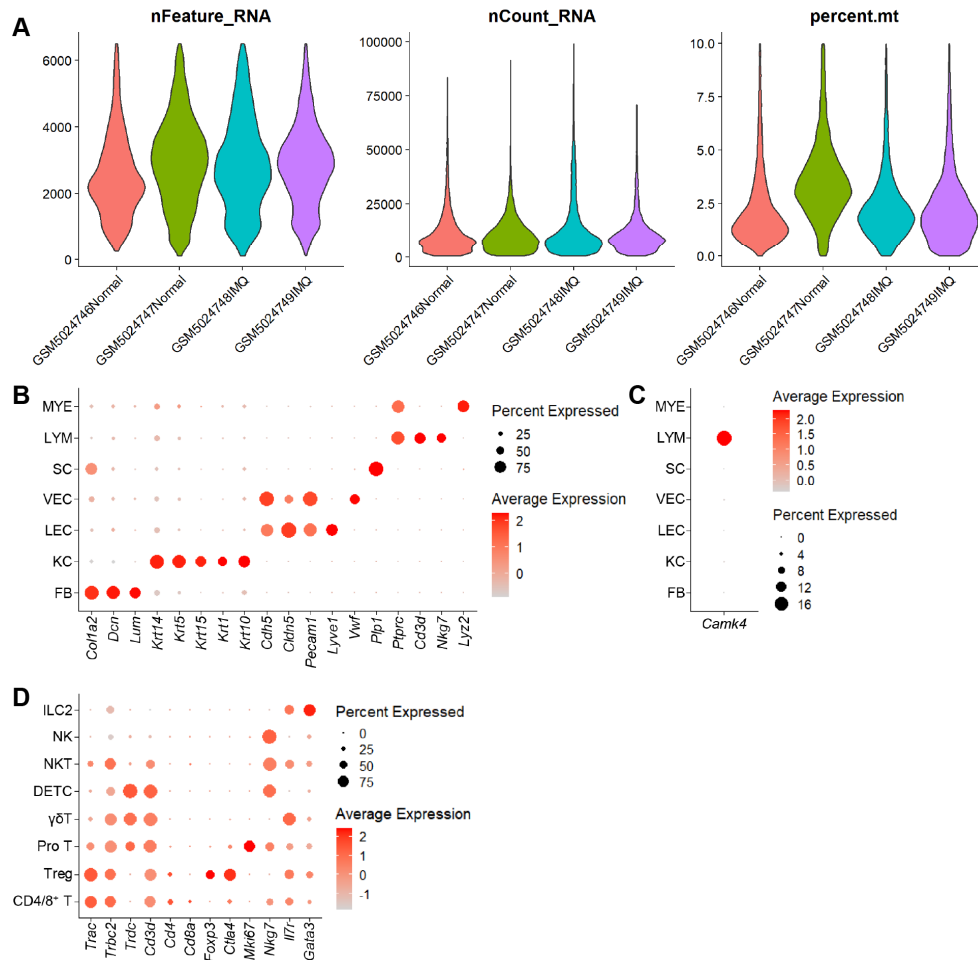
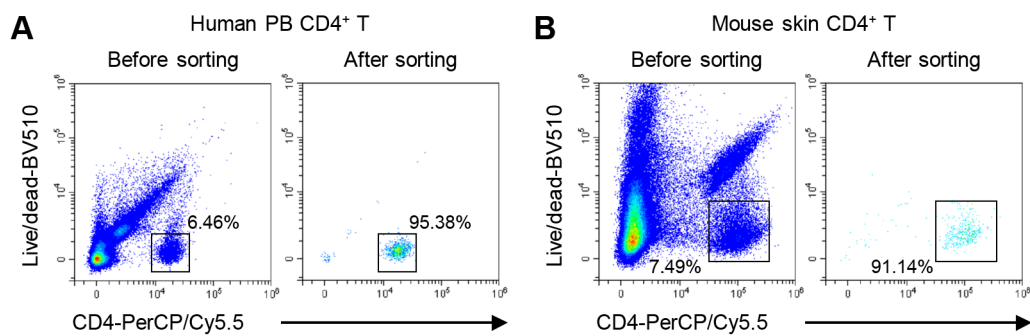




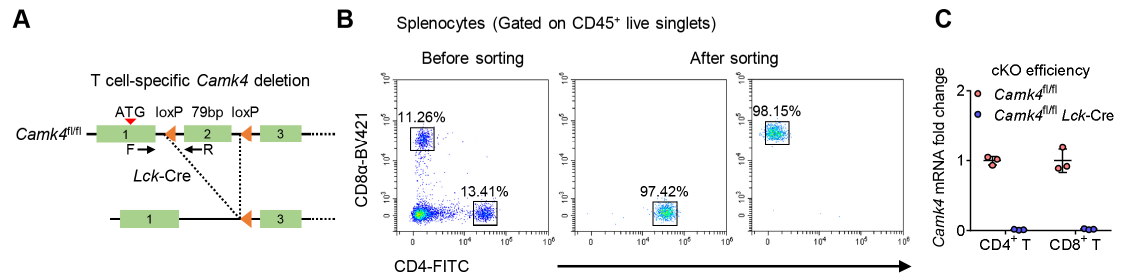
Supplementary Fig. 1. Single-cell RNA sequencing analysis of human skin. (A) Violin plot of nFeature_RNA, nCount_RNA, and percent.mt after quality control. **(B)** Dot plot showing the expression of marker genes for annotating cell identities. **(C)** Dot plot of *CAMK4* expression. **(D)** Dot plot showing the expression of marker genes for annotating lymphoid cell identities. KC-B, stratum basale keratinocytes; KC-S/G, stratum spinosum/granulosum keratinocytes; KC-C, stratum corneum keratinocytes; MEL, melanocytes; LYM, lymphoid cells; DC, dendritic cells; MAC, macrophages.



Supplementary Fig. 2. Single-cell RNA sequencing analysis of mouse skin. (A) Violin plot of nFeature_RNA, nCount_RNA, and percent.mt after quality control. **(B)** Dot plot showing the expression of marker genes for annotating cell identities. **(C)** Dot plot of *Camk4* expression. **(D)** Dot plot showing the expression of marker genes for annotating lymphoid cell identities. FB, fibroblasts; KC, keratinocytes; LEC, lymphatic endothelial cells; VEC, vascular endothelial cells; SC, Schwann cells; LYM, lymphoid cells; MYE, myeloid cells; DETC, dendritic epidermal T cells; Pro T, proliferating T cells.

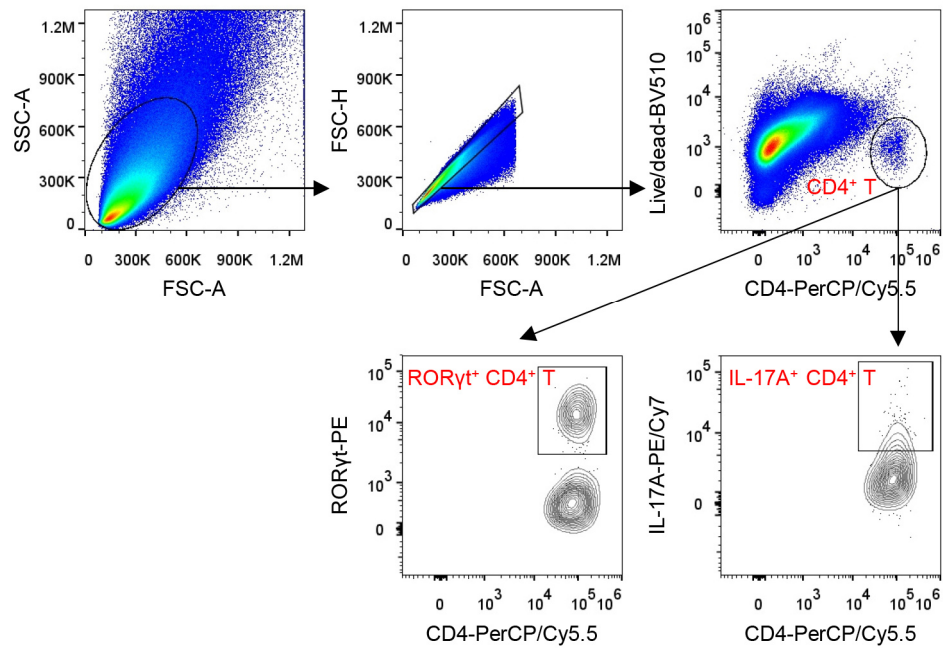


Supplementary Fig. 3. The purity of CD4⁺ T cells after sorting. (A) The purity of human peripheral blood (PB) CD4⁺ T cells. (B) The purity of mouse skin CD4⁺ T cells.

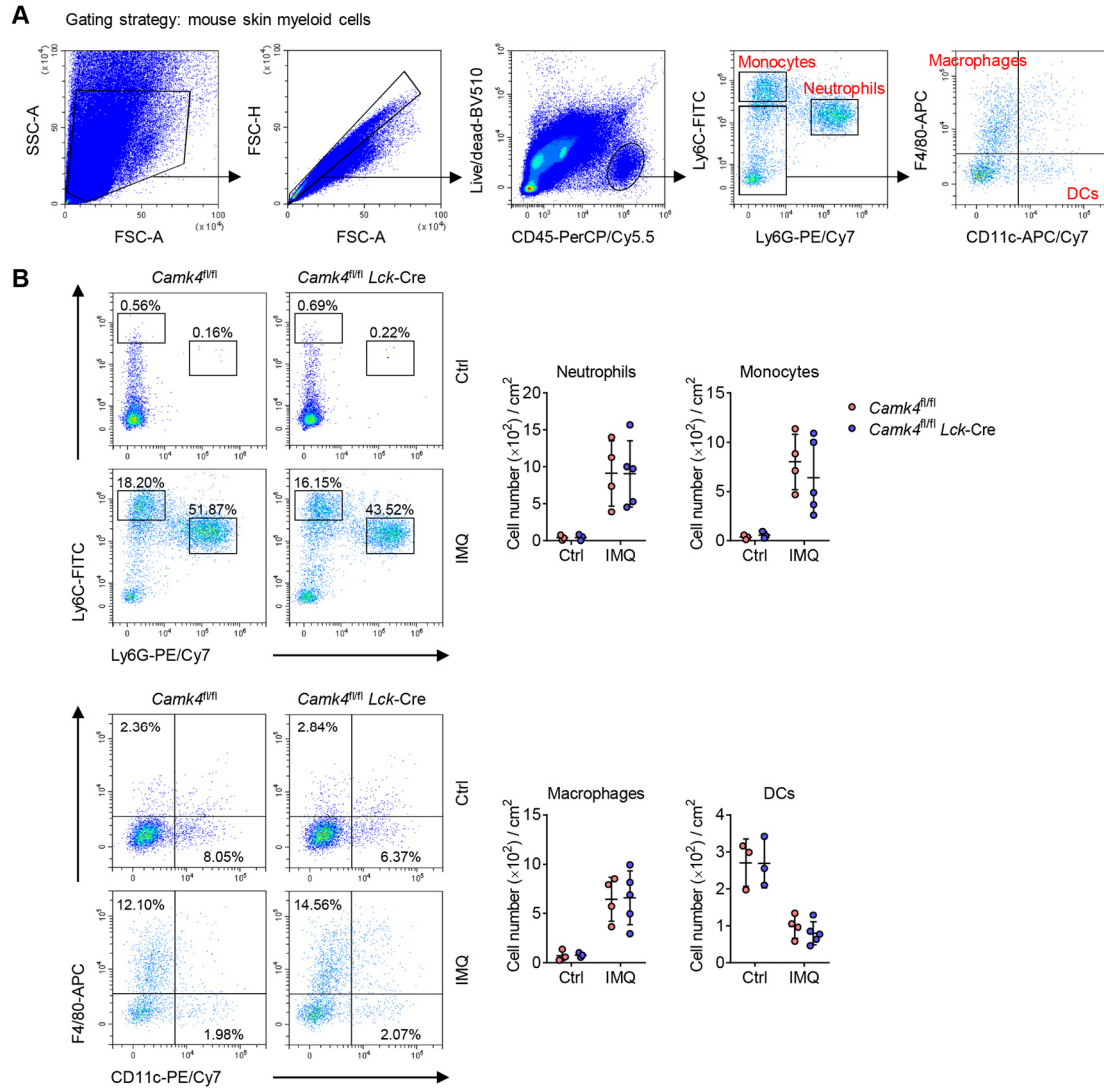


Supplementary Fig. 4. Construction strategy for T cell-specific *Camk4*-deficient mice and verification of knockout efficiency. (A) Diagram of T cell-specific *Camk4* deletion strategy. (B) The purity of splenic CD4⁺ T and CD8⁺ T cells after sorting. (C) Verification of knockout efficiency by quantitative PCR.

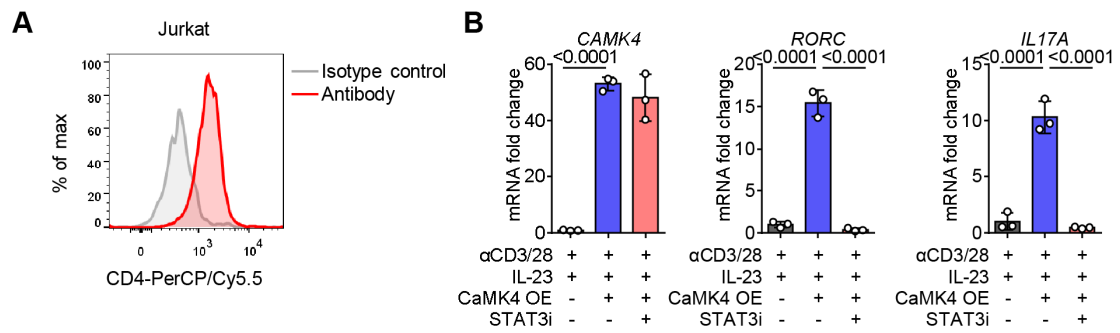
Gating strategy: mouse skin Th17 cells



Supplementary Fig. 5. The gating strategy for mouse skin Th17 cell subsets.



Supplementary Fig. 6. Deletion of *Camk4* in T cells does not substantially alter skin myeloid cells. (A) The gating strategy for mouse skin myeloid cell subsets. (B) Representative flow cytometry plots and statistical analyses of neutrophils, monocytes, macrophages, and DCs in the skin of Ctrl *Camk4^{fl/fl}* ($n = 3$), Ctrl *Camk4^{fl/fl} Lck-Cre* ($n = 3$), IMQ *Camk4^{fl/fl}* ($n = 4$), and IMQ *Camk4^{fl/fl} Lck-Cre* ($n = 5$) mice. Data are representative of two independent experiments. Data are shown as mean $\pm$ SD (B). The P values were calculated by two-way ANOVA with Tukey's post-hoc test (B).



Supplementary Fig. 7. CaMK4 overexpression promotes the expression of *RORC* and *IL17A* via STAT3. (A) Validation of CD4 expression in Jurkat cells by flow cytometry. (B) The expression of *RORC* and *IL17A* as indicated ($n = 3$). Data are representative of three independent experiments. Data are mean $\pm$ SD (B). The P values were calculated by one-way ANOVA with Dunnett's post-hoc test (B).