

## Description of Additional Supplementary Files

File Name: Supplementary Data 1

Description: **Clinical characteristics and sequencing data summary of thymus samples involved in this study.**

File Name: Supplementary Data 2

Description: **Differentially expressed genes for 34 cell types in normal thymus microenvironment.**  $p\_val\_adj$  were determined by one-tailed Wilcoxon test followed by Bonferroni correction.

File Name: Supplementary Data 3

Description: **Spatial distance varying genes inferred by TSO-his.** The  $p$ -values of distance-varying genes from a single ST sample were calculated using generalized linear Gaussian models and corrected with the Benjamini-Hochberg method. These corrected  $p$ -values were then pooled across multiple ST samples using Stouffer's Z-score method.

File Name: Supplementary Data 4

Description: **Differentially expressed genes in the cortical and medullary regions of normal thymus tissues.**  $p\_val\_adj$  were determined by one-tailed Wilcoxon test followed by Bonferroni correction.

File Name: Supplementary Data 5

Description: **Co-localization indexes of thymic cell types.**

File Name: Supplementary Data 6

Description: **Differentially expressed genes of four T-cell subpopulations in normal thymus tissues.**  $p\_val\_adj$  were determined by one-tailed Wilcoxon test followed by Bonferroni correction.