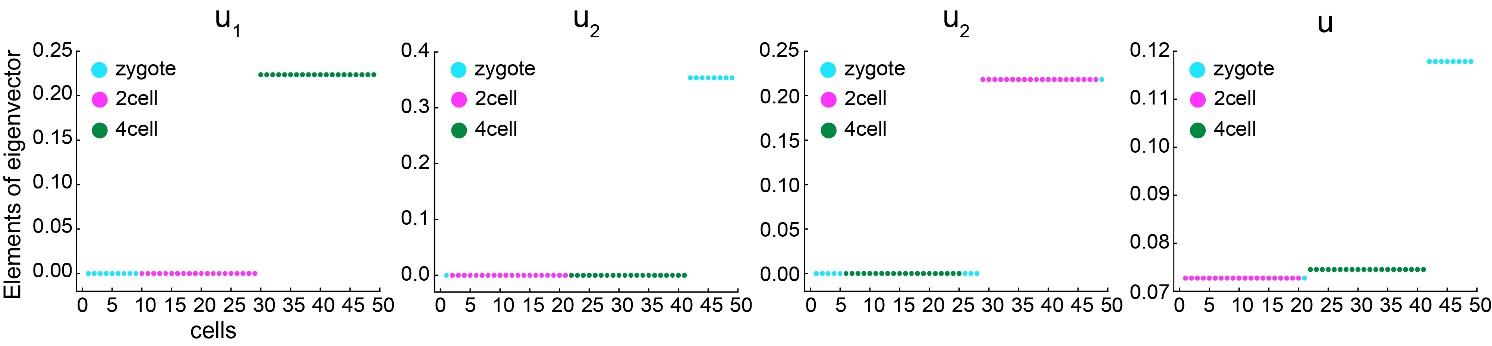
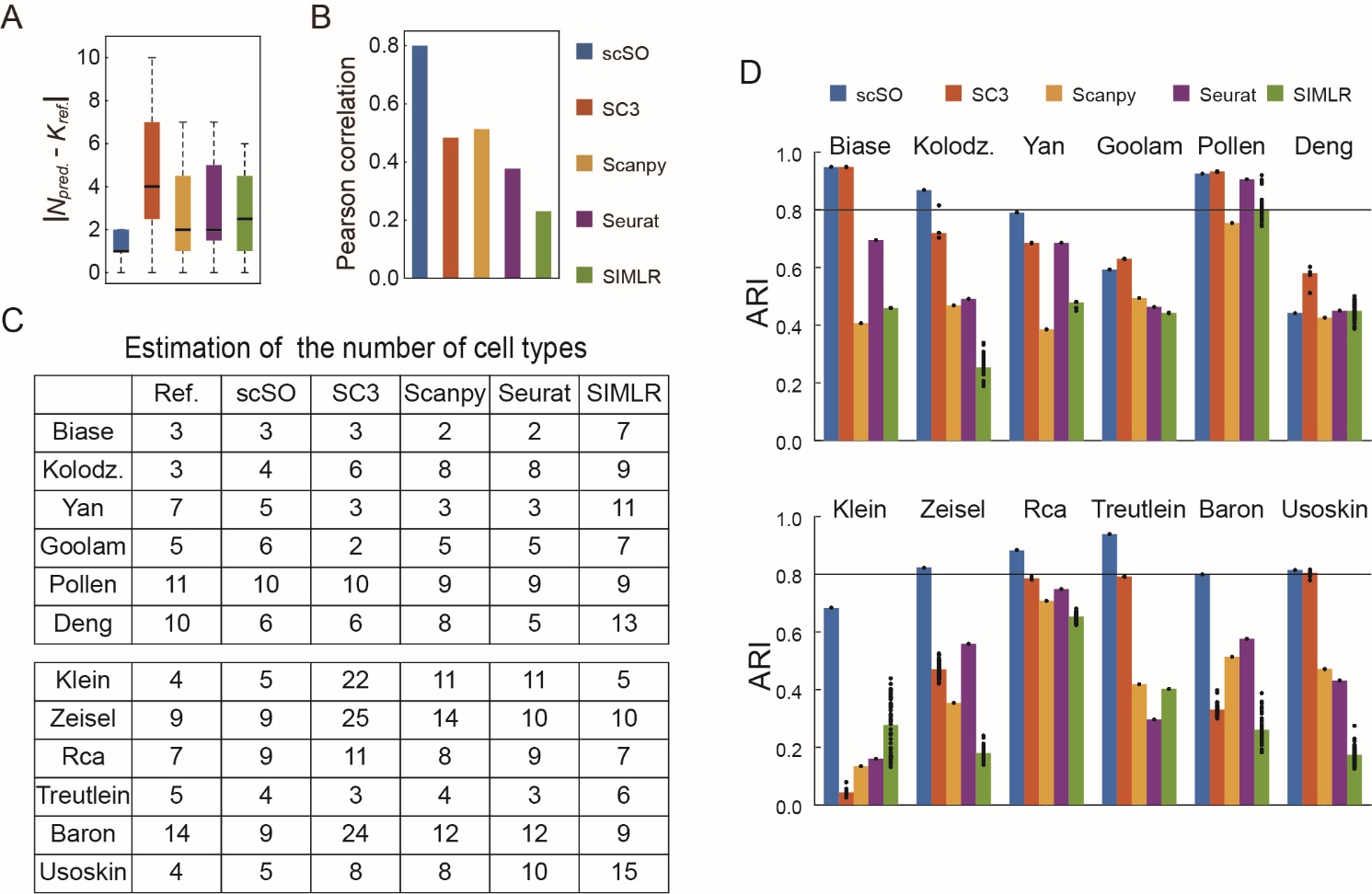
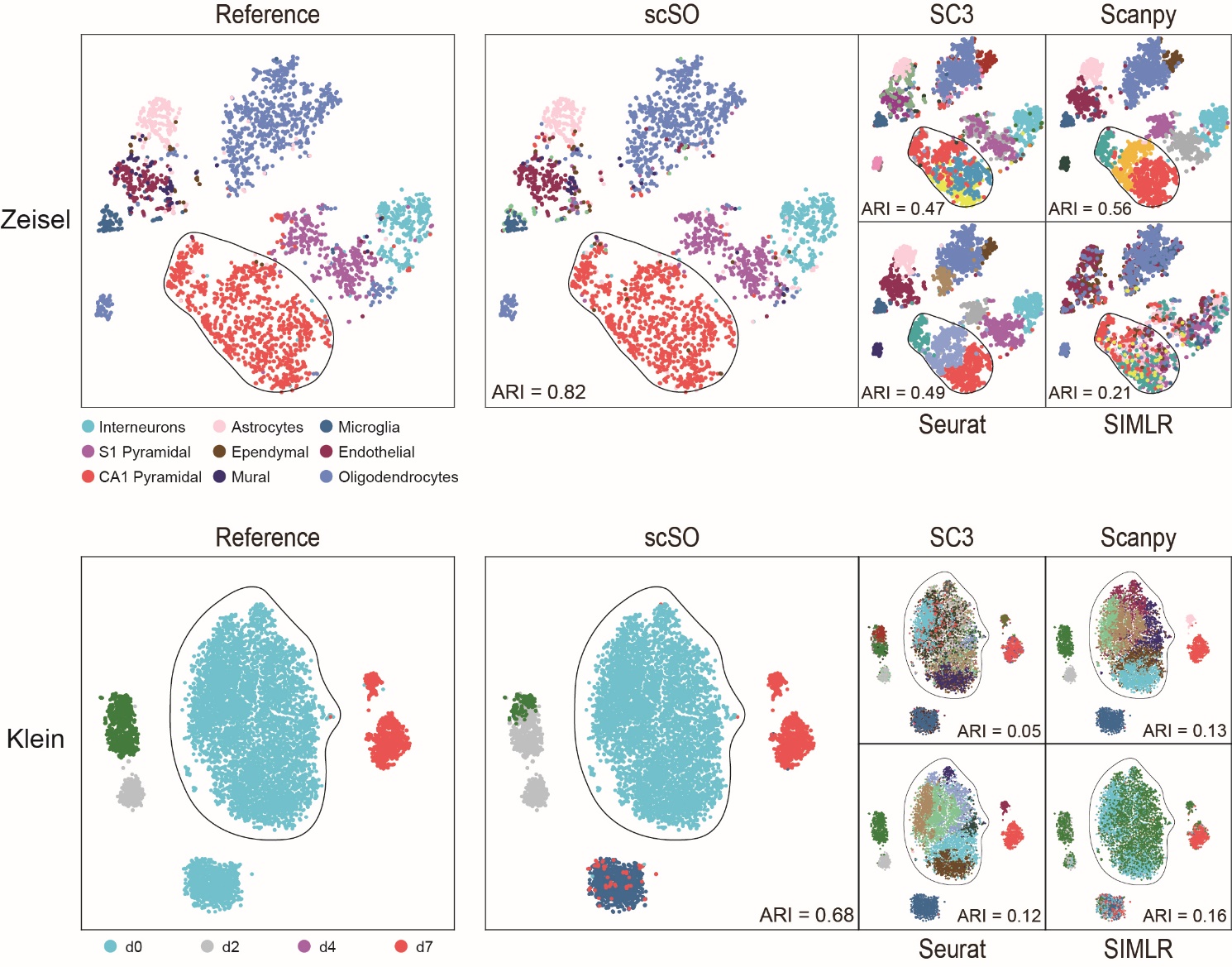
**

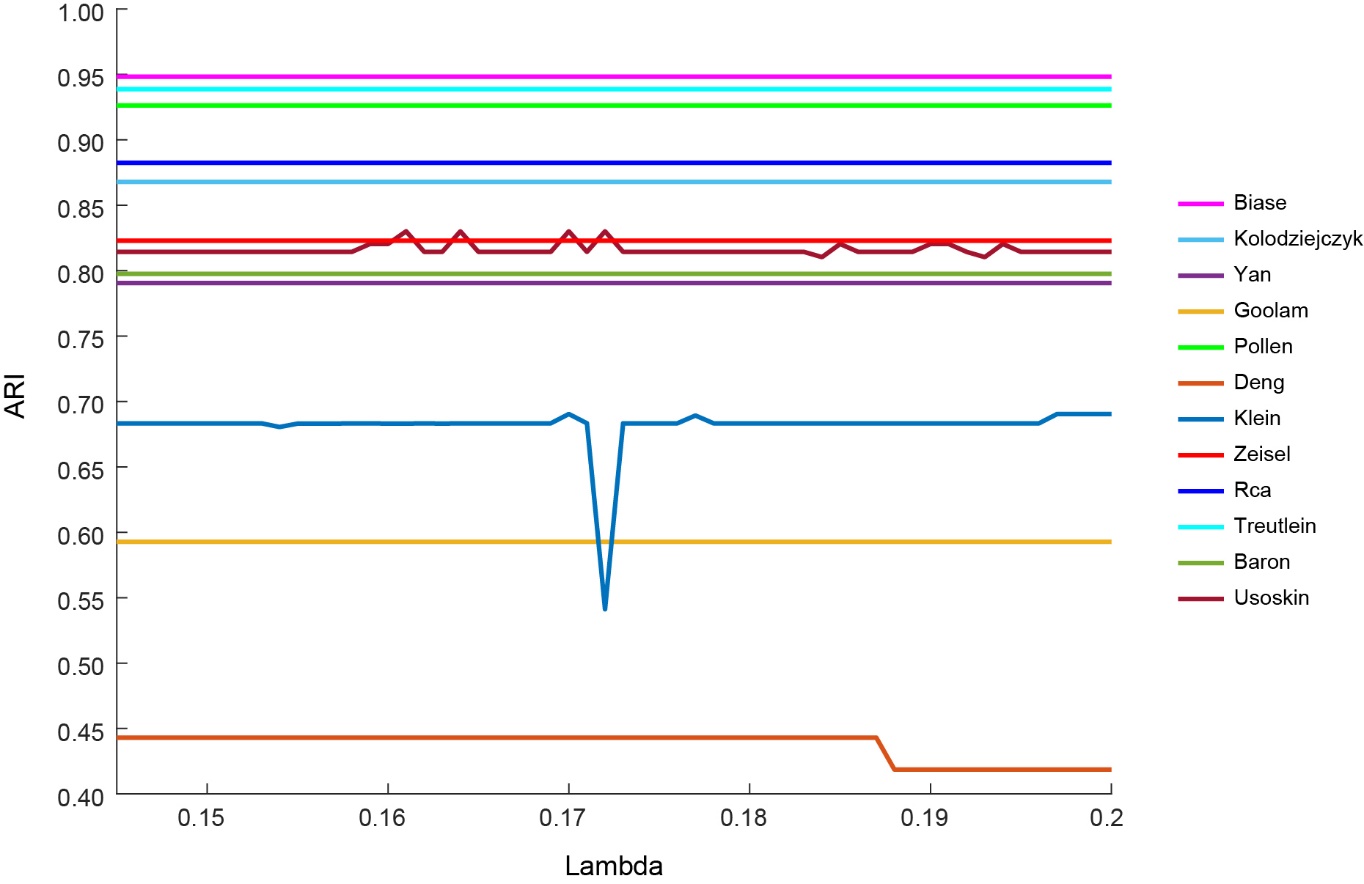
**Figure S1.** **The center of eigenvectors corresponding to the eigenvalue 0 of *L* improves the clustering accuracy.**  , , and are the eigenvectors corresponding to the top three smallest eigenvalues of Laplace matrix of generated from Biase’s dataset, is the center of , , and .

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**Figure S2. Results of different methods using their own filtering and normalization processes, as in Fig. 2.** (**A**) Difference () between the reference and predicted cell type numbers. Center line, median; box limits, upper and lower quartiles; whiskers, 1.5x interquartile range. (**B**) Pearson correlation coefficient between the reference and predicted cell type numbers. (**C**) A table listing the reference cell type numbers reported by the data source papers, and the predicted cell type numbers generated by different methods. (**D**) ARI values between the reference cell types and predicted cell clusters. Bar: average ARI; Dots: ARI values for multiple runs. SC3 and SIMLR were performed 50 times for each dataset.

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**Figure S3. Clustering results of different methods on single-cell datasets (Upper: Zeisel’s dataset; Bottom: Klein’s dataset).** 2D-TSNE embedding of the cells in those datasets, colored by the reference cell types (left panel), and the cell clusters predicted by different methods (right panels).

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**Figure S4. Clustering results of scSO corresponding to different balance parameters** **.** The horizontal axis and the vertical axis represent and ARI values, respectively. The color of the solid line indicates different datasets.