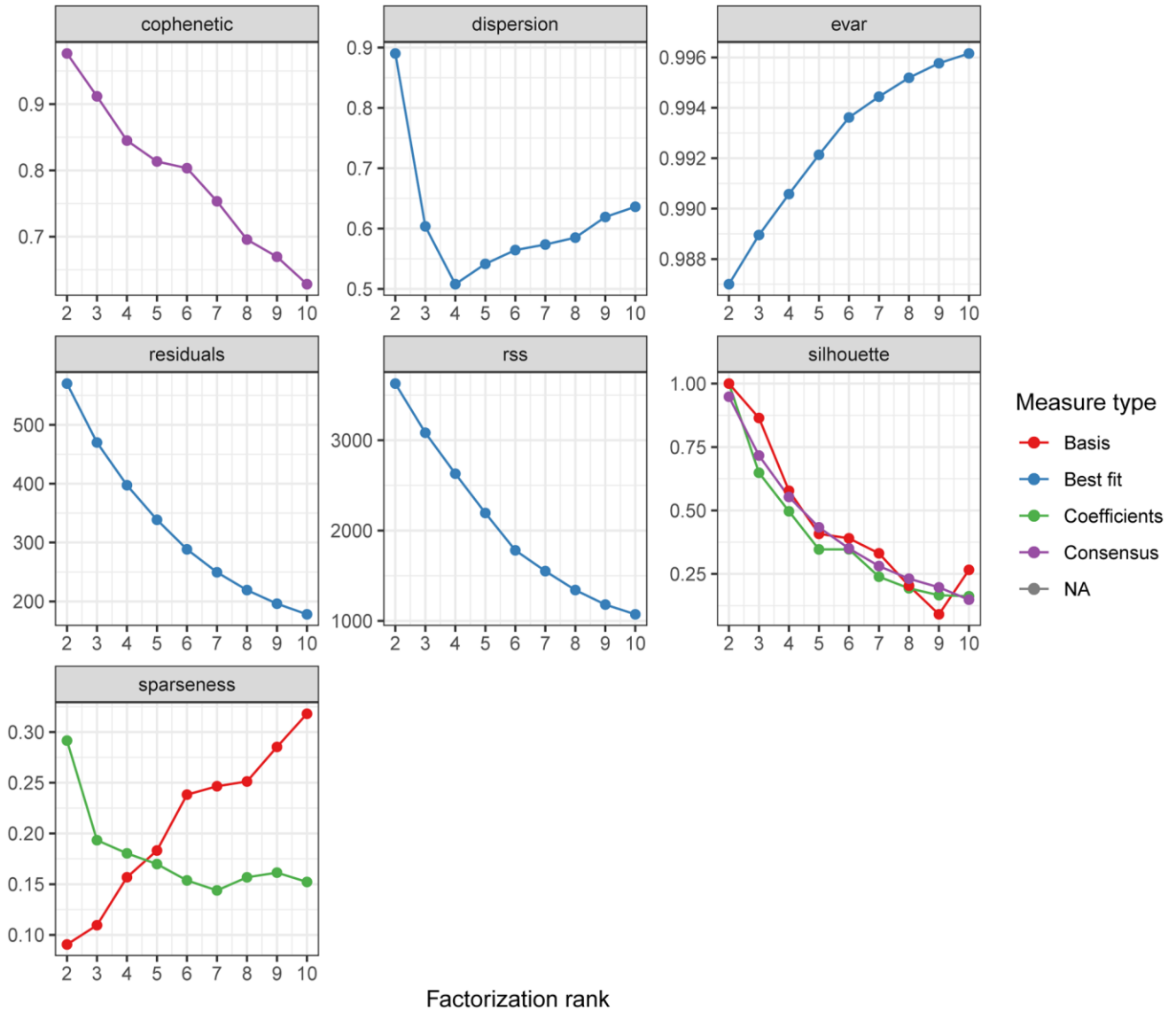
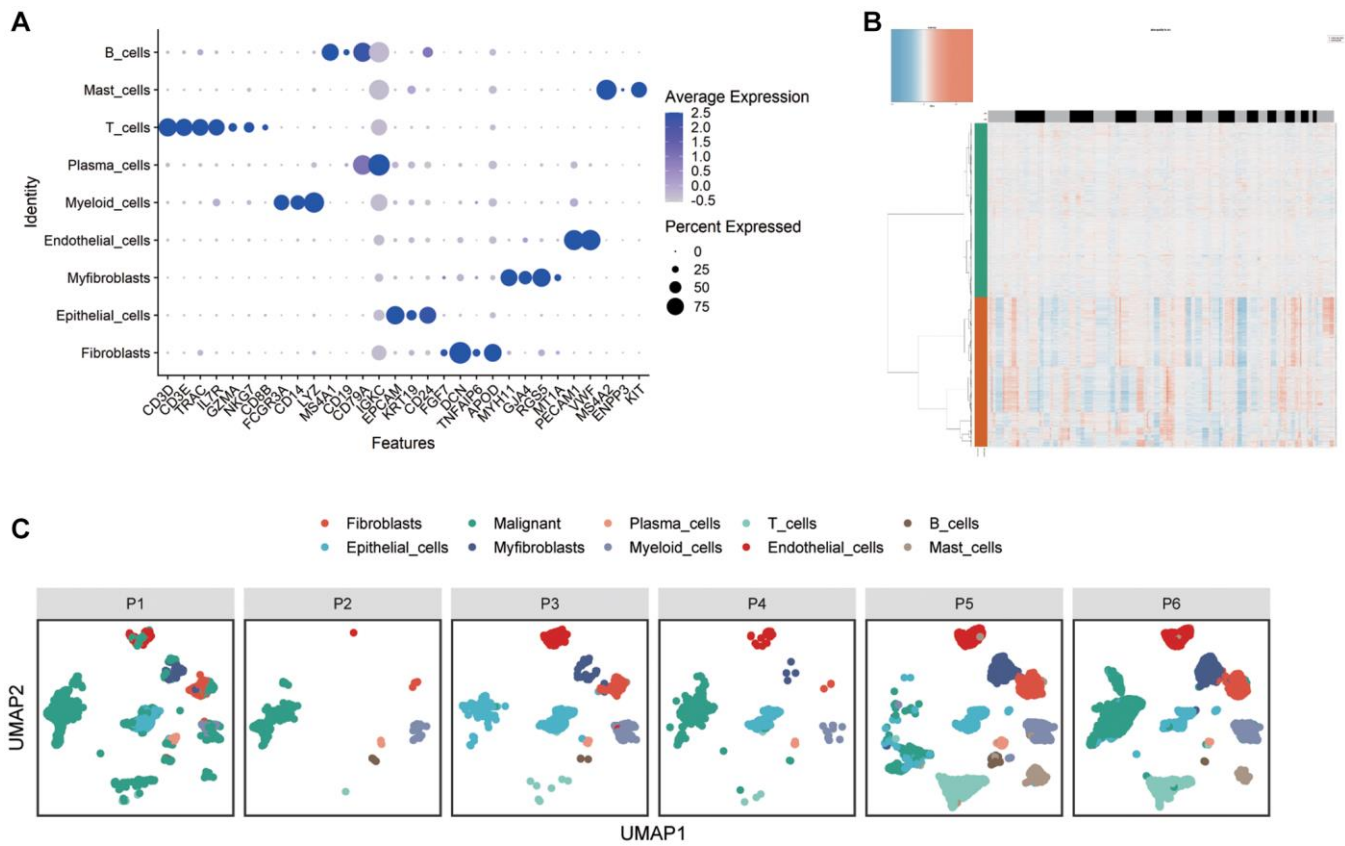


SUPPLEMENTARY FIGURES

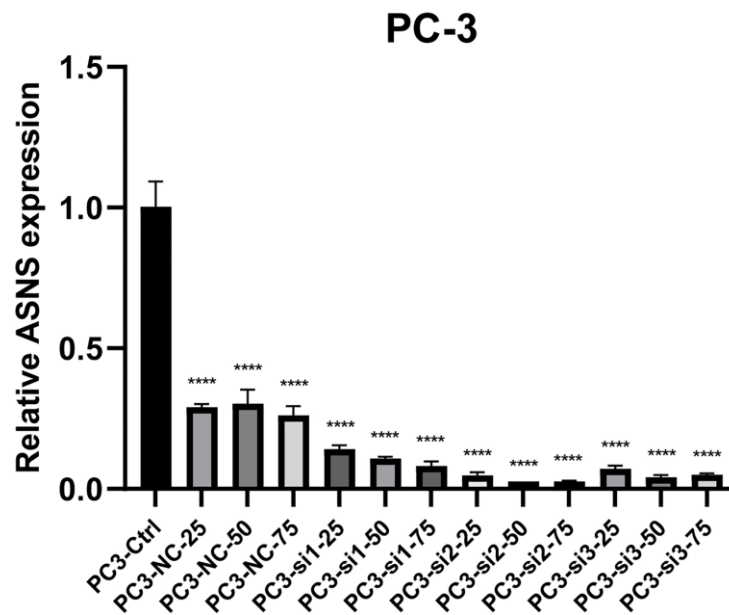
NMF rank survey



Supplementary Figure 1. The plots of cophenetic correlation coefficient reflected the stability of the cluster generated from NMF.



**Supplementary Figure 2. Sample preprocessing of the scRNA-seq.** (A) Markers of the main clusters. (B) The “copykat” R package was utilized to identify malignant cells. (C) UMAP plot revealed the composition of 10 main clusters from 6 patients.



**Supplementary Figure 3. Relative RNA expression for knockdown of ASNS.** \*\*\*\* $p < 0.0001$ .