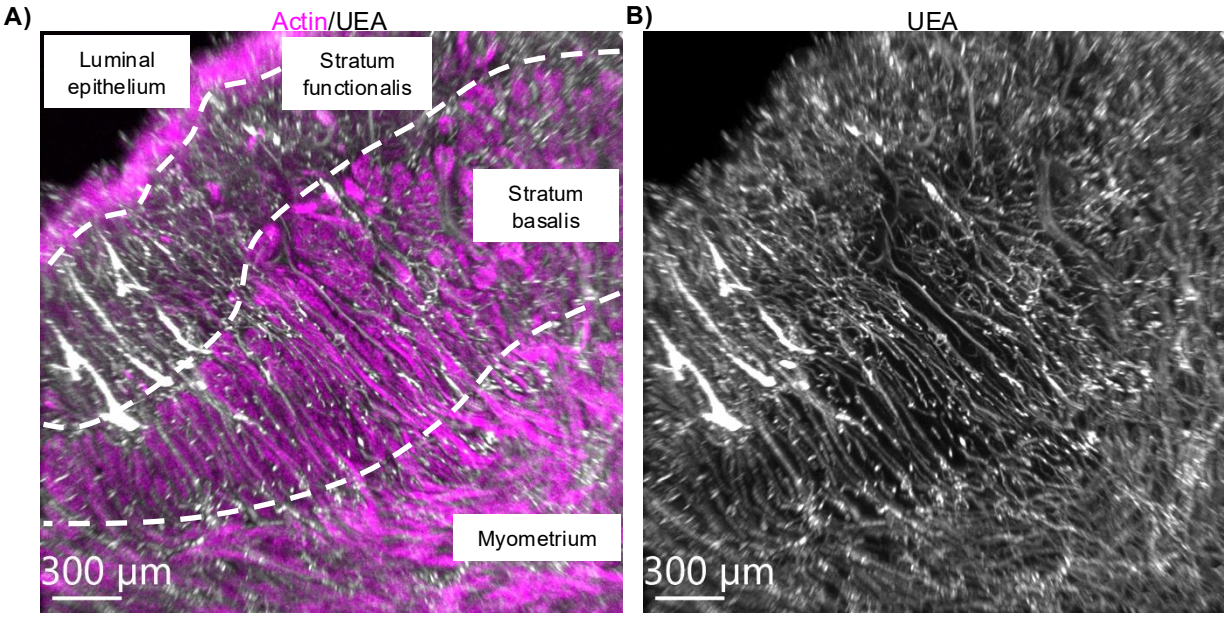
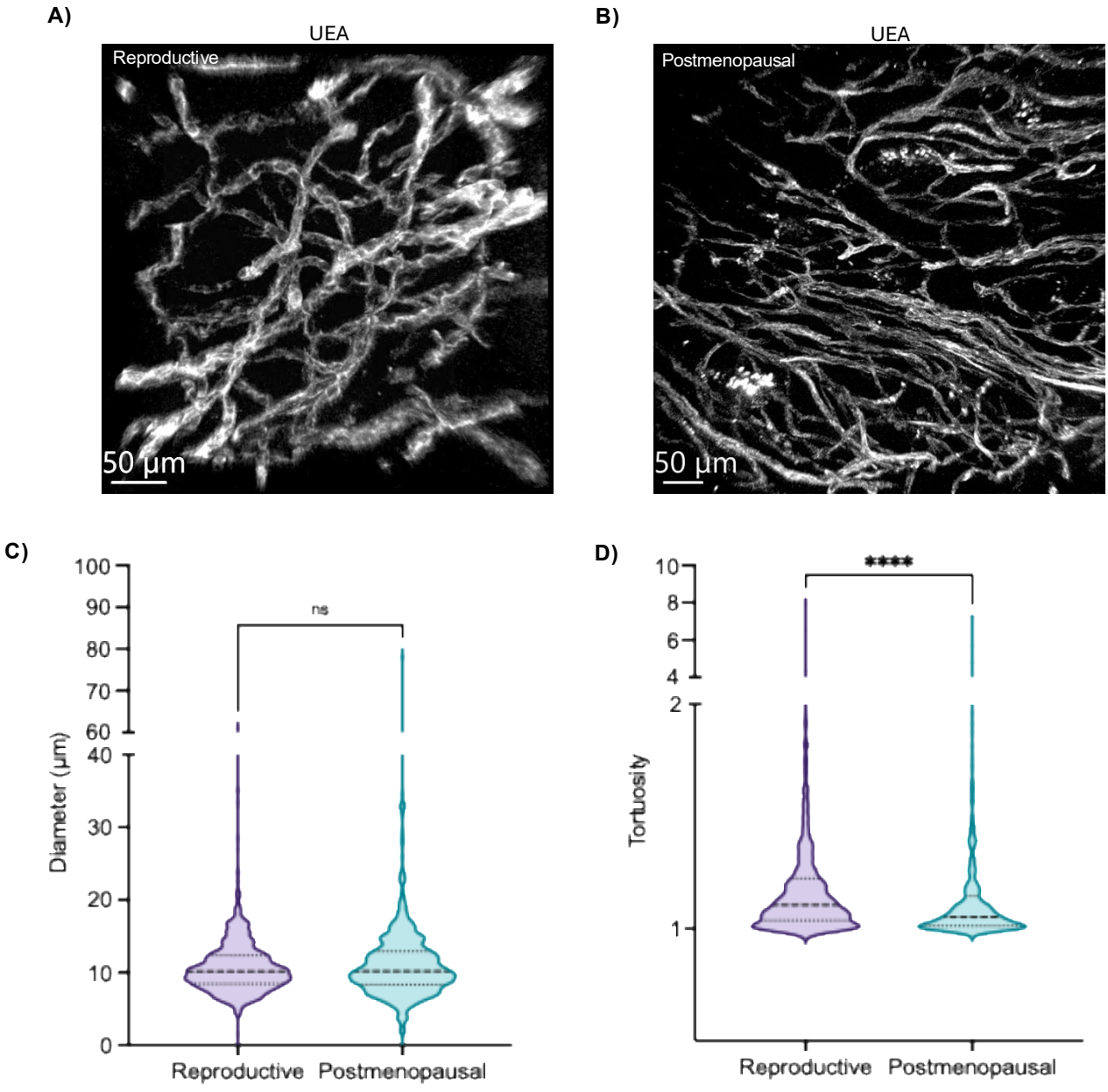
**Supplemental Figure 1**



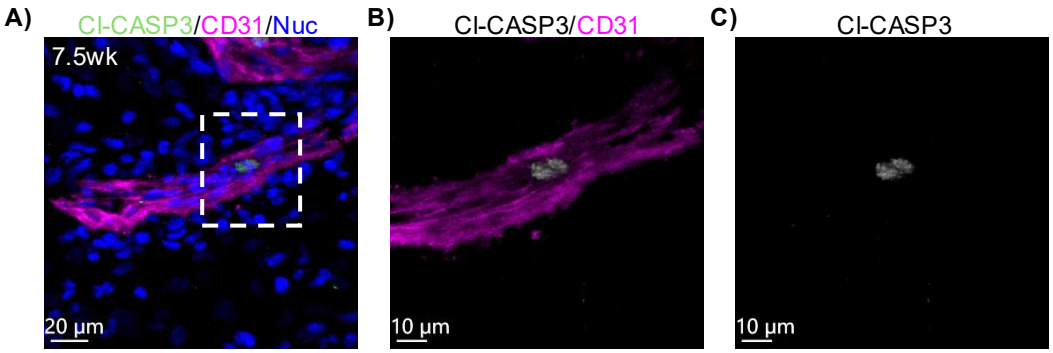

**Supplemental Figure 1: Representative image of secretory phase endometrial vasculature.** (A) Merged image of phalloidin (magenta) and UEA-1 (grayscale) with functional layers indicated by dashed lines. (B) Isolated vascular stain.

**Supplemental Figure 2**




**Supplemental Figure 2: The reproductive and postmenopausal endometrium have different vascular qualities.** (A) Representative image of the vasculature from reproductive endometrium samples stained with UEA (grayscale). (B) Representative image of the postmenopausal endometrial vasculature stained with UEA (grayscale). (C) Summary data of blood vessel diameter measurements of the reproductive ($n_{vessels}$= 1032, $n_{samples}$= 4) and the postmenopausal endometrium ($n_{vessels}$= 457, $n_{samples}$= 3). (D) Summary data of blood vessel tortuosity measurements (1= perfectly straight vessel) of images in the reproductive ($n_{vessels}$= 1025, $n_{samples}$= 4) and the postmenopausal endometrium ($n_{vessels}$= 457, $n_{samples}$= 3). Unpaired Mann-Whitney U test; dashed line indicates the median, and dotted lines represent quartiles 1 and 3. **** = p <0.001

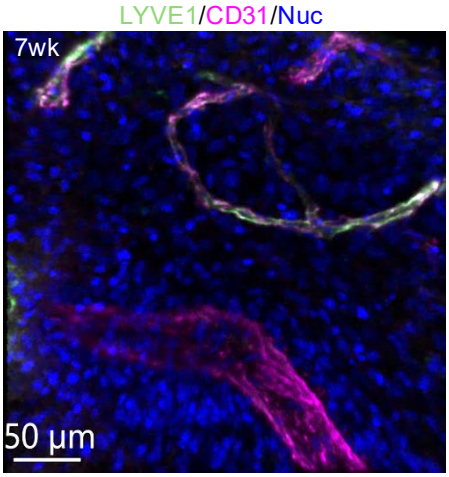
**Supplemental Figure 3**




**Supplemental Figure 3: Rare endothelial cell apoptosis is seen in the decidua.** (A) Representative merged image of anti-cleaved-caspase 3 (green), anti-CD31 (magenta) and Hoechst (nuclei; blue) staining in 7.5-week GA decidua. (B) Zoomed inset of outlined area of anti-cleaved-caspase 3 (grayscale) and anti-CD31 (magenta). (C) isolated anti-cleaved-caspase 3 (grayscale) channel of outlined zoomed inset.

**Supplemental Figure 4**

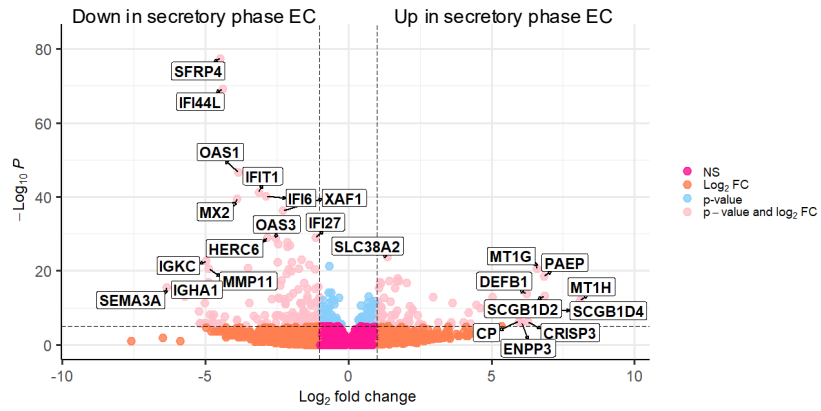
**A)**



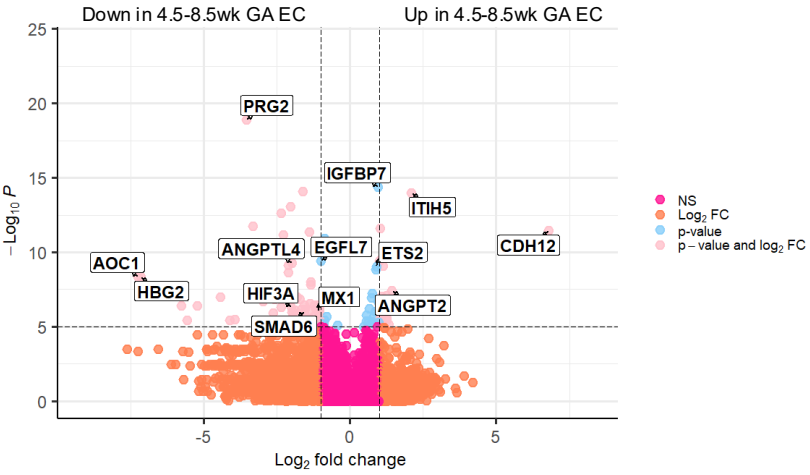

**Supplemental Figure 4: Lymphatic vessels are present in the decidua basalis.** (A) Representative confocal image of 7-week GA decidua staining of anti-CD31(green), anti-LYVE1 (magenta), and Hoechst (nuclei; blue).

**Supplemental Figure 5**

**A)**



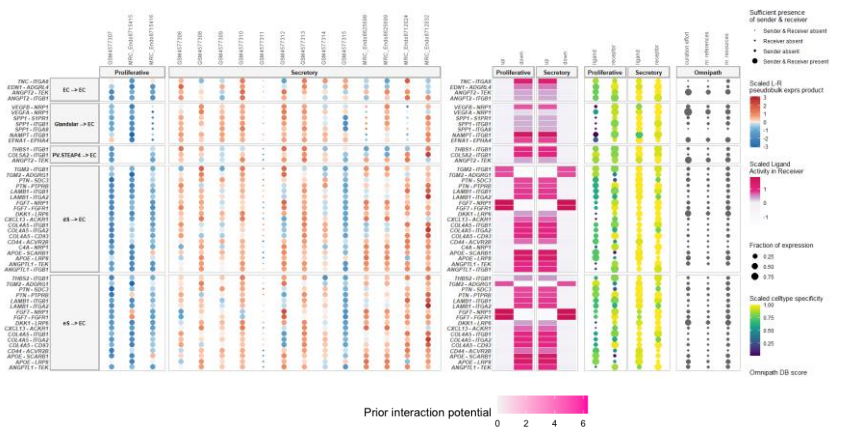

**B)**



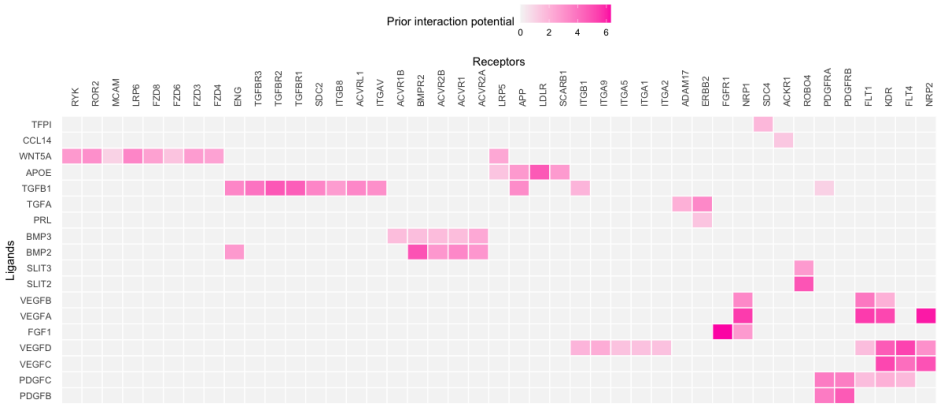

**Supplemental Figure 5: Endothelial cells adapt their gene expression across the endometrial phases and decidual gestational ages.** (A) Volcano plot of the differentially expressed genes up- and down- regulated of the endometrial EC in the secretory phase when compared to proliferative phase EC. Top up- and down-expressed genes are highlighted. (B) Volcano plot of the differentially expressed genes up- and down- regulated of the decidual EC of 4-8.5-weeks GA when compared to 10+ weeks GA EC. Top up- and down-expressed genes are highlighted.

## Supplemental Figure 6

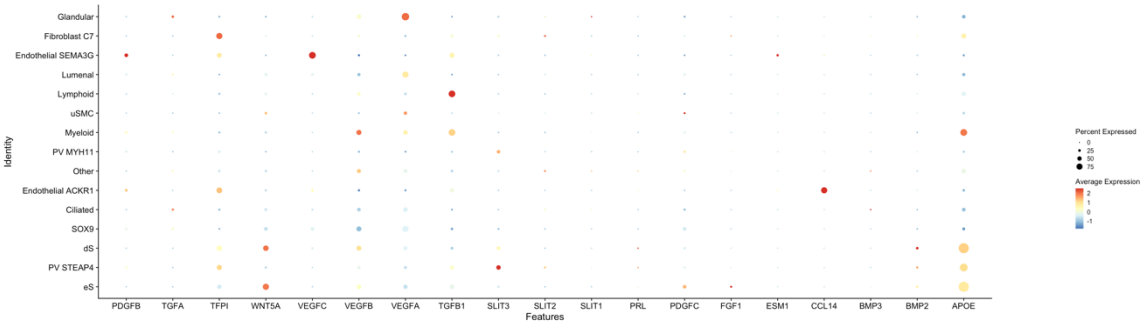
A)



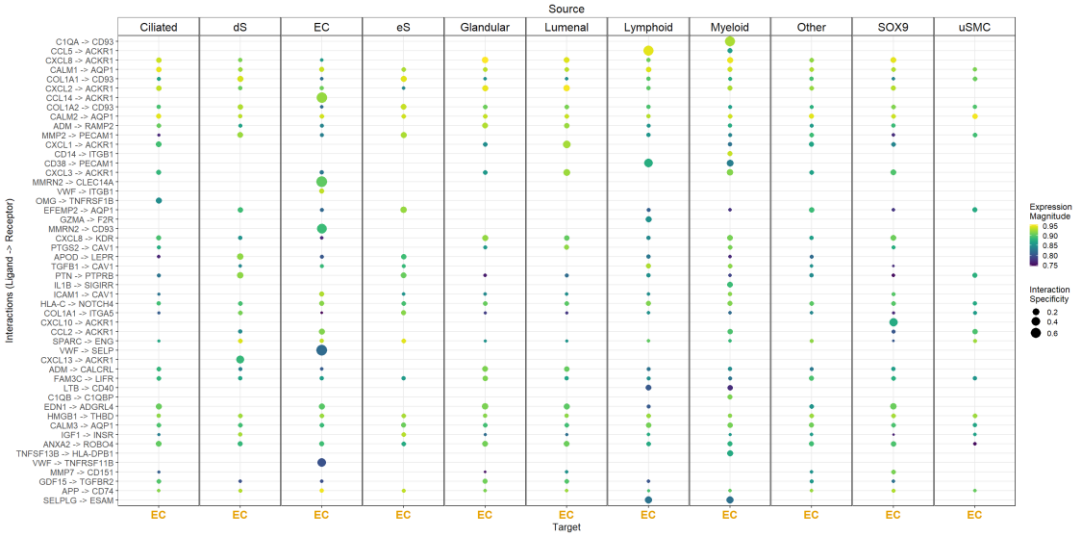

B)




C)




D)

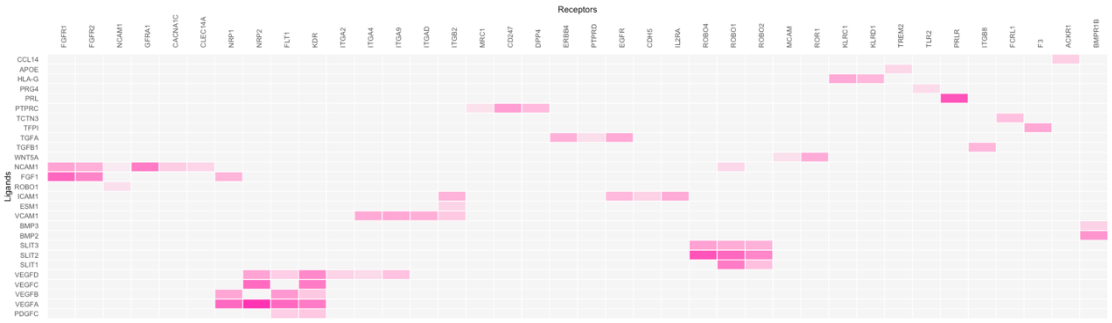


**Supplemental Figure 6: EC of the endometrium communicate with multiple cell types.** (A) MultiNicheNet interactome dotplot of endometrial tissue cells types signaling to the EC of receptor-ligand interactions. (B) NicheNet heatmap of curated ligands and their receptor interaction potentials from all cell types to the EC. (C) Dotplot of NicheNet curated ligands and originating cell type. (D) LIANA dotplot of the top 50 ligand-receptor interactions from all cells to the EC.

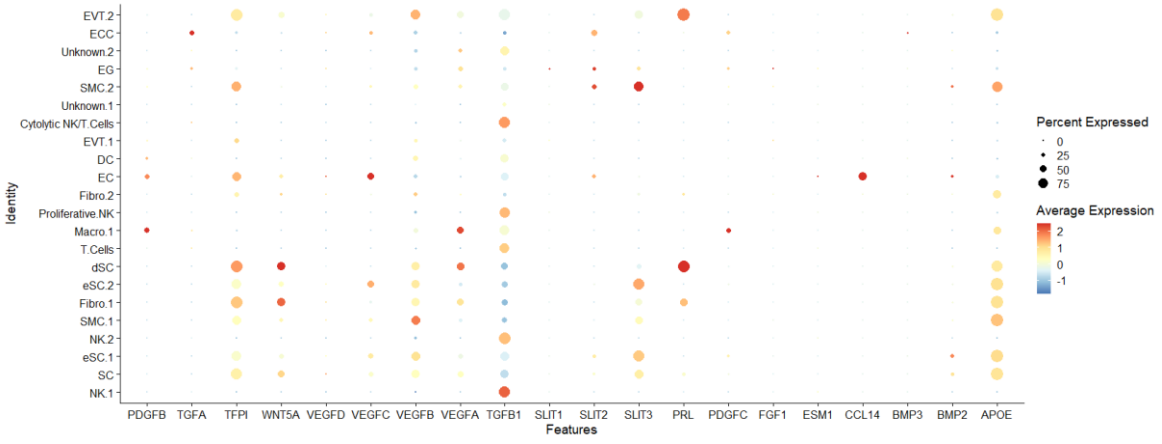
**Supplemental Figure 7**

A)

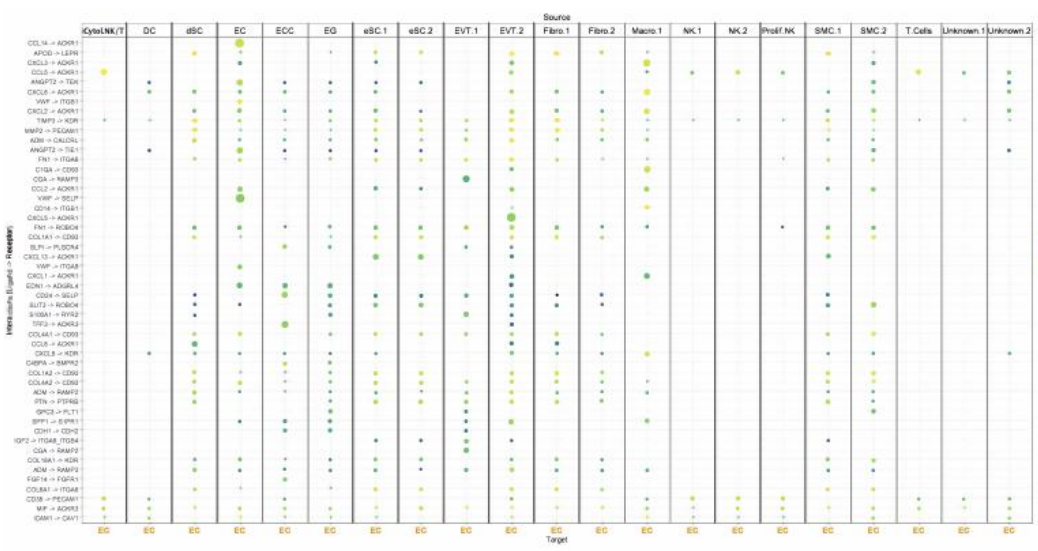

B)




C)

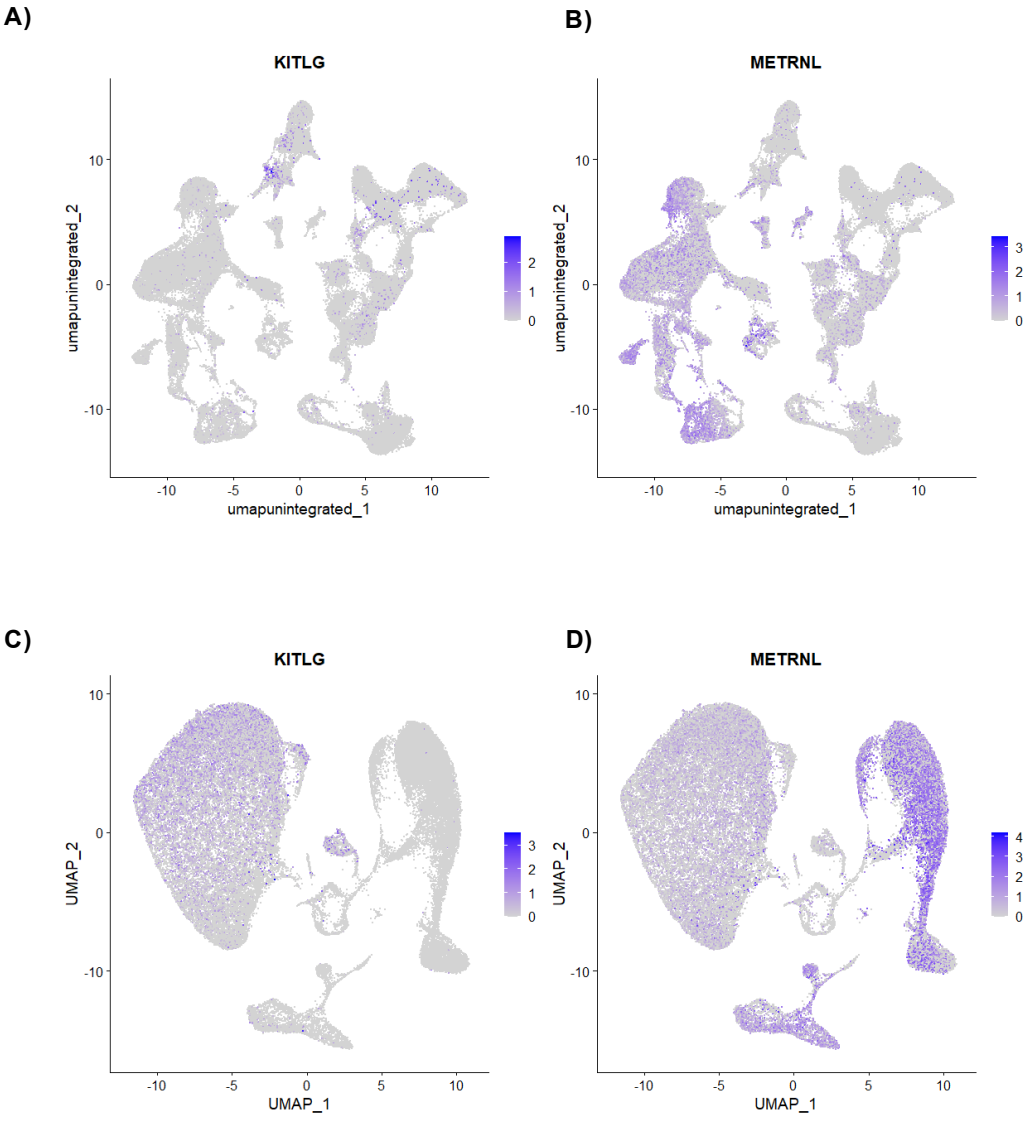



D)



**Supplemental Figure 7: EC of the decidua communicate with tissue cell types.** (A) MultiNicheNet interactome dotplot of decidual tissue cells types signaling to the EC of receptor-ligand interactions. (B) NicheNet heatmap of curated ligands and their receptor interaction potentials from all cell types to the EC. (C) Dotplot of NicheNet curated ligands and originating cell types. (D) LIANA dotplot of the top 50 ligand-receptor interactions from all cells to the EC.

**Supplemental Figure 8**




**Supplemental Figure 8: Overall *KITLG* and *METRNL* gene expression in the endometrium and decidua.** (A) *KITLG* gene expression UMAP in the endometrium. (B) *METRNL* gene expression UMAP in the endometrium. (C) *KITLG* gene expression UMAP in the decidua. (D) *METRNL* gene expression UMAP in the decidua.