

## **Description of Additional Supplementary Files**

**Supplementary Data 1 :** Ontogenic genes and DEG lists.

**Supplementary Movie 1 : Development of columnar epiblast-like cysts and squamous amniotic ectoderm-like cysts in the Gel-3D culture.** Representative time-lapse video showing progressive development of hPSC-derived epithelial cysts with different morphologies (columnar and squamous cysts) in the Gel-3D culture. Time stamps indicate culture time (t). Scale bar, 50  $\mu\text{m}$ . Experiments were repeated three times with similar results.

**Supplementary Movie 2. : Development of irregular cysts in the Gel-3D culture.** Representative time-lapse video showing progressive development of hPSC-derived irregular cyst in the Gel-3D culture. After finishing live imaging, cells were stained for DAPI and hPGCLC markers (TFAP2C, NANOG, and SOX17) to detect the presence of hPGCLCs in the irregular cyst. Time stamps indicate culture time (t). Scale bar, 50  $\mu\text{m}$ . Experiments were repeated five times with similar results.