**SUPPLEMENTARY FIGURE LEGENDS**

**Supplementary Figure 1.** **Characterization of ID8 cell line in use.** A. Morphology: Our ID8 cells exhibit cobblestone appearance under microscope. B. Cytokeratin: Our ID8 cells were transferred to slides by cytospin and then fixed by formalin. Immunohistochemistry staining was performed to show cytokeratin expression. C. Tumor initiation: We injected 1-10X106 ID8 cells into C57Bl/6 mice intraperitoneally and observed ascites development within 3-4 months (left). Our ID8 cells are capable of initiating locally invasive cancers (arrows) within the peritoneum (right). D. Histologic features: Tumors established by our ID8 cells contained areas of carcinomatous glandular formation (arrows, 1 and 2), and occasional giant cells (arrows, 3-5).

**Supplementary Figure 2. Ascites from ovarian cancer-bearing mice contributes to a faster progression of the cancer. A.** We injected 1-10X106 ID8 cells into C57Bl/6 mice intraperitoneally and allowed them to reach endpoint. Volume of ascites correlates positively (R2 = 0.492) with the extent of ovarian cancer invasion measured by tumor weight. Volume of ascites was measured by conical tubes and tumor nodules were dissected and weighed on a scale. **B.** Four groups of mice were injected with 106 ID8 cells, ID8 cells with 1ml acellular ascites obtained from ID8 bearing mice, ID8 cells pre-incubated with 50% ascites obtained from ID8 bearing mice for 1 month, or cells from murine ovarian cancer ascites and then observed for survival. (n=5)

**Supplementary Figure 3. Optimization of ascites treatment conditions.** **A.** To recapitulate the microenvironment of ovarian cancer cells, ascites supernatant was added to culture medium at 0, 20%, 40%, 60% and 80%. MemGRP78 expression was analyzed at the end of 7-day incubation. **B.** ID8 cells cultured with 50% ascites were harvested at day 3, 7, and 9 and seeded in sphere assay to measure their sphere-forming ability. Numbers on the Y axis represent spheres that are larger than 50μm. Error bars represent SD, and experiments were performed in triplicate. **C.** To normalize the protein concentration, we measured the protein level in 50% ascites treatment by BCA assay and added albumin to the control accordingly. Sphere forming ability of ID8 cells from normal culture, ID8 cells pre-treated with 50% ascites for 7 days and ID8 cells pre-treated with protein concentration adjusted culture for 7 days.

**Supplementary Figure 4. MemGRP78 positive tumor cells have a lower proliferation rate.** MemGRP78+ (F4/80-, 7AAD-, N20+) and memGRP78- (F4/80-, 7AAD-, N20-) populations were sorted as described previously. 5000 cells from unsorted, memGRP78 + and memGRP78 – groups were seeded in 1% serum containing DMEM and cultured in 96 well plates for 2 days. 3H thymidine was added to each well and cells were allowed to proliferate for 8 hours. Unsorted cells have an incorporation of 15253±277 cpm; memGRP78 + cells 5940±286 cpm; memGRP78 – cells 18112±311 cpm. Error bars represent SD, and experiments were performed in triplicate.

**Supplementary Figure 5.** **Identification of GRP78 ligands in the acellular ascites. A.** ELISA for GRP78 antibody present in ascites fluids and the sera collected at different time points after the injection of ID8 cells. ELISA plate was coated with full-length recombinant GRP78 as capture antigens. After allowing the samples to incubate for 1 hour at 37C, the plate was washed and added with anti-mouse antibody for detection. **B.** Mass spectrometry identified murinoglobulin and alpha-2-macroglobulin, two ligands for GRP78.

**Supplementary Table 1. Selected gene list.** The list of 1257 probesets which were differentially expressed genes with the FDR 2.5%.

**Supplementary Table 2.** The expression of 38 stemness-associated genes and their mean expression value as “stemness score” between ID8 cells in normal medium and ID8 cells after ascites pretreatment for 7 days.