**Supplementary Figure Legends**

**Supp. Fig. 1. Mechanical stress and branching morphogenesis are affected by cellular contractility. (A-E)** Frequency maps of branching from control tubules and tubules treated with 0.1 μg/ml cytochalasin D, 10 μM ML7, 20 mM BDM, or 10 μg/ml LPA. **(F)** Branching was also quantified by measuring the pixel intensity 12 μm away from the tubule tip. Branch frequency decreases when tubules are treated with contractility inhibitors, and increases when tubules are treated with LPA. *$p<0.05$; **$p<0.01$; Scale bars, 50 μm.

**Supp. Fig. 2. Pharmacological manipulations of contractility do not affect proliferation in the tubules. (A-F)** Immunofluorescence analysis of EdU incorporation in one control tubule or one tubule treated with contractility modulators. **(G-L)** Quantification of EdU incorporation in 50 control or treated tubules. Scale bars, 50 μm.

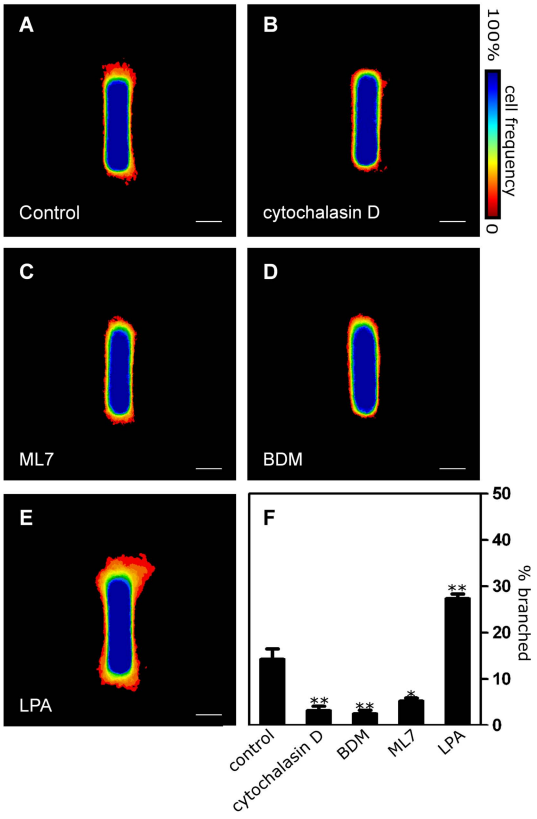
**Supp. Fig. 3. Pharmacological manipulations of contractility do not affect cell motility in the tubules.** Average speed of cells within control tubules and tubules treated with contractility modulators. Error bars indicate s.e.m.

**Supp. Fig. 4. Disrupting intercellular transmission of tension or FAK activation does not affect proliferation in the tubules. (A-C)** Immunofluorescence analysis of EdU incorporation in one control tubule or one tubule transduced with EΔ or FAK Dter adenoviruses. **(D-F)** Quantification of EdU incorporation in 50 tubules. Scale bars, 50 μm.

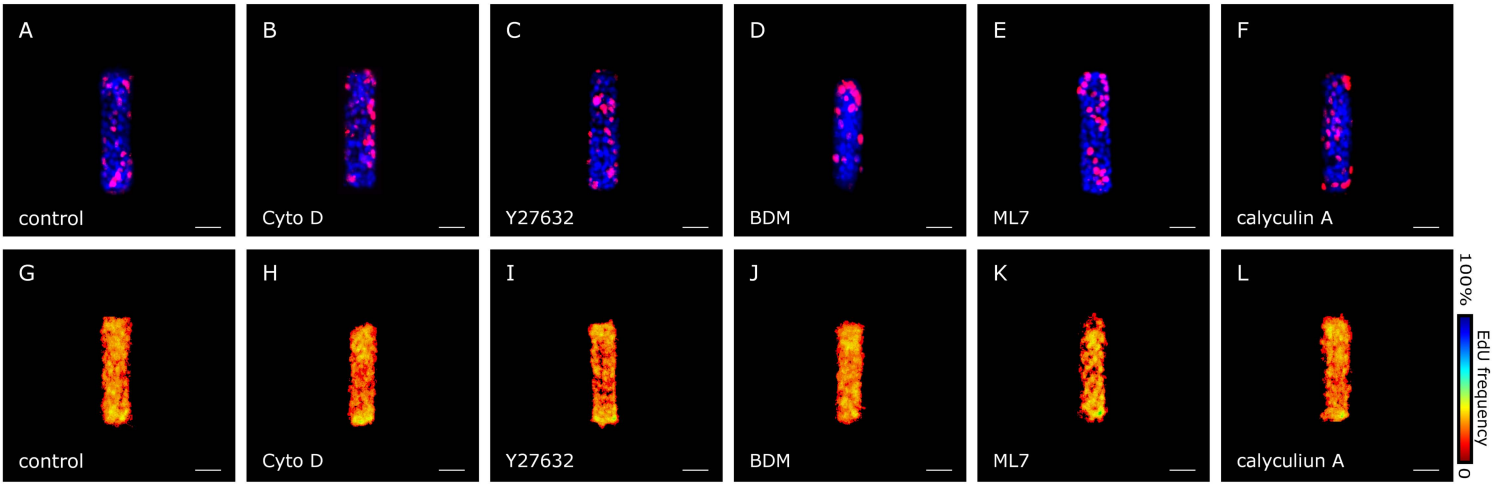
**Supp. Fig. 5. Disrupting intercellular transmission of tension or FAK activation does not affect cell motility in the tubules.** Average speed of cells within control tubules and tubules transduced with EΔ or FAK Dter adenoviruses. Error bars indicate s.e.m.

**Supp. Fig. 6. Levels of FAK pY397 at cell-matrix adhesions are affected by cellular contractility. (A-E)** Immunofluorescence analysis of cells treated with 10 μM Y27632, 0.1 μg/ml cytochalasin D, 20 mM BDM, 10 μM ML7 or 0.1 nM calyculin A. Levels of FAK pY397 at the matrix adhesions decrease when cells are treated with contractility inhibitors, and increase when cells are treated with calyculin A. Scale bars, 50 μm.

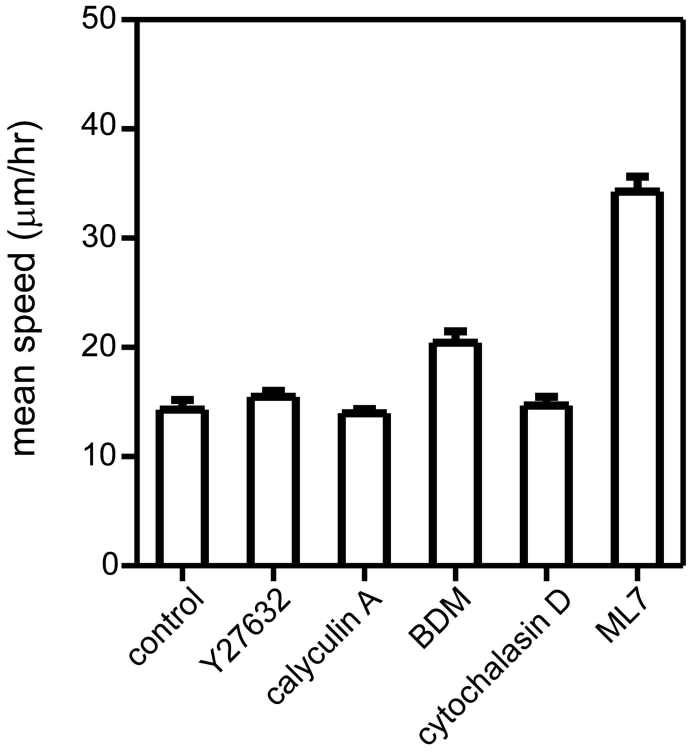
# Supplemental Figure 1



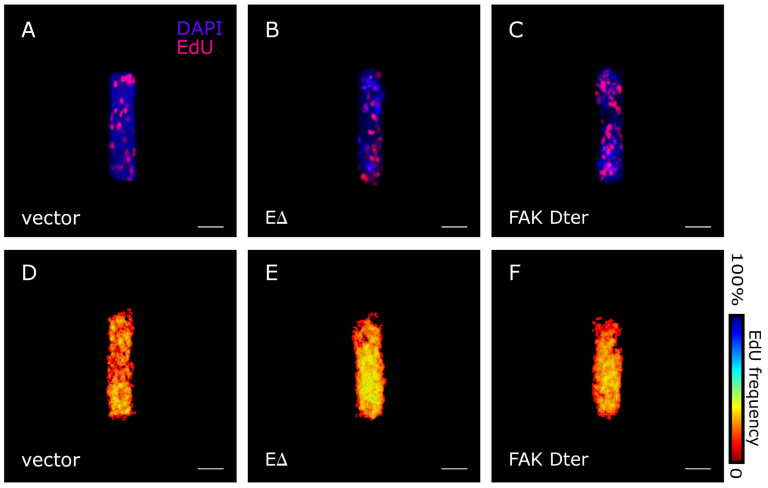
## Supplemental Figure 2



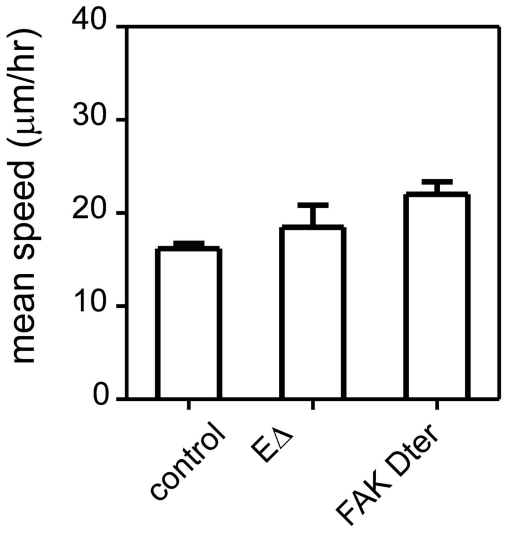
**Supplemental Figure 3**



# Supplemental Figure 4



**Supplemental Figure 5**



## Supplemental Figure 6