**Plasmid nucleofection**

For testing transduction efficiency, organoids were dissociated into single cells using pre-warmed TrypLE™ Express (12605028, Thermo Fisher Scientific) at 37°C for 10 min. The reaction was terminated by adding Advanced DMEM/F12 (12634028, Thermo Fisher Scientific) and cells passed through a 30-micron cell strainer. 2 × 105 organoid single cells were re-suspended with Lonza P3 nucleofection buffer and 1 µl of pmaxGFP (Lonza) and transferred to a 20 µl nucleofection cuvette (V4XP-3024, Lonza). Nucleofection was performed Lonza 4D Nucleofector with X unit using program EA125. After nucleofection, self-renewing medium supplemented with 10 µM Y-27632 (ROCK inhibitor, ROCKi, 688000, Merck) was added to dilute the P3 buffer. Cell mixture was then seeded in Matrigel in 2 wells of a 24-well plate and cultured with selfrenewing medium with ROCKi (10 µM) for 72 hrs before FACS analysis.