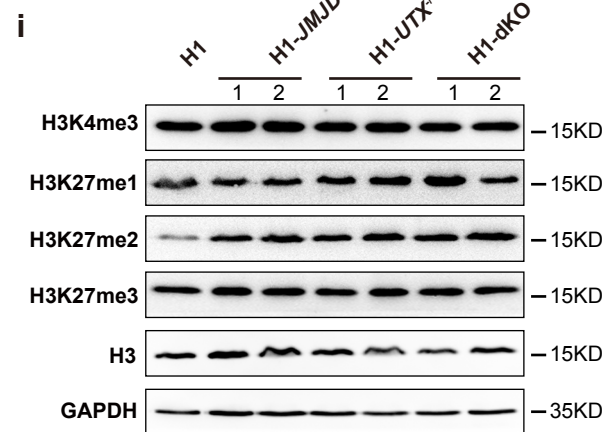
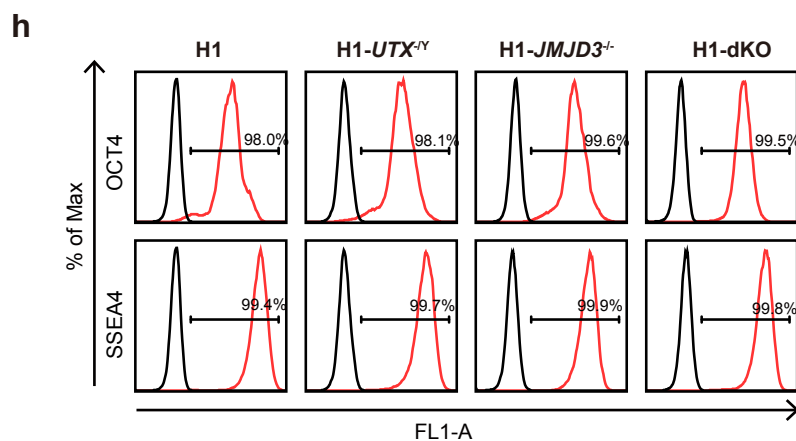
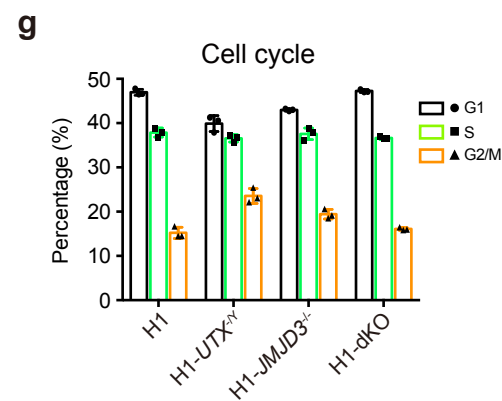
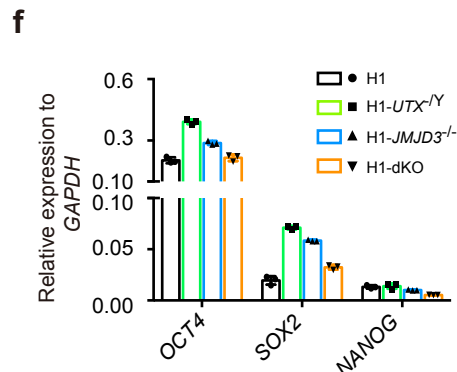
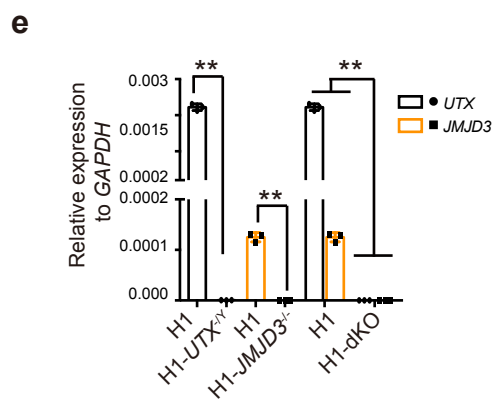
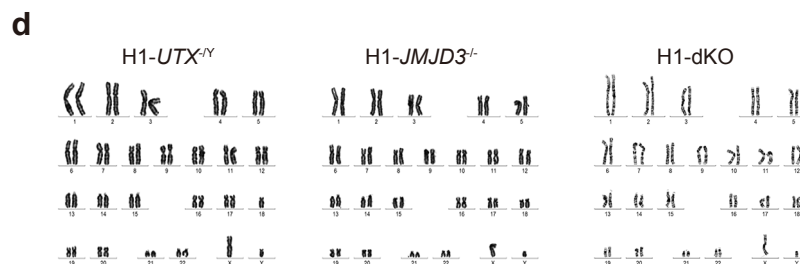
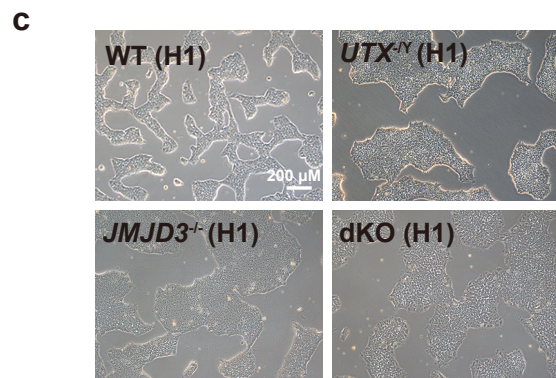
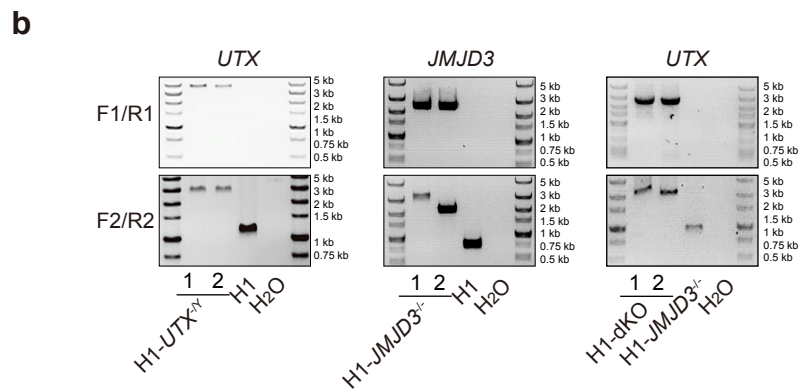
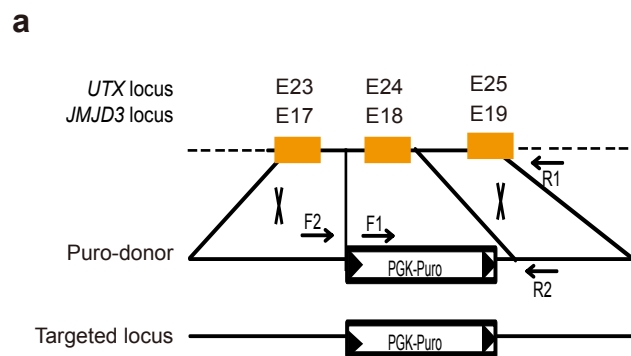


# **JMJD3 and UTX Determine Fidelity and Lineage Specification of Human Neural Progenitor Cells**

**Shan et al.**

# Supplementary Figure 1

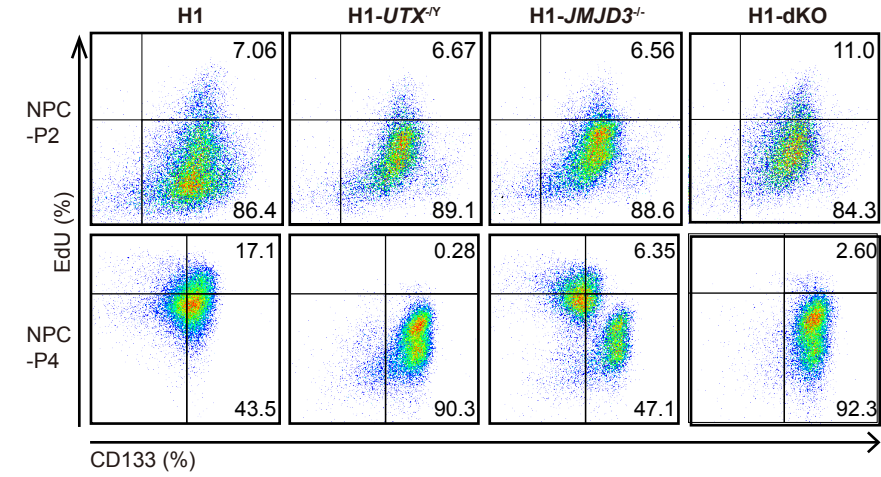


### Supplementary Figure 1 Deletion of KDM6s in human embryonic stem cells

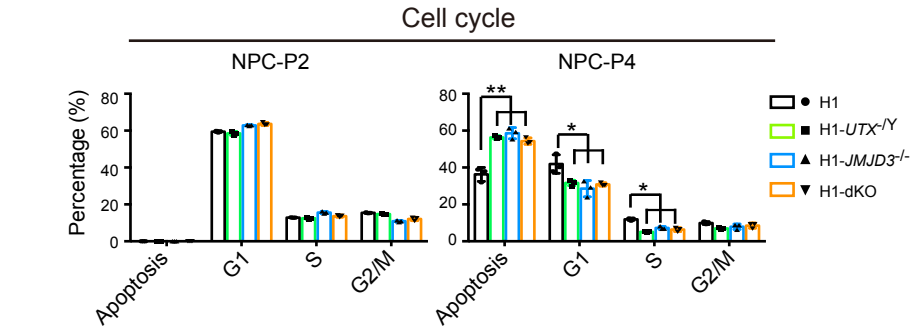
**a.** Overview of the gene targeting strategy for *UTX* and *JMJD3*. Key catalytic sites of JmjC domain of *UTX* and *JMJD3* were deleted. Key catalytic sites of JmjC domain are in exon 24 (E24) of *UTX* and exon 18 (E18) of *JMJD3*, respectively. **b.** PCR identification of H1 hESCs with targeted deletion of *UTX*, *JMJD3*, and *JMJD3/UTX*. Wild type (WT) H1 hESCs serve as a negative control. hESCs, human embryonic stem cells. **c.** Morphology of H1 hESCs with targeted deletion of *UTX*, *JMJD3*, and *JMJD3/UTX* (dKO). Scale bar, 200  $\mu$ m. **d.** Karyotype of H1 hESCs with targeted deletion of *UTX*, *JMJD3*, and *JMJD3/UTX* (dKO). **e.** qRT-PCR analysis on the expression level of targeted genes *UTX* and *JMJD3* in KDM6-deficient hESCs (H1-*UTX*<sup>-/-</sup>, H1-*JMJD3*<sup>-/-</sup>, H1-dKO). Wild type H1 hESCs serve as control. Significance level were determined using unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD (standard deviation) from three independent repeats (n=3). **f.** qRT-PCR analysis on the expression level of pluripotent genes *OCT4*, *SOX2*, and *NANOG* in KDM6-deficient hESCs (H1-*UTX*<sup>-/-</sup>, H1-*JMJD3*<sup>-/-</sup>, H1-dKO). Wild type H1 hESCs serve as control. The data represent mean  $\pm$  SD from three independent repeats (n=3). **g.** Cell cycle assay for three KDM6 mutant hESCs, respectively. Wild type H1 serve as control. The data represent mean  $\pm$  SD from three independent repeats (n=3). **h.** FACS analysis on the expression of indicated pluripotent markers *OCT4* and *SSEA4* in the indicated hESCs. **h.** Total level of the indicated histone modifications in gene targeted cells. The total histone modification level was analyzed by western-blot using the specific antibody on the whole cell lysates from each indicated cell line. All error bars throughout the figure represent SD (standard deviation) from three independent repeats (n=3). Source data are provided as a Source Data file. Related to Figure 1.

Supplementary Figure 2

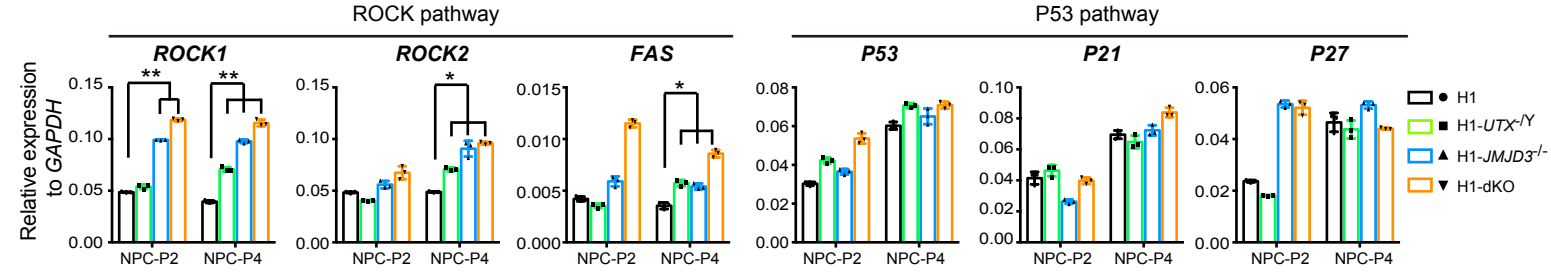
**a**



**b**



**c**

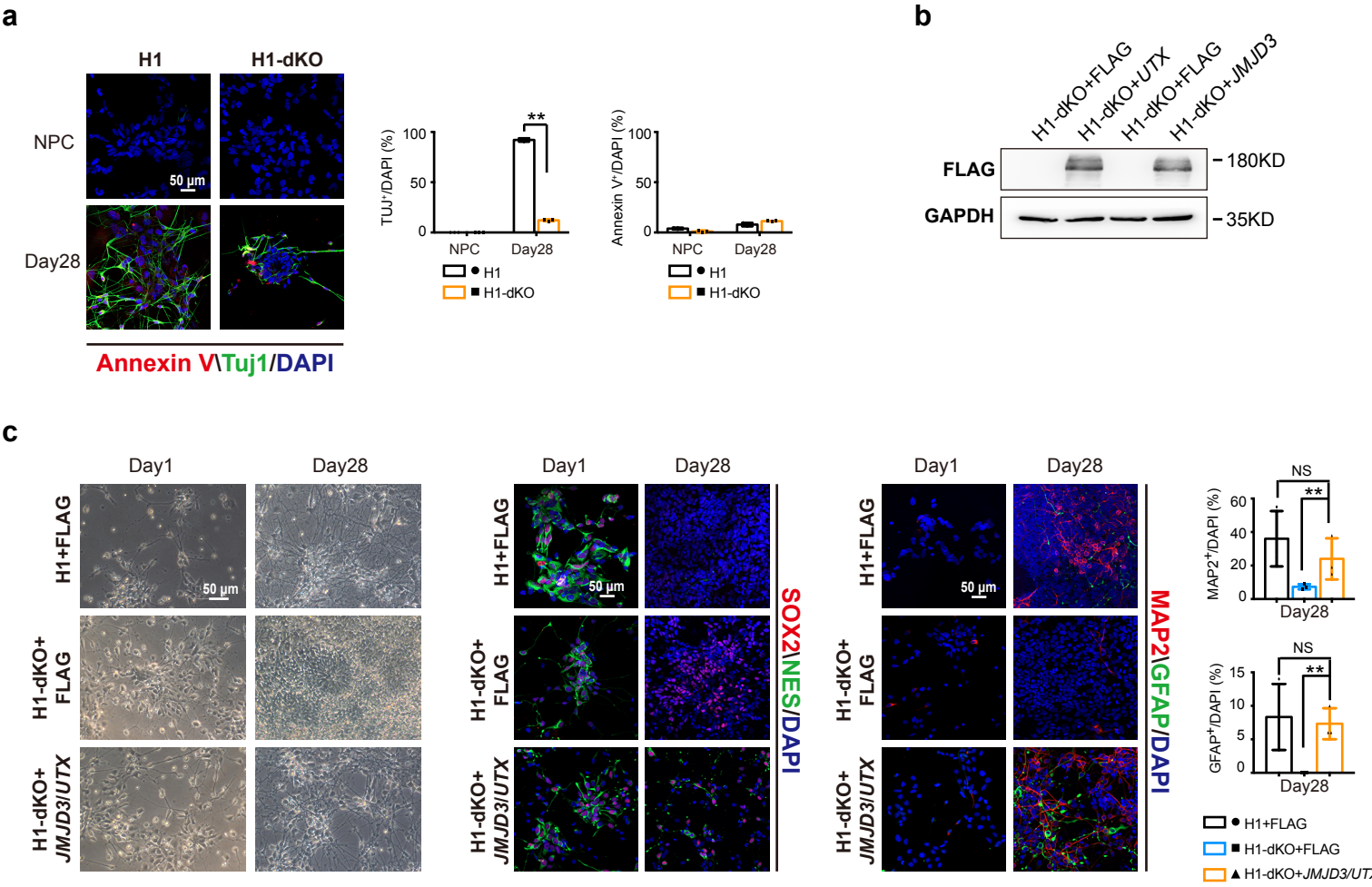




**Supplementary Figure 2 KDM6s maintain the proliferation ability of human NPCs**

**a.** FACS result of EdU insertion assay for CD133<sup>+</sup> three KDM6 mutant NPCs lacking UTX or JMJD3 or both at passage 2 (P2) and passage 4 (P4), respectively. dKO, deletion of both *JMJD3* and *UTX*. NPC, neural progenitor cell. **b.** Cell cycle assay for three KDM6 mutant NPCs at passage 2 (P2) and passage 4 (P4), respectively. Wild type H1 serve as control. Significance level was determined using unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD (standard deviation) from three independent repeats (n=3). **c.** qRT-PCR analysis on the expression level of ROCK pathway *ROCK1*, *ROCK2*, *FAS* and P53 pathway genes *P53*, *P21*, *P27* in three KDM6 mutant NPCs at passage 2 (P2) and passage 4 (P4), respectively. Wild type H1 serve as control. Significance level was determined using unpaired two-tailed Student's t-tests. \*,  $P < 0.05$ . \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD from three independent repeats (n=3). All error bars throughout the figure represent SD (standard deviation) from three independent repeats (n=3). Source data are provided as a Source Data file. Related to Figure 2.

Supplementary Figure 3

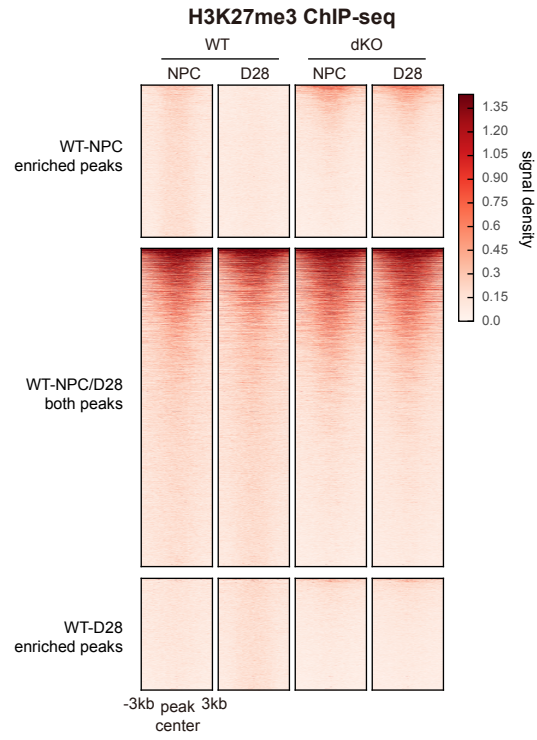


**Supplementary Figure 3 KDM6 over-expression rescues the neuron/glia defect**

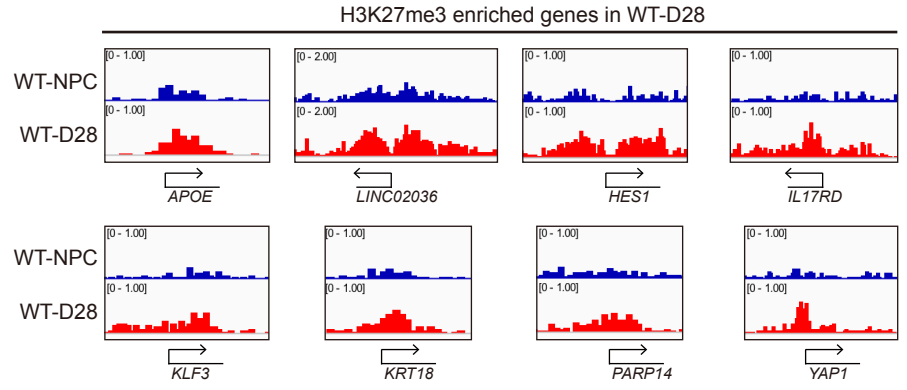
**a.** Immunostaining on the neuronal marker TUJ1, apoptosis marker Annexin V in the induced undifferentiated or differentiated NPCs. Scale bar, 50  $\mu$ m. Quantity data of TUJ<sup>+</sup> or Annexin V<sup>+</sup> cells were analyzed. Significance level was determined by unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD (standard deviation) from three independent replicates (n=3). WT, wild type. dKO, deletion of both *JMJD3* and *UTX*. **b.** Western-blot for UTX-FLAG or JMJD3-FLAG with FLAG antibody in dKO hES cells with UTX-FLAG-OE or JMJD3-FLAG-OE, respectively. dKO, deletion of both *JMJD3* and *UTX*. **c.** Morphology, NPC markers SOX2/NES immuno-staining, neuron and glia markers MAP2/GFAP immune-staining assay in forced expression of *JMJD3/UTX* in dKO-NPCs (H1-dKO+*JMJD3/UTX*) during random differentiation at day1 (Day1) and day 28 (Day28), respectively. Quantity data of MAP2<sup>+</sup> or GFAP<sup>+</sup> cells were analyzed. Significance level was determined by unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . NS, no significance. The data represent mean  $\pm$  SD from three independent replicates (n=3). Overexpression of FLAG in H1 (H1+FLAG) and dKO (H1-dKO+FLAG) cells serve as positive control and negative control, respectively. Scale bar, 50  $\mu$ m. All error bars throughout the figure represent SD (standard deviation) from three independent repeats (n=3). Related to Figure 3.

# Supplementary Figure 4

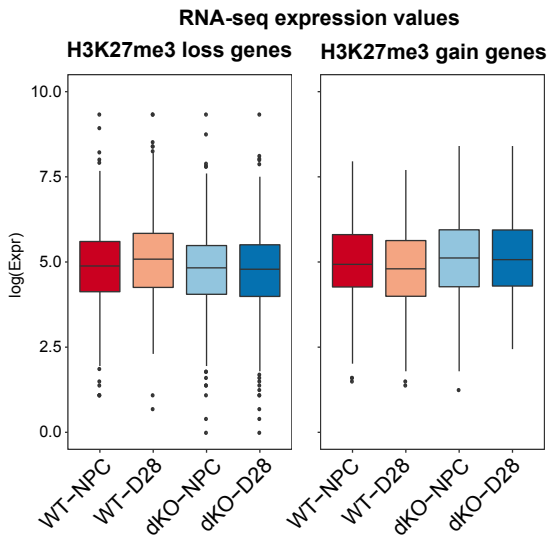
**a**



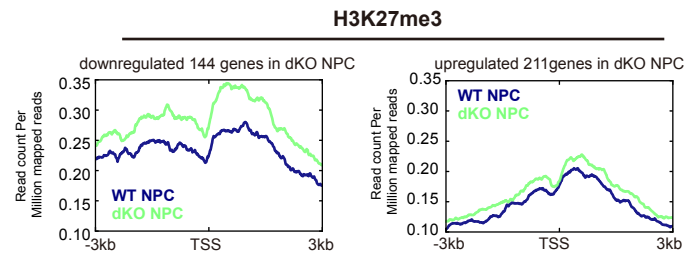
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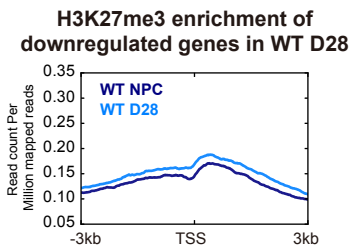
**c**



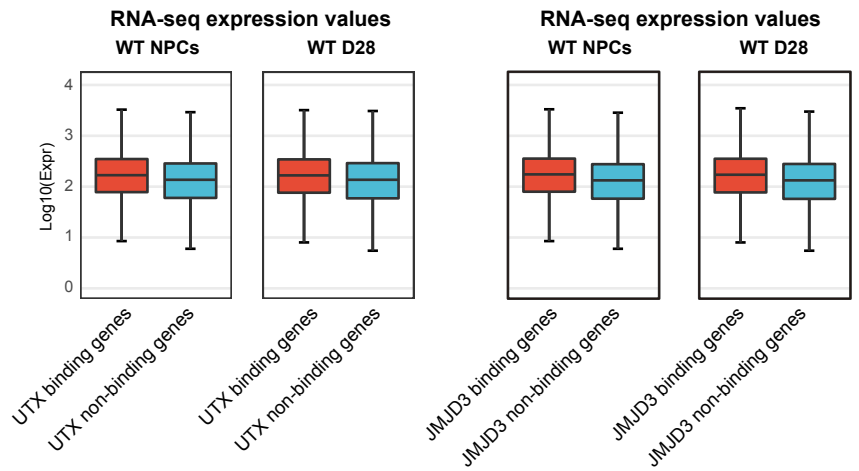
**d**



**e**



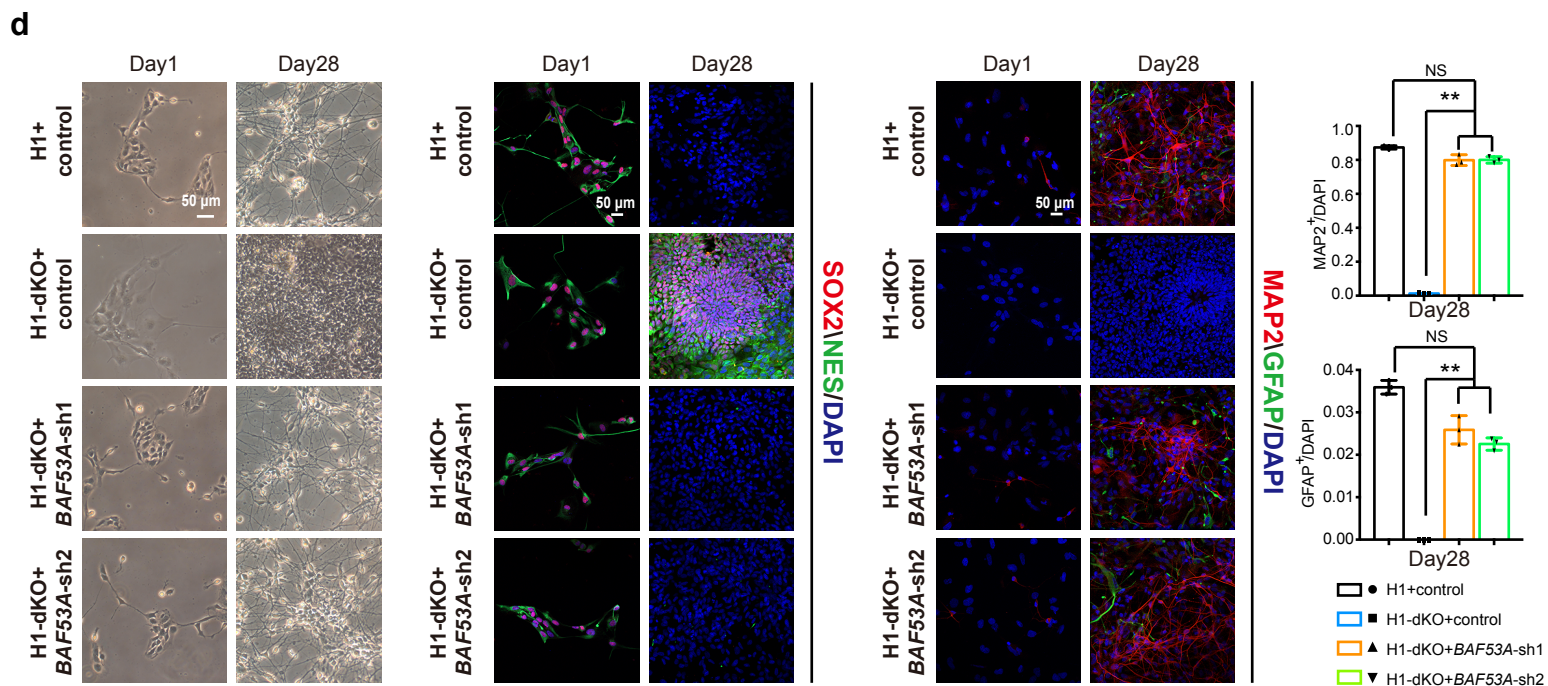
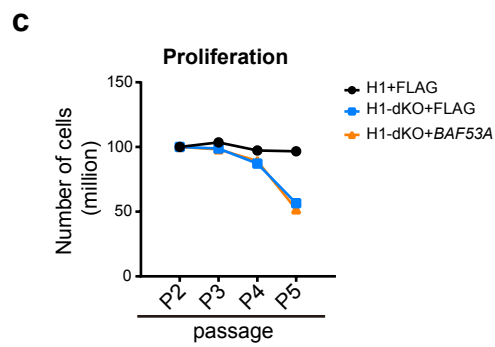
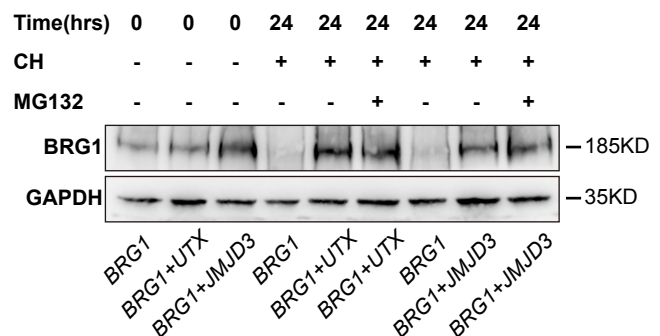
**f**



**Supplementary Figure 4 KDM6s deficiency leads to H3K27me3 accumulation**

**a.** Heatmap of H3K27me3 ChIP-seq for WT-NPC enriched peaks compared with WT-D28, WT-NPC/D28 both shared peaks, WT-D28 H3K27me3 enriched peaks compared with WT-NPC from NPC to D28 in WT and dKO cells, respectively. WT, wild type. dKO, deletion of both JMJD3 and UTX. NPC, neural progenitor cell. **b.** Genomic views of selected H3K27me3 enriched genes in wild-type D28 differentiated cells. **c.** Box-plot of expression value for the indicated genes described in the indicated cells. **d.** H3K27me3 enrichment analysis for downregulated or upregulated genes in dKO NPC cells compared with WT NPC cells. **e.** H3K27me3 enrichment analysis for downregulated genes in wild-type D28 differentiated cells compared with WT NPC cells. **f.** Box-plot of expression value for UTX or JMJD3 binding or non-binding sites in the indicated cells, respectively. Related to Figure 6.

**a**

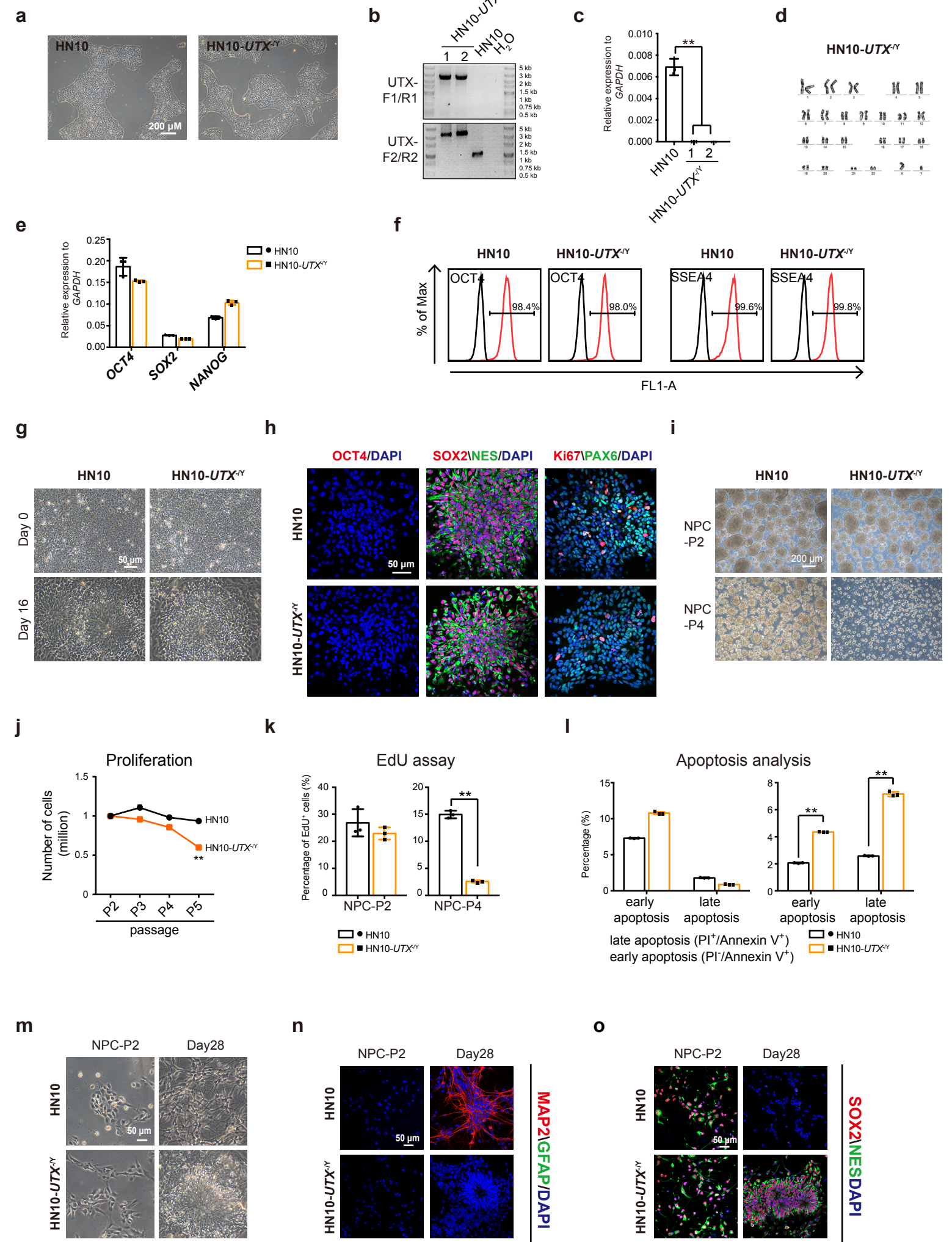


**Supplementary Figure 5 BAF53B rescues neuron/glia defect in KDM6-dKO NPCs**

**a.** Left panel, western blot analysis of BRM in 293T plus Cycloheximide (CH) or/and MG132 with overexpression of BRM, BRM and UTX, or BRM and JMJD3, respectively. Right panel, western blot analysis of BRG1 in 293T plus Cycloheximide (CH) or/and MG132 with overexpression of BRG1, BRG1 and UTX, or BRG1 and JMJD3, respectively. Cycloheximide (CH), a protein synthesis inhibitor. MG132, a proteasome inhibitor. **b.** Morphology of indicated NPCs maintained as neural spheres at passage 2 (P2) or passage 4 (P4). Scale bar, 200  $\mu$ m. dKO, deletion of both JMJD3 and UTX. NPC, neural progenitor cell. **c.** Proliferation curve of the indicated NPCs at different passages. The data represent mean  $\pm$  SD (standard deviation) from three independent replicates (n=3). **d.** Morphology, NPC markers SOX2/NES immuno-staining, neuron and glia markers MAP2/GFAP immune-staining assay in knock-down expression of *BAF53A* in dKO-NPCs by shRNA (H1-dKO+*BAF53A*-sh1 and H1-dKO+*BAF53A*-sh2) during random differentiation at day1 (Day1) and day 28 (Day28), respectively. Quantity data of MAP2<sup>+</sup> or GFAP<sup>+</sup> cells were analyzed. Significance level was determined by unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . NS, no significance. The data represent mean  $\pm$  SD from three independent replicates (n=3). WT (H1+control) and dKO (H1-dKO+control) cells serve as positive control and negative control, respectively. WT, wild type. Scale bar, 50  $\mu$ m. All error bars throughout the figure represent SD (standard deviation) from three independent repeats (n=3). Related to Figure 7.



Supplementary Figure 6





**Supplementary Figure 6 None of *UTX* in HN10 cells fails to generate neuron/glia**

**a.** Morphology of HN10 hESCs with targeted deletion of *UTX*. Scale bar, 200  $\mu$ m. **b.** PCR identification of HN10-*UTX*<sup>+/Y</sup> hESCs. **c.** qRT-PCR analysis for *UTX* in HN10-*UTX*<sup>+/Y</sup>. Significance level were determined using unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD (standard deviation) from three independent repeats (n=3). **d.** Karyotype of HN10-*UTX*<sup>+/Y</sup>. **e.** qRT-PCR analysis for *OCT4*, *SOX2*, and *NANOG* in HN10-*UTX*<sup>+/Y</sup> hESCs. The data represent mean  $\pm$  SD from three independent repeats (n=3). **f.** FACS analysis for *OCT4* and *SSEA4* in the indicated hESCs. **g.** Morphology of neural differentiation from HN10-*UTX*<sup>+/Y</sup> hESCs at Day 0 and Day16, respectively. Scale bar, 50  $\mu$ m. **h.** Immunostaining on the pluripotent marker *OCT4*, NPC markers *SOX2/NES/PAX6*, and proliferation marker *Ki67* in wild type and *UTX*-deficient HN10-NPCs. Scale bar, 50  $\mu$ m. **i.** Morphology of *UTX*-deficient HN10-NPCs at passage 2 (P2) and passage 4 (P4), respectively. Scale bar, 200  $\mu$ m. **j.** Proliferation curve of *UTX*-deficient HN10-NPCs. Significance level was determined using unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD from three independent repeats (n=3). **k.** EdU insertion assay for *UTX*-deficient HN10-NPCs at passage 2 (P2) and passage 4 (P4), respectively. Significance level was determined using unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD from three independent repeats (n=3). **l.** Percentage of Early and late apoptosis in *UTX*-deficient HN10-NPCs at passage 2 (P2) and passage4 (P4), respectively. Significance level was determined using unpaired two-tailed Student's t-tests. \*\*,  $P < 0.01$ . The data represent mean  $\pm$  SD from three independent repeats (n=3). **m.** Morphology of *UTX*-deficient HN10-NPCs (NPC-P2) and their differentiated cells at day 28 (Day28), respectively. Scale bar, 50  $\mu$ m. **n.** Immunostaining on the neuronal marker *MAP2*, glia marker *GFAP* in *UTX*-deficient HN10-NPCs and Day28. Scale bar, 50  $\mu$ m. **o.** Immunostaining on the NPC markers *SOX2/NES* in *UTX*-deficient HN10-NPCs and Day28. Scale bar, 50  $\mu$ m. All error bars throughout the figure represent SD (standard deviation) from three independent repeats (n=3). Source data are provided as a Source Data file.

# Supplementary Figure 7

Figure 1e

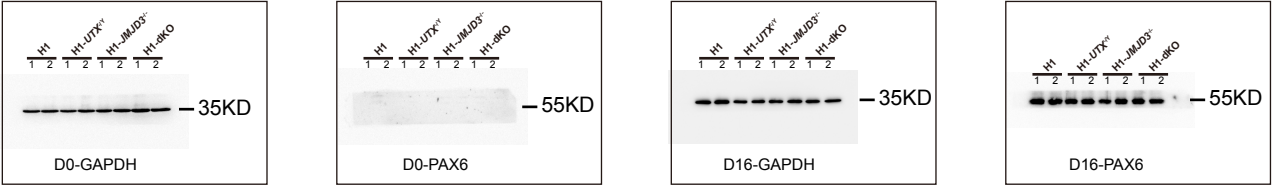


Figure 1g

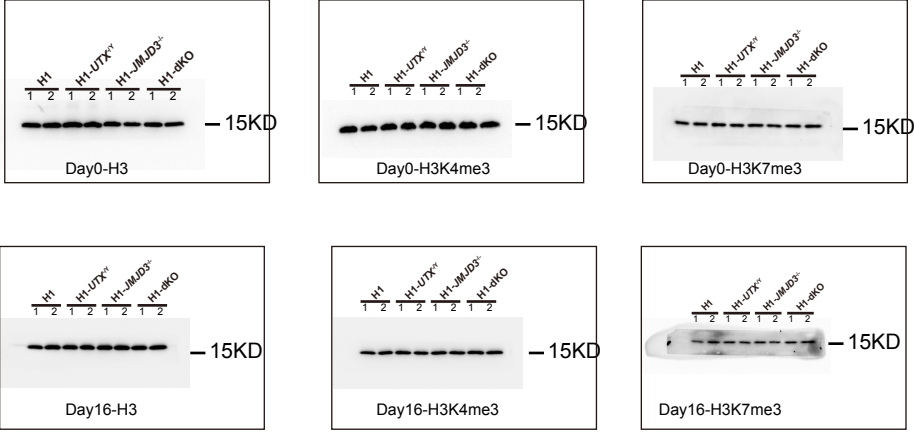


Figure 6a

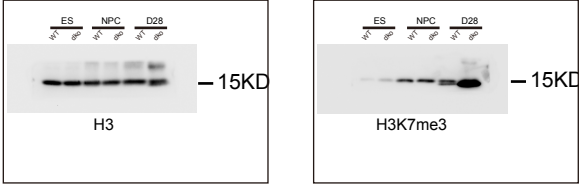
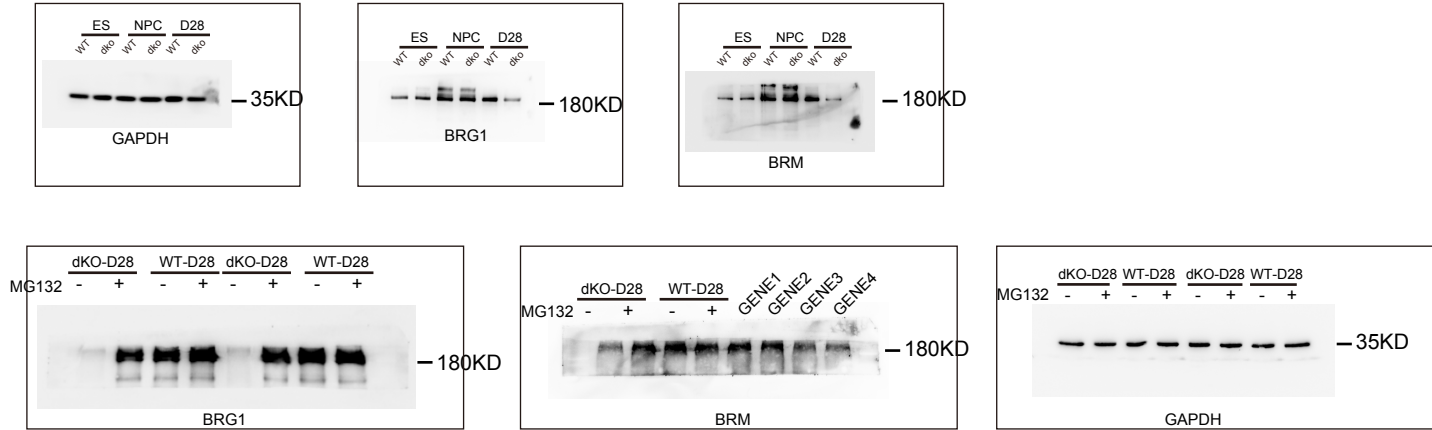


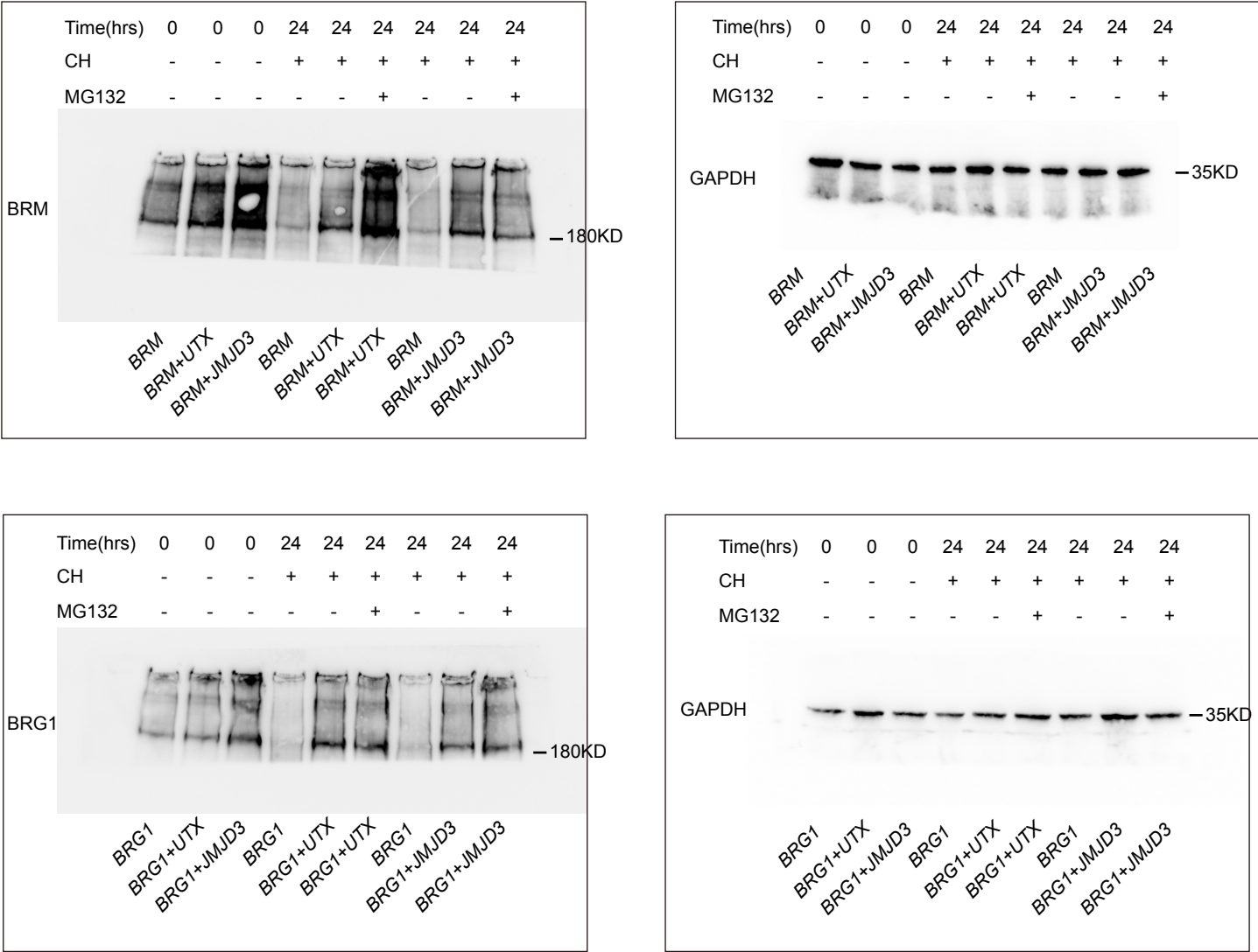
Figure 7a



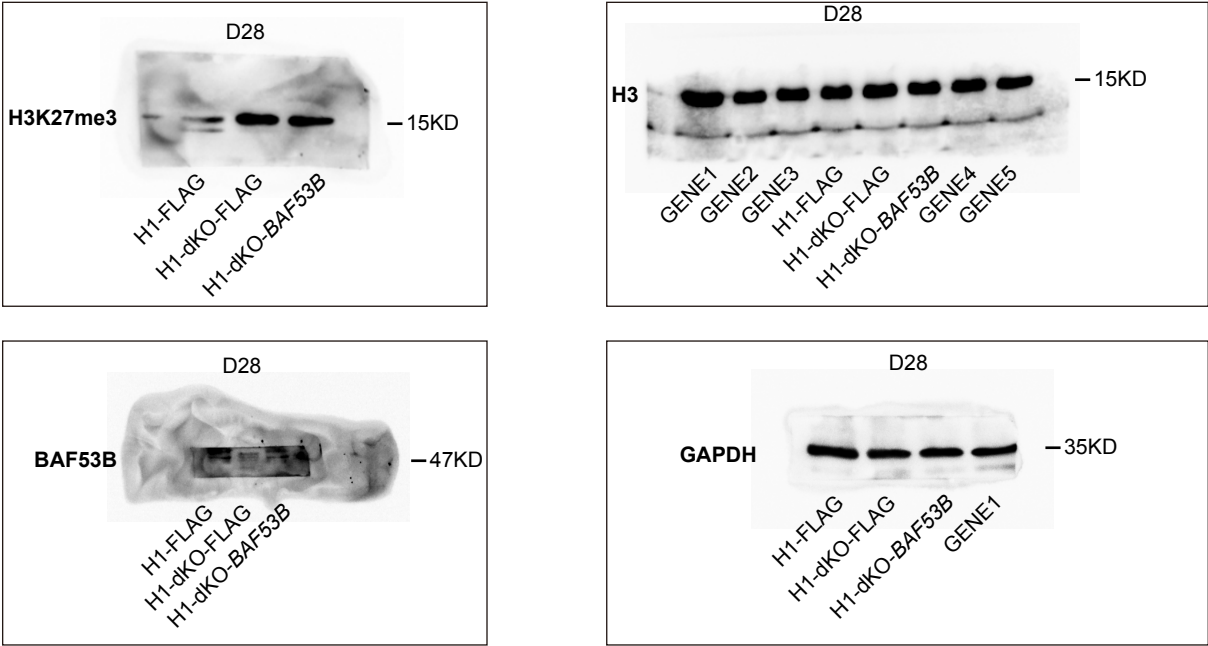
**Supplementary Figure 7 The uncropped western blots in this paper**

Supplementary Figure 8

Supplementary Figure 6a



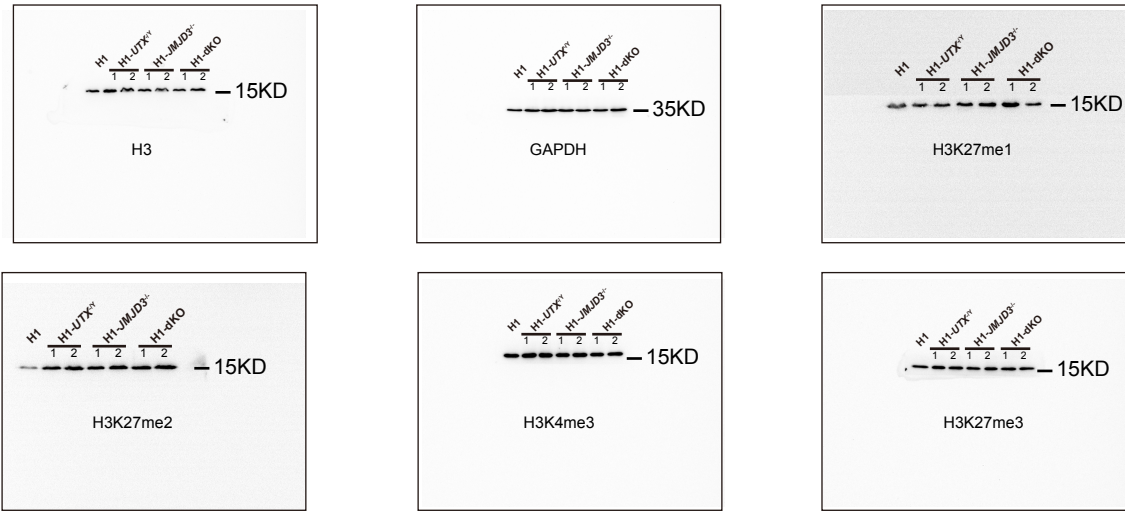
Supplementary Figure 6b



**Supplementary Figure 8 The uncropped western blots in this paper**

Supplementary Figure 9

Supplementary Figure 1i



Supplementary Figure 3b

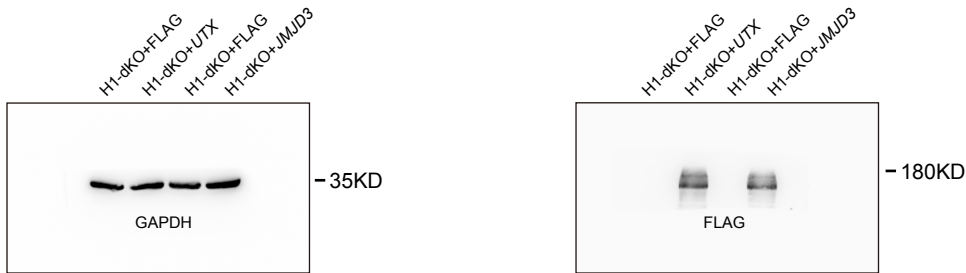


Figure 6d

Figure 6d left upper panel, FLAG WB for 3×FLAG knock-in at C-terminal of *UTX*.

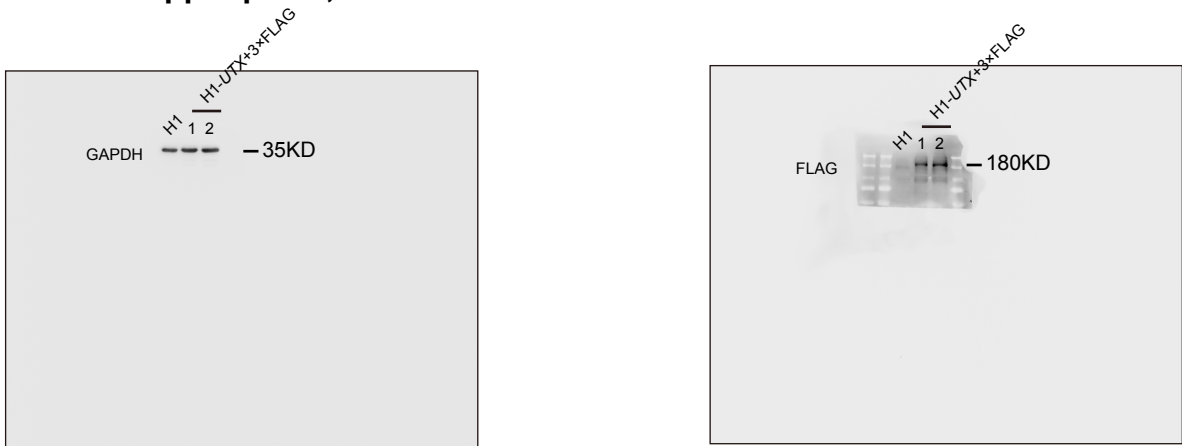
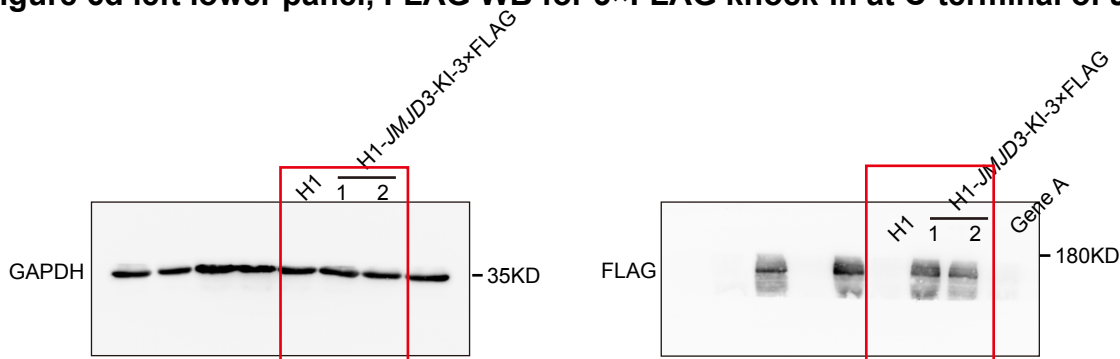


Figure 6d left lower panel, FLAG WB for 3×FLAG knock-in at C-terminal of *JMJD3*.



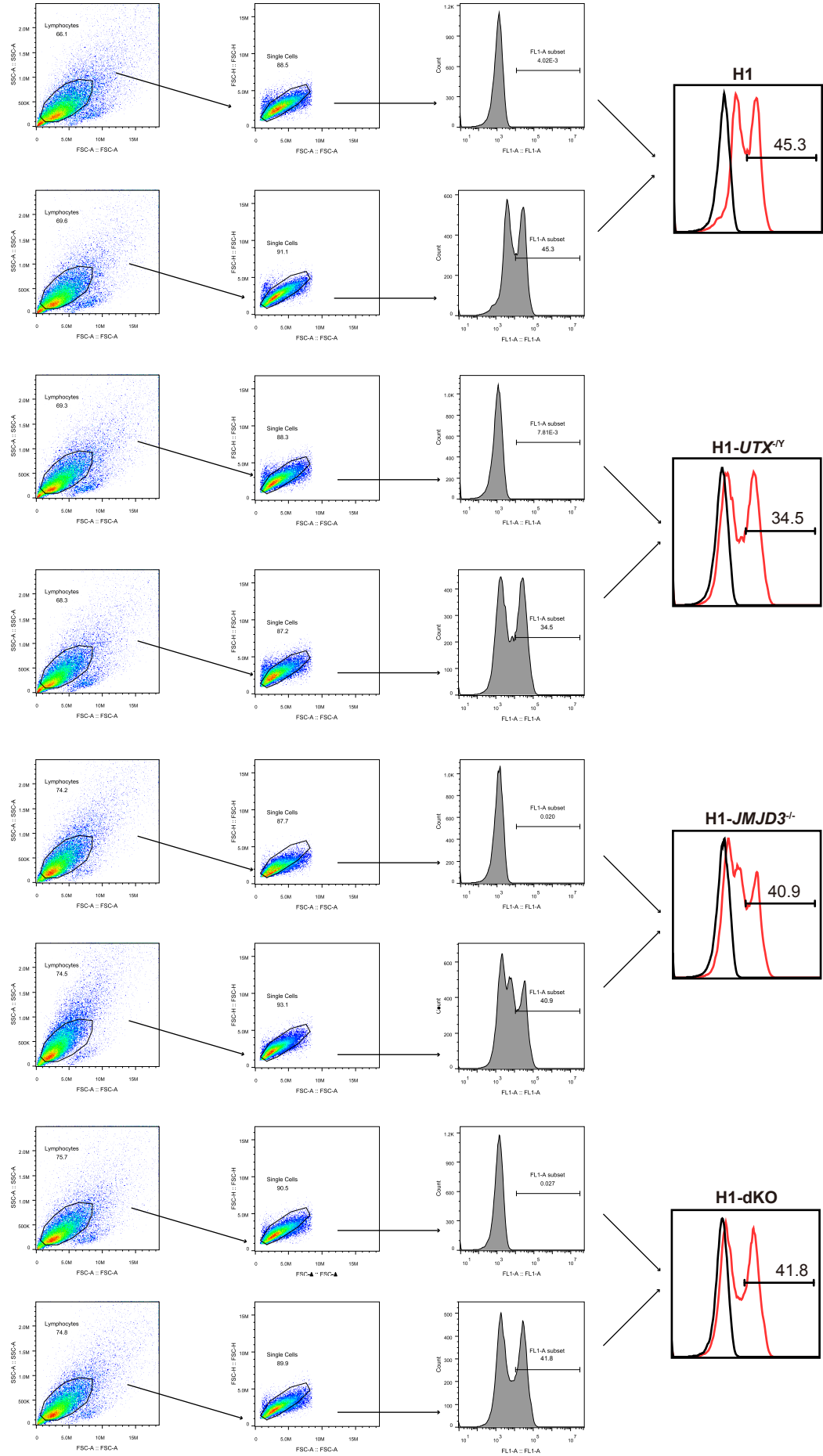
**Supplementary Figure 9 The uncropped western blots in this paper**



# Supplementary Figure 10

## Figure 1d

Figure 1d for PAX6 positive cells in Day 16 during neural differentiation from hESCs (%)

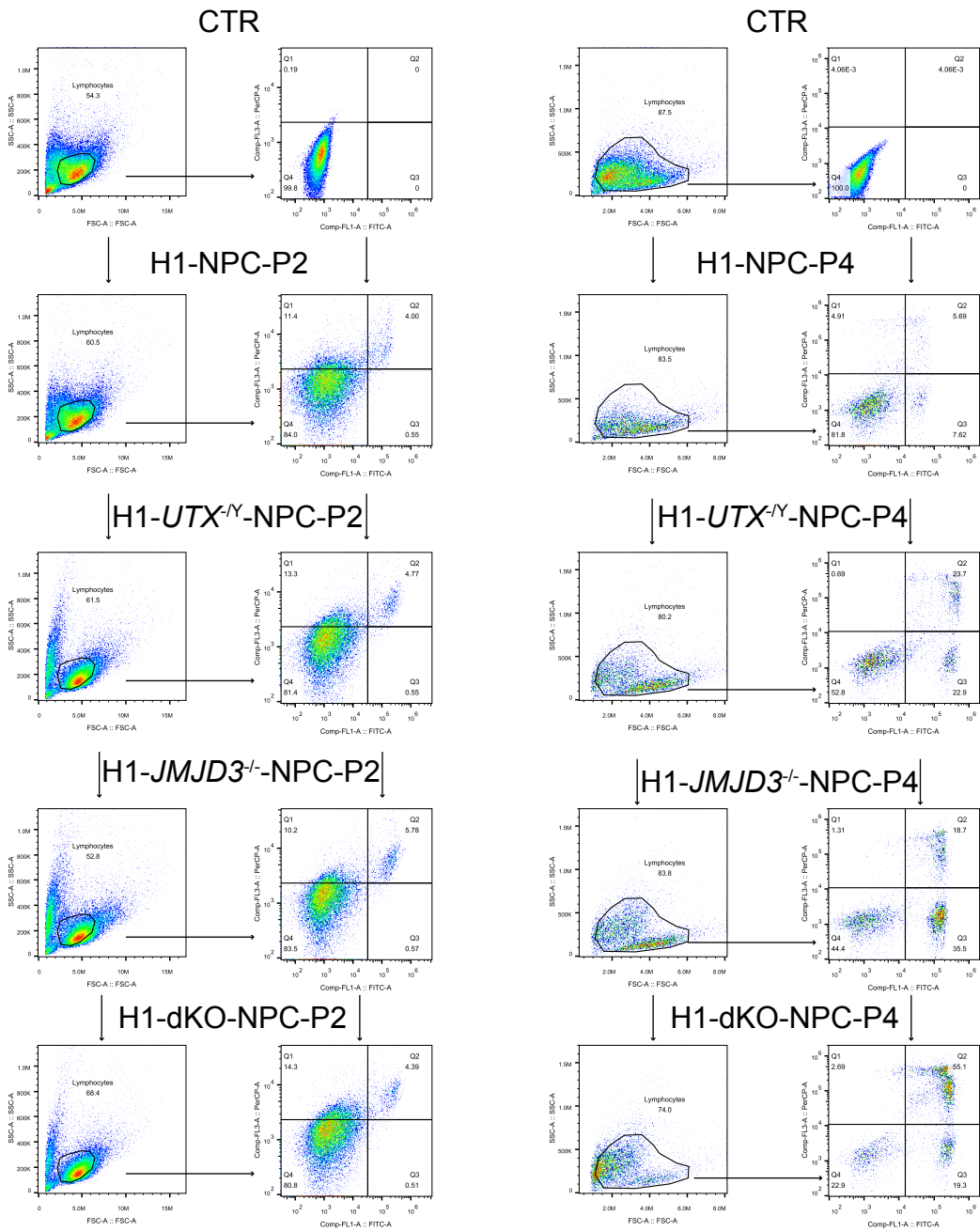


**Supplementary Figure 10 The FACS sequential gating strategies in this paper**

# Supplementary Figure 11

## Figure 2e

Figure 2e for apoptosis analysis in indicated NPCs at passage 2 (P2) and passage 4 (P4) (%)

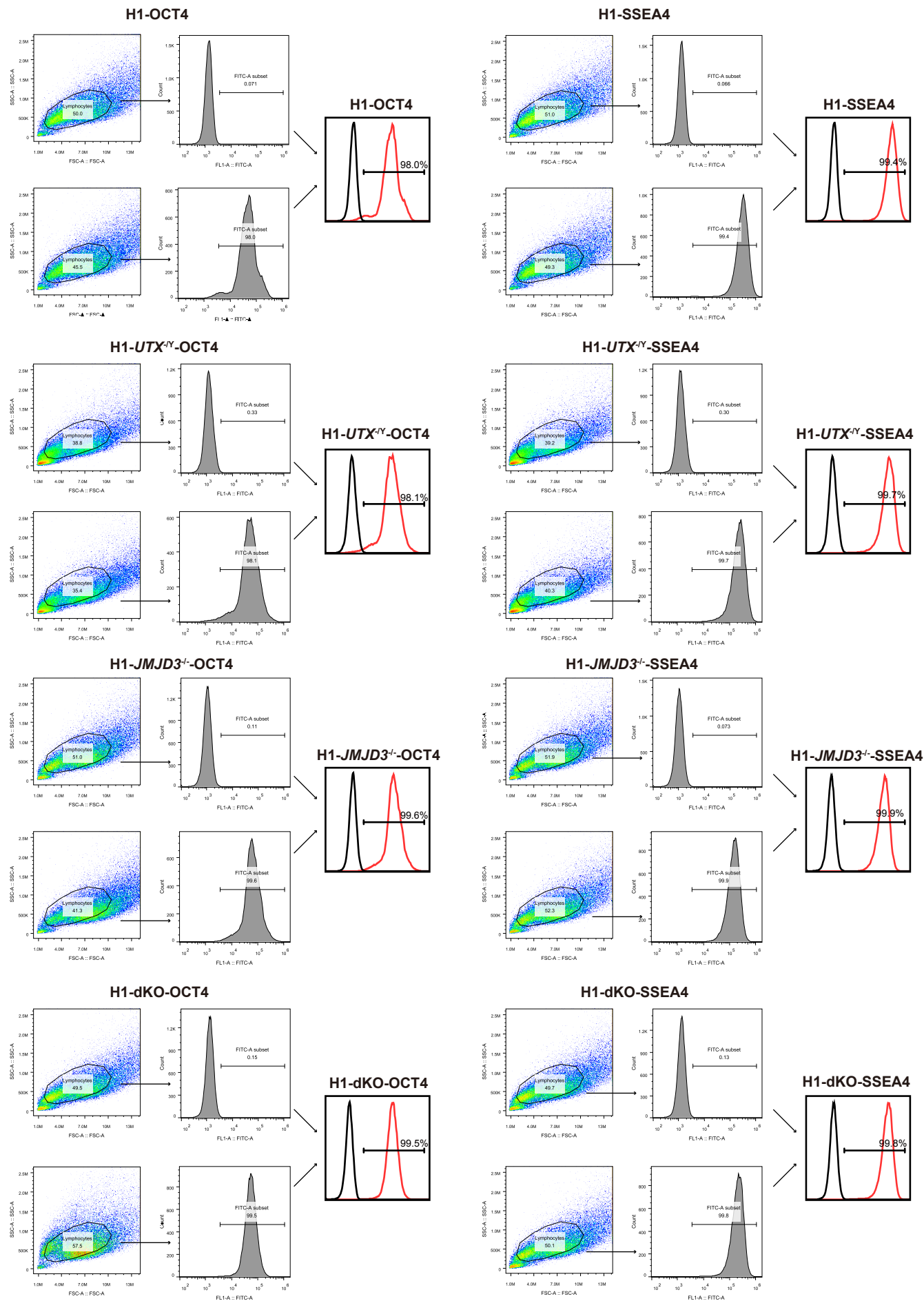


**Supplementary Figure 11 The FACS sequential gating strategies in this paper**

# Supplementary Figure 12

## Supplementary Figure 1h

Supplementary Figure 1h for OCT4 and SSEA4 in indicated hESCs (%)

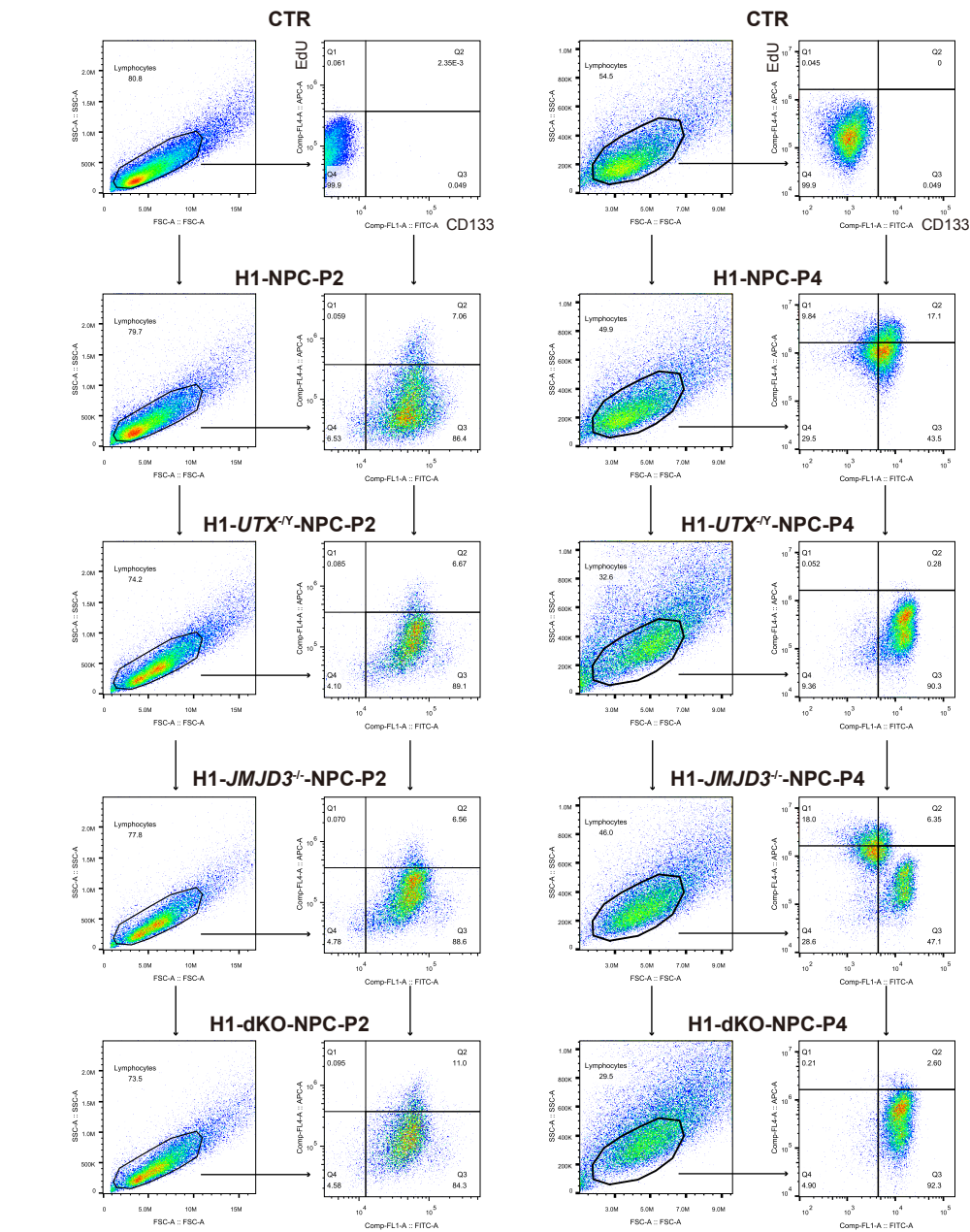


**Supplementary Figure 12 The FACS sequential gating strategies in this paper**

Supplementary Figure 13

Supplementary Figure 2a

Supplementary Figure 2a for EdU analysis in indicated NPCs at passage 2 (P2) and passage 4 (P4) (%)



**Supplementary Figure 13 The FACS sequential gating strategies in this paper**

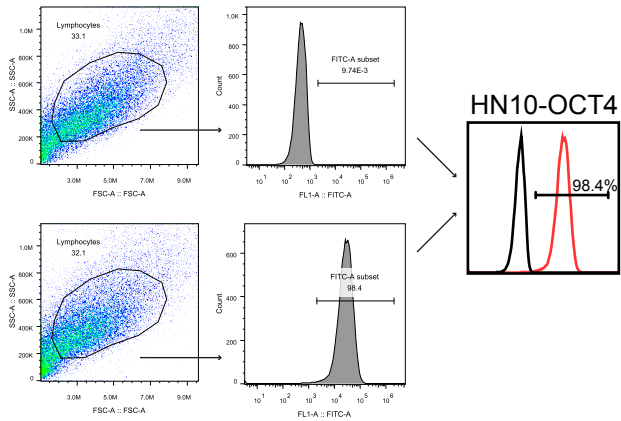


# Supplementary Figure 14

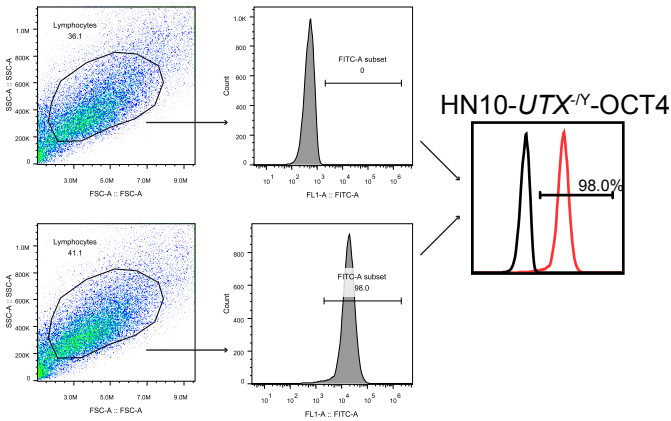
## Supplementary Figure 6f

Supplementary Figure 6f for OCT4 and SSEA4 in indicated hESCs

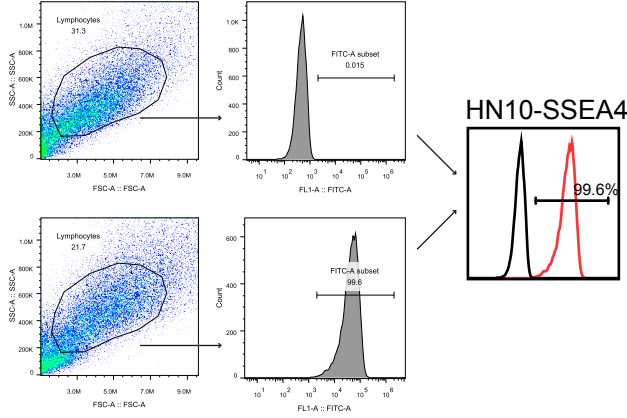
HN10-OCT4



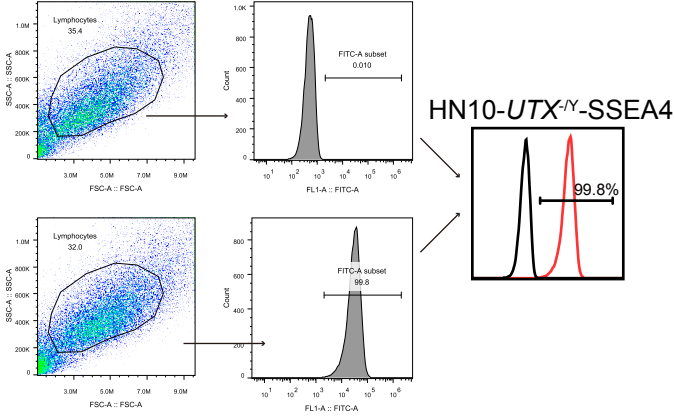
HN10-UTX<sup>-/-</sup>-OCT4



HN10-SSEA4



HN10-UTX<sup>-/-</sup>-SSEA4



**Supplementary Figure 14 The FACS sequential gating strategies in this paper**

### Supplementary Table 1 List of sgRNAs and primers for gene targeting

|                                           |                       |                                                                                                                     |                        |                                                                                                                |
|-------------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Gene</b>                               | <b><i>UTX</i></b>     |                                                                                                                     | <b><i>JMJD3</i></b>    |                                                                                                                |
|                                           |                       |                                                                                                                     |                        |                                                                                                                |
| <b>Knock-out</b>                          |                       |                                                                                                                     |                        |                                                                                                                |
| <b>sgRNA sequence</b>                     | TAAACGACAACCTTACCAAGC |                                                                                                                     | GCGAACCACTCGCAGTCGCC   |                                                                                                                |
|                                           |                       |                                                                                                                     |                        |                                                                                                                |
| <b>Primers for validation</b>             | <i>UTX</i> -F1        | 5' CATTCTGCACGCTTCAAAGCG 3'                                                                                         | <i>JMJD3</i> -F1       | 5' GACCCTCTGAGAAATCCCACACTTG 3'                                                                                |
|                                           | <i>UTX</i> -R1        | 5' CCCTAAAAATAGCCAGTCCCTACTCAG 3'                                                                                   | <i>JMJD3</i> -R1       | 5' ACCGGTGGATGTGGAATGTGTG 3'                                                                                   |
|                                           | <i>UTX</i> -F2        | 5' AATGGTTTACCAACTTGCCAGG 3'                                                                                        | <i>JMJD3</i> -F2       | 5' CTTCATGCGGGTAACATCCACG 3'                                                                                   |
|                                           | <i>UTX</i> -R2        | 5' CGGGTGCTCAATAAAGAATTCCTTC 3'                                                                                     | <i>JMJD3</i> -R2       | 5' TTCCAGGCAATGTTGTTGCACC 3'                                                                                   |
|                                           |                       |                                                                                                                     |                        |                                                                                                                |
| <b>Primers for donor DNA construction</b> | <i>UTX</i> -5' arm-F  | 5' GCTGTACCAATGTACTTGGGGCTG 3'                                                                                      | <i>JMJD3</i> -5' arm-F | 5' CCGTGAGGAGTCCACTGAGTGATG 3'                                                                                 |
|                                           | <i>UTX</i> -5' arm-R  | 5' GGTGCAATTGGTTAGCACACGG 3'                                                                                        | <i>JMJD3</i> -5' arm-R | 5' ACTACTACAGCTGCACCGTGTTTCATGC 3'                                                                             |
|                                           | <i>UTX</i> -3' arm-F  | 5' CGACAACCTACCAAGCTGGATCTCC 3'                                                                                     | <i>JMJD3</i> -3' arm-F | 5' TAGTAGCCATCAGCGCTTTCTGTGATCG 3'                                                                             |
|                                           | <i>UTX</i> -3' arm-R  | 5' AGTTAGTATGGGGCTGGGCGTG 3'                                                                                        | <i>JMJD3</i> -3' arm-R | 5' TACCAGGTACGTGTTGCGGCTG 3'                                                                                   |
|                                           |                       |                                                                                                                     |                        |                                                                                                                |
| <b>Knock-in</b>                           |                       |                                                                                                                     |                        |                                                                                                                |
| <b>sgRNA sequence</b>                     | GTTGGTTGACACTCCGCACT  |                                                                                                                     | CCGGCCTCATCGCGACGTGC   |                                                                                                                |
| <b>Primers for donor DNA construction</b> | <i>UTX</i> -5' arm-F  | 5' CAGTACAAAATGGAGGACCTGATGC 3'                                                                                     | <i>JMJD3</i> -5' arm-F | 5' TACTTGACGGGTTCTGGTGGC 3'                                                                                    |
|                                           |                       | 5'<br>TCACTTATCGTCGTCATCCTTGTAATCCTTATCGTCG<br>TCATCCTTGTAATCCTTATCGTCGTCATCCTTGTAATC<br>AGATGAGGCGGATGGTAATGGAG 3' |                        | 5'<br>TCACTTATCGTCGTCATCCTTGTAATCCTTATC<br>GTCGTCATCCTTGTAATCCTTATCGTCGTCATC<br>CTTGTAATCTCGCGACGTGCTGGCTGG 3' |
|                                           | <i>UTX</i> -5' arm-R  |                                                                                                                     | <i>JMJD3</i> -5' arm-R |                                                                                                                |
|                                           | <i>UTX</i> -3' arm-F  | 5' TATTGTTCCATGGACATTAAATGAGACC 3'                                                                                  | <i>JMJD3</i> -3' arm-F | 5' ACATGCCTGGGCTGGACCTAG 3'                                                                                    |
|                                           | <i>UTX</i> -3' arm-R  | 5' CCCCCAAATCATGTCATGCAAG 3'                                                                                        | <i>JMJD3</i> -3' arm-R | 5' GTCCTCCCCATCAATCACGGTC 3'                                                                                   |

**Supplementary Table 2 List of primers for qRT-PCR**

| Gene            | Forward primer          | Reward primer            |
|-----------------|-------------------------|--------------------------|
| <i>GAPDH</i>    | GGAGCGAGATCCCTCCAAAAT   | GGCTGTTGTCATACTTCTCATGG  |
| <i>OCT4</i>     | CCTCACTTCACTGCACTGTA    | CAGGTTTTCTTTCCCTAGCT     |
| <i>SOX2</i>     | CCCAGCAGACTTCACATGT     | CCTCCCATTTCCTCGTTTT      |
| <i>NANOG</i>    | TGAACCTCAGCTACAAACAG    | TGGTGGTAGGAAGAGTAAAG     |
| <i>PAX6</i>     | ATGTGTGAGTAAATTCTGGGCA  | GCTTACAACCTTCTGGAGTCGCTA |
| <i>SOX1</i>     | AATTTTATTTTCGGCGTTGC    | TGGGCTCTGTCTCTTAAATTTGT  |
| <i>NES</i>      | GAAGGGCAATCACAAACAGGTG  | GGGGCCACATCATCTTCCA      |
| <i>UTX</i>      | TTGGCCCAGGTGACTGTGAATG  | TTCAAGATTGGGCCACCAAGAAC  |
| <i>JMJD3</i>    | GCCAGGCCACCAGGAGAATAAC  | CTCCCAGTAGTGCTCGTGCACC   |
| <i>CASPASE3</i> | GAAATTGTGGAATTGATGCGTGA | CTACAACGATCCCCTCTGAAAAA  |
| <i>CASPASE6</i> | CACCAACATAACTGAGGTGGATG | AGGAGGAGCCATATTTTCCCA    |
| <i>CASPASE7</i> | AGGGACCGAGCTTGATGATG    | CACTGGGATCTTGATCGAGGA    |
| <i>CASPASE8</i> | AGAGTCTGTGCCAAATCAAC    | GCTGCTTCTCTCTTTGCTGAA    |
| <i>CASPASE9</i> | CTCAGACCAGAGATTGCAAAAC  | GCATTTCCCCTCAAACCTCAA    |
| <i>ROCK1</i>    | GGTGGTCGGTTGGGGTATTTT   | CGCCCTAACCTCACTTCCC      |
| <i>ROCK2</i>    | TCAGAGGTCTACAGATGAAGGC  | CCAGGGGCTATTGGCAAAGG     |
| <i>FAS</i>      | TCTGGTTCTTACGTCTGTTGC   | CTGTGCAGTCCCTAGCTTTCC    |
| <i>P53</i>      | GAGGTTGGCTCTGACTGTACC   | TCCGTCCCAGTAGATTACCAC    |
| <i>P21</i>      | CGATGGAACCTCGACTTTGTCA  | GCACAAGGGTACAAGACAGTG    |
| <i>P27</i>      | AACGTGCGAGTGTCTAACGG    | CCCTCTAGGGGTTTGTGATTCT   |
| <i>NESTIN</i>   | CTGGAGCAGGAGAAACAGG     | TGGGAGCAAAGATCCAAGAC     |
| <i>FABP7</i>    | TTCATGGGCTCAAGCGAT      | CATGGCGAAATCCCATCT       |
| <i>VIM</i>      | GACGCCATCAACACCGAGTT    | CTTTGTGTTGGTTAGCTGGT     |
| <i>DLX1</i>     | TGCCAGAAAGTCTCAACAGCC   | CGAGTGTAACAGTGCATGGA     |
| <i>DLX2</i>     | GCCTCAACAACGTCCCTTACT   | GGGAGCGTAGGAGGTGTAGG     |
| <i>MAP2</i>     | TGAAGCAAAGGCACCTCAC     | TATGGGAATCCATTGGCG       |
| <i>TUJ1</i>     | GGCCAAGGGTCACTACACG     | GCAGTCGCAGTTTTCACTC      |
| <i>NEUN</i>     | CCAAGCGGTACACGTCTC      | CGTCCCATTGAGCTTCTCCC     |
| <i>SLC32A1</i>  | ACGTCCGTGTCCAACAAGTC    | AAAGTCGAGGTCGTGCAATG     |
| <i>GBJ6</i>     | CAAGAGGACTTCGTCTGCAAC   | GTGGTTTCGTGCCTGTAGTAG    |
| <i>GFAP</i>     | CTGCGGCTCGATCAACTCA     | TCCAGCGACTCAATCTTCCTC    |
| <i>BRG1</i>     | CAGATCCGTACAGGCAAAAT    | TCTCGATCCGCTCGTTCTCTT    |
| <i>BRM</i>      | AGCGGGAATACAGACTTCAGG   | AAGTGCTTTTAGTTCCACGGTT   |
| <i>BAF53A</i>   | CTATGCAGTGCAGAGAACTCTTC | CCTCGTAACCTGAGGCAACTT    |
| <i>BAF53B</i>   | GCACTACGAGATGCCCAATG    | TTGACGTTGAGGGATCAAAC     |

**Supplementary Table 3 List of antibodies used in this study**

| Name of Antibody                                                              | Company (Cat. No.)                 | Dilution Factor                         |
|-------------------------------------------------------------------------------|------------------------------------|-----------------------------------------|
| Rabbit anti-HIST3H3 (H3)                                                      | Abclonal (A2348)                   | 1:1000                                  |
| Rabbit anti-Histone H3K27me3 (tri-methyl Lys27)                               | GeneTex (GTX54106)                 | 1:1000                                  |
| Rabbit anti-TriMethyl-Histone H3-K4 Polyclonal                                | Abclonal (A2357)                   | 1:1000                                  |
| HRP-conjugated Monoclonal Mouse Anti-GAPDH                                    | KangChen Bio-tech (KC-5G5)         | 1:1000                                  |
| Goat anti Rabbit IgG HRP                                                      | KangChen Bio-tech (KC-RB-035)      | 1:4000                                  |
| mouse anti-OCT-3/4                                                            | Santa Cruz Biotechnology (sc-5279) | 1:200                                   |
| mouse anti-SSEA4                                                              | Invitrogen (414000)                | 1:200                                   |
| mouse anti-Isotype antibody mouse IgG2b                                       | Invitrogen (MG2800)                | 1:200                                   |
| Goat Anti-Mouse IgG H&L (Alexa Fluor® 488)                                    | Abcam (ab150113)                   | 1:500                                   |
| Rabbit anti-OCT-3/4                                                           | Cell Signaling Technology (2750S)  | 1:200                                   |
| Rabbit anti-Glial Fibrillary Acidic Protein Antibody, clone GA5               | Millipore (MAB360)                 | 1:1000                                  |
| Goat anti-Rabbit IgG (H+L) Cross-Adsorbed Secondary Antibody, Alexa Fluor 488 | Thermo Fisher SCIENTIFIC (A-11008) | 1:500                                   |
| Goat anti-Mouse IgG (H+L) Cross-Adsorbed Secondary Antibody, Alexa Fluor 568  | Thermo Fisher SCIENTIFIC (A-11004) | 1:500                                   |
| Donkey anti-Goat IgG (H+L) Cross-Adsorbed Secondary Antibody, Alexa Fluor 568 | Thermo Fisher SCIENTIFIC (A-11057) | 1:500                                   |
| Mouse anti-PAX6                                                               | BD Biosciences (561664)            | 1:100                                   |
| Mouse anti-IgG2a                                                              | BD Biosciences (554647)            | 1:100                                   |
| Rabbit anti-CD133                                                             | proteintech (18470-1-AP)           | 1:100                                   |
| Mouse anti-SOX2                                                               | R&D system (MAB2018)               | 1:1000                                  |
| Rabbit anti-NES                                                               | Millipore (ABD69)                  | 1:1000                                  |
| Mouse anti-Ki67                                                               | BD Biosciences (556003)            | 1:1000                                  |
| Rabbit anti-PAX6                                                              | BioLegend (901301)                 | 1:1000                                  |
| Mouse anti-MAP2                                                               | Millipore (MAB3418)                | 1:1000                                  |
| Rabbit anti-GFAP                                                              | proteintech (16825-1-AP)           | 1:500                                   |
| Rabbit anti-TUBB3                                                             | GeneTex (gtx130245)                | 1:1000                                  |
| Mouse anti-Annexin V                                                          | proteintech (66245-1-IG)           | 1:500                                   |
| Rabbit anti-BRM (SMARCA2)                                                     | GeneTex (gtx133724)                | 1:500                                   |
| mouse anti-BRG1                                                               | GeneTex (gtx633391)                | 1:500                                   |
| Rabbit anti-BAF53A(ACTL6A)                                                    | HUABIO (ET7106-60)                 | 1:500                                   |
| Rabbit anti-BAF53B                                                            | Novus Biologicals (NBP2-15269)     | 1:1000                                  |
| Mouse anti-NES                                                                | Cell Signaling Technology (33475)  | 1:500                                   |
| Rabbit anti-MAP2                                                              | Cell Signaling Technology (8707)   | 1:500                                   |
| Mouse anti-FLAG                                                               | Sigma-Aldrich (F1804)              | 1:1000                                  |
| Anti-FLAG M2 magnetic beads ChIP                                              | Sigma-Aldrich (M8823)              | 25 µL per chromatin immunoprecipitation |
| Anti-H3K27me3 ChIP                                                            | Millipore (17-622)                 | 4 µL per chromatin immunoprecipitation  |

**Supplementary Table 4 List of primer sequences for over-expression and knock-down**

| Gene                   | Forward primer                                        | Reverse primer           |
|------------------------|-------------------------------------------------------|--------------------------|
| <b>Over-expression</b> |                                                       |                          |
| <i>UTX</i>             | ATGAAATCCTGCGGAGTGTGCT                                | TCAAGATGAGGCGGATGGTAATGG |
| <i>JMJD3</i>           | ATGCATCGGGCAGTGGACCC                                  | TCATCGCGACGTGCTGGCT      |
| <i>BAF53B</i>          | ATGAGCGGGGGCGTCTAC                                    | TCAGGGGCACTTTCGCTCC      |
| <i>BAF53A</i>          | ATGAGCGGCGGCGTGTAC                                    | TCAAGGGCATTTCCTTCTACACAC |
| <i>BRG1</i>            | ATGGAGACCAGCCAGATGAGCGACC                             | TCAGATTTTCTGCCGCACGCTGG  |
| <i>BRM</i>             | ATGCAGAAGATTGAGCAGGAGAGGAAAC                          | TCAAATTTTCTGCCGGGCACTCT  |
| <b>Knock-down</b>      |                                                       |                          |
| <i>BAF53A-sh1</i>      | GCTTTCCTTGAAATGCACTTACTCGAGTAAGTGCATTTCAAGGAAAGCTTTTT |                          |
| <i>BAF53A-sh2</i>      | CGGTACTTCAAGTGTGAGATTCTCGAGAATCTGACACTTGAAGTACCGTTTTT |                          |