

Supplementary Information

Supplementary Fig. 1: Effects of WAPL depletion on expression of different gene categories. a, Percentage of differentially expressed cell identity, cell cycle and DNA damage genes (FDR<0.05) following WAPL depletion in the RNA-seq data. Numbers in the bar plot represent number of differential genes from the gene sets at different time points. The numbers on or next to the bars indicate number of genes in one gene category up- or down-regulated at the investigated time points. A list of cell identity genes is obtained from Whyte et al.¹. The lists of cell cycle and DNA damage genes are downloaded from MSigDB (version 6.2)². **b,** The same analysis as **(a)** but using the TT-seq data.

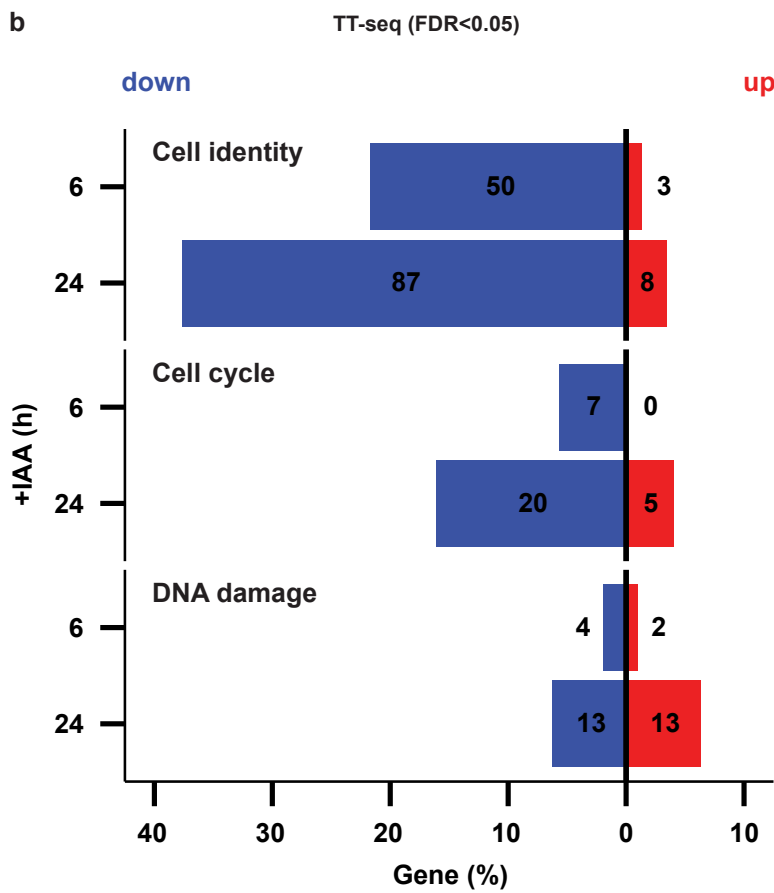
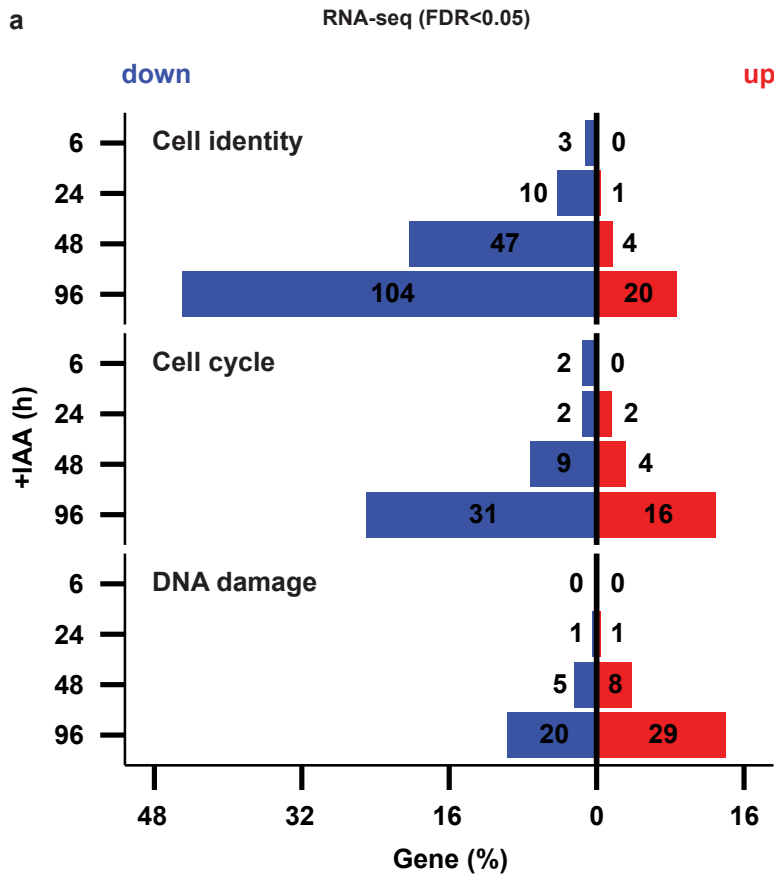
Supplementary Fig. 2: Transcriptomic analyses of a second WAPL-AID clone. a, Pearson correlation of transcriptomic analyses following WAPL depletion in two independent WAPL-AID clones. The correlations are computed based on average normalized reads from two technical replicates generated from the same clone. Correlations of the same time points from the two clones are highlighted by red rectangles, while correlations between the samples with 0 and 96 h IAA treatment are highlighted by blue rectangles. **b,** Transcriptomic changes in the second clone following WAPL depletion are plotted using the same gene clusters identified from the Clone 1 described in **Extended Data Fig. 3d**.

Supplementary Fig. 3: Further analyses of Cohesin binding at Pluripotency factor binding sites. a-c, RAD21 binding becomes weaker at pluripotency transcription factor SOX2 **(a)**, OCT4 **(b)** and NANOG **(c)** binding sites in response to WAPL depletion.

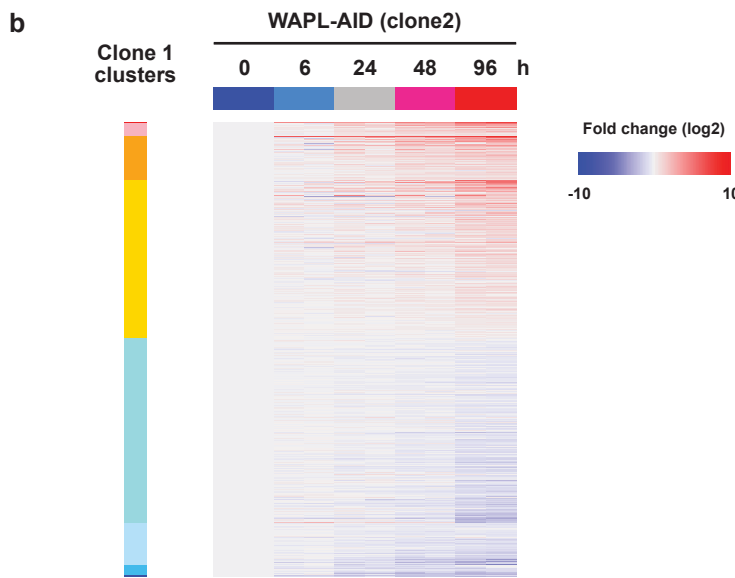
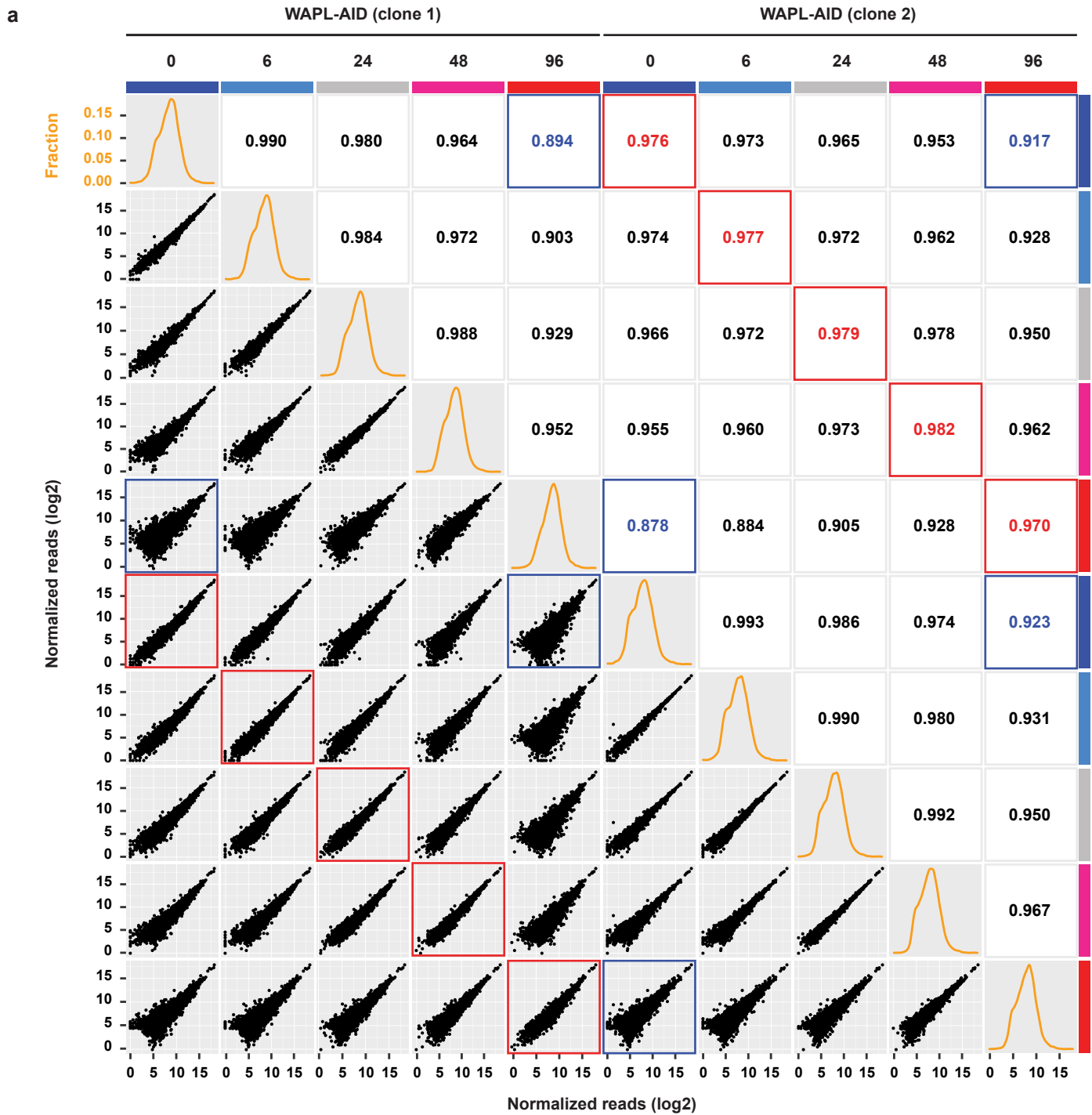
REFERENCES

1. Whyte, W. A. *et al.* Master Transcription Factors and Mediator Establish Super-Enhancers at Key Cell Identity Genes. *Cell* **153**, 307-319 (2013).
2. Liberzon, A. *et al.* The Molecular Signatures Database Hallmark Gene Set Collection. *Cell Syst.* **1**, 417–425 (2015).

Supplementary Fig. 1



Supplementary Fig. 2



Supplementary Fig. 3

