

Figure S1: PCR validation of selected RNAs. Comparison between the relative quantitative value (RQV) of selected RNAs as measured by high throughput sequencing (y-axis) or RT-qPCR (x-axis). Pearson's correlation value (r) is shown in red on each plot.

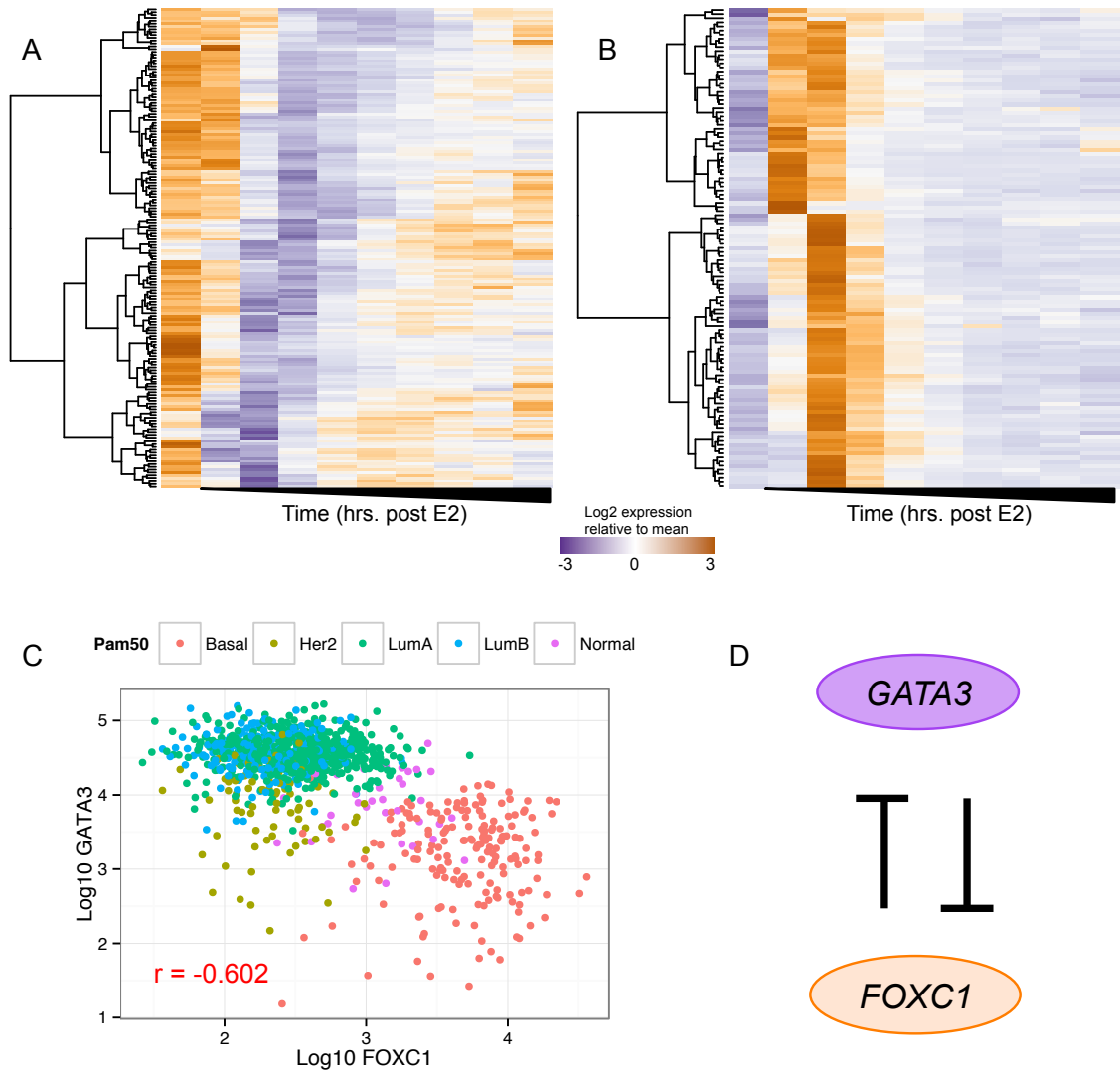


Figure S2: *GATA3*-like and anti-*GATA3*-like genes. (A) The expression profile of 170 mRNAs that exhibit an expression pattern similar to *GATA3*. (B) The expression profile of 118 mRNAs that exhibit a pattern of expression opposite of that of *GATA3*. (C) Normalized expression of *GATA3* and *FOXC1* in 1046 samples from The Cancer Genome Atlas breast cancer dataset. Pearson's correlation (r) is shown in red. (D) Opposite expression pattern of *GATA3* and *FOXC1* is consistent with a mutual inhibition relationship.

ChEA binding by p-value ranking

SUZ12_20075857_ChIP-Seq_MESC_Mouse	2.818e-170
EGR1_20690147_ChIP-Seq_ERYTHROLEUKEMIA_Human	7.993e-167
HNF4A_19822575_ChIP-Seq_HepG2_Human	3.015e-161
ZNF217_24962896_ChIP-Seq_MCF7_Human	2.917e-160
MITF_21258399_ChIP-Seq_MELANOMA_Human	5.178e-159
WT1_25993318_ChIP-Seq_PODOCYTE_Human	3.600e-131
FOXM1_26456572_ChIP-Seq_MCF7_Human	9.495e-125
ESR2_21235772_ChIP-Seq_MCF-7_Human	1.499e-118
MTF2_20144788_ChIP-Seq_MESC_Mouse	5.288e-112
RUNX1_21571218_ChIP-Seq_MEGAKARYOCYTES_Human	6.654e-110

Figure S3: Top ChEA binding hits for estrogen responsive mRNAs. The ten most enriched transcription factor binding sites for estrogen responsive mRNAs in our dataset using ChEA. Transcription factors are sorted by p-value ranking.

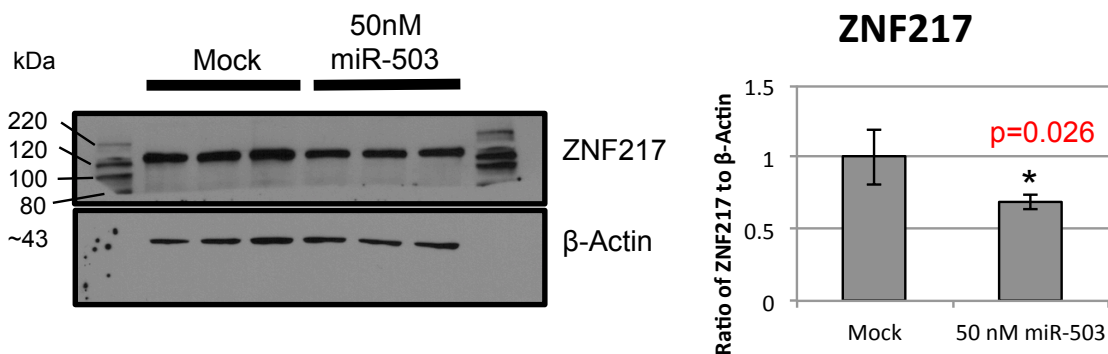


Figure S4: ZNF217 protein levels in Mock and miR-503 transfected MCF-7 cells. Western blot showing ZNF217 protein levels in Mock or miR-503 (50nM) transfected MCF-7 cells at 48 hours post transfection. Significance assessed using a 1-tailed Student's t-test.

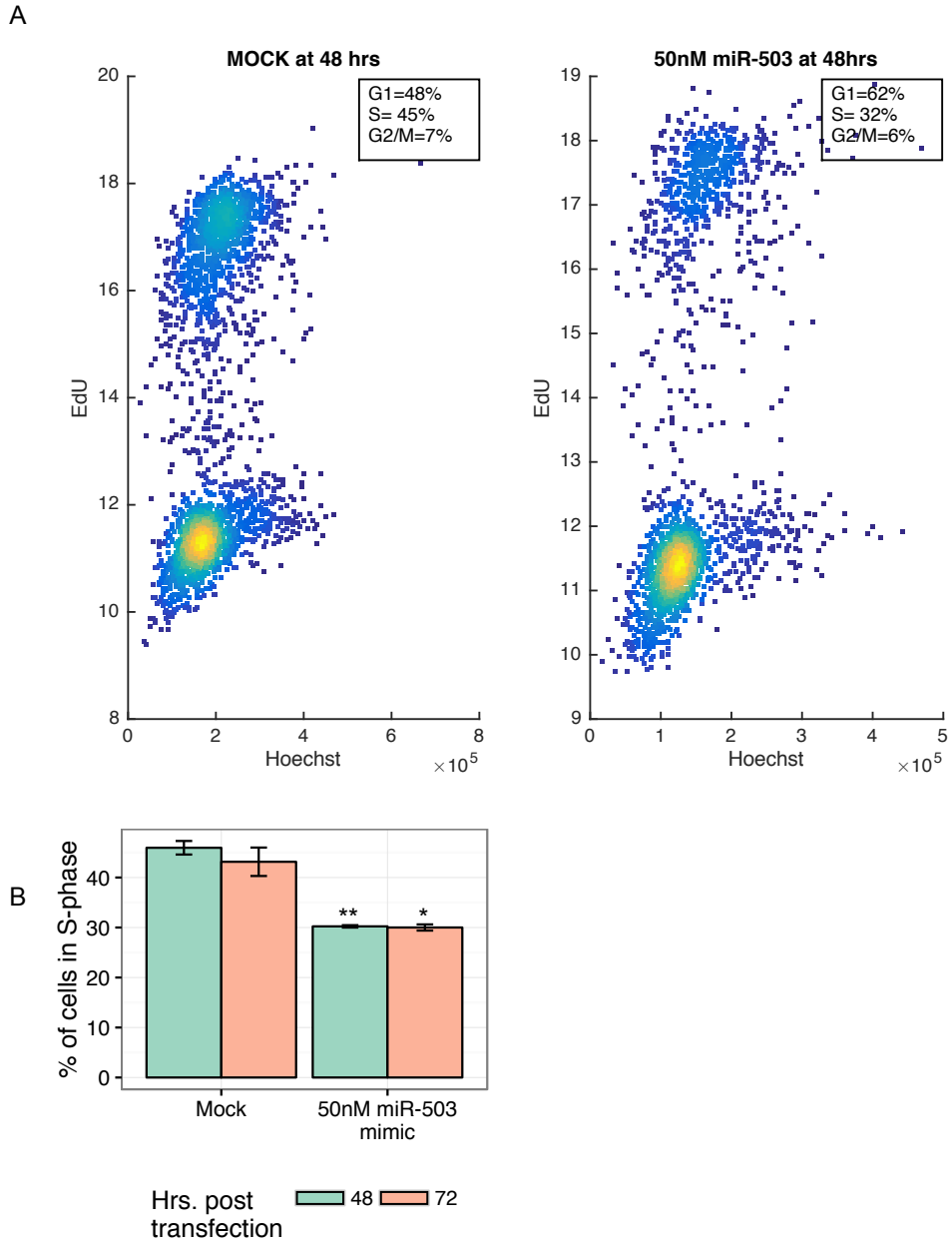


Figure S5: miR-503/ZNF217 circuit inhibits proliferation. (A) Total EdU and DNA (Hoechst) fluorescence in cells from Mock or miR-503 (50nM) transfected MCF7 cells. (B) The percentage of MCF7 cells in S-phase during the EdU pulse experiment from Mock or miR-503 (50nM) transfected MCF7 cells at 48 or 72 hours post transfection. Significance assessed using a Student's t-test (* $P < 0.05$, ** $P < 0.01$).

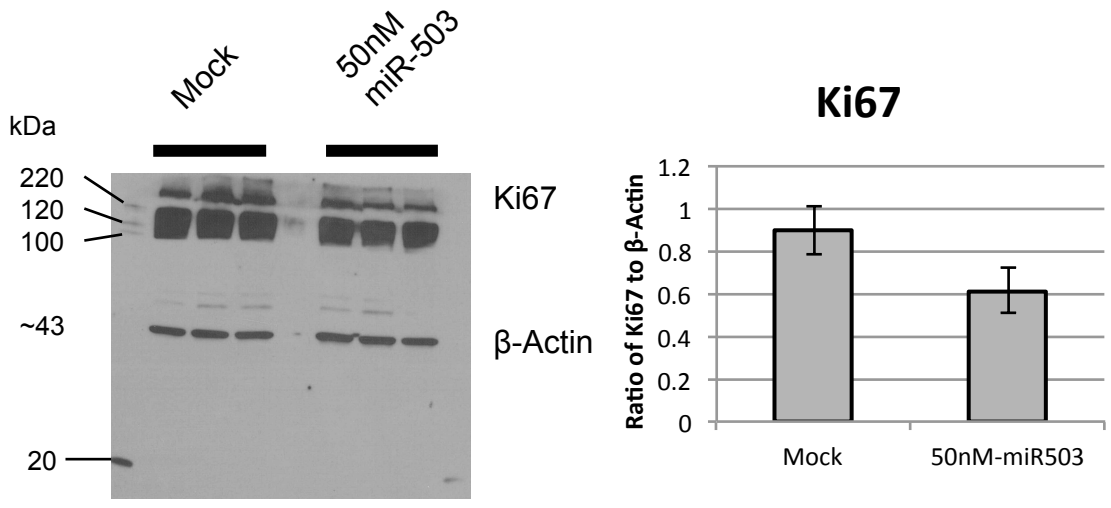


Figure S6: Ki67 protein levels in Mock and miR-503 transfected MCF7 cells. Western blot showing Ki67 protein levels in Mock or miR-503 (50nM) transfected MCF7 cells at 72 hours post transfection.

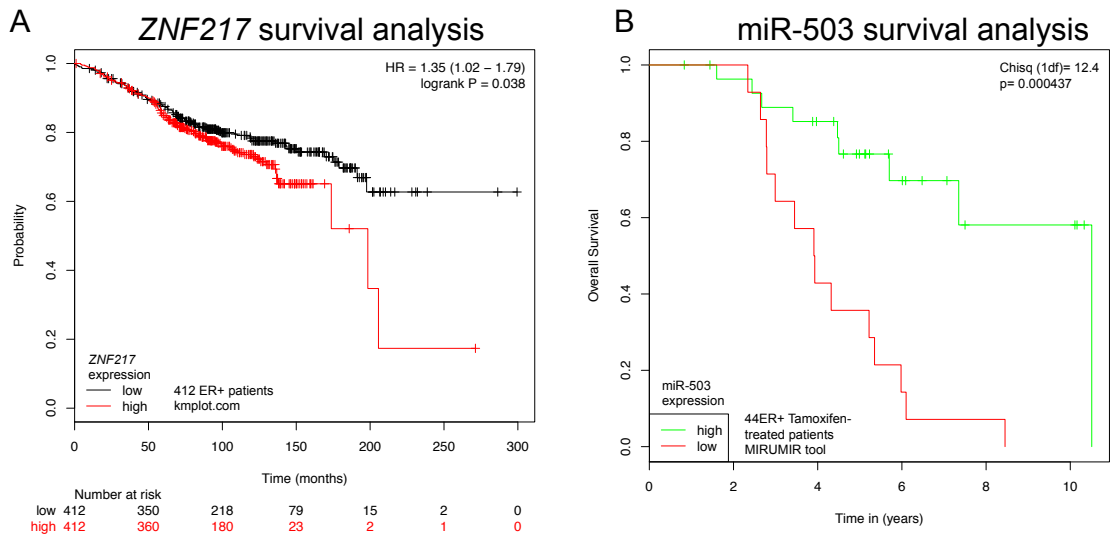


Figure S7: Association of ZNF217 and miR-503 expression in breast cancer patient cohorts. (A) Survival analysis of 412 ER+ patients based on ZNF217 high/low status (Fietze et al. 2014; Győrffy et al. 2009). (B) Survival analysis of 44 ER+ tamoxifen treated patients based on miR-503 high/low status (Antonov et al. 2013; Lyng et al. 2012; Antonov 2011).