

Supporting Information

Proliferation-associated long noncoding RNA, *TMPO-AS1*, is a potential therapeutic target for triple-negative breast cancer

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Table S1. Primers used in the present study.

Table S2. *TMPO-AS1* coexpressed genes in breast cancer.

Figure S1. *TMPO-AS1* overexpression promotes cell proliferation.

Figure S2. *TMPO-AS1* overexpression increases E2F-associated gene expression.

Figure S3. *TMPO-AS1* overexpression promotes cell migration.

Table S1. Primers used in the present study

Gene name	Forward (5' to 3')	Reverse (5' to 3')
<i>GAPDH</i>	ggtggtctcctctgacttcaaca	gtggtcgttgagggcaaagtg
<i>TMPO-AS1</i>	cttttgtgcgccgtttcct	cccagagacgaaagctgctt
<i>MCM6</i>	tcgggccttgaaaacattcgt	tgtgtctggttaggcaggtctt
<i>TMPO</i>	cggtcctgacaaaagacaagttg	ccggcagcgtcacattg
<i>MAD2L1</i>	ggactcaccttgcttgtaactac	gatcactgaacggatttcacct
<i>CHEK1</i>	ccagatgctcagagattcttcca	tgttcaacaaacgctcacgatta
<i>TGFBR1</i>	acggcgttacagtgtttctg	gcacatacaaacggcctatctc
<i>TGFBR2</i>	gtagctctgatgagtgcaatgac	cagatatggcaactcccagtg
<i>rRNA</i>	gcttaatttgactcaacacggga	agctatcaatctgtcaatcctgtc

Table S2. TMPO-AS1 coexpressed genes in breast cancer

Correlated Gene	Spearman's Correlation	<i>p</i> -value
TMPO	0.675040008	1.29E-109
NUSAP1	0.655626446	2.08E-101
TROAP	0.650623855	2.17E-99
OIP5	0.644886186	4.01E-97
PRC1	0.644358911	6.44E-97
KIFC1	0.638498114	1.18E-94
TYMS	0.638236951	1.48E-94
ESPL1	0.637709963	2.35E-94
RFC5	0.633629499	8.18E-93
E2F1	0.63202859	3.25E-92
CDCA3	0.631710578	4.27E-92
SPC25	0.627805809	1.18E-90
PARPBP	0.627018336	2.30E-90
ZWINT	0.626918729	2.50E-90
FOXM1	0.626184534	4.64E-90
RAD54L	0.625175791	1.08E-89
ASF1B	0.624758916	1.53E-89
TCF19	0.623618859	3.97E-89
CCNB2	0.62246223	1.04E-88
NCAPG	0.621738415	1.89E-88
CDC25C	0.620064097	7.50E-88
KIF18B	0.61990519	8.54E-88
KNTC1	0.617235359	7.57E-87
KIF11	0.616189623	1.77E-86
HMGB2	0.614971066	4.74E-86
ARHGEF39	0.614842011	5.26E-86
FANCI	0.6146186	6.30E-86
UHRF1	0.613101281	2.13E-85
NEIL3	0.611815216	5.96E-85
CIT	0.610960565	1.18E-84

Table S2 (continued)

CDK1	0.610937478	1.20E-84
LMNB1	0.610829818	1.31E-84
UBE2C	0.606302397	4.63E-83
HJURP	0.605238046	1.06E-82
TPX2	0.60363935	3.68E-82
SKA1	0.603540472	3.97E-82
CENPA	0.602618835	8.11E-82
RAD51AP1	0.602391375	9.66E-82
BUB1B	0.601901492	1.41E-81
CDCA5	0.601395221	2.08E-81
TACC3	0.601231544	2.36E-81
KIF23	0.600707096	3.53E-81
KIF4A	0.59794837	2.89E-80
RAD51	0.59740897	4.36E-80
NDC80	0.596651434	7.73E-80
E2F7	0.595901911	1.36E-79
AURKB	0.595774473	1.50E-79
GTSE1	0.594930946	2.83E-79
TIMELESS	0.594258336	4.68E-79
ZNF367	0.59374272	6.89E-79
PLK1	0.592859579	1.33E-78
CENPK	0.592267902	2.07E-78
CENPU	0.590961886	5.46E-78
DEPDC1B	0.590060524	1.06E-77
POLQ	0.588344442	3.76E-77
SGO1	0.58729735	8.11E-77
PTTG1	0.58698299	1.02E-76
BIRC5	0.586132778	1.90E-76
MAD2L1	0.58573888	2.53E-76
CDC25A	0.584845579	4.84E-76
BLM	0.583233211	1.55E-75

Table S2 (continued)

MCM2	0.583128569	1.67E-75
TICRR	0.5825484	2.54E-75
CCNA2	0.582243484	3.16E-75
AURKA	0.582033074	3.68E-75
CDC45	0.581381965	5.87E-75
MELK	0.581047764	7.46E-75
UBE2T	0.580482392	1.12E-74
NCAPH	0.57996404	1.62E-74
EZH2	0.579903591	1.69E-74
PCLAF	0.578109171	6.05E-74
H2AFZ	0.576897505	1.42E-73
CCNB1	0.576877827	1.44E-73
MND1	0.57661162	1.74E-73
CEP55	0.576572911	1.79E-73
KIF15	0.57559076	3.57E-73
WDR62	0.574928851	5.69E-73
E2F2	0.574761264	6.40E-73
PIMREG	0.574655209	6.89E-73
CDCA8	0.574226658	9.30E-73
CDKN3	0.573908999	1.16E-72
ARHGAP11A	0.573846806	1.21E-72
KIF2C	0.572835081	2.45E-72
KIF18A	0.572434027	3.24E-72
RACGAP1	0.572209437	3.79E-72
DLGAP5	0.570829787	9.86E-72
BUB1	0.569791758	2.02E-71
MKI67	0.569292489	2.84E-71
DNAJC9	0.566039992	2.63E-70
MCM10	0.565608923	3.52E-70
PBK	0.565385195	4.10E-70
FAM72B	0.564818895	6.01E-70

Table S2 (continued)

PLK4	0.563838016	1.17E-69
PCNA	0.563468177	1.50E-69
FEN1	0.562055818	3.87E-69
FANCA	0.561515734	5.55E-69
KNSTRN	0.561279858	6.50E-69
DTL	0.560677581	9.73E-69
WDR76	0.559259612	2.50E-68
KIF20A	0.558944537	3.08E-68
NUF2	0.55810782	5.36E-68
CENPM	0.557887691	6.21E-68
ORC1	0.555790388	2.47E-67
RMI2	0.555144867	3.77E-67
CDT1	0.555035211	4.05E-67
C17ORF53	0.553486741	1.11E-66
MYBL2	0.55305293	1.48E-66
CKAP2L	0.552924745	1.61E-66
HMMR	0.551764185	3.41E-66
STIL	0.550397587	8.25E-66
TRIP13	0.550297318	8.80E-66
TOP2A	0.550276248	8.92E-66
PIF1	0.549585278	1.39E-65
CDC7	0.549544173	1.43E-65
PKMYT1	0.549416275	1.55E-65
HELLS	0.549379458	1.59E-65
RFC4	0.548999606	2.03E-65
POLA2	0.54864301	2.55E-65
CHAF1B	0.547993358	3.86E-65
GIN51	0.547262255	6.15E-65
IQGAP3	0.547035369	7.11E-65
DSN1	0.546231272	1.19E-64
CENPE	0.545674049	1.69E-64

Table S2 (continued)

SPAG5	0.544589221	3.36E-64
SKA3	0.543392176	7.15E-64
TTK	0.543380779	7.20E-64
HASPIN	0.543200626	8.06E-64
CENPO	0.543041653	8.91E-64
ERCC6L	0.54293785	9.51E-64
EXO1	0.542901136	9.73E-64
DEPDC1	0.541072889	3.06E-63
NCAPG2	0.540260576	5.08E-63
RRM2	0.538455312	1.56E-62
ORC6	0.53647588	5.29E-62
MCM3	0.53369096	2.91E-61
CIP2A	0.532772562	5.08E-61
SPC24	0.53231475	6.71E-61
E2F8	0.531806607	9.13E-61
CDC20	0.531262371	1.27E-60
KIF14	0.53003403	2.66E-60
GINS2	0.529389127	3.92E-60
CDC6	0.526793495	1.85E-59
CENPH	0.526776762	1.87E-59
FAM72A	0.524984999	5.42E-59
ASPM	0.523815709	1.08E-58
NEK2	0.522586065	2.23E-58
CENPN	0.522088628	2.98E-58
POLE	0.520815078	6.28E-58
DBF4	0.519864509	1.09E-57
FAM111B	0.519819255	1.12E-57
MTFR2	0.518491222	2.43E-57
CENPI	0.518088257	3.06E-57
KIF4B	0.518004484	3.22E-57
POC1A	0.51727942	4.89E-57

Table S2 (continued)

CCNE2	0.517270851	4.91E-57
FAM83D	0.516259347	8.80E-57
MCM7	0.515342393	1.49E-56
TK1	0.513940104	3.32E-56
EME1	0.512464031	7.69E-56
TUBA1B	0.511825662	1.10E-55
FAM72D	0.510570112	2.25E-55
UBE2S	0.510207266	2.76E-55
CENPF	0.510152272	2.84E-55
TYMSOS	0.509081088	5.19E-55
PSRC1	0.508712179	6.38E-55
STMN1	0.507763769	1.09E-54
DNA2	0.507077035	1.59E-54
CHEK1	0.506500841	2.20E-54
TEDC2	0.506332857	2.41E-54
CDCA2	0.505613893	3.59E-54
PSMC3IP	0.504491505	6.69E-54
UNG	0.504174509	7.97E-54
ANLN	0.50384075	9.58E-54
MCM6	0.502887862	1.62E-53
CKS2	0.502101213	2.50E-53
RNASEH2A	0.500747888	5.23E-53
DSCC1	0.50038237	6.39E-53
CDK2	0.499570458	9.94E-53
CCDC150	0.499238474	1.19E-52
SUV39H1	0.49857609	1.71E-52
RAN	0.498096499	2.21E-52
POLE2	0.497729213	2.70E-52
ARHGAP11B	0.496184894	6.20E-52
CHAF1A	0.495852877	7.42E-52
CLSPN	0.495721688	7.96E-52

Table S2 (continued)

TRAIP	0.495430982	9.30E-52
WDHD1	0.495125661	1.10E-51
GIN53	0.494997144	1.17E-51
CCNE1	0.492983612	3.44E-51
PTTG3P	0.492168092	5.30E-51
ATAD2	0.492075823	5.57E-51
LRR1	0.491842929	6.30E-51
DONSON	0.490980349	9.95E-51
SMC4	0.490176606	1.52E-50
FANCD2	0.489505863	2.17E-50
NUP37	0.487232934	7.13E-50
SGO2	0.486101991	1.28E-49
AUNIP	0.484636714	2.75E-49
RFC2	0.484274575	3.31E-49
DIAPH3	0.483933594	3.95E-49
FBXO43	0.483421056	5.15E-49
CCNF	0.482907638	6.71E-49
CNIH2	0.482400072	8.71E-49
DDX12P	0.482083785	1.02E-48
FANCG	0.481610839	1.31E-48
CENPW	0.478044021	8.04E-48
NCAPD2	0.477127859	1.28E-47
SHCBP1	0.476749752	1.55E-47
ZGRF1	0.476476949	1.77E-47
FBXO5	0.476355544	1.89E-47
FANCB	0.474132139	5.75E-47
SPDL1	0.473828598	6.70E-47
GEN1	0.473431862	8.16E-47
SLBP	0.472125975	1.56E-46
CENPL	0.470758207	3.08E-46
ESCO2	0.470748953	3.09E-46

Table S2 (continued)

DDIAS	0.47059305	3.34E-46
GPSM2	0.469556523	5.57E-46
C5ORF34	0.46949168	5.75E-46
CEP152	0.46942082	5.96E-46
PRIM1	0.467564613	1.48E-45
NSD2	0.467051518	1.90E-45
KPNA2	0.466898839	2.05E-45
NRM	0.466194967	2.89E-45
LIG1	0.46558803	3.88E-45
RAD54B	0.464573589	6.35E-45
MIS18A	0.464315385	7.20E-45
CENPQ	0.462319521	1.88E-44
VRK1	0.46099702	3.55E-44
BRIP1	0.460480841	4.55E-44
C21ORF58	0.460460699	4.59E-44
GIN54	0.459754773	6.43E-44
SNRPA1	0.458479809	1.18E-43
RTKN2	0.456797695	2.62E-43
KNL1	0.456783494	2.63E-43
XRCC2	0.456764258	2.66E-43
KIF20B	0.45657209	2.91E-43
CCDC59	0.455442428	4.95E-43
RNFT2	0.455411331	5.03E-43
RECQL4	0.45476581	6.80E-43
TONSL	0.452863391	1.66E-42
GMNN	0.45199582	2.48E-42
NEMP1	0.450610383	4.71E-42
H2AFX	0.450532509	4.88E-42
HNRNPA2B1	0.450144153	5.84E-42
RACGAP1P	0.448478516	1.26E-41
FIGNL1	0.448333139	1.35E-41

Table S2 (continued)

RDM1	0.447807955	1.71E-41
SAPCD2	0.446725263	2.81E-41
MCM5	0.44589283	4.10E-41
ATAD5	0.444777104	6.81E-41
MASTL	0.443236736	1.37E-40
CCDC18	0.441866958	2.53E-40
CABLES2	0.441247564	3.35E-40
HAUS8	0.440838758	4.02E-40
C12ORF73	0.439747945	6.54E-40
CKS1B	0.439707859	6.66E-40
C4ORF46	0.439313254	7.94E-40
LINC00634	0.438878221	9.64E-40
KIF22	0.437975986	1.44E-39
LOC399815	0.437052607	2.17E-39
RHNO1	0.435651776	4.02E-39
APOBEC3B	0.435108288	5.10E-39
ECT2	0.434017356	8.23E-39
TCHP	0.431430553	2.54E-38
SNRPD1	0.431355064	2.62E-38
ZWILCH	0.430426131	3.92E-38
MTBP	0.429836583	5.06E-38
RCCD1	0.429518152	5.81E-38
RIBC2	0.428769667	8.01E-38
RHEBL1	0.427726064	1.25E-37
LOC642846	0.427135751	1.61E-37
TMEM106C	0.426816097	1.85E-37
PRIM2	0.42675333	1.90E-37
GAS2L3	0.425086887	3.87E-37
DDX11	0.424093945	5.89E-37
SNRPF	0.423543458	7.43E-37
EXOSC9	0.423341299	8.09E-37

Table S2 (continued)

MIR924HG	0.422700495	1.06E-36
CMC2	0.422181454	1.32E-36
KMT5A	0.422151087	1.34E-36
PRR11	0.421346552	1.87E-36
HNRNPL	0.420515816	2.65E-36
SRSF2	0.420304169	2.90E-36
SRSF9	0.420107054	3.15E-36
DHFR	0.419649504	3.81E-36
MCM4	0.418074727	7.33E-36
C2ORF48	0.414968496	2.64E-35
ANAPC7	0.414909491	2.71E-35
ZNF695	0.414290795	3.49E-35
INCENP	0.411770779	9.74E-35
CDCA4	0.411764706	9.77E-35
KDM2B	0.411651097	1.02E-34
TOPBP1	0.410246216	1.81E-34
MRGBP	0.408737859	3.32E-34
ALYREF	0.407996	4.47E-34
EBP	0.406567496	7.91E-34
DDX39A	0.404457272	1.83E-33
NASP	0.403761906	2.41E-33
KCNG3	0.40364354	2.52E-33
CDC25B	0.403590342	2.58E-33
GPR19	0.403428321	2.75E-33
TUBB	0.401715618	5.39E-33
NUDT1	0.400848224	7.58E-33
SKA2	0.400743957	7.89E-33

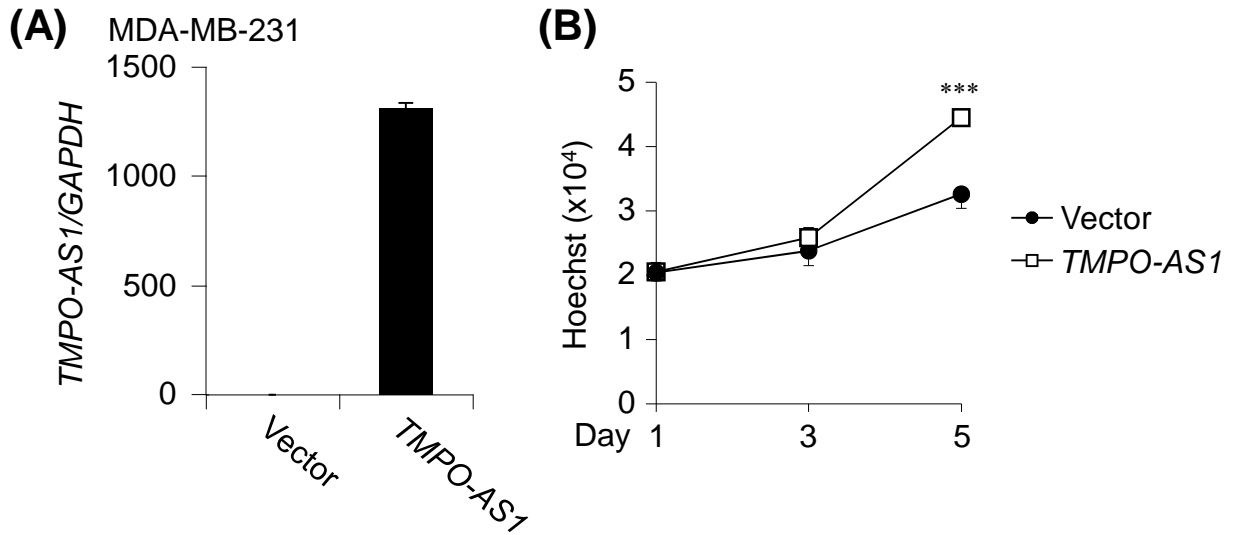


FIGURE S1. *TMPO-AS1* overexpression promotes cell proliferation. A, Expression levels of *TMPO-AS1* in *TMPO-AS1*- and control vector-transfected MDA-MB-231 cells. Data are normalized to *GAPDH* and presented as mean fold change \pm SD versus Vector ($n = 3$). B, Growth of the *TMPO-AS1*- and control vector-transfected MDA-MB-231 cells was measured by DNA assay. Data are presented as mean \pm SD ($n = 5$). ***, $P < 0.001$.

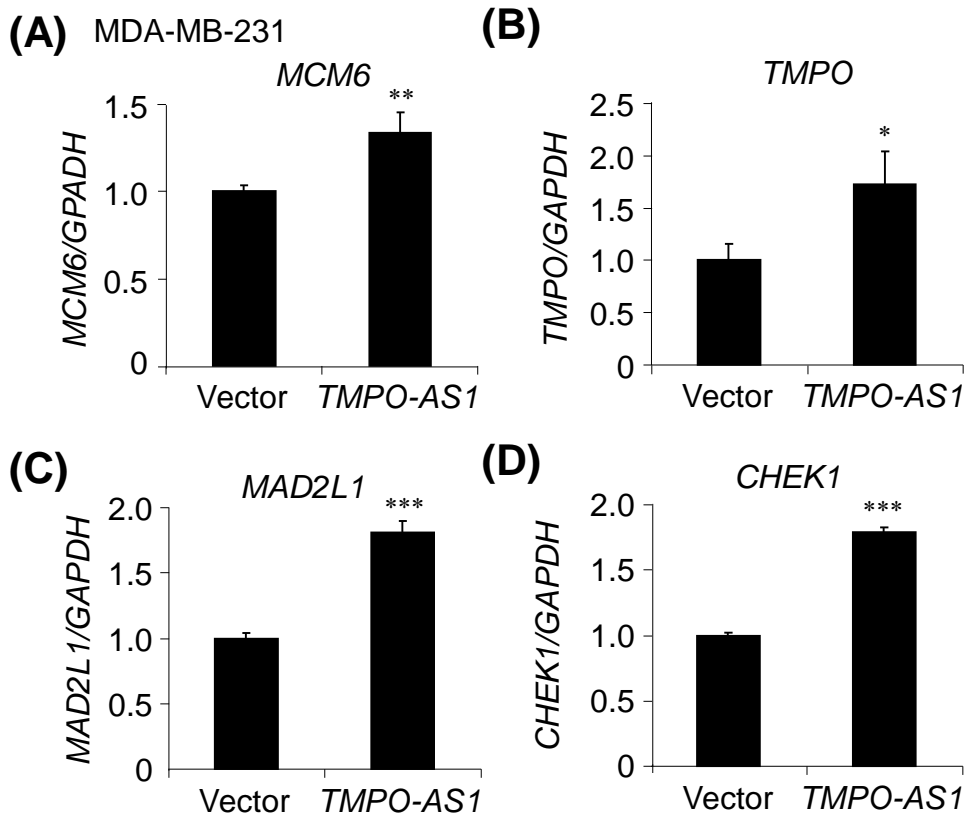


FIGURE S2. *TMPO-AS1* overexpression increases E2F-associated gene expression. A-D, Expression levels of *MCM6* (A), *TMPO* (B), *MAD2L1* (C), and *CHEK1* (D) mRNAs in *TMPO-AS1*- and control vector-transfected MDA-MB-231 cells. Data are normalized to *GAPDH* and presented as mean fold change \pm SD versus Vector ($n = 3$). . *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$.

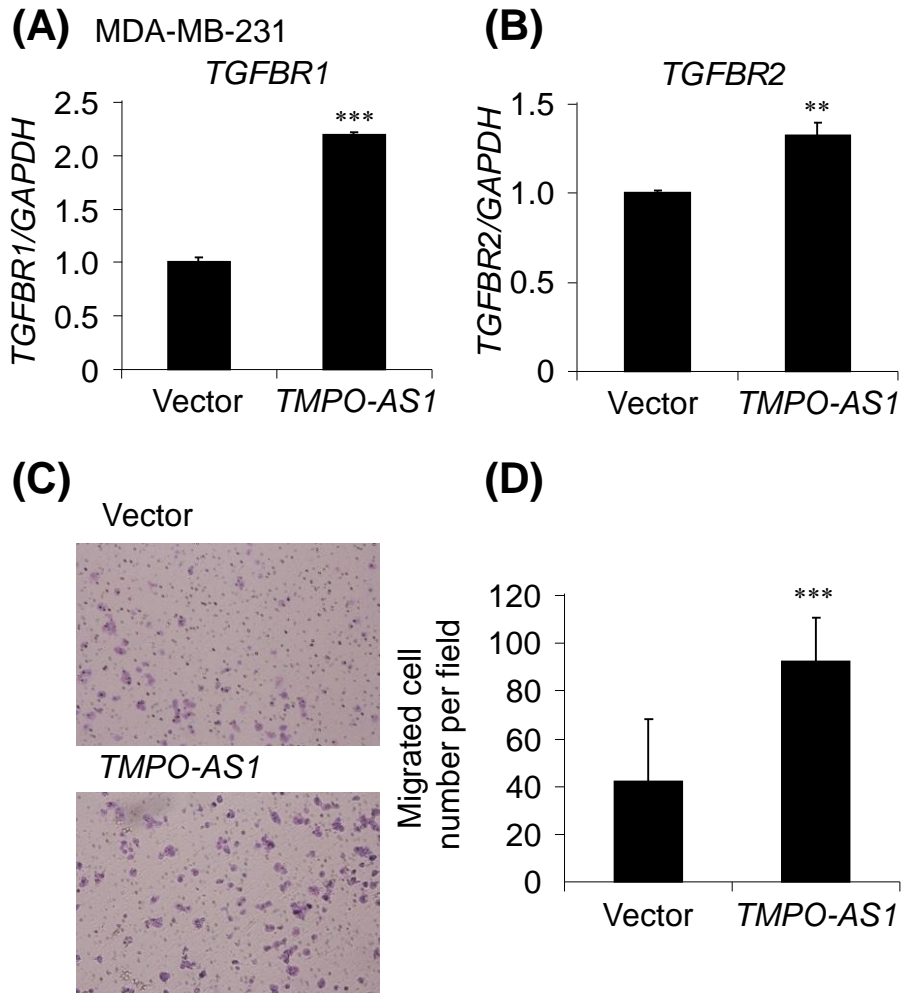


FIGURE S3. *TMPO-AS1* overexpression promotes cell migration. A and B, Expression levels of *TGFBR1* (A) and *TGFBR2* (B) mRNAs in *TMPO-AS1*- and control vector-transfected MDA-MB-231 cells. Data are normalized to *GAPDH* and presented as mean fold change \pm SD versus Vector ($n = 3$). C and D, *TMPO-AS1*- and control vector-transfected MDA-MB-231 cells were seeded onto the transwell membrane. Migrating cells were stained with Giemsa and counted under a microscope in 8 independent fields. Representative photograph of migrating cells (C) is shown. The number of migrating cells are presented as mean \pm SD ($n = 5$). **, $p < 0.01$; ***, $p < 0.001$.