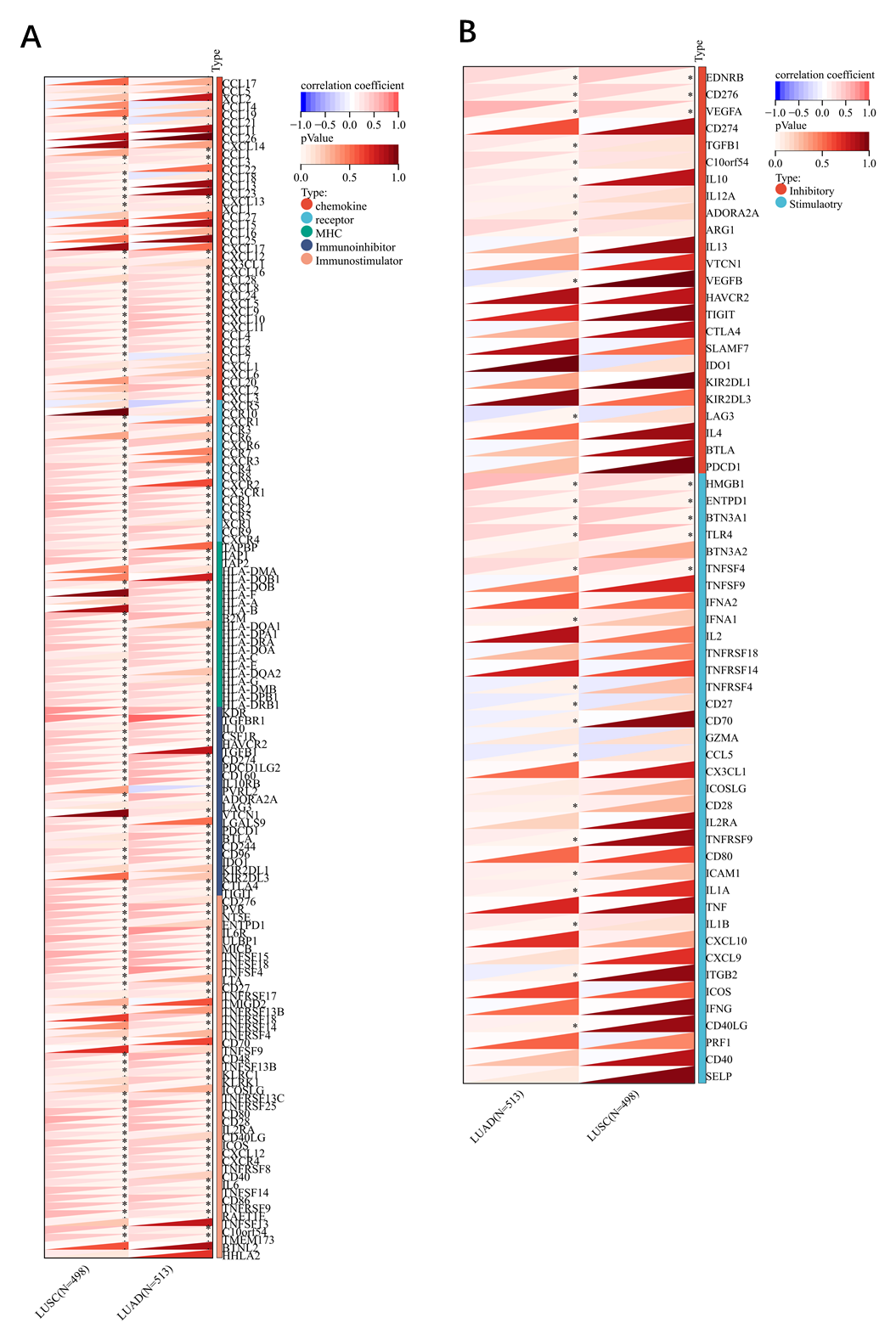
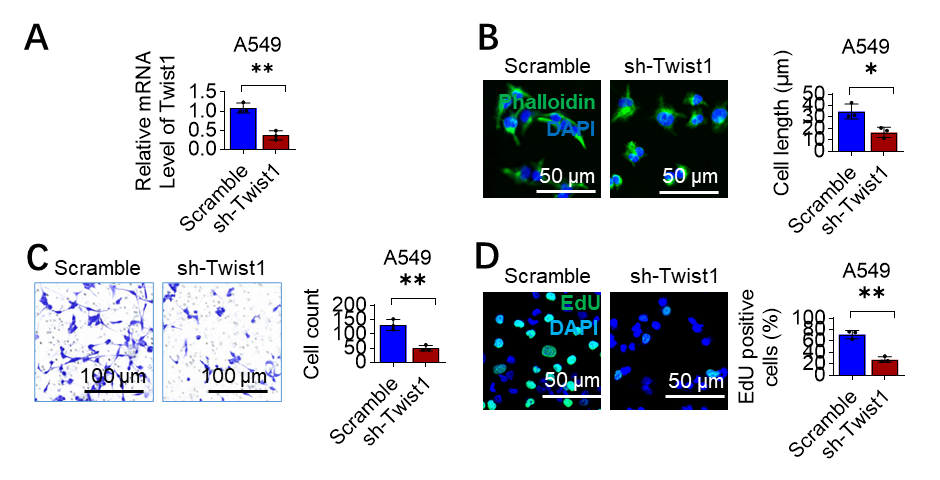
**Supplementary Figure Legends**

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**Supplementary Fig. 1. FUBP3 analysis with tumor immune regulation**

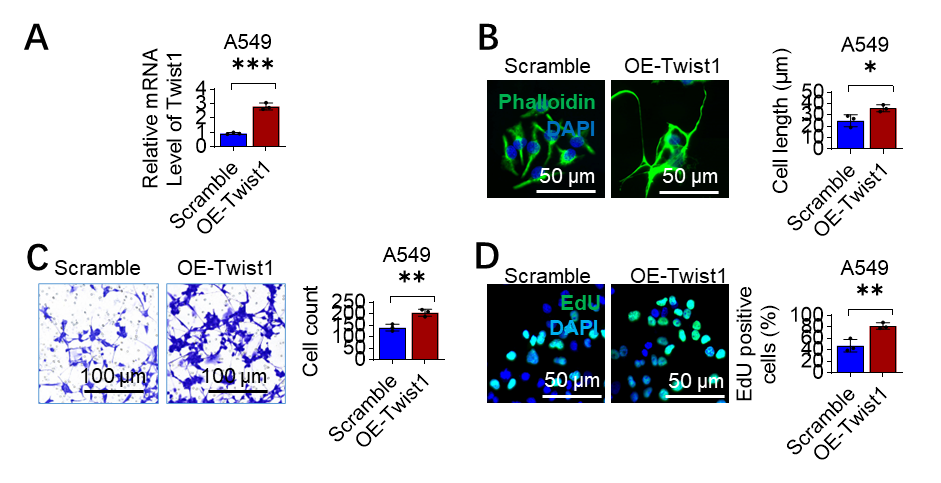
**A.** Correlation heatmap showing associations between FUBP3 expression and immune regulation-related genes based on TCGA lung cancer database.

**B.** Scatter plot analysis depicting correlations between FUBP3 expression levels and major immune checkpoint molecules.



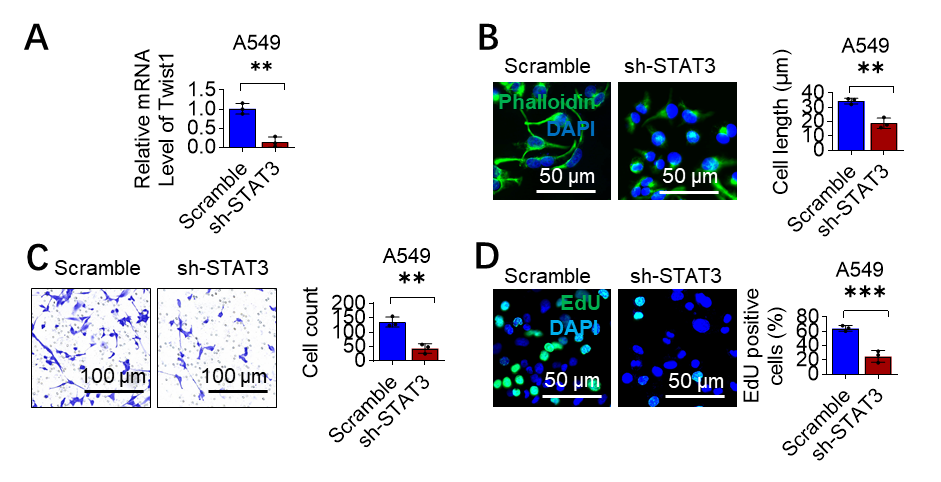
**Supplementary Fig. 2. Twist1 knockdown suppresses malignant phenotypes in A549 cells.**

(A) qRT-PCR validation of Twist1 knockdown efficiency. (B) Cell length quantification showing sh-Twist1 induced epithelial morphology. (C) Transwell invasion assay demonstrating reduced invasive capacity upon Twist1 knockdown. (D) EdU proliferation assay showing decreased proliferation in sh-Twist1 cells. Data are presented as mean ± SD (n=3). \*P < 0.05, \*\*P < 0.01.



**Supplementary Fig. 3. Twist1 overexpression promotes malignant phenotypes in A549 cells.**

(A) qRT-PCR validation of Twist1 overexpression efficiency. (B) Cell length quantification showing OE-Twist1 promoted mesenchymal morphology. (C) Transwell invasion assay demonstrating enhanced invasive capacity upon Twist1 overexpression. (D) EdU proliferation assay showing increased proliferation in OE-Twist1 cells. Data are presented as mean ± SD (n=3). \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001.



**Supplementary Fig. 4. STAT3 knockdown suppresses malignant phenotypes in A549 cells.**

(A) qRT-PCR validation of STAT3 knockdown efficiency. (B) Cell length quantification showing sh- STAT3 induced epithelial morphology. (C) Transwell invasion assay demonstrating reduced invasive capacity upon STAT3 knockdown. (D) EdU proliferation assay showing decreased proliferation in sh- STAT3 cells. Data are presented as mean ± SD (n=3). \*\*P < 0.01, \*\*\*P < 0.001.