Supplemental Figure S1: Plate photographs showing controls for the Cytotrap Two Hybrid analysis.
cdc25 yeast cells were co-transformed with the control vectors and plated on selective media. Isolated colonies were spotted on plates containing selective medium supplemented with either glucose (repressing) or galactose (de-repressing) as sole carbon source and incubated either at 23ºC (permissive) or 37ºC (restrictive) for 3-5 days. Three colonies were spotted for each condition. (+) represents the positive controls where the two proteins are known to interact and (-) represents the negative controls where the two proteins do not interact. Growth at 37ºC in the plates containing galactose is considered a positive interaction (Blue box). NH9: NUP98-HOXA9, SB: SOS Binding protein.

Supplemental Figure S2: Purification of Rabbit anti-AES antibody from serum.
K562 cell lysates were subjected to SDS-PAGE and transferred to Hybond C-extra nitrocellulose membrane. Membrane strips were subjected to immunoblotting with 1: 2000 dilutions of the indicated serum fractions and eluates.

Supplemental Figure S3: Specificity of the anti-AES antibody
A) K562 cells were nucleofected with either empty vector or vector containing HA-tagged AES. Whole cell lysates were subjected to immunoprecipitation with the anti-AES antibody. Both input and immunoprecipitates (IP) were probed for HA-tagged AES using the anti-HA antibody.

B) K562 cells were nucleofected with empty vector or vector containing non-specific shRNA or vectors containing shRNA against AES. Lysates were subjected to SDS-PAGE and AES was detected with the anti-AES antibody. Actin was used as the loading control.

C) K562 cells were nucleofected with empty vector or vector containing non-specific shRNA or vectors containing AES shRNAs. Cytospin smears were prepared from the transfected cells and AES was detected by immunostaining with the anti-AES antibody.

D) Fluorescence intensity of AES was measured in 35 cells for each condition with Metamorph version 6.3r2 software. Error bars represent standard deviations. The P value indicated was obtained by a two-tailed t-test.

Supplemental Figure S4: AES interacts with NUP98-HOXA9 *in vitro* and *in vivo*
A) GST, GST-NUP98-HOXA9, or GST-HOXA9 were immobilized on beads and incubated with purified recombinant AES protein. The samples were subjected to SDS-PAGE and AES was detected by immunoblotting with anti AES antibody. The asterisk indicates a non-specific band that is seen both in the presence and absence of AES.

B) A portion of the samples described in S4*A* were subjected to SDS-PAGE and visualized by Coomassie blue staining.

C) Co-immunoprecipitation of NUP98-HOXA9 with AES in K562 cells transfected with HA-NUP98-HOXA9. Whole cell lysates were subjected to immunoprecipitation with either normal rabbit serum, rabbit IgG, or anti-AES antibody. NUP98-HOXA9 in the cell lysates (Input) and immunoprecipitated complexes (IP) was detected by immunoblotting with anti-HA antibody.

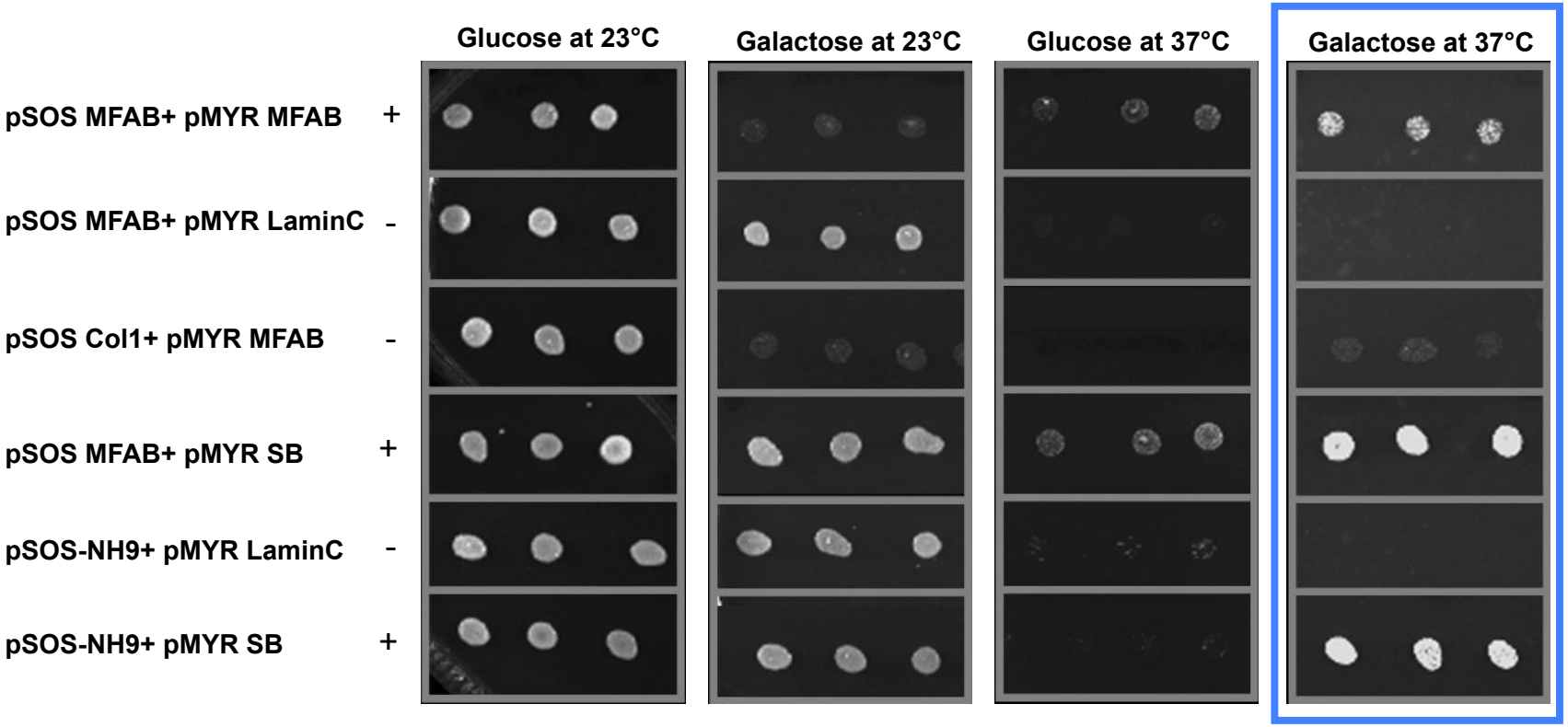
D) Co-immonoprecipitaion of AES with NUP98-HOXA9 was carried out in K562 cells containing empty vector or vector expressing HA-NUP98-HOXA9. Whole cell lysates were

subjected to immunoprecipitation with anti-HA antibody. Both input and immunoprecipitates (IP) were probed for AES using the anti-AES antibody

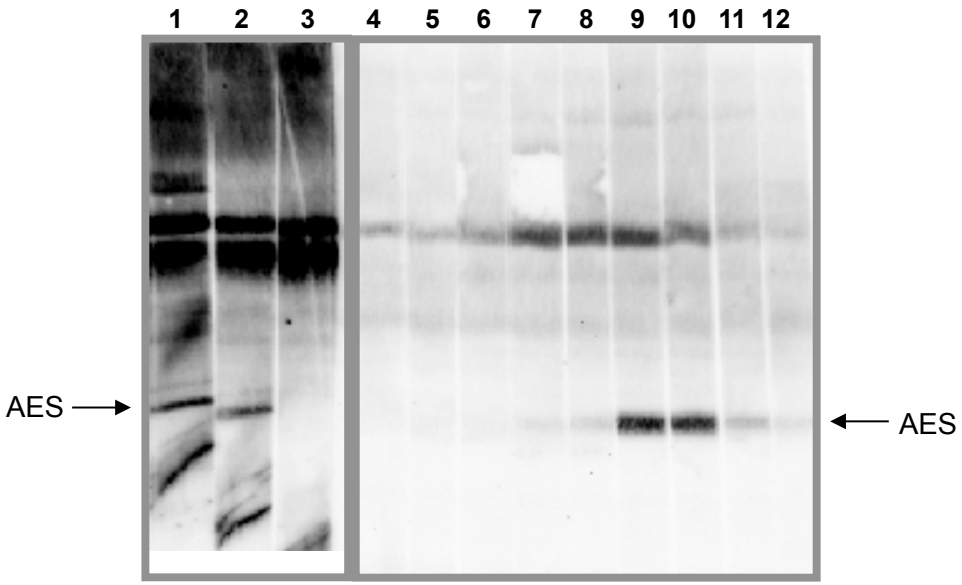
Supplemental Figure S5: Expression of AES and NUP98-HOXA9 in primary human CD34+ cells.
Primary human CD34+ cells were retrovirally transduced with either control MSCV-IRES-GFP vector or vector expressing NUP98-HOXA9 with or without empty MSCV-IRES-YFP vector or vector expressing human AES. Cells positive for both GFP and YFP were sorted and grown in liquid culture. NUP98-HOXA9 was detected with an anti-HA antibody and AES was detected with an anti-AES antibody at weeks 3,4 and 5.

Supplemental Figure S6: AES counteracts the erythroid hyperplasia caused by NUP98-HOXA9
Primary human CD34+ cells were retrovirally transduced to express AES, NUP98-HOXA9, both, or neither as described in Fig. 8. Cells positive for both GFP and YFP were sorted and 1,000 cells were seeded into each of two duplicate plates for CFC assay. Low power photomicrographs of representative erythroid colonies are shown. For quantification of the number of colonies see supplemental Table S2.

Supplemental Figure S1



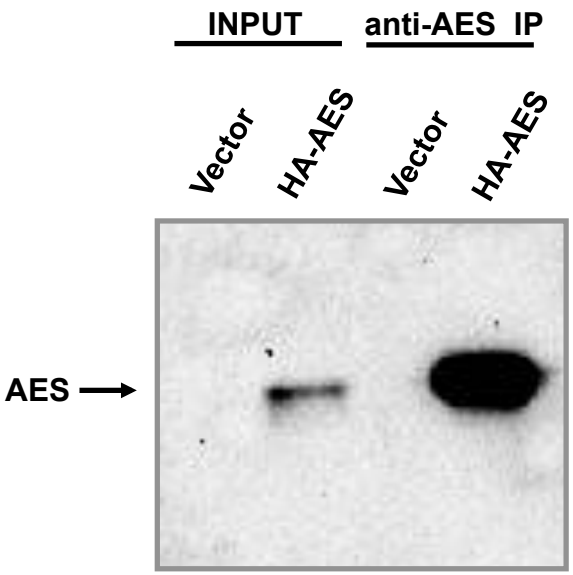
Supplemental Figure S2



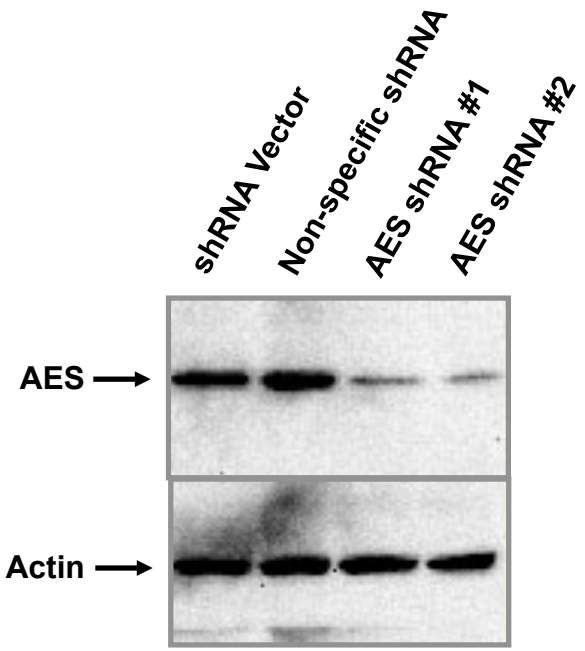
1. Anti –AES Rabbit Serum
2. Anti –AES Rabbit Serum/ Bacterial lysate Flow through
3. Anti –AES Rabbit Serum/ AES-Affigel Beads Flowthrough

4-12: Purified fractions (0.1 M Glycine) 1-9

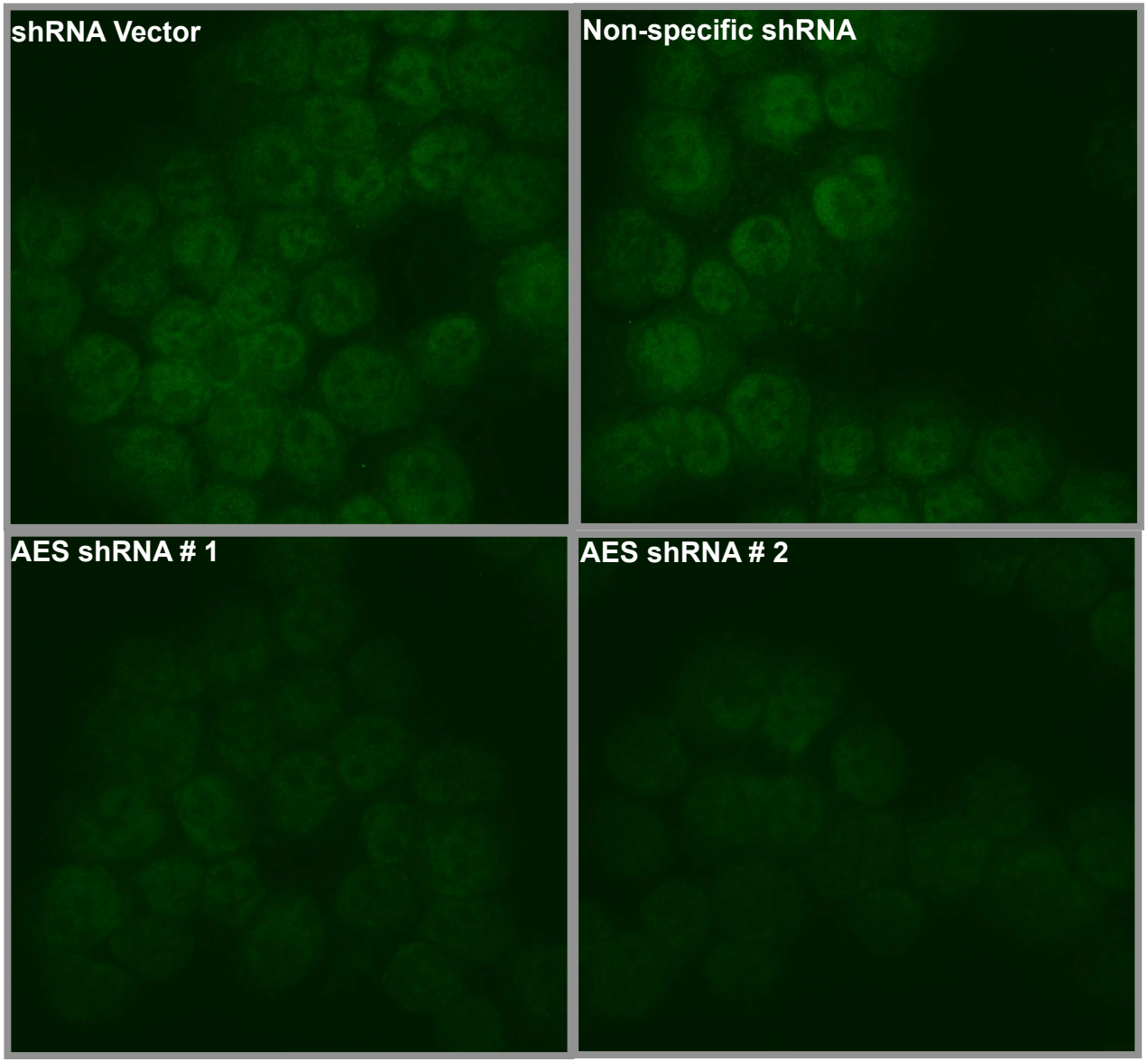
Supplemental Figure S3A



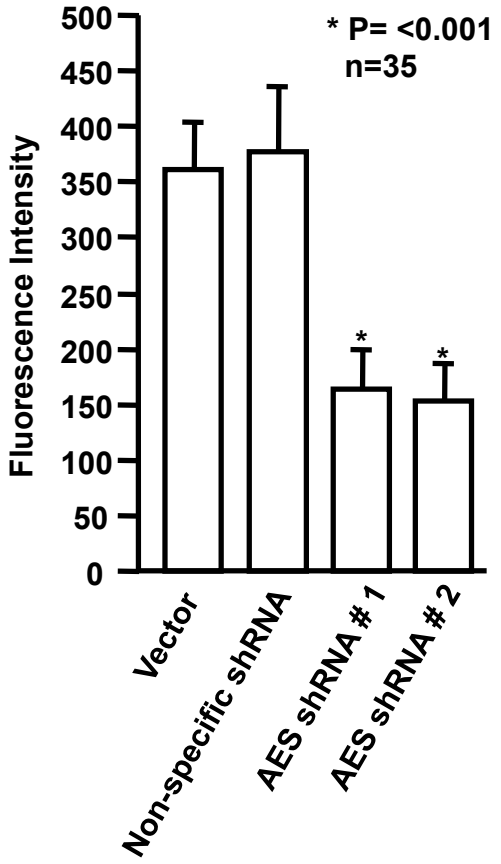
Supplemental Figure S3B



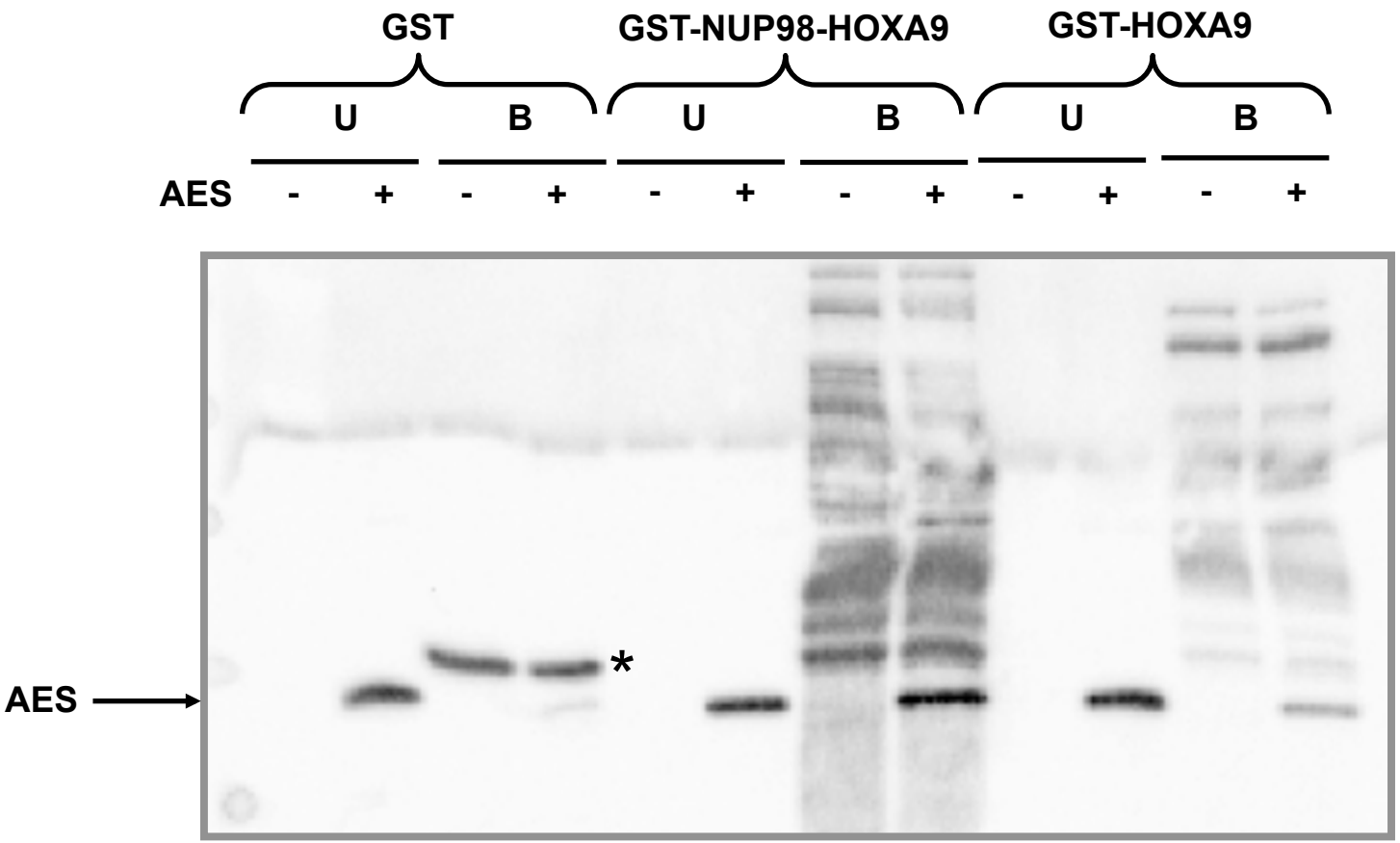
Supplemental Figure S3C



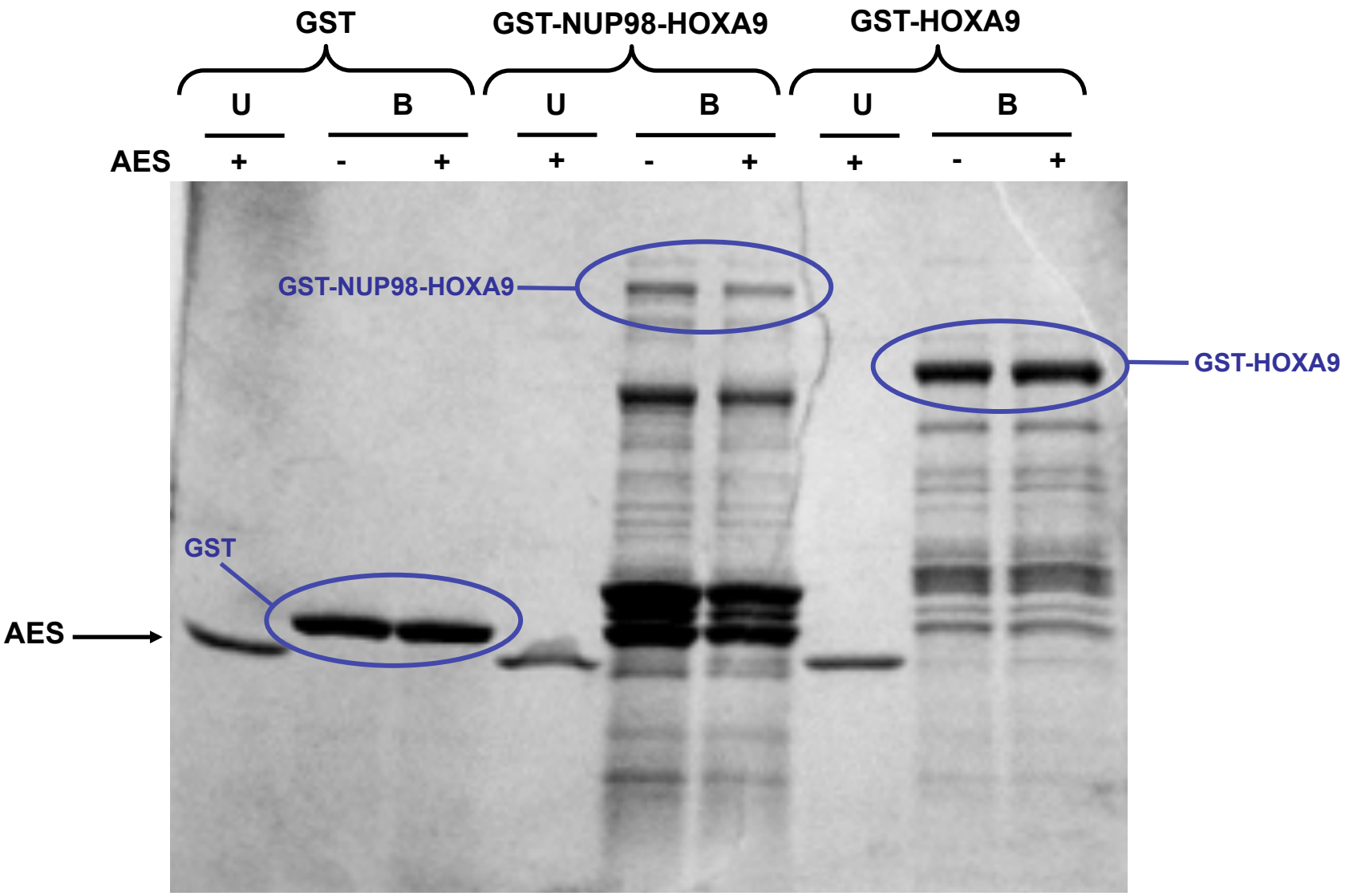
Supplemental Figure S3D



Supplemental Figure S4A



Supplemental Figure S4B



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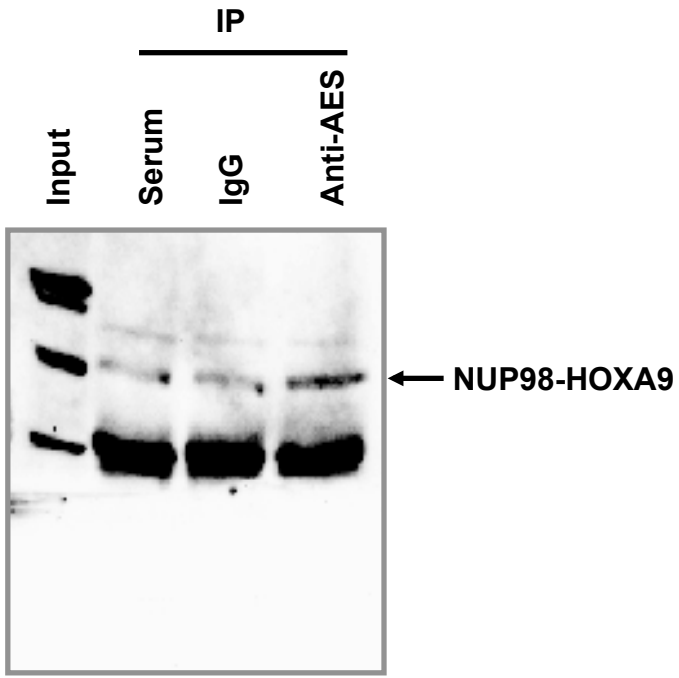
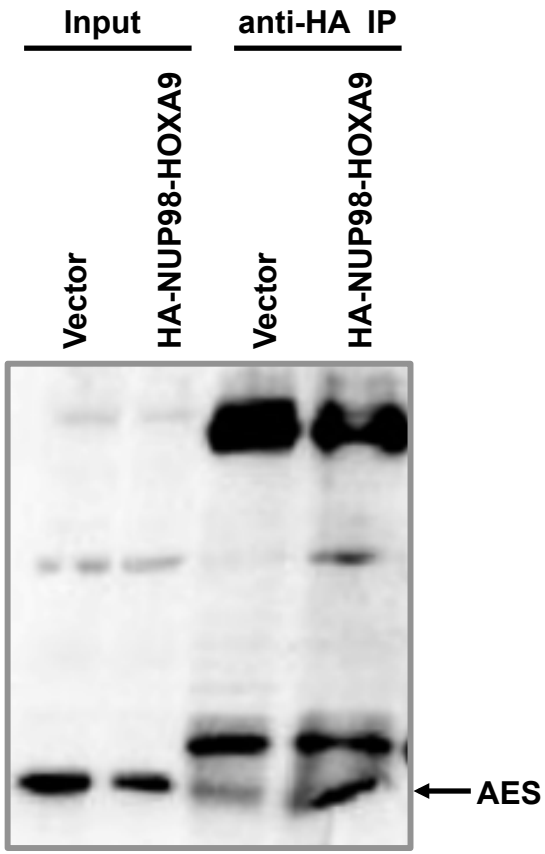
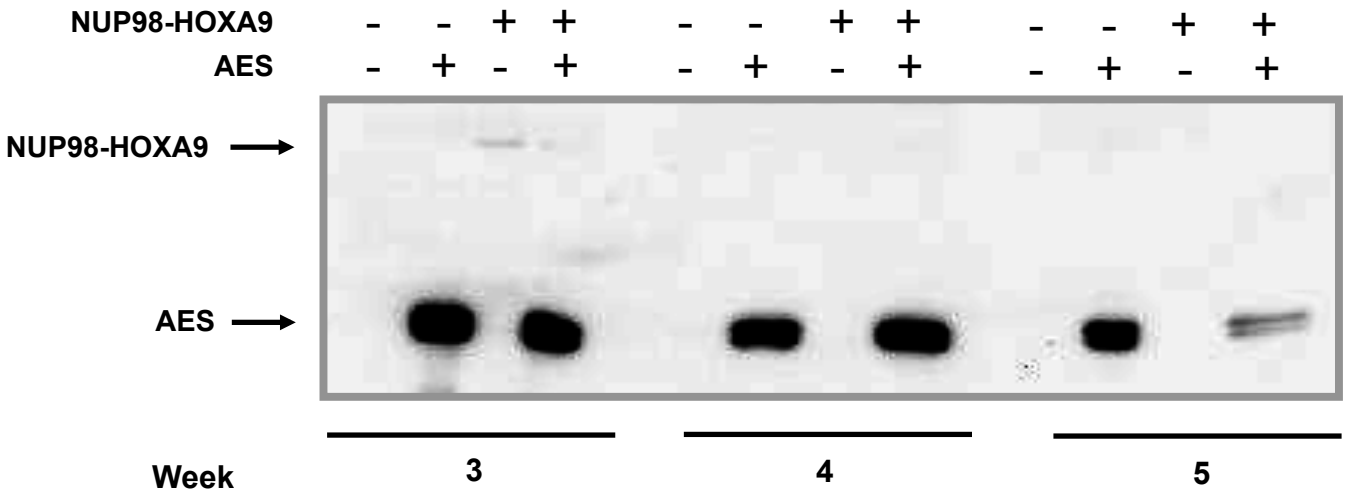


Supplemental Figure S4D



Supplemental Figure S5



Supplemental Figure S6