SUPPLEMENTARY FIGURE LEGENDS

Supplementary Figure S1. (A) Alignment of amino acids sequences of Sas10 from human (hu, accession number: NM_020368.2), mouse (mu, accession number: NM_023054.2) and zebrafish (zf, accession number: NM_001004595.1) using the software Genedoc . The Sas10/C1D domain is highlighted by a blue underline. **(B,C)** The specificity test of a rabbit polyclonal antibody (Rb poly) (**B**) and a mouse monoclonal antibody (Mus mono) (**C**) against zebrafish Sas10 using total proteins extracted from the 5-dpf old WT and *sas10*$^{\Delta 2}$ (*s*$^{\Delta 2}$) embryos. The anti-Sas10 monoclonal antibody also detected a non-specific band (lower band).

Supplementary Figure S2. (A) Alignment of amino acids sequences of Mpp10 from human (hu, accession number: NM_005791.2), mouse (mu, accession number: NM_026483.2) and zebrafish (zf, accession number: NM_001305543.1) using the software Genedoc. Red box, predicted Capn3 recognition sites; light blue underline, domain responsible for interaction with Utp3/Sas10 in yeast; purple underline, domain responsible for interaction with Imp3 in yeast; green underline, domain responsible for interaction with Imp4 in human; orange underline, domain responsible for interaction with Imp3 in human. **(B)** The specificity test of a rabbit polyclonal antibody against zebrafish Mpp10 using total protein extracted from the 5-dpf old WT and *mpp10*$^{\Delta 10}$ (*m*$^{\Delta 10}$) embryos.

Supplementary Figure S3. *sas10* is essential for the organogenesis of digestive organs. **(A)** Whole-mount in situ hybridization (WISH) using the *sas10* probe on WT unfertilized

eggs and embryos at 6hpf, 12hpf, and 1dpf to 5dpf. **(B)** Upper panel: diagram showing the *sas10* genomic DNA. Red bar, exons; blue line, introns. Lower panels: showing the DNA sequence changes in $sas10^{\Delta 8}$ and $sas10^{\Delta 2}$ two mutant alleles which are mutated in the exon4 of the *sas10* gene (red letters, deletion; blue letters, insertion; small letters: intron). **(C)** Representative images showing the overall morphology of a 5dpf-old WT and $sas10^{\Delta 2}$ ($s^{\Delta 2}$). Black arrow, cardiac region; red arrow, swimming bladder; blue arrow, eye. **(D-G)** WISH using the *prox1* **(D)** and *hhex* **(E)** probes on 30hpf- and 50hpf-old embryos, and the *gata6* **(F)** and *foxa3* **(G)** probes on 30hpf-, 50hpf- and 3dpf-old embryos as shown. The number of total embryos examined (as denominator) and the number of embryos exhibiting the displayed phenotype (as numerator) are shown at the bottom.

Supplementary Figure S4. *mpp10* is essential for the organogenesis of digestive organs. **(A)** Whole-mount in situ hybridization (WISH) using the *mpp10* probe on WT unfertilized eggs and embryos at 6hpf, 12hpf, and 1dpf to 5dpf. **(B)** Upper panel: diagram showing the *mpp10* genomic DNA. Red bar, exons; blue line, introns. Lower panels: showing the DNA sequence changes in $mpp10^{\Delta 10}$ and $mpp10^{+2}$ two mutant alleles which are mutated in the exon2 of the *mpp10* gene (red letters, deletion; blue letters, insertion). **(C)** Representative images showing the overall morphology of a 5dpf-old WT and $mpp10^{\Delta 10}$ ($m^{\Delta 10}$). Black arrow, cardiac region; red arrow, swimming bladder; blue arrow, eye. **(D-G)** WISH using the *prox1* **(D)** and *hhex* **(E)** probes on 30hpf- and 50hpf-old embryos, and the *gata6* **(F)** and *foxa3* **(G)** probes on 30hpf-, 50hpf- and 3dpf-old embryos. The number of total embryos genotyped (as denominator) and the number of embryos exhibiting the displayed phenotype (as numerator) are shown at the bottom.

Supplementary Figure S5. Small liver phenotype in *sas10*$^{\Delta 2}$ and *mpp10*$^{\Delta 10}$ is due to cell cycle arrest. **(A)** Co-immunostainings of phosphorylated-Histone 3 (P-H3) and Bhmt were performed on cryosections of WT, *sas10*$^{\Delta 2}$ and *mpp10*$^{\Delta 10}$ embryos at 2.5dpf. **(B)** Histogram showing the statistic analysis of P-H3-positive cells (red) against total cells counted in the liver area (Bhmt-positive, green) and in the neural tube. For each genotype, at least 17 cryosections from three embryos were used in counting P-H3-positive cells. Bar: 20μm.

Supplementary Figure S6. (A) *sas10*$^{\Delta 2}$ and *mpp10*$^{\Delta 10}$ mutant embryos did not show abnormal apoptotic activities. TUNEL assay was performed on cryosections of WT, *sas10*$^{\Delta 2}$ and *mpp10*$^{\Delta 10}$ embryos at 5dpf. The liver area was defined by immunostaining of Bhmt (green). Compared to the WT embryos, no abnormal apoptotic activities were observed in *sas10*$^{\Delta 2}$ and *mpp10*$^{\Delta 10}$ mutant embryos. DNaseI treated embryos were used as the positive control for apoptotic cells (red). At least 16 cryosections from three embryos were examined. Bar: 50μm. **(B)** Northern blot analysis of rRNA precursors using the 18S-F (left panel) and 18S-B (right panel) probes in 5dpf-old WT, *sas10*$^{\Delta 2}$ (*s*$^{\Delta 2}$) and *mpp10*$^{\Delta 10}$ (*m*$^{\Delta 10}$) embryos. 28S: loading control.

Supplementary Figure S7. (A) Sas10 directly interacts with Mpp10. *sas10* and *mpp10* coding sequences were cloned to the vector harboring the Gal4-activation domain (AD-V, vector; AD-S, AD-Sas10; AD-M, AD-Mpp10) or the vector harboring DNA-binding domain (BD-V, vector; BD-S, BD-Sas10; BD-M, BD-Mpp10), respectively, for yeast two-hybrid experiments as shown. Mpp10 showed an auto-activation activity (AD-V + BD-M

panel). **(B)** His-tagged Capn3 and Capn3^{C129S} (C129S) expressed in the SF9 cells were purified using the Ni-NTA agarose beads. Proteins in different purification process were stained by Coomassie brilliant blue. CE, total protein extract from the cultured cells; FT, flow-through protein; wash1-3, supernatant collected after the beads being washed with washing buffer; elute1, eluted protein from the beads. Red arrow, Capn3; Black arrow, Capn3^{C129S}. Smaller fragments in the elute1 sample likely represent the cleaved or early termination of translation products harboring the His-tag. **(C)** Western blot of Capn3 and Capn3^{C129S} in different purification process using the anti-Capn3 antibody. Since this anti-Capn3 antibody was raised using the C-terminal 610-640 aa as the antigen, it cannot detect C-terminus-truncated Capn3 observed in the elute1 shown in **(B)**. WT Capn3 exhibited quick autocleavage after purification and majority of WT Capn3 displayed a smaller sizes compared with Capn3^{C129S} (C129S). *, cleaved Capn3 fragments. **(D,E)** His-tagged Mpp10 **(D)** and Mpp10-X **(E)** expressed in the *E.coli* were purified using the Ni-NTA agarose beads. Proteins in different purification process were stained by Coomassie brilliant blue. none-induced, total protein from *E.coli* without IPTG induction (as a negative control); induced, total protein from *E.coli* with IPTG induction; supernatant, soluble proteins after centrifugation of the cell lysates; pellet, insoluble proteins after centrifugation of the cell lysates; FT, flow-through proteins; wash1-3, supernatant after the beads being washed with washing buffer; elute1-5, eluted proteins from the beads. Red arrow, Mpp10; Black arrow, Mpp10-X.

Supplementary Figure S8. Mpp10 is a Capn3 target. **(A)** Cell lysates containing Capn3 or its inactive mutant Capn3^{C129S} (C129S) were mixed with Ni-NTA beads purified Mpp10.

Reaction mixture containing 3 mM Ca^{2+} was incubated at 37ºC for different time intervals (minutes) as indicated. **(B)** Cell lysates containing Capn3 and Mpp10 were mixed and placed on ice for 0, 10 and 30 min. **(C)** Western blot of Mpp10, Capn3b and β-Actin in the WT and *capn3b*$^{-/-}$ mutant. Total proteins were extracted from 5dpf-old embryos. Value below the figures indicated the relative intensity of Mpp10/Actin where WT was taken as 1.0.

Supplementary Figure S9. Nucleolus-localisation of Mpp10 depends on Sas10. **(A)** *HA-Sas10* plasmid transfected 293T cells were co-stained with antibodies against Sas10 and HA-tag. *Myc-Mpp10* plasmid transfected 293T cells were co-stained with antibodies against Mpp10 and Myc-tag. Untransfected cells were used as the negative control. Bar, 10μm. **(B)** HA-Sas10, Myc-Mpp10 were over-expressed alone or together in 293T cells. The cells were subjected to immunostaining using antibodies against HA-tag, Myc-tag or Fib as indicated. Bar, 10μm. **(C)** Immunostaining of HA-Sas10 or HA-Sas10-s5 (lacking the Mpp10-interacting domain) over-expressed in 293T cells using antibodies against HA-tag or Fib as indicated. Bar, 10μm.

Supplementary Figure S10. (A,B) *HA-sas10* or *HA-sas10-s5* mRNA was injected into one-cell stage WT and *sas10*$^{\Delta 2}$ (*s*$^{\Delta 2}$) embryos, respectively. Total proteins were extracted at 28 hour post injection (hpi) for Western blot of Mpp10, Sas10 and Tub **(A)**. The signal of maternal Sas10 in *s*$^{\Delta 2}$ were low but still distinguishable. The nonspecific band detected by Mpp10 antibody is likely due to protein extraction without deyolk. Embryos were also fixed and sectioned for co-immunostaining of Mpp10 and Fib **(B)**. The big box shows the

high magnification view of the nucleoli in the small box. The nucleolus-localisation of Mpp10 was only detected in WT and $s^{\Delta 2}$ injected with *HA-sas10* mRNA but not in $s^{\Delta 2}$ and $s^{\Delta 2}$ injected with *HA-sas10-s5* mRNA. Bar, 5μm. **(C)** *Myc-Mpp10* was co-expressed with HA-Imp3 or HA-Imp4 in 293T cells for Co-IP analysis using an anti-HA antibody. Mpp10 was detected with its specific antibody and Imp3 and Imp4 were detected with anti-HA antibody.

Supplementary Table S1. List of key resources and notes.

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Antibodies		
Mouse monoclonal Bhmt antibody	Huabio	Hangzhou, China, Clone# D5G5
Mouse monoclonal Fibrillarin antibody	Abcam	Cat# ab4566; Clone# 38F3
Mouse monoclonal α-Tubulin antibody	Beyotime	Cat# AT819-1; Clone# B-5-1-2
Mouse monoclonal HA antibody	Beyotime	Cat# AH158; Clone# HA-7
Mouse monoclonal Sas10 antibody	Huabio	Hangzhou, China, Clone# E4D4
Rabbit polyclonal β-Actin antibody	Huabio	Hangzhou, China, Clone# 1207-1
Rabbit polyclonal Sas10 antibody	Huabio	Hangzhou, China, Clone# 3382
Rabbit polyclonal Mpp10 antibody	Huabio	Hangzhou, China, Clone# 3570
Rabbit polyclonal Def antibody	Huabio	Hangzhou, China, Clone# 3203L
Rabbit polyclonal Capn3 antibody	Abcam	Cat# ab103250; Clone# N/A; RRID: N/A
Rabbit polyclonal HA antibody	Sigma-Aldrich	Cat# H6908; Clone# N/A; RRID: I2149
Rabbit polyclonal C-Myc antibody	Huabio	Cat# 0912-2; Clone# N/A; RRID: N/A
Chemicals		
AciI (SsiI) restriction enzyme	Thermo Scientific	Cat# ER1791
Albumin Bovine Fraction V	HXbio	Cat# D332
Anti-Digoxigenin-AP Fab fragments	Roche	Cat# 11093274910
Adhesion Microscope Slides	Citoglas	Cat# 188105
Anti-HA-Tag mAb (Agarose conjugated)	Abmart	Cat# M20013
Anti-Myc-Tag mAb (Agarose conjugated)	Abmart	Cat# M20012
Benzyl alcohol	Sigma-Aldrich	Cat# 402834
Benzyl benzoate	Sigma-Aldrich	Cat# B6630
CDP-Star	Roche	Cat# 12041677001
Cell lysis buffer for Western and IP	Beyotime	Cat# P0013
cOmplete, EDTA-free	Roche	Cat# 16829800
Difco™ Yeast Nitrogen Base w/o Amino Acids	Becton, Dickinson and Company	Cat# 291940
DMEM High Glucose	Biological Industries	Cat# 06-1055-57-1ACS
DNase I	Thermo Scientific	Cat# EN0521
Fetal Bovine Serum	Gibco	Cat# 10270

HisSep Ni-NTA Agarose Resin	YEASEN	Cat# 20502ES10
Pierce™ Protein Concentrator PES	Thermo Scientific	Cat# 88529
Phosphate Buffered Saline	Biological Industries	Cat# 02-024-1ACS
Poly(ethylene glycol)	Sigma-Aldrich	Cat# P4338
PolyJet	SignaGen	Cat# 100688
TRIpure Reagent	Aidlab	Cat# RN01
Trypsin-EDTA	Bio-light Biotech	Cat# BL-025TE-00
PvuII restriction enzyme	New England Biolabs	Cat# R0151S
Sf-900™ II SFM	Gibco	Cat# 10902088
Critical Commercial Assays		
BCIP/NBT	Beyotime	Cat# C3206
Cell lysis buffer for Western and IP	Beyotime	Cat# P0013
DIG RNA Labeling Mix,10x conc.	Roche	Cat# 11277065910
DIG RNA Labeling Mix,10x conc.	Roche	Cat# 11277073910
EasySee Western Blot Kit	Trans	Cat# DW101-02
In Situ Cell Death Det. Kit TMR red	Roche	Cat# 12156792910
Maxi ECL Substrate	Sunky	Cat# 61804
PCR Cleanup Kit	Axygen	Cat# 156
p-Histone H3	Santa Cruz	Cat# SC-8656-R
Plasmid Miniprep Kit	Axygen	Cat# 155
Matchmaker® Gold Yeast Two-Hybrid System	Clontech	Cat# PT4084-1
Experimental Models: Cell Lines		
Human: HEK293T cells	ATCC	Cat# CRL-3216; RRID: CVCL_0063
Experimental Models: Zebrafish		
Zebrafish: AB	Singapore	N/A
Zebrafish: sas10$^{\Delta 2}$	This paper	N/A
Zebrafish: mpp10$^{\Delta 10}$	This paper	N/A
Oligonucleotides		
Primers for *sas10* gRNA, Forward: 5'-TAATACGACTCACTATAgaagaggatga agataaagGTTTTAGAGCTAGAAATAGC-3'	This paper	N/A
Primers for *mpp10* gRNA, Forward: 5'-TAATACGACTCACTATAggtggttgaaaa cttcgacgGTTTTAGAGCTAGAAATAGC-3'	This paper	N/A
Primers for *sas10* mutant ID, Forward:	This paper	N/A

5’-GACAGTGATGATCCTGAAGCGT-3’		
Primers for *sas10* mutant ID, Reverse: 5’-TCTAGATCGCTCTCCATGTCTG-3’	This paper	N/A
Sequencing primers 1 for *sas10*, Forward: 5’-AGAGGAAGACGAGGCTACAA-3’	This paper	N/A
Sequencing primers 2 for *sas10*, Forward: 5’-GCGCTTCTATAACGCCATGG-3’	This paper	N/A
Primer: Sas10(1-470aa), Forward: 5’-CGCGGATCCATGGTCCGAGCAAGA-3’	This paper	N/A
Primer: Sas10(1-470aa), Reverse: 5’-TCCCCCGGGGAGTTTGACACTTCT-3’	This paper	N/A
Primer: 5’ETS probe, Forward: 5’- CCGGTCTACCTCGAAAGTCC-3’	This paper	N/A
Primer: 5’ETS probe, Reverse: 5’-CGAGCAGAGTGGTAGAGGAA-3’	This paper	N/A
Primer: ITS1 probe, Forward: 5’-CTCGGAAAACGGTGAACCTG-3’	This paper	N/A
Primer: ITS1 probe, Reverse: 5’-GTGTTCGTTTCAGGGTCCGA-3’	This paper	N/A
Primer: 18S F probe, Forward: 5’-ATCGCTCCATCCGTTACTTG-3’	This paper	N/A
Primer: 18S F probe, Reverse: 5’-GCGCCTAAAGTACCATCGAA-3’	This paper	N/A
Primer: 18S F probe, Forward: 5’-ACGCGAGATGGAGCAATAAC-3’	This paper	N/A
Primer: 18S F probe, Reverse: 5’-CCTCGTTGATGGGAAACAGT-3’	This paper	N/A
Primer: Sas10(1-150aa), Reverse: 5’-TCCCCCGGGCTCAATTTCTTCAAG-3’	This paper	N/A
Primer: Sas10(1-320aa), Reverse: 5’-TCCCCCGGGACGCAGTTGAGGAGC-3’	This paper	N/A
Primer: Sas10(100-320aa), Forward: 5’-CGGGATCCGATGATGAGGAAGAT-3’	This paper	N/A
Primer: Sas10(200-470aa), Forward: 5’-CGGGATCCGTGAAAGATTTAAAG-3’	This paper	N/A
Primers for *mpp10* mutant ID, Forward: 5’-AGTGTCCAGGATGTTTTGGCA-3’	This paper	N/A
Primers for *mpp10* mutant ID, Reverse: 5’-TCCAAATCGGAGTCTTCGCC-3’	This paper	N/A
Sequencing primers 1 for *mpp10*, Forward:	This paper	N/A

5’-AACCGAACTGGACTCAGTCT-3’		
Sequencing primers 2 for *mpp10*, Forward: 5’-AATGGCTCCTGCAATCACTG-3’	This paper	N/A
Sequencing primers 3 for *mpp10*, Forward: 5’-TTGCGGTCTTCTCAGGCCTT-3’	This paper	N/A
Primer: Mpp10(1-695aa), Forward: 5’-CCGGAATTCATGGCGACGAGGGAT-3’	This paper	N/A
Primer: Mpp10 (1-695aa), Reverse: 5’-CGCGGATCCTTACAGCTTGAGTTT-3’	This paper	N/A
Primer: Mpp10 (1-230aa), Reverse: 5’-CGGGATCCCTCCCCTTCATTCCC-3’	This paper	N/A
Primer: Mpp10 (1-440aa), Reverse: 5’-CGGGATCCTTTGATGATATCCTC-3’	This paper	N/A
Primer: Mpp10 (231-560aa), Forward: 5’-CGGAATTCGAAATTGATTACTTT-3’	This paper	N/A
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Primer: Mpp10 (211-220aa deletion), Reverse: 5’- ATTCCCTTTTCCCTCTCTTTTTTCTGA CAGTTTAAAAAACGTGTCATCCAC-3’	This paper	N/A
Primer: Imp3, Forward: 5’- CGGGATCCGTACGTAAATTAAAATTTCACGAGC-3’	This paper	N/A
Primer: Imp3, Reverse: 5’- CGGAATTCTTAGGCCATGAGGTCAAAGT-3’	This paper	N/A
Primer: Imp4, Forward: 5’- CGGGATCCCTGCGACGGGAAGTGAGACT-3’	This paper	N/A
Primer: Imp3, Reverse:	This paper	N/A

5’- CGGGATCCCTATTCCACGCTCAAGAATT-3’		
Recombinant DNA		
pCS2+-Sas10	This paper	N/A
pCS2+-HA-Sas10	This paper	N/A
pCS2+-HA-Sas10(1-150aa)	This paper	N/A
pCS2+-HA-Sas10(1-320aa)	This paper	N/A
pCS2+-HA-Sas10(100-320aa)	This paper	N/A
pCS2+-HA-Sas10(200-470aa)	This paper	N/A
pCS2+-HA-Sas10(226-307aa deletion)	This paper	N/A
pCS2+-Mpp10	This paper	N/A
pCS2+-HA-Mpp10	This paper	N/A
pCS2+-Myc-Mpp10	This paper	N/A
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pCS2+-Myc-Def	(29)	N/A
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pcDNA^{+}-HA-Capn3	(29)	N/A
pcDNA^{+}-HA-Capn3C129S	(29)	N/A
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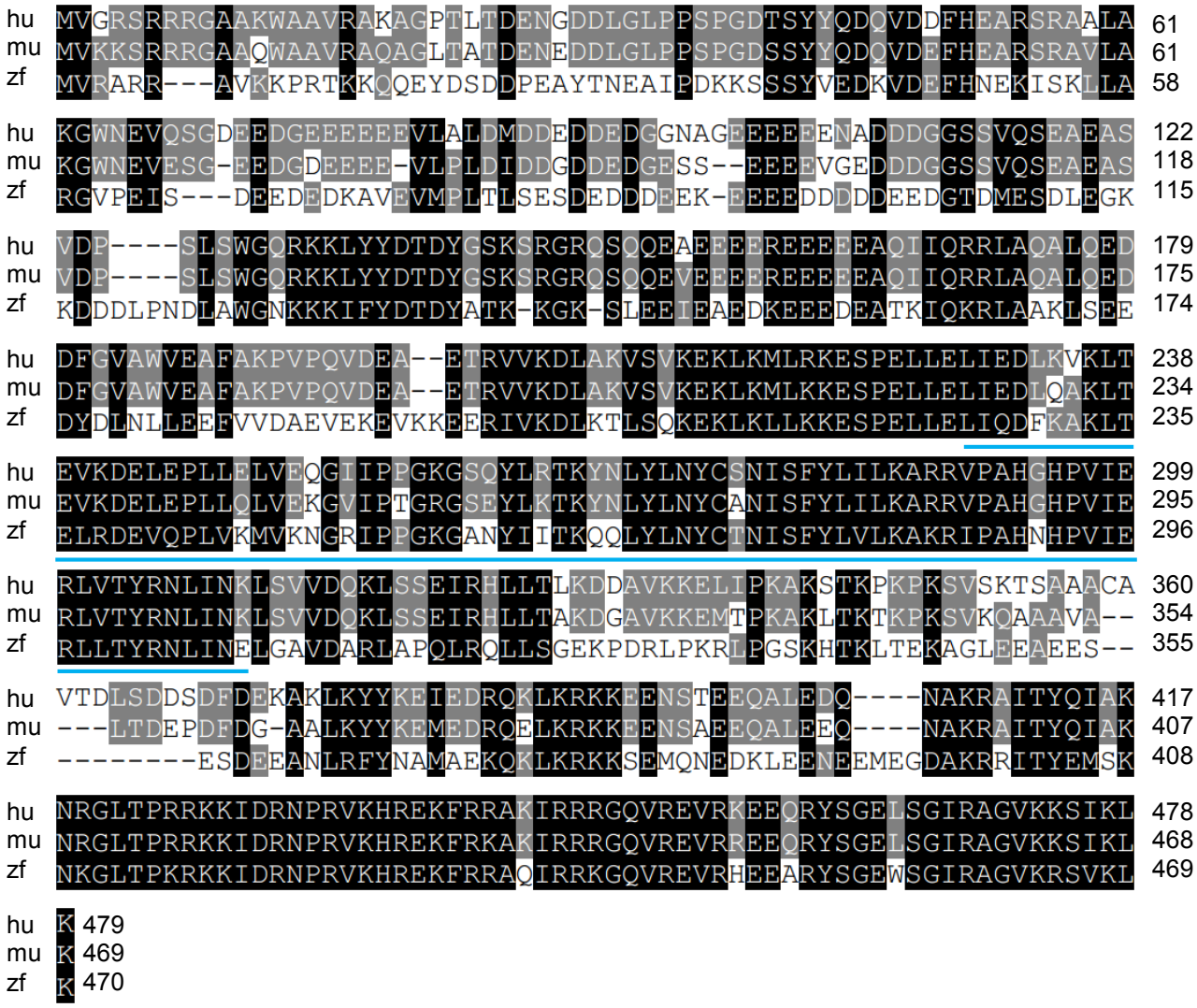
pcDNA^{+}- Capn3C129S	(29)	N/A
pFastBac-Capn3	(29)	N/A
pFastBac-Capn3C129S	(29)	N/A
pGAD-Sas10	This paper	N/A
pGAD-Mpp10	This paper	N/A
pGBK-Sas10	This paper	N/A
pGBK-Mpp10	This paper	N/A
Software and Algorithms		
Motif Scan	MyHits database	https://myhits.isb-sib.ch/cgi-bin/motif_scan

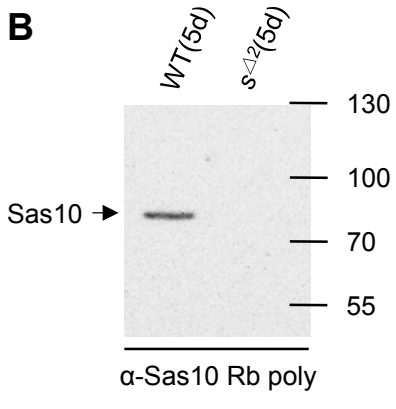
Figure S1

A



[Sas10/Utp3/C1D family]

B



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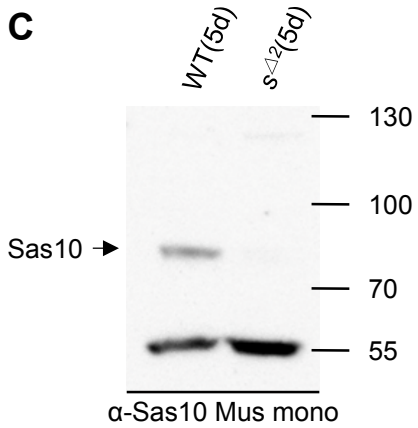
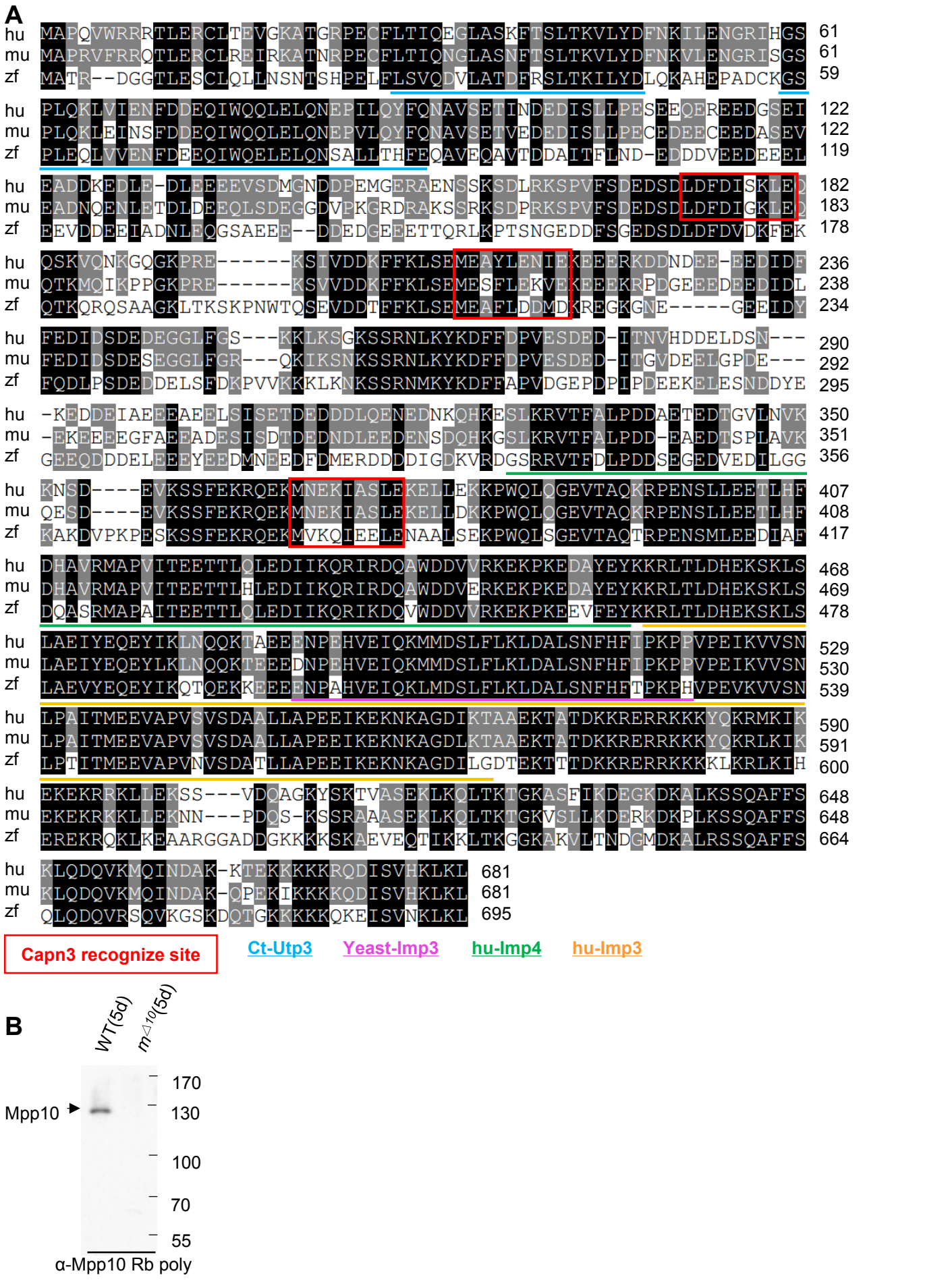


Figure S2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mu
zf
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Yeast-Imp3
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hu-Imp3
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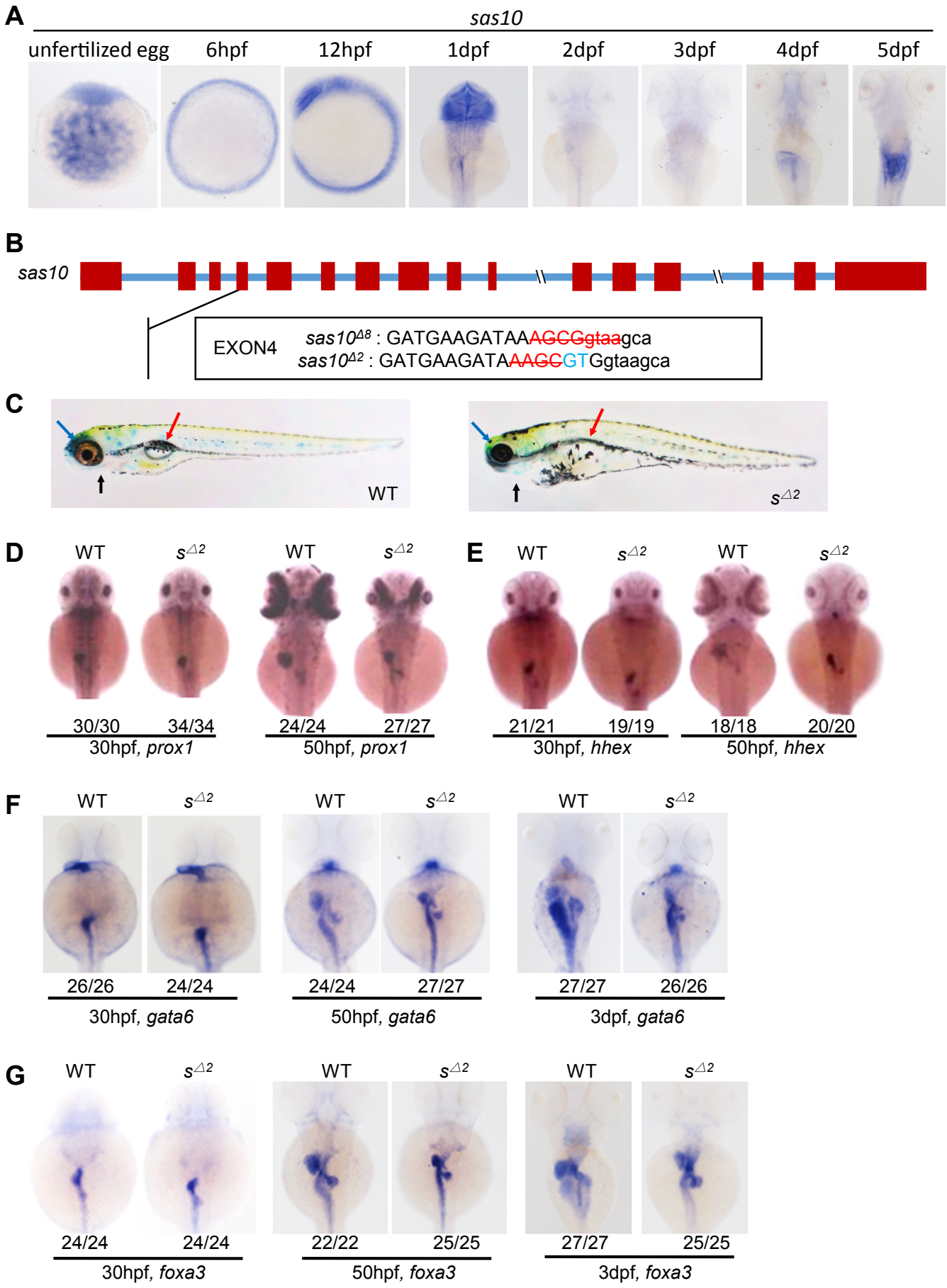
m△10(5d)
Mpp10
170
130
100
70
55
α-Mpp10 Rb poly

Figure S3


A
sas10
unfertilized egg
6hpf
12hpf
1dpf
2dpf
3dpf
4dpf
5dpf
B
sas10
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sas10Δ2 : GATGAAGATAAAGCGTGgtaagca
C
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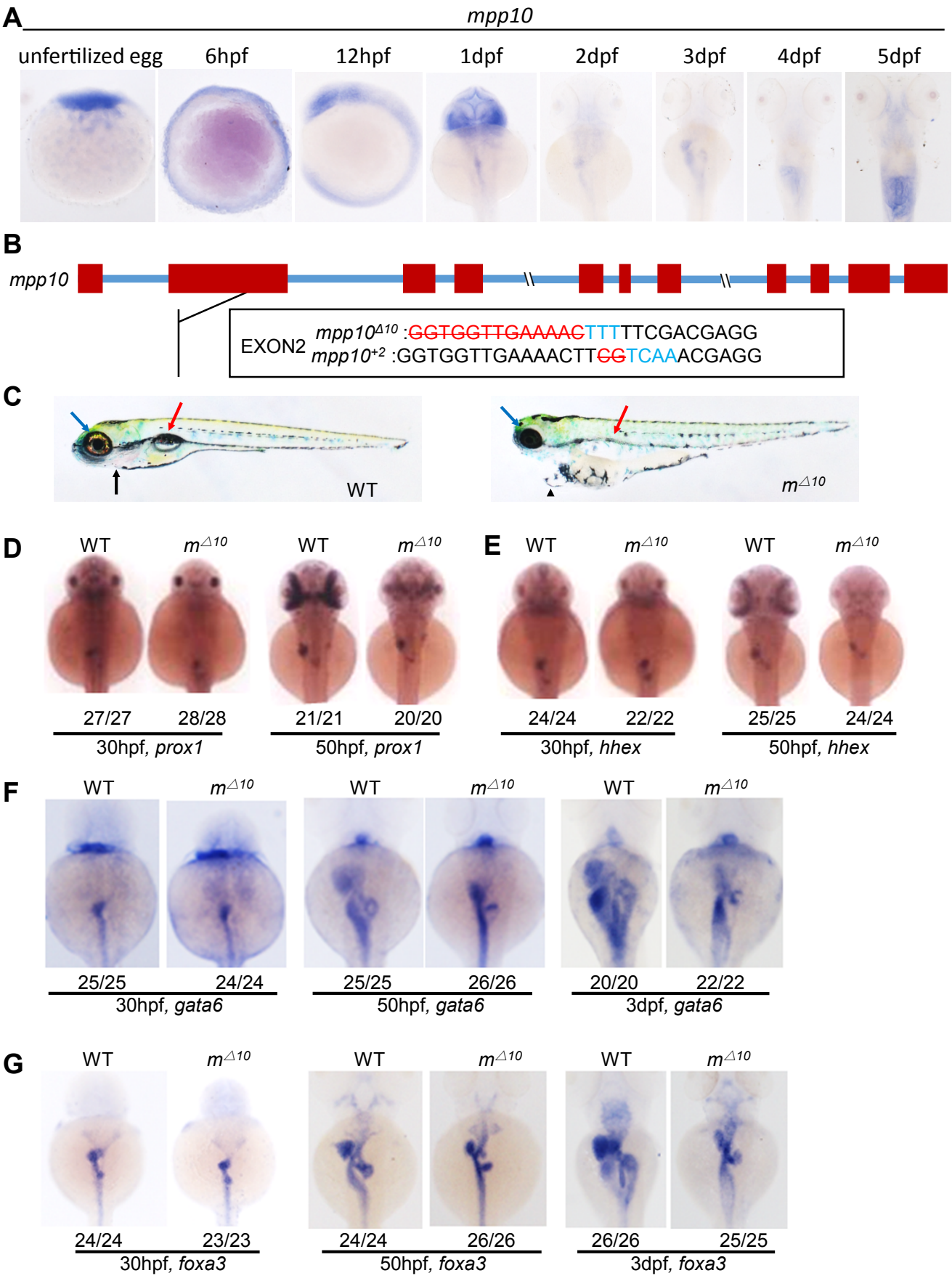
Figure S4


A
mpp10
unfertilized egg
6hpf
12hpf
1dpf
2dpf
3dpf
4dpf
5dpf
B
mpp10
EXON2
mpp10Δ10 :GGTGGTTGAAAACTTTTTCGACGAGG
mpp10+2 :GGTGGTTGAAAACTTCGTCAAACGAGG
C
WT
mΔ10
D
WT
mΔ10
WT
mΔ10
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20/20
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WT
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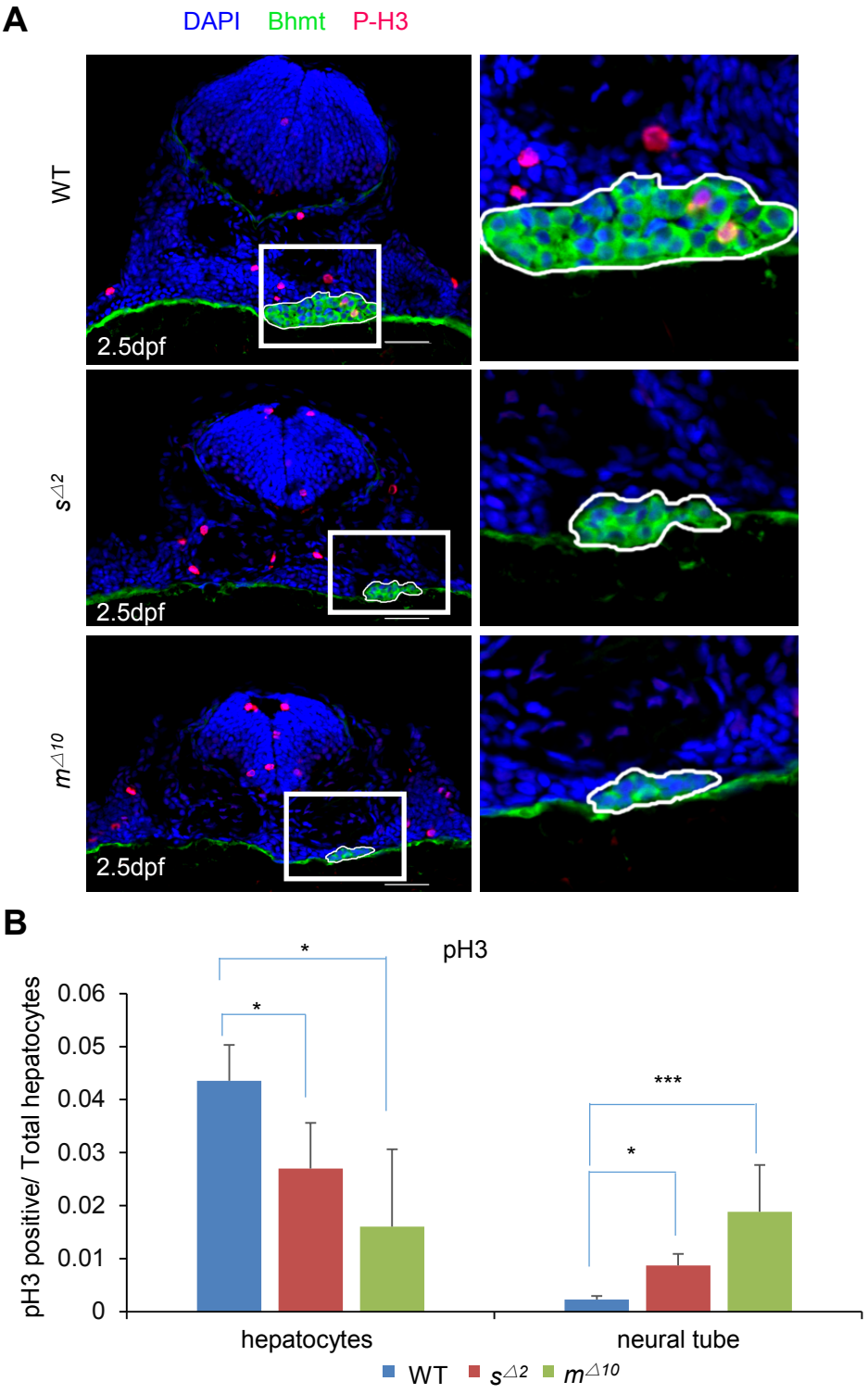
3dpf, foxa3

Figure S5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WT
s△2
m△10
2.5dpf
2.5dpf
2.5dpf
B
pH3
pH3 positive/ Total hepatocytes
0.06
0.05
0.04
0.03
0.02
0.01
0
*
*
***
*
hepatocytes
neural tube
WT
s△2
m△10

Figure S6

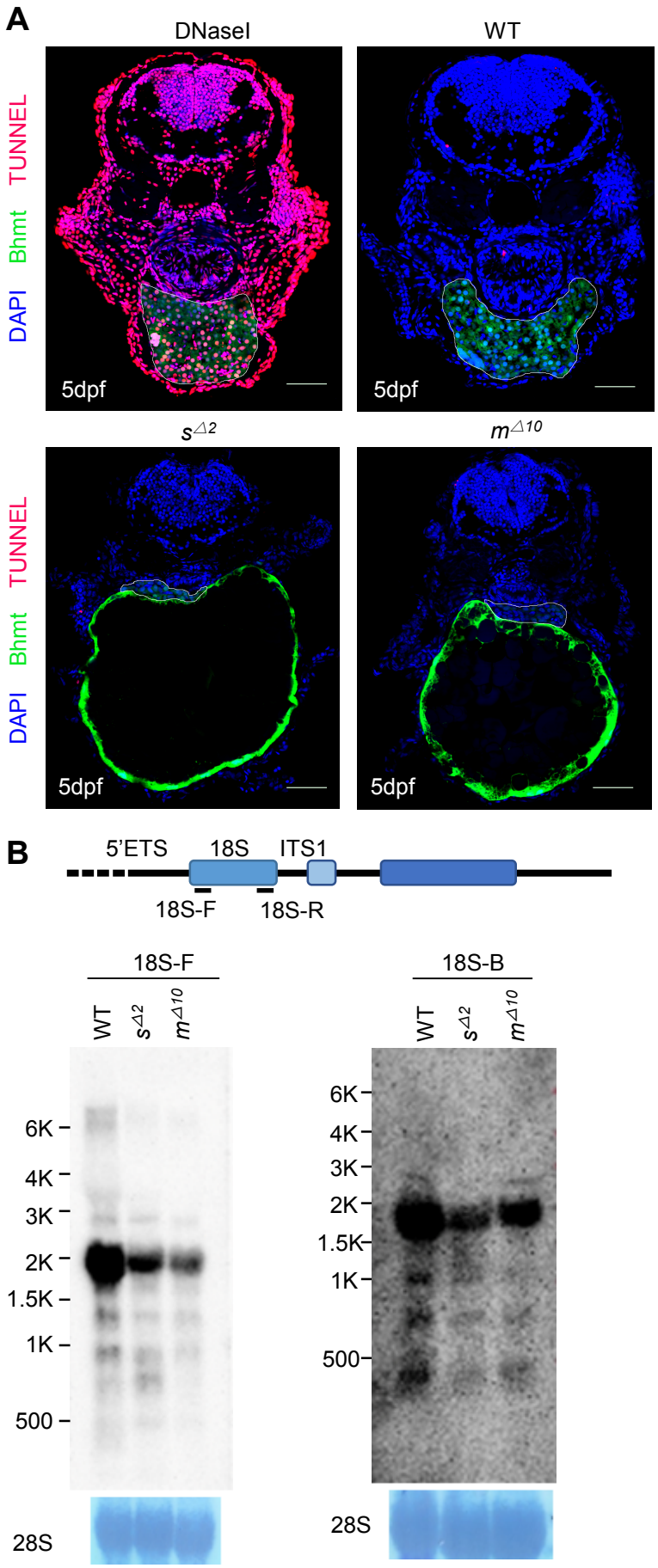
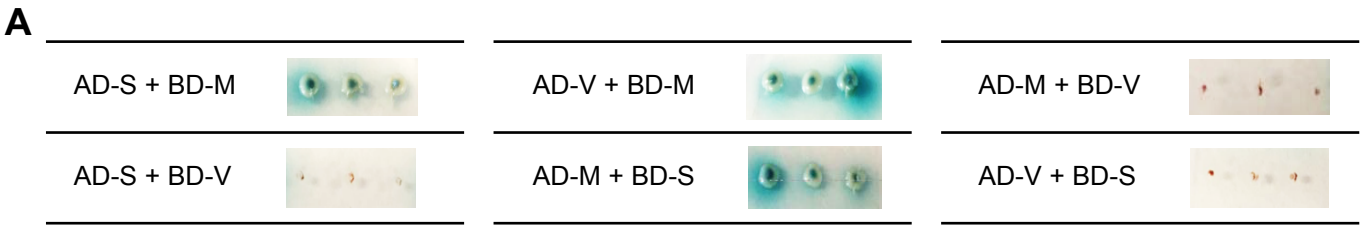
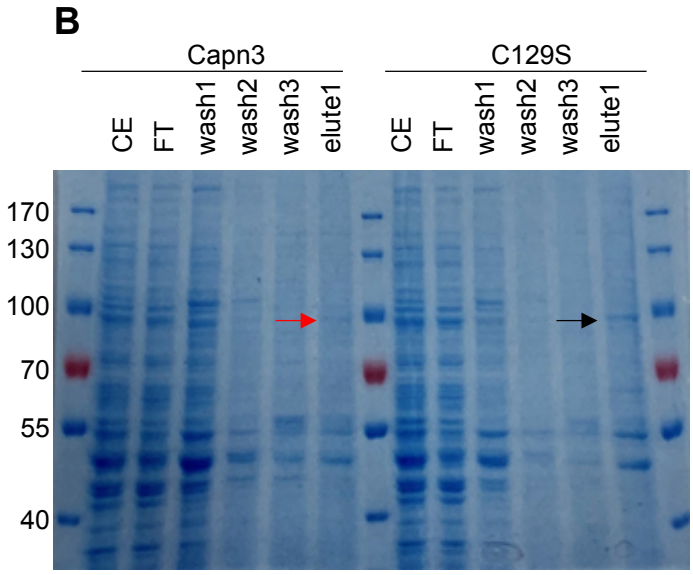
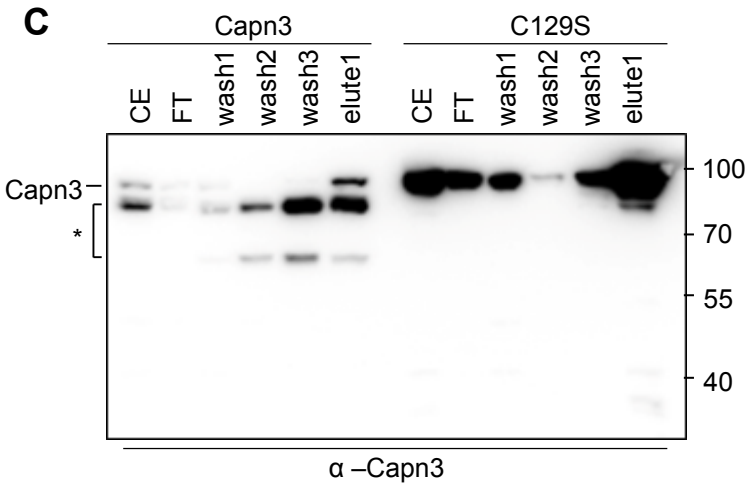

A
DNaseI
WT
TUNNEL
Bhmt
DAPI
5dpf
5dpf
s△2
m△10
TUNNEL
Bhmt
DAPI
5dpf
5dpf
B
5'ETS
18S
ITS1
18S-F
18S-R
18S-F
18S-B
WT
s△2
m△10
WT
s△2
m△10
6K
4K
3K
2K
1.5K
1K
500
6K
4K
3K
2K
1.5K
1K
500
28S
28S

Figure S7

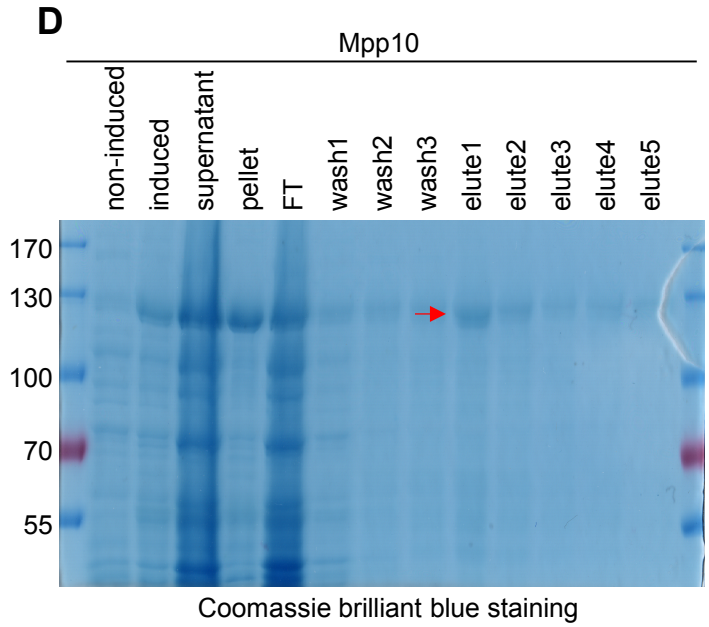




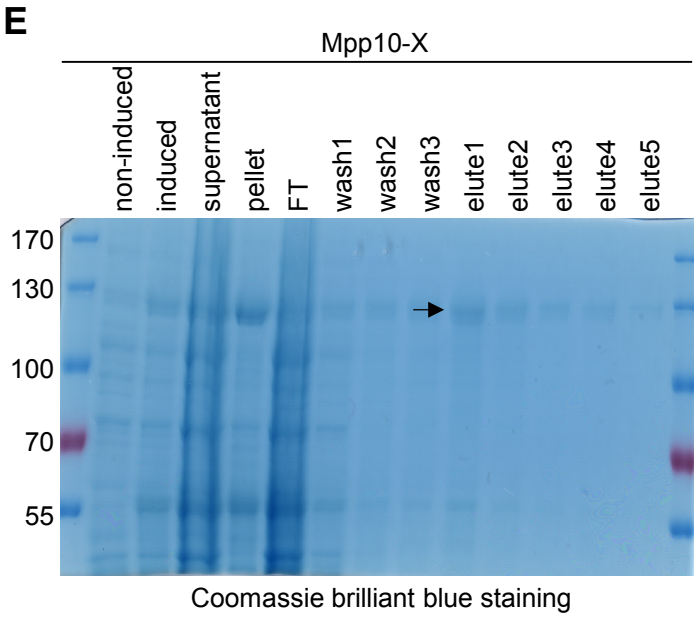
Coomassie brilliant blue staining



α –Capn3



Coomassie brilliant blue staining



Coomassie brilliant blue staining

Figure S8

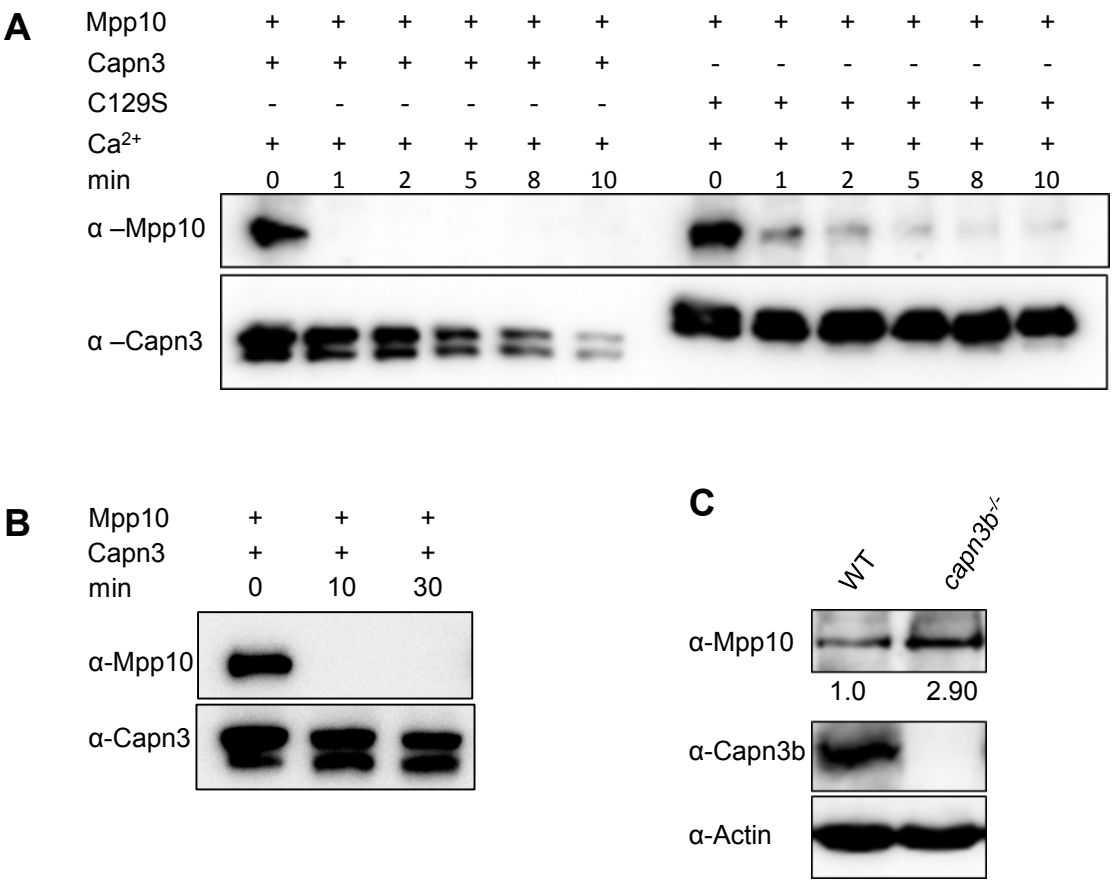

A
Mpp10 + + + + + + + + + + + +
Capn3 + + + + + + - - - - - -
C129S - - - - - - + + + + + +
Ca2+ + + + + + + + + + + + +
min 0 1 2 5 8 10 0 1 2 5 8 10
α –Mpp10
α –Capn3
B
Mpp10 + + +
Capn3 + + +
min 0 10 30
α-Mpp10
α-Capn3
C
WT
capn3b-/-
α-Mpp10
1.0 2.90
α-Capn3b
α-Actin

Figure S9

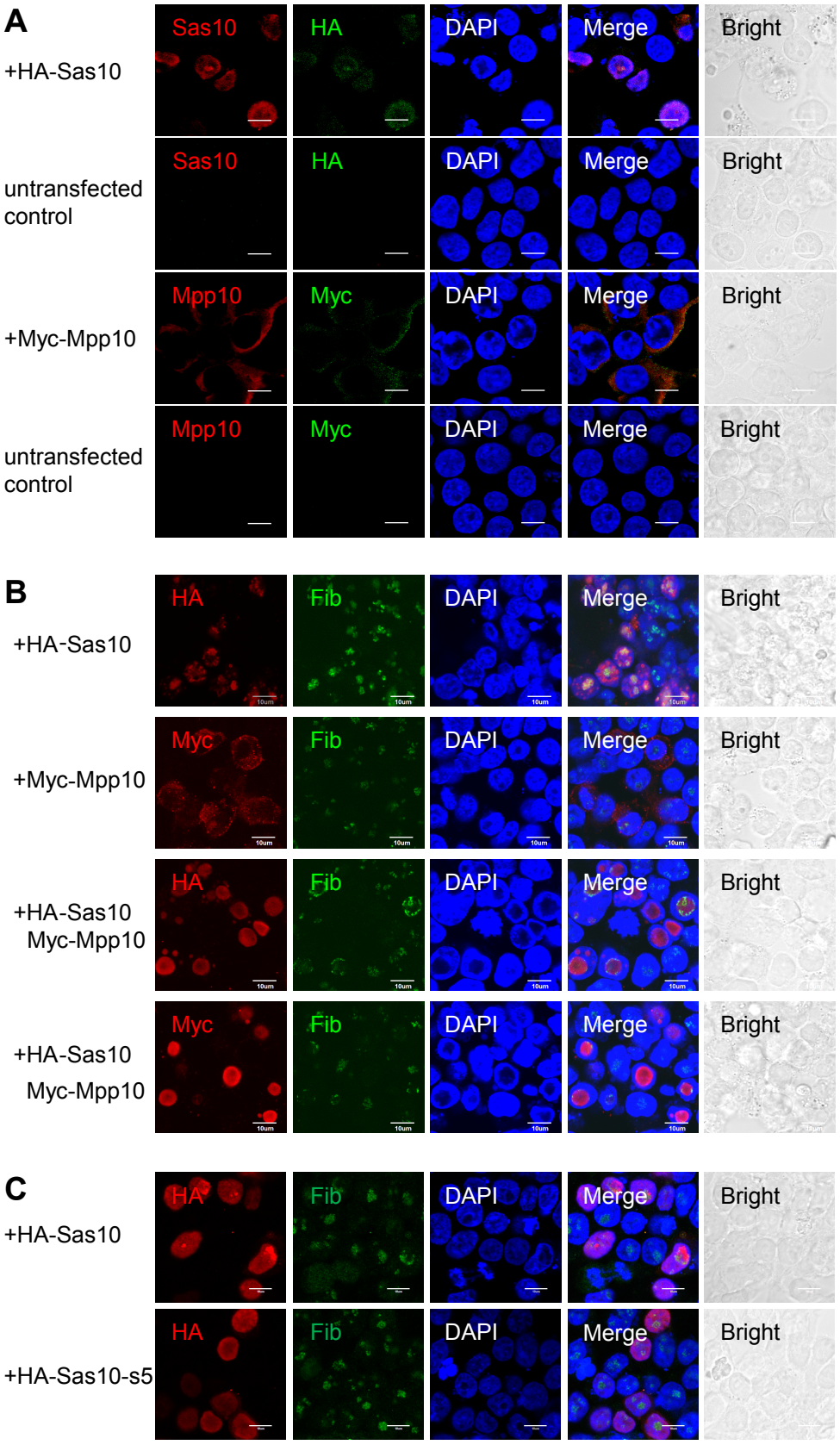
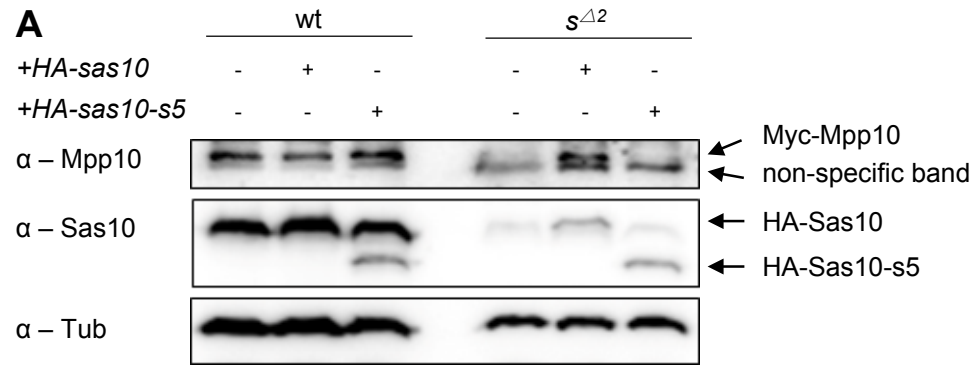
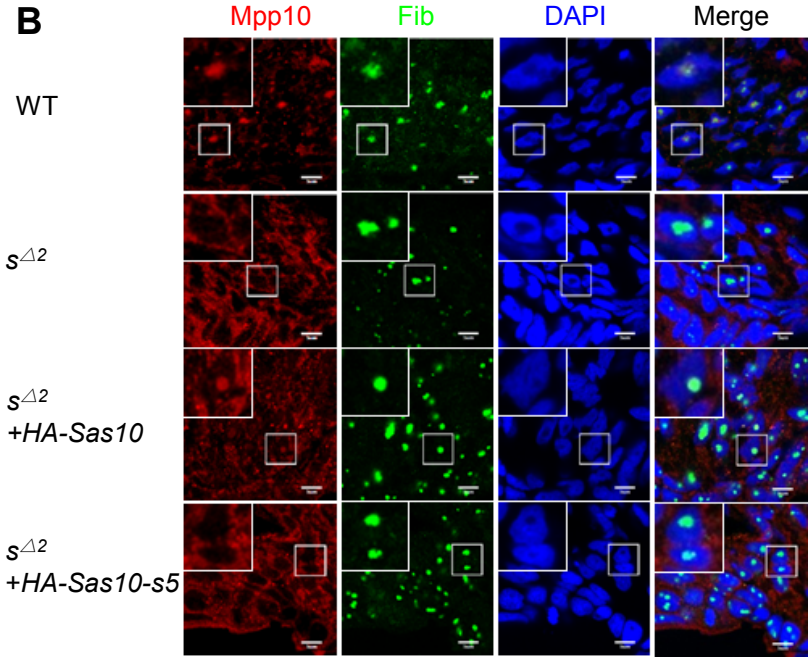
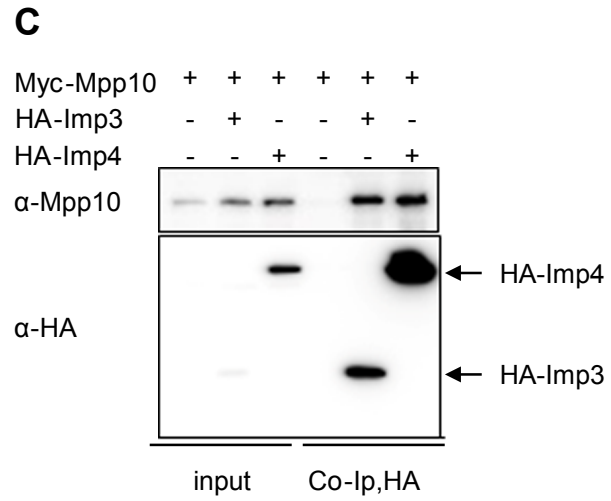

A
+HA-Sas10
Sas10
HA
DAPI
Merge
Bright
untransfected control
Sas10
HA
DAPI
Merge
Bright
+Myc-Mpp10
Mpp10
Myc
DAPI
Merge
Bright
untransfected control
Mpp10
Myc
DAPI
Merge
Bright
B
+HA-Sas10
HA
Fib
DAPI
Merge
Bright
+Myc-Mpp10
Myc
Fib
DAPI
Merge
Bright
+HA-Sas10
Myc-Mpp10
HA
Fib
DAPI
Merge
Bright
+HA-Sas10
Myc-Mpp10
Myc
Fib
DAPI
Merge
Bright
C
+HA-Sas10
HA
Fib
DAPI
Merge
Bright
+HA-Sas10-s5
HA
Fib
DAPI
Merge
Bright

Figure S10


A
wt
s⊿2
+HA-sas10
+HA-sas10-s5
α – Mpp10
α – Sas10
α – Tub
Myc-Mpp10
non-specific band
HA-Sas10
HA-Sas10-s5


B
Mpp10
Fib
DAPI
Merge
WT
s⊿2
s⊿2 +HA-Sas10
s⊿2 +HA-Sas10-s5


C
Myc-Mpp10
HA-Imp3
HA-Imp4
α-Mpp10
α-HA
HA-Imp4
HA-Imp3
input
Co-Ip,HA