

## Supplementary Information for

### **PP2C phosphatases promote autophagy by dephosphorylation of the Atg1 complex**

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#### **This PDF file includes:**

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Fig. S1. GFP-Atg8 localization in WT and *ptc2* $\Delta$  *ptc3* $\Delta$  strains 4 h after MMS or rapamycin treatment.

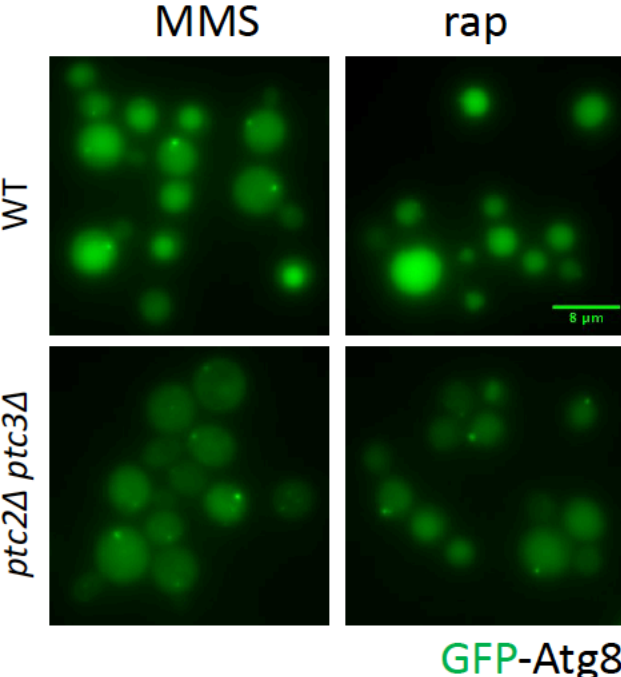


Fig. S2. Atg1-GFP, Atg11-GFP and Atg13-GFP localization in WT and *ptc2* $\Delta$  *ptc3* $\Delta$  strains under nutrient-replete conditions.

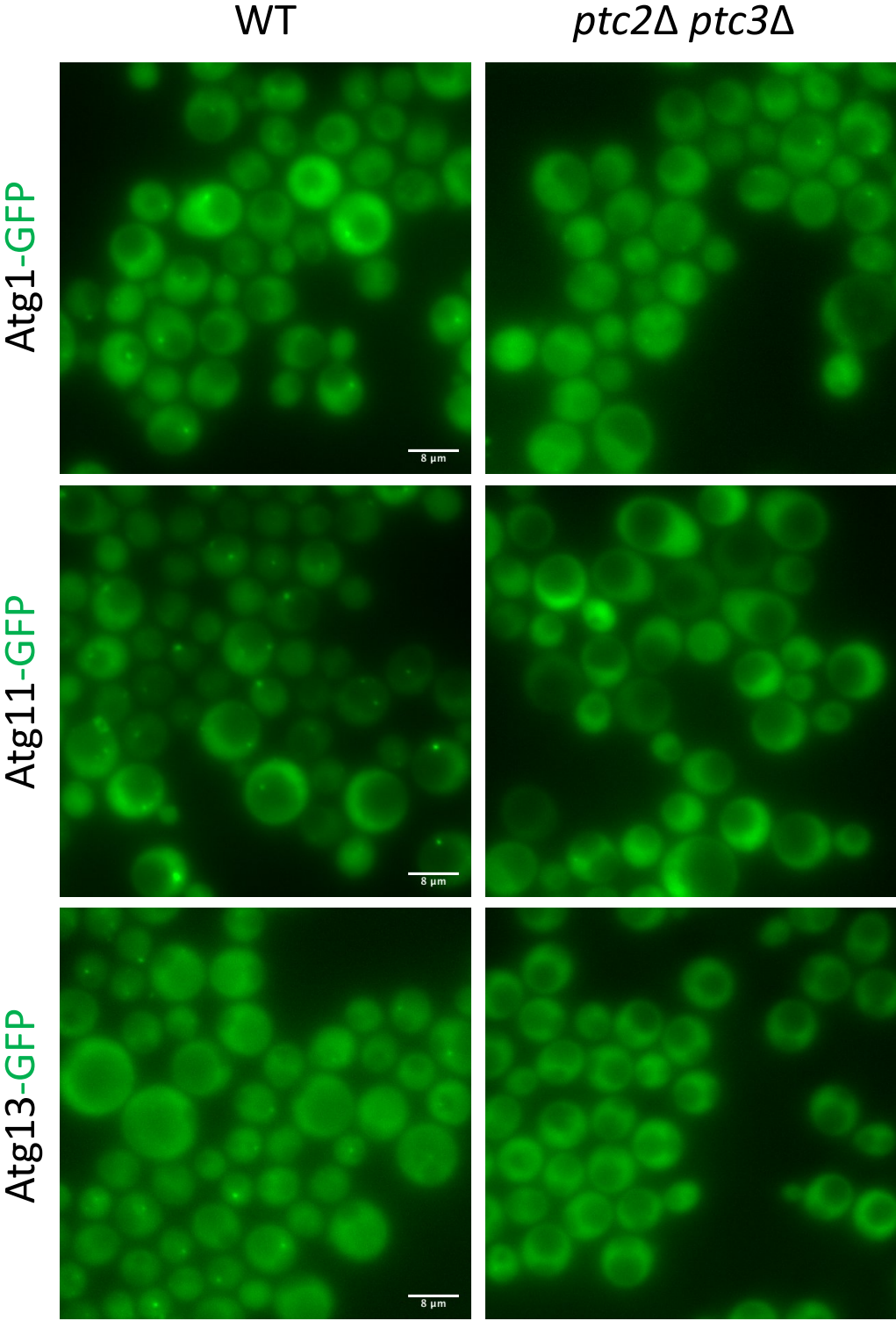


Fig. S3. Atg1-GFP, Atg13-GFP and Atg17-GFP localization in WT and *ptc2Δ ptc3Δ* mutant strains 4 h after rapamycin treatment.

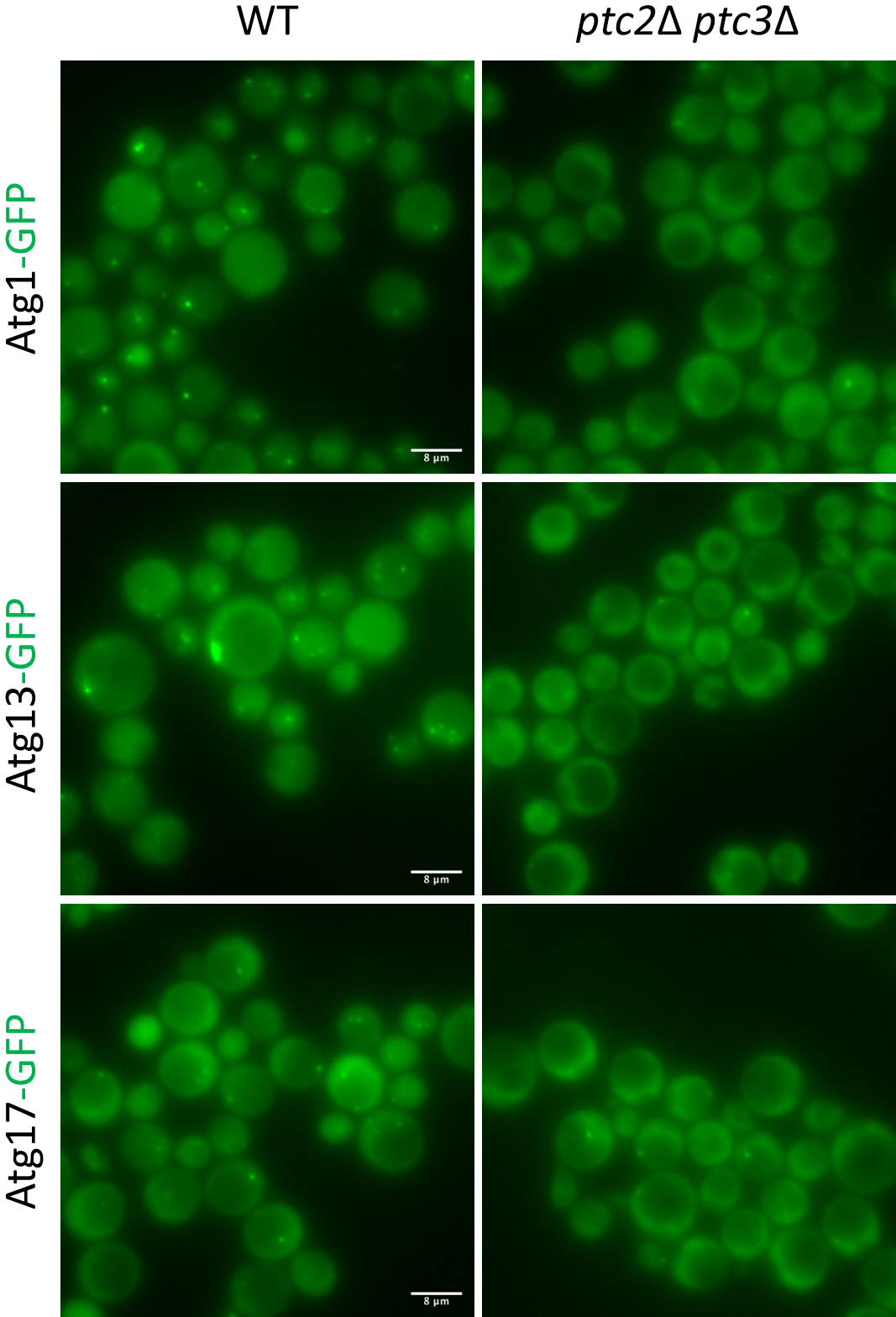
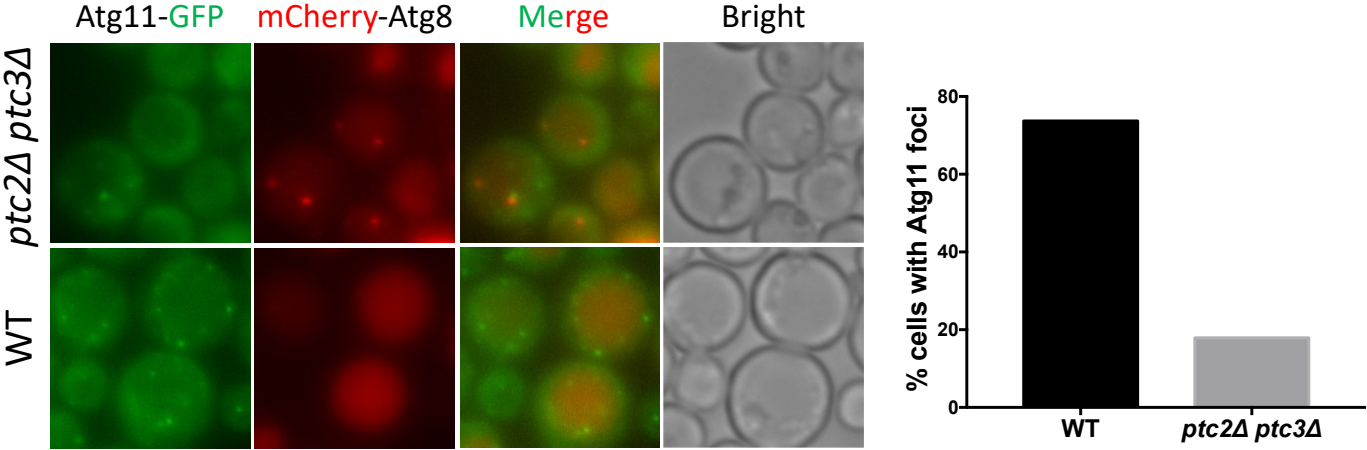


Fig. S4. Atg11-GFP and mCherry-Atg8 localization in WT and *ptc2Δ ptc3Δ* mutant strains 4 h after rapamycin treatment. Percentage of cells with visible Atg11 foci were counted and plotted.



**Fig. S5. Sch9 phosphorylation in WT and *ptc2Δ ptc3Δ* strains 4 h after MMS, rapamycin or CHX treatment. Samples were collected as explained previously and blotted with anti-Sch9 antibody.**

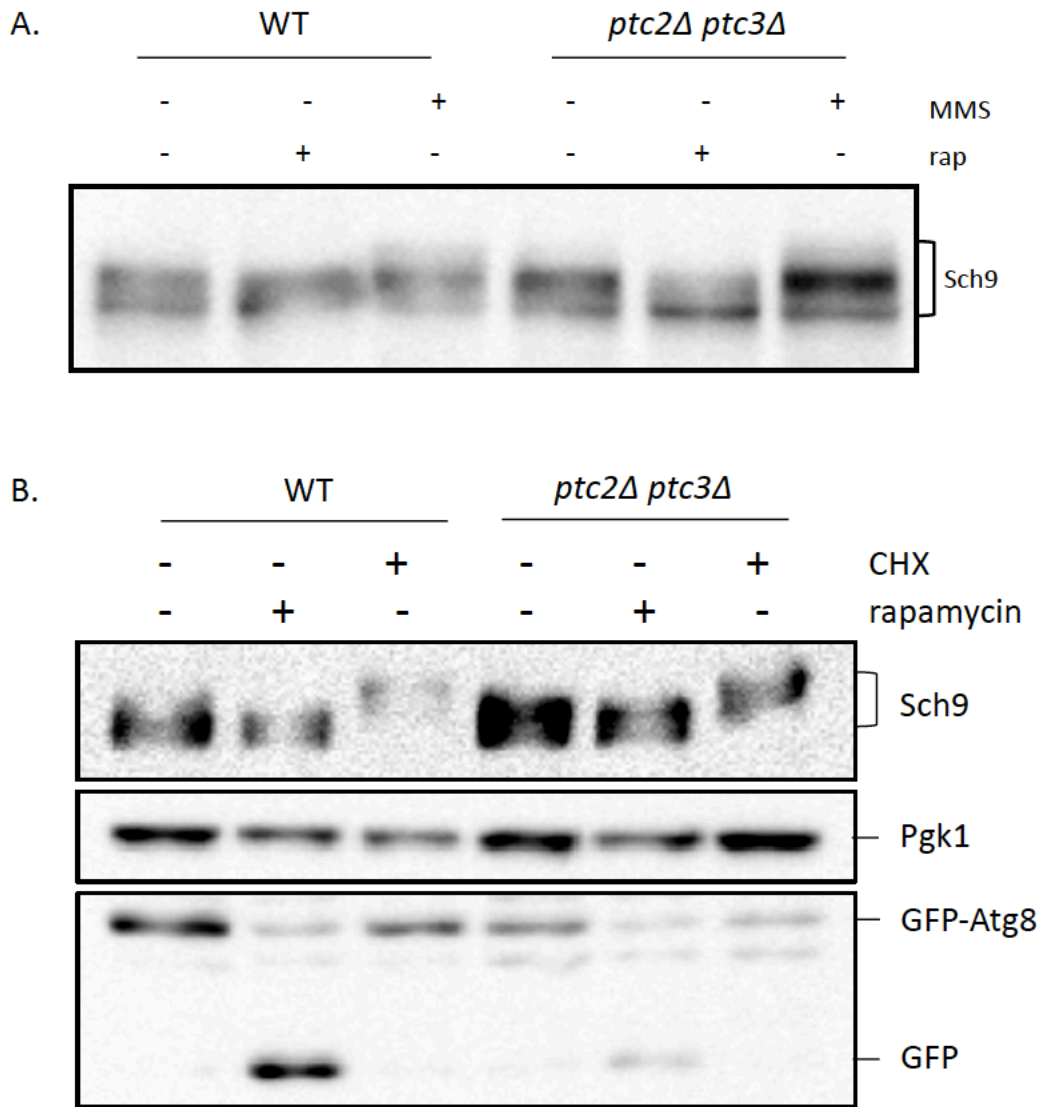


Fig. S6. Atg1 hyperphosphorylation in WT, *atg13Δ*, *ptc2Δ*, *ptc3Δ* and *ptc2Δ ptc3Δ* strains. Cells were treated with rapamycin and MMS for 4 h, as previously explained. Samples were collected and analyzed by blotting.

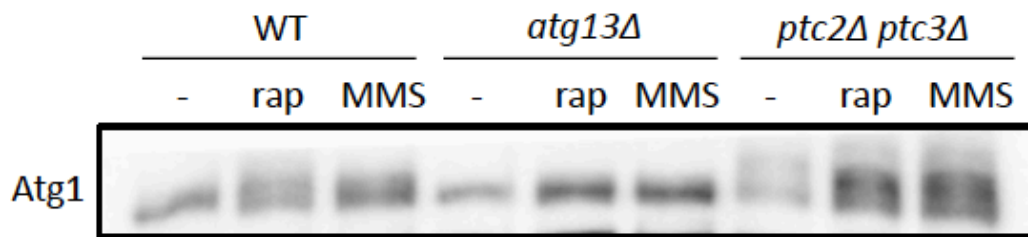
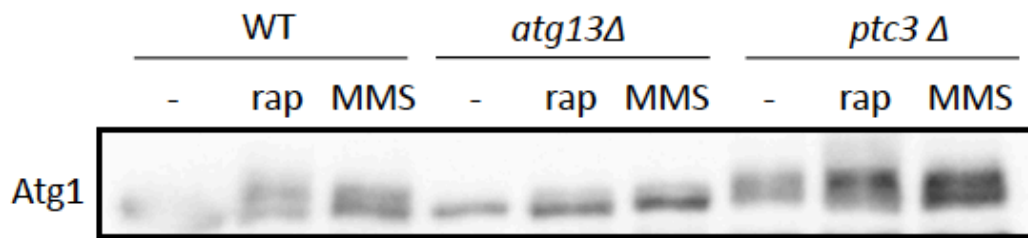
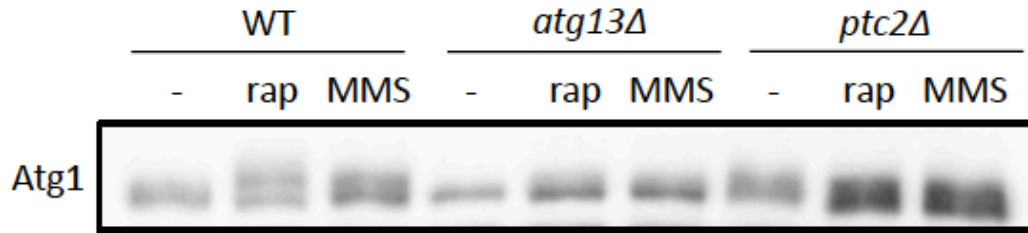
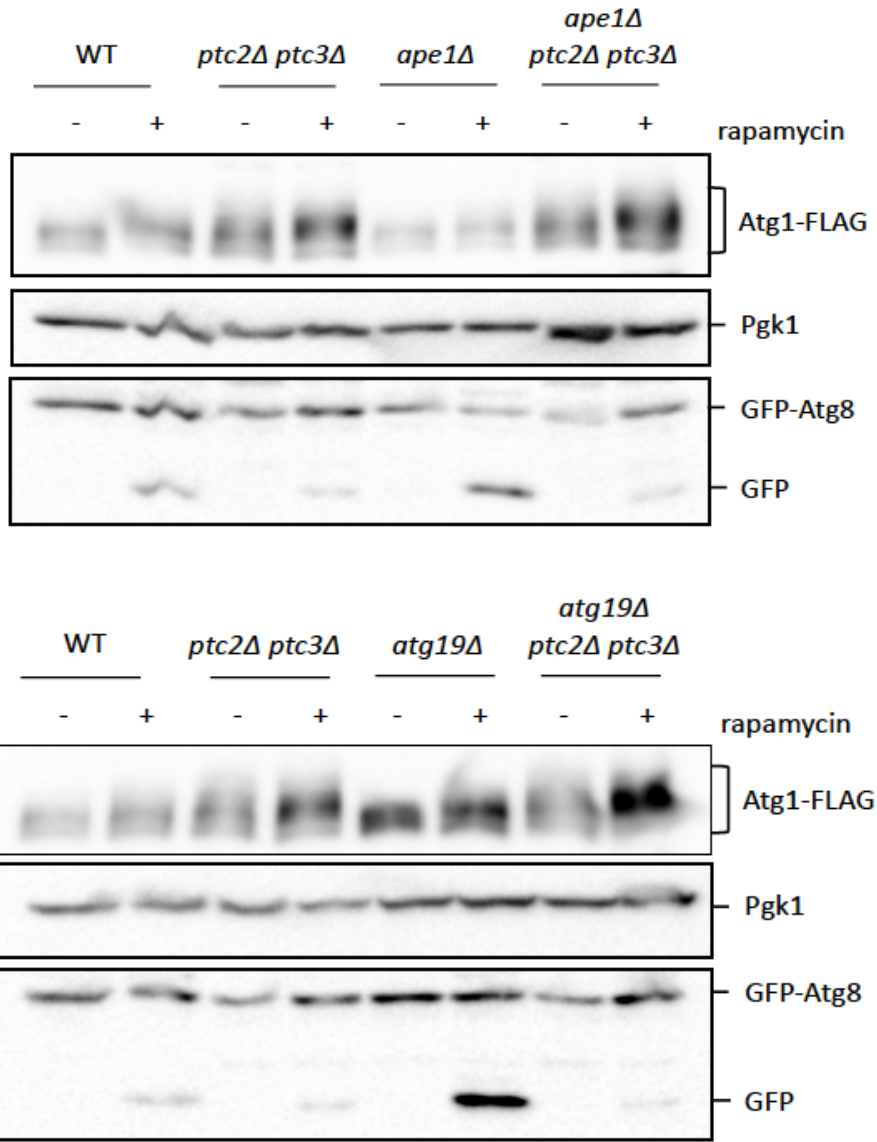


Fig S7. Atg1 hyperphosphorylation in WT, *ape1* $\Delta$ , *atg19* $\Delta$ , *ptc2* $\Delta$  *ptc3* $\Delta$ , *ape1* $\Delta$  *ptc2* $\Delta$  *ptc3* $\Delta$  and *atg19* $\Delta$  *ptc2* $\Delta$  *ptc3* $\Delta$  mutant strains. Cells were treated with rapamycin as previously explained and blotted for FLAG, Pgk1 (loading control) and GFP.





**Fig. S8. Atg1 hyperphosphorylation in WT, *atg1-S34A*, *atg1-S34D*, *atg1-S390A*, *atg1-S34A,S390A*, *ptc2Δ ptc3Δ atg1-S34A*, *ptc2Δ ptc3Δ atg1-S34D*, *ptc2Δ ptc3Δ atg1-S390A* and *ptc2Δ ptc3Δ atg1S34A,S390A* mutant strains 4 h after rapamycin treatment. Samples were blotted for Pgk1 as loading control and for GFP to measure percent GFP-Atg8 cleavage as previously described.**

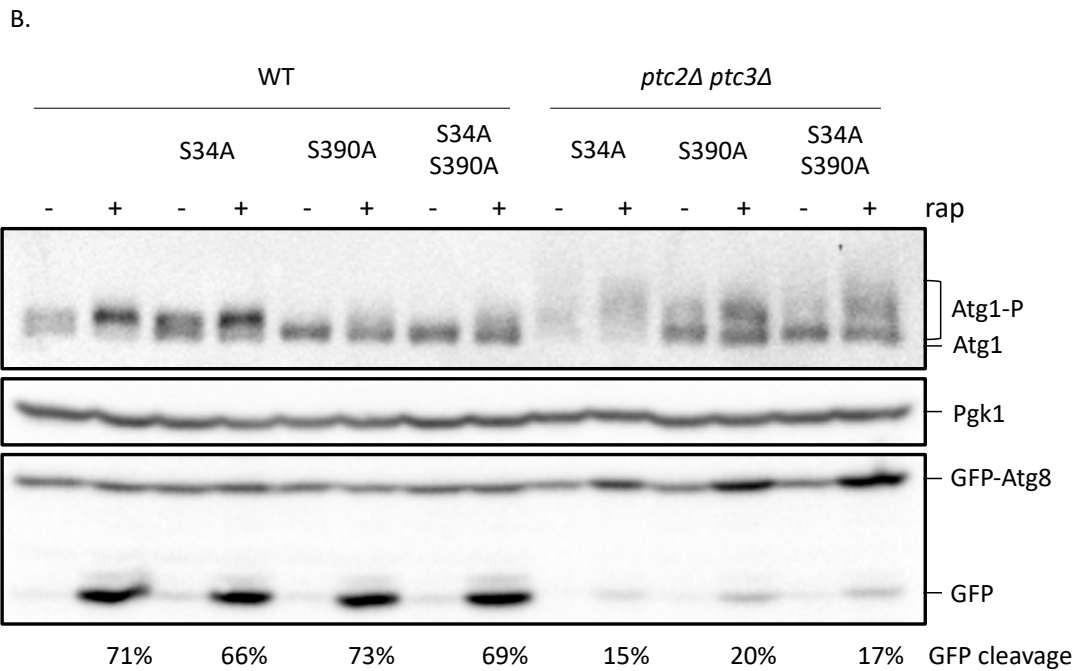
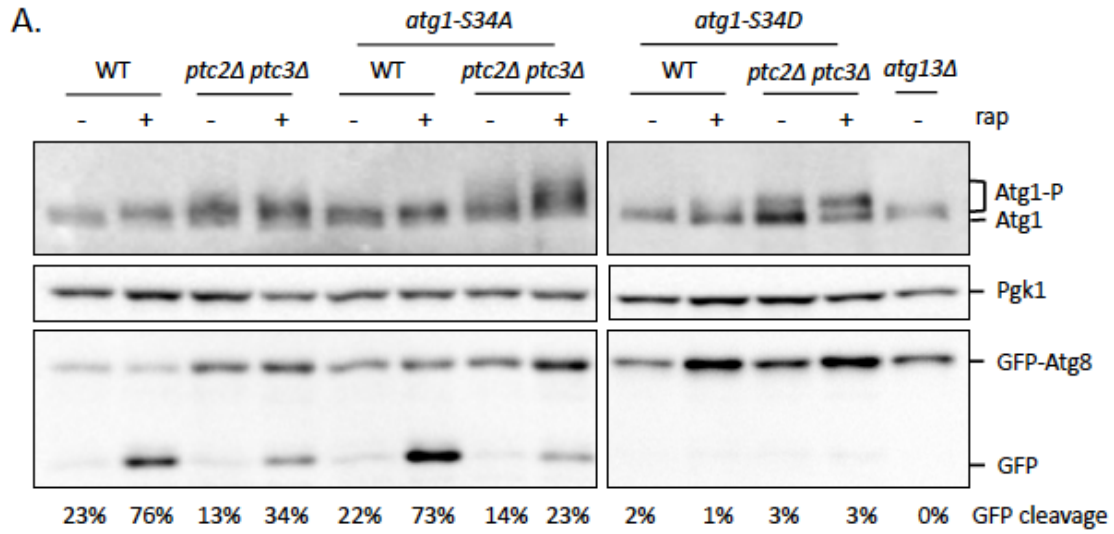
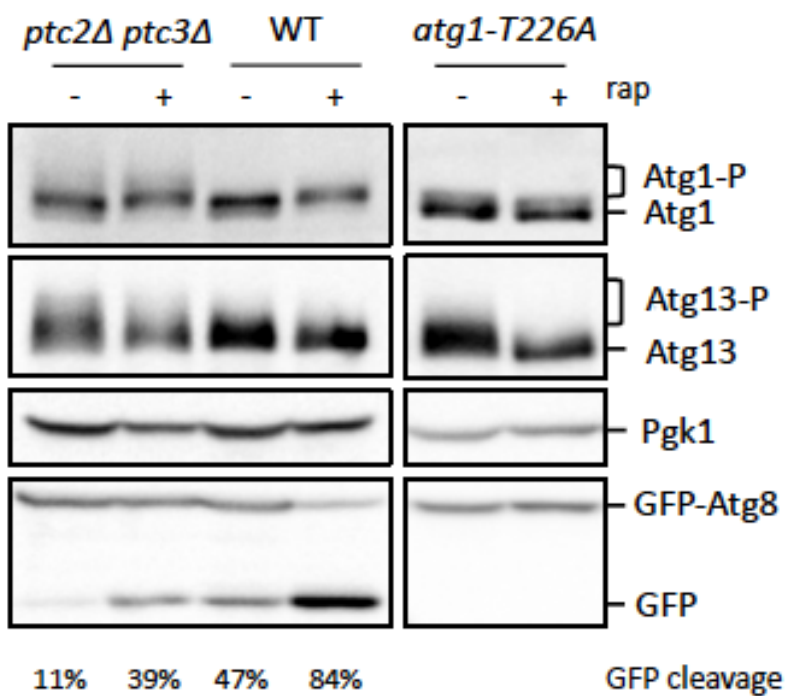


Fig. S9. Atg13 and Atg1 hyperphosphorylation in WT, *ptc2Δ ptc3Δ* and *atg1-T226A* mutant strains 4 h after rapamycin treatment. Samples were also blotted for Pgk1 for loading control and GFP to measure percent GFP-Atg8 cleavage.



**Table S1. Yeast strains used in this study.**

<b>Yeast strain</b>	<b>Genotype</b>	<b>Source</b>
JKM179	<i>MAT<math>\alpha</math>, ho<math>\Delta</math>, hml<math>\Delta</math>::ADE1, hmr<math>\Delta</math>::ADE1, ade1-100, leu2,3-112, lys5, trp1::hisG, ura3-52, ade3::GAL::HO</i>	Lee et. al, 1998
FD529	JKM179 <i>ptc3<math>\Delta</math>::KAN bar1<math>\Delta</math>::ADE3</i>	This study
VE213	JKM179 <i>GFP::Atg8::URA3</i>	Eapen et. al, 2017
GM187	JKM179 <i>ptc2<math>\Delta</math>::NAT</i>	This study
GM189	JKM179 <i>ptc2<math>\Delta</math>::NAT ptc3<math>\Delta</math>::KAN bar1<math>\Delta</math>::ADE3</i>	This study
GM207	JKM179 <i>ptc2<math>\Delta</math>::NAT ptc3<math>\Delta</math>::KAN bar1<math>\Delta</math>::ADE3 GFP::Atg8::URA3</i>	This study
GM221	JKM179 [GFP-ATG8::URA3]	This study
GM223	JKM179 <i>ptc2<math>\Delta</math>::NAT [GFP-ATG8::URA3]</i>	This study
GM224	JKM179 <i>ptc3<math>\Delta</math>::KAN bar1<math>\Delta</math>::ADE3 [GFP-ATG8::URA3]</i>	This study
GM225	JKM179 <i>ptc2<math>\Delta</math>::NAT ptc3<math>\Delta</math>::KAN bar1<math>\Delta</math>::ADE3 [GFP-ATG8::URA3]</i>	This study
VDY630	BY4741 <i>atg1<math>\Delta</math>::2x-FLAG-ATG1</i>	Kamber et. al, 2015
GM261	VDY630 <i>ptc2<math>\Delta</math>::NAT ptc3<math>\Delta</math>::HPH</i>	This study
GM262	VDY630 <i>atg13<math>\Delta</math>::HPH</i>	This study
GM264	JKM179 <i>GFP-Atg8::LEU2</i>	This study
GM265	JKM179 <i>ptc2<math>\Delta</math>::NAT GFP-Atg8::LEU2</i>	This study
GM266	JKM179 <i>ptc3<math>\Delta</math>::HPH GFP-Atg8::LEU2</i>	This study
GM267	JKM179 <i>ptc2<math>\Delta</math>::NAT ptc3<math>\Delta</math>::KAN GFP-Atg8::LEU2</i>	This study
GM281	VDY630 <i>GFP-Atg8::LEU2</i>	This study

GM282	VDY630 <i>ptc2Δ::NAT GFP-Atg8::LEU2</i>	This study
GM283	VDY630 <i>ptc3Δ::HPH GFP-Atg8::LEU2</i>	This study
GM284	VDY630 <i>ptc2Δ::NAT ptc3Δ::HPH GFP-Atg8::LEU2</i>	This study
GM285	VDY630 <i>atg13Δ::HPH GFP-Atg8::LEU2</i>	This study
GM287	VDY630 <i>ptc2Δ::NAT ptc3Δ::HPH atg13Δ::KAN GFP-Atg8::LEU2</i>	This study
GM302	JKM179 <i>Atg13::13xmyc::TRP1 GFP-Atg8::LEU2</i>	This study
GM341	JKM179 <i>Atg13::13xmyc::TRP1 GFP-Atg8::LEU2 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM477	VDY630 <i>atg1-S34A GFP-Atg8::LEU2</i>	This study
GM478	VDY630 <i>atg1-S34D GFP-Atg8::LEU2</i>	This study
GM480	VDY630 <i>atg1-T226A GFP-Atg8::LEU2</i>	This study
GM494	VDY630 <i>atg1-S34A GFP-Atg8::LEU2 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM496	VDY630 <i>atg1-S34D GFP-Atg8::LEU2 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM497	VDY630 <i>atg1-T226A GFP-Atg8::LEU2 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM525	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-Atg1 Atg13::13xmyc::TRP1</i>	This study
GM528	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-Atg1-T226A Atg13::13xmyc::TRP1</i>	This study
GM542	VDY630 <i>atg1-S390A GFP-Atg8::LEU2</i>	This study
GM543	VDY630 <i>atg1-S34A,S390A GFP-Atg8::LEU2</i>	This study
GM550	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-Atg1 Atg13::13xmyc::TRP1 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM558	JKM179 <i>-HOcs [pGAL-ATG13]</i>	This study
GM559	JKM179 <i>-HOcs [pGAL-ATG13-8SA]</i>	This study
GM560	JKM179 <i>-HOcs ptc2Δ::NAT ptc3Δ::KAN [pGAL-ATG13]</i>	This study

GM561	JKM179 -HOcs <i>ptc2Δ::NAT ptc3Δ::KAN</i> [pGAL-ATG13-8SA]	This study
GM562	VDY630 <i>Atg1-S390A GFP-Atg8::LEU2 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM563	VDY630 <i>atg1-S34A,S390A GFP-Atg8::LEU2 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM581	VDY630 <i>GFP-Atg8::LEU2</i> [pGAL-ATG13]	This study
GM582	VDY630 <i>GFP-Atg8::LEU2</i> [pGAL-ATG13-8SA]	This study
GM583	VDY630 <i>ptc2Δ::NAT ptc3Δ::HPH GFP-Atg8::LEU2</i> [pGAL-ATG13]	This study
GM584	VDY630 <i>ptc2Δ::NAT ptc3Δ::HPH GFP-Atg8::LEU2</i> [pGAL-ATG13-8SA]	This study
GM594	VDY630 <i>atg1-T226A GFP-Atg8::LEU2</i> [pGAL-ATG13]	This study
GM595	VDY630 <i>atg1-T226A GFP-Atg8::LEU2</i> [pGAL-ATG13-8SA]	This study
GM604	JKM179 <i>ptc2Δ::NAT ptc3Δ::KAN GFP-Atg8::LEU2 atg13-8SA</i>	This study
GM605	JKM179 <i>GFP-Atg8::LEU2 10xMYC::Atg13</i>	This study
GM611	JKM179 <i>GFP-Atg8::LEU2 atg13-8SA</i>	This study
GM617	JKM179 <i>GFP-Atg8::LEU2 10xMYC::Atg13 ptc2Δ::NAT ptc3Δ::HPH</i>	This study
GM624	JKM179 <i>GFP::Atg8::URA3 mCherry::Ape1</i>	This study
GM625	JKM179 <i>GFP::Atg8::URA3 mCherry::Ape1 ptc2Δ::NAT ptc3Δ::KAN bar1Δ::ADE3</i>	This study
GM626	VDY630 <i>GFP-Atg8::LEU2 ape1Δ::KAN</i>	This study
GM627	VDY630 <i>GFP-Atg8::LEU2 atg11Δ::KAN</i>	This study
GM628	VDY630 <i>GFP-Atg8::LEU2 atg19Δ::KAN</i>	This study
GM629	VDY630 <i>ptc2Δ::NAT ptc3Δ::HPH GFP-Atg8::LEU2 ape1Δ::KAN</i>	This study
GM630	VDY630 <i>ptc2Δ::NAT ptc3Δ::HPH GFP-Atg8::LEU2 atg11Δ::KAN</i>	This study
GM631	VDY630 <i>ptc2Δ::NAT ptc3Δ::HPH GFP-Atg8::LEU2 atg19Δ::KAN</i>	This study

GM632	JKM179 <i>Atg1::2GFP::URA3</i>	This study
GM634	JKM179 <i>Atg9::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM635	JKM179 <i>Atg11::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM636	JKM179 <i>Atg13::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM637	JKM179 <i>Atg17::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM638	JKM179 <i>ptc2Δ::NAT ptc3Δ::KAN bar1Δ::ADE3 Atg1::2GFP::URA3</i>	This study
GM640	JKM179 <i>ptc2Δ::NAT ptc3Δ::KAN bar1Δ::ADE3 Atg9::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM641	JKM179 <i>ptc2Δ::NAT ptc3Δ::KAN bar1Δ::ADE3 Atg11::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM642	JKM179 <i>ptc2Δ::NAT ptc3Δ::KAN bar1Δ::ADE3 Atg13::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM643	JKM179 <i>ptc2Δ::NAT ptc3Δ::KAN bar1Δ::ADE3 Atg17::2GFP::URA3 [pRS315 mCherry::Atg8]</i>	This study
GM646	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-Atg1 Atg13::13xmyc::TRP1 Ptc2::3XHA::KANMX</i>	This study
GM647	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-Atg1 Atg13::13xmyc::TRP1 Ptc3::3XHA::KANMX</i>	This study
GM666	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-atg1-T226A Atg13::13xmyc::TRP1</i>	This study
GM667	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-atg1-T226A Atg13::13xmyc::TRP1 Ptc2::3XHA::KANMX</i>	This study
GM668	JKM179 <i>GFP-Atg8::LEU2 2XFLAG-atg1-T226A Atg13::13xmyc::TRP1 Ptc3::3XHA::KANMX</i>	This study
SEY6210	<i>MATα leu2-3,112 ura3-52 his3-Δ200 trp1-Δ901 suc2-Δ9 lys2-801 GAL</i>	
JM347	SEY6210 <i>pZEO1-pho8Δ60 pho13Δ pCu405-GFP-ATG8::LEU2</i>	
YYY145	JMY347 <i>ptc3Δ::HPH ptc2Δ::NAT</i>	This study
YYY146	YYA145 <i>atg13Δ::HIS3</i>	This study
YYY147	JMY347 <i>atg13Δ::HIS3</i>	This study

**Table S2. Plasmids used in this study.**

<b>Plasmid name</b>	<b>Genotype</b>	<b>Source</b>
bRA89	[pPGK1::CaCas9::HPHMX BpII]	Anand et. al, 2017
bRA90	[pPGK1::CaCas9::LeuMX BpII]	Anand et. al, 2017
pJH2971	[pPGK1::CaCas9::KANMX BpII]	
pGM041	bRA89 targeting CAGATGCCCTCTATATACAG (to mutate <i>Atg1-S34</i> )	This study
pGM042	bRA89 targeting GTTCTGCTAATGACGTGTT (to mutate <i>Atg1-T226</i> )	This study
pGM044	bRA90 targeting AGACGAGAAATTAAGAAAAT (to integrate the N'-2XFLAG- <i>Atg1</i> )	This study
pGM049	bRA89 targeting ATGAGTCATGGTTGCCGAAG (for N'terminus epitope-tagging of <i>Atg13</i> )	This study
pGM050	bRA90 targeting ATGAGTCATGGTTGCCGAAG (for N'terminus epitope-tagging of <i>Atg13</i> )	This study
pGM057	bRA90 targeting AGAGGGCATCACTGAGCTCCG (to mutate <i>Atg1-S390</i> )	This study
pGM071	bRA90 targeting GGAGGAACAACGTGAAATAC (for N'terminus epitope-tagging of <i>Ape1</i> )	This study
pGM072	pJH2971 targeting ATGAGTCATGGTTGCCGAAG (for N'terminus epitope-tagging of <i>Atg13</i> )	This study
pJH2668	pRS316 URA3 GFP-ATG8	Kamada et. al, 2010
pJH2663	pRS416 URA3 GAL1-ATG13	Kamada et. al, 2010
pJH2664	pRS416 URA3 GAL1-ATG13-8SA	Kamada et. al, 2010
pJH2978	pRS315 mCherry- <i>Atg8::LEU2</i>	Kamada et. al, 2010

LD201	Atg1-2GFP C.a URA3	Li et. al, 2015
LD211	Atg11-2GFP C.a URA3	Li et. al, 2015
LD213	Atg13-2GFP C.a URA3	Li et. al, 2015
LD217	Atg17-2GFP C.a URA3	Li et. al, 2015



**Table S3. Sequences of DNA oligonucleotides uses in this study**

GM021: Forward primer to amplify a Ptc2 deletion cassette

TGACTATTCCATTGTTGTATAAAATATAGAGAACCAGAAAAAGAAAAATGCGTACGCTGCA  
GGTCGAC

GM022: Reverse primer to amplify a Ptc2 deletion cassette

CGTTCGGTTCGTATATAGGTATGTATATATAATGAAGGATGGAAGATCCTGCAGGTAACT  
GGCTTATC

GM023: Reverse primer to confirm Ptc2 deletion

GGTAAACGCGCAGTTTCTGCG

GM024: Forward primer in NAT drug cassette to confirm deletions

CGCCTCGACATCATCTGC

GM025: Forward primer to amplify a Ptc3 deletion cassette

CAGACGAAGAAGGCCAAGAAGACAAATCGAAGAAAGAGAGATAACATGCGTACGCTGC  
AGGTCGAC

GM026: Reverse primer to amplify a Ptc3 deletion

casseteAACAAAGTTTGACTACTCTTTCGTTGCAAAGTACGGTTCGACAATTTAGCAGGTAA  
ACCTGGCTTATC

GM028: Reverse primer in HPH drug cassette to confirm deletions

AGCACGAGATTCTTCGCC

CSL246: Reverse primer downstream of Ptc2

TCCGGATATCCTGCTGTTGGTAG

GM106: Forward primer to tag Atg13 on its C-terminus using pFA6 plasmids

ATGATGATCTAGTATTTTTTCATGAGTGATATGAACCTTTCTAAAGAAGGTCCGGATCCCCGGG  
TTAATTAA

GM107: Reverse primer to tag Atg13 on its C-terminus using pFA6 plasmids

TTTGATTATTTTTCTTTAGTTGTGCCCTTTAAAATAAACTTTACCATTTGAATTCGAGCTCGT  
TTAAAC

GM108: Forward primer in TRP gene to confirm tagging

TGAAAGTTTGCGGCTTGCAG

GM109: Reverse primer downstream of Atg13 ORF to confirm tagging or deletions

TCAGCGGGTGACAAATAAGC

GM148: Forward primer upstream of Atg1 ORF

CACACAACCTCTGTGAACC

GM149: Reverse primer in Atg1 ORF

CGGACGCTAACTGCTGTAA

GM150: Forward primer upstream of Atg1 ORF  
GGCGGTAATGTAAGGAAAACCC

GM175: Forward Cas9 gRNA primer to target Atg1-S34 CAGATGCCCTCTATATACAGGTTTT

GM176: Reverse Cas9 gRNA primer to target Atg1-S34 CTGTATATAGAGGGCATCTGGATCA

GM177: 80mer repair primer to introduce Atg1-S34A mutation with Cas9  
ACCGCTGAGAAAGAAATCGGAAAGGGTGCTTTTGCAACAGTGTATAGAGGGCATCTGACAT  
CCGACAAATCTCAGCATGT

GM179: 80mer repair primer to introduce Atg1-S34D mutation with Cas9  
ACCGCTGAGAAAGAAATCGGAAAGGGTGAATTTGCAACAGTGTATAGAGGGCATCTGACAT  
CCGACAAATCTCAGCATGT

GM180: Forward primer to screen for Atg1 S34 mutants  
TTGCAACAGTGTATAGAGGG

GM181: Forward primer in Atg1 ORF  
CTCTTTTACAACACCAGACGAG

GM195: Forward Cas9 gRNA primer to target Atg1T226  
GTTTCTGCTAATGACGTGTTGTTTT

GM196: Reverse Cas9 gRNA primer to target Atg1-T226  
AACACGTCATTAGCAGAAACGATCA

GM197: 80mer repair primer to introduce Atg1-T226A mutation with Cas9  
TTCGGGTTTGCAAGATTTTGGCAAACACCTCTTTGGCCGAAGCTCTTTGTGGCTCACCATTA  
TATATGGCACCAGAAAT

GM198: Forward primer to screen for Atg1-T226A mutants  
AACACCTCTTTGGCCGAA

GM199: Reverse primer in Atg1 ORF  
CCGATTTCTTCTCTACCACCAC

GM200: Forward primer in Atg1 ORF  
GGTTCATAGAGACATCAAGCC

VE087: Forward primer to amplify an Atg13 deletion cassette  
TCTTGAAAAGAAAGCAGAACATACAGCCCGGTTGAATAGCATGAGTCATGCGTACGCTGCA  
GGTCGAC

VE088: Reverse primer to amplify an Atg13 deletion cassette  
GATTATTTTCTTTAGTTGTGCCCTTTAAAATAAAACTTTACCATTTTTAATCGATGAATTCGA  
GCTCG

GM316: Forward Cas9 gRNA primer to target the N terminus of Atg1 for tagging  
AGACGAGAAATTAAGAAAATGTTTT

GM317: Reverse Cas9 gRNA primer to target the N terminus of Atg1 for tagging  
ATTTTCTTAATTTCTCGTCTGATCA

GM320: Forward primer upstream of Atg1 ORF  
CCATACCGTTAAAGAAGCAAGC

GM321: Forward primer upstream of Atg1 ORF  
ACCAAGGCCATCTTTTACC

GM342: Forward Cas9 gRNA primer to target the N terminus of Atg13 for tagging  
ATGAGTCATGGTTGCCGAAGGTTTT

GM343: Reverse Cas9 gRNA primer to target the N terminus of Atg1 for tagging  
ATGAGTCATGGTTGCCGAAGGTTTT

GM344: Forward primer upstream of Atg13 ORF  
GTTACAGAAAGAGGCGAGAAG

GM345: Reverse primer in Atg13 ORF  
TCGATAAGCCAACGTTCCATC

GM372: 80mer repair primer to introduce Atg1-S390A  
CATCAATCAATGGCAGATAATCCGGCGGAGCTCTCCGATGCCCTCAAGAACGCTAATATATT  
AACTGCCCCAGCCGTTAA

GM373: Forward primer to screen for Atg1-S390 mutations  
AATCCGGCGGAGCTCTC

GM374: Reverse primer in Atg1 ORF  
GCACCACCAAACAATCTCG

GM375: Forward primer in Atg1 ORF  
GATCCAGCCCAAAGAATAGG

GM376: Forward Cas9 gRNA primer to target Atg1-S390  
GAGGGCATCACTGAGCTCCGGTTTT

GM377: Reverse Cas9 gRNA primer to target Atg1-S390  
CGGAGCTCAGTGATGCCCTCGATCA

GM395: Forward primer upstream of Atg1 ORF  
CGAGCATCTCATAAAGGAGCTT

GM429: Forward primer to amplify a deletion cassette targeting the N terminus of Atg13

ACCAGGTCCAGACACAACAACAAAGACAGATACCTGATAGGAGATCTCTTTATGCGGCATC  
AGAGCAGAT

GM430: Reverse primer to amplify a deletion cassette targeting the N terminus of Atg13  
TATGGTTGTCTGATAGGTATCCTACTTTTTATGAAAGAACTTCAAATGCTATTTACACCGCA  
GGTAAT

GM431: Forward primer in Atg13 ORF  
GGACAAAGTGATCAAGACATAG

GM432: Reverse primer in Atg13 ORF  
TTCGCCTGAGCTTGAAAGG

GM433: Forward primer in URA3 ORF to screen for deletions  
TTGGCAGCAACAGGACTAG

GM434: Forward primer in Atg13 ORF  
GGACAAAGTGATCAAGACATAG

GM435: Reverse primer in Atg13 ORF  
GCATCACACCAACTGCAT

GM436: Forward primer in Atg13 ORF  
GTCTCGGTATCATACAGACGTG

GM437: Forward primer in Atg13 ORF  
AGTATGAGCTCCAACACTACGG

GM439: Forward primer in Atg13 ORF  
CGGTGGGAATTCATCTACTAGT

GM442: Forward primer to amplify an mCherry fragment to tag Ape1 on N terminus  
TTAGTGCAATTGTAGAAACCTGCACAACCAACAAAATTAAGAAAAAAGAATGGTTAGCAA  
AGGCGAGGA

GM443: Reverse primer to amplify an mCherry fragment to tag Ape1 on N terminus  
AGCATCTGCAGAGTTTTCTTCAATTGTTCTAGGATTTACGTTGTTCCCTCgtaattaaccagaccgtca  
ccCTTGACAGTTCATCCATAC

GM444: Forward Cas9 gRNA primer targeting the N terminus of Ape1  
GGAGGAACAACGTGAAATACGTTTT

GM445: Reverse Cas9 gRNA primer targeting the N terminus of Ape1  
GTATTTACGTTGTTCCCTCCGATCA

GM446: Reverse primer in mCherry  
GAGGAATCTTGCGTAACGG

GM447: Forward primer upstream of Ape1 ORF  
GGTGATGCTGTTTTGCACC

GM448: Forward primer upstream of Ape1 ORF  
GACATACACTGTATAGAGCCTG

GM449: Forward primer in mCherry  
TCGAGGATGGAGGGGTTGTGA

GM454: Reverse primer in Ape1 ORF  
TCGAGGATGCACCACGAAT

GM456: Reverse primer to amplify MYC tag for N terminus tagging of Atg13  
AAGCTGTCTATCAATTGAAGGACTTGCTTCTCGATGTCCTCTTCGGCAACGGAACCACCGGA  
ACCACCGTGATTGATTAATTTTTGTTACCG

GM457: Forward primer to amplify MYC tag for N terminus tagging of Atg13  
TCTTGAAAAGAAAGCAGAACATACAGCCCGGTTGAATAGCATGAGTCATGCGGATCCCCGG  
GTTAATTAA

GM472: Forward primer to amplify an Ape1 deletion cassette  
TTAGTGCAATTGTAGAAACCTGCACAACCAACAAAATTAAGAAAAAAGACGGATCCCCGG  
GTTAATTAA

GM473: Reverse primer to amplify an Ape1 deletion cassette  
AAAAGGATAAAGAAACAGAAATCAAAAGAAATAAAAAGAGTGTGGCAAAGAATTTCGAGC  
TCGTTTAAAC

DW270: Forward primer to amplify an Atg11 deletion cassette  
GTGTACTGTTGTTGTTTCGGAAAGTACTTCTTTTATTTTCTTTTATAACATCATGCGTACGCTGCA  
GGTCGAC

DW271: Reverse primer to amplify an Atg11 deletion cassette  
TAGATACATAATTAATCTTGTCAATTTGTGACAAACGTTTAGCACTGTTCAATCGATGAATT  
CGAGCTCG

DW272: Forward primer upstream of Atg11 ORF  
GTACGGCTCTGATAGATCCGC

VE076: Forward primer to create an Atg19 deletion cassette  
TTGCGGCGGCACTTGCTTCAGTAACGCCAAAGGAGAGTTCTGGTAAATGCGTACGCTGCAG  
GTCGAC

VE077: Reverse primer to amplify an Atg19 deletion cassette  
TGTTGATGTGAAAAGGTAATGCTGTATAAAAATAGAGTTTGACCTAATCGATGAATTC  
GAGCTCG

VE053: Forward primer upstream of Atg19 ORF  
CTGTAAATGTTGGGCAACTC

GM498: Forward primer to tag Ptc2 on its C terminus  
CCGAGAATGACAGTAACACTGACCACAAGGCCGGCCGTTCCCCTTCAAGGTGGTTCCGGT  
GGTCCCAGGATCCCCGGGTTAATTAA

GM499: Reverse primer to tag Ptc2 on its C terminus  
CGTTCGGTTCGTATATAGGTATGTATATATAATGAAGGATGGAAGATCCTGAATTCGAGCTC  
GTTTAAAC

GM500: Forward primer in Ptc2 ORF  
ACGCTGACACAGATGCAGAA

GM501: Forward primer to tag Ptc3 on its C terminus  
ACGGCAAGAATGAAAATGCGAAGAAGGGTCCAAGATTGAAGAAATTGAAGGTGGTTCCGG  
TGGTCCCAGGATCCCCGGGTTAATTAA

GM502: Reverse primer to tag Ptc3 on its C terminus  
AACAAAGTTTGACTACTCTTTCGTTGCAAAGTACGGTTCGACAATATTTAGAATTCGAGCTC  
GTTTAAAC

GM503: Forward primer in Ptc3 ORF  
CAGGTGAGGATAGAACTGGC

GM514: Reverse primer downstream of Ptc2 ORF  
GTAGCGATGGTGGTGGTAG

GM515: Reverse primer downstream of Ptc3 ORF  
GCCGCAAAGATGATCCAGT