## **Supporting Information Appendix**

Structure and function of yeast Atg20, a sorting nexin that facilitates autophagy induction

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<sup>4</sup>Department of Molecular, Cellular, and Developmental Biology, University of Michigan, Ann Arbor, MI 48109, USA **Fig. S1.** Atg20 is essential for the efficient initiation of A nonselective autophagy. Wild-type and  $atg20\Delta$  cells were monitored using the (A) Pho8 $\Delta$ 60 assay and (B) GFP-Atg8 processing assay (strains ZFY202 and YAB87). (C) The vac8 $\Delta$  and  $atg20\Delta$  vac8 $\Delta$  strains were examined for prApe1 maturation (strains HPY081 and HPY082) as described in the legend for Figure 1C. B





**Fig. S2.** Multiple sequence alignment of Atg20 proteins from three fungi that are often used in autophagy studies. Phosphorylation (P) and acetylation (Ac) sites for the *S. cerevisiae* sequence are marked. Predicted BR and MoRF regions from the *S. cerevisiae* sequence are boxed in green and purple respectively. Black asterisks show the amino acid residues mutated in the Atg20[Aroma] mutant.



**Fig. S3.** Functionality and binding properties of Atg20 mutants. (*A*) The prApe1 maturation in  $atg20\Delta vac8\Delta$  (HPY079) cells transformed with the plasmids pCuGFP(426), pCuGFP-Atg20(426), pCuGFP-Atg20[ $\Delta$ FR](426), pCuGFP-Atg20[ $\Delta$ 380-480](426), pCuGFP-Atg20[ $\Delta$ 533-632](426) or pCuGFP-Atg20[Aroma](426), cultured in rich selective medium and then nitrogen starved for 0.5 h. Statistical significance was tested by unpaired two-tailed Student's t-test. The p values less than 0.005 were considered to be significant (\*\*\*). (*B*) Kinetics of prApe1 maturation after the shift to nitrogen starvation medium for the indicated times. Deletion mutants of Atg20 were compared to empty vector and wild-type Atg20. (*C*) Kinetics of GFP-Atg8 processing during nitrogen starvation for the indicated times. The  $atg20\Delta$  (D3Y009)

cells were transformed with the plasmid pCuGFP-Atg8 (426) and the plasmid pCuPA(424), pCuPA-Atg20(424), pCuPA-Atg20[ $\Delta$ FR](424), pCuPA-Atg20[ $\Delta$ 380-480](424), or pCuPA-Atg20[ $\Delta$ 533-632](424). Error bars represent standard deviation from 3 independent experiments. (*D*) Deletion of Atg20 FR weakens the interaction between Atg20 and Atg11. The plasmids pCuPA(424) or pCuPA-Atg20(424) were transformed into *atg20* $\Delta$  (D3Y009) cells and coexpressed with a plasmid encoding GFP-Atg11 (pCuGFP-Atg11; 416) under the *CUP1* promotor. The large GFP tag at Atg11 completely abolished interaction with the deletion mutant of Atg20. Cells were cultured in SMD media and cell lysates were prepared and incubated with IgG-Sepharose for affinity purification. The proteins were separated by SDS-PAGE and detected with monoclonal antibody that recognizes HA or PA or GFP.



Fig. S4. Multiple sequence alignment of Atg20 proteins from various fungi. The alignment was created in the BioEdit Sequence Alignment Editor (1). The most conserved acetylated lysine

Saccharomyces cerevisiae S288c Schizosaccharomyces pombe 972h Kluyveromyces lactis NRRL Y-11 Debaryomyces hansenii CBS767 Vanderwaltozyma polyspora DSM Ashbya gossypii ATCC 10895 Ogataea angusta

Aspergillus kawachii IFO 4308 Trichophyton equinum CBS 127.9 Talaromyces stipitatus ATCC 10 Neosartorya fischeri NRRL 181 Candida glabrata CBS 138

Saccharomyces cerevisiae 52000 Schizosaccharomyces pombe 972h Kluyveromyces lactis NRRL Y-11 Debaryomyces hansenii CBS767 Vanderwaltozyma polyspora DSM Ashbya gossypii ATCC 10895 Ogataea angusta pergillus kawachii IFO 4308 Aspergillus kawachil fro 4506 Trichophyton equinum CBS 127.9 Talaromyces stipitatus ATCC 10 Neosartorya fischeri NRRL 181 Candida glabrata CBS 138

Saccharomyces cerevisiae S288c Schizosaccharomyces pombe 972h Kluyveromyces lactis NRRL Y-11 Debaryomyces hansenii CBS767 Vanderwaltozyma polyspora DSM

Vanderwaltozyma polyspora DSM Ashbya gossypii ATCC 10895 Ogataea angusta Aspergillus kawachii IFO 4308 Trichophyton equinum CBS 127.9 Talaromyces stipitatus ATCC 10 Neosartozya fischeri NRRL 181 Condida Dibarto CG 128 Candida glabrata CBS 138

Saccharomyces cerevisiae S288c Schizosaccharomyces pombe 972h Kluyveromyces lactis NRRL Y-11 Debarvomvces hansenii CBS767 Vanderwaltozyma polyspora DSM Ashbya goszypii ATCC 10895 Ogataea angusta Aspergillus kawachii IFO 4308 Trichophyton equinum CBS 127.9 Talaromyces stipitatus ATCC 10 Neosartorya fischeri NRRL 181 Candida glabrata CBS 138

Schizosaccharomyces pombe 972h Kluyveromyces lactis NRRL Y-11 Debaryomyces hansenii CBS767 Vanderwaltozyma polyspora DSM Ashbya gossypii ATCC 10895 Ogataea angusta Aspergillus kawachii IFO 4308 Trichophyton equinum CBS 127.9 Talaromyces stipitatus ATCC 10 Neosartorya fischeri NRRL 181 Candida glabrata CBS 138

Saccharomyces cerevisiae S288c Schizosaccharomyces pombe 972h Kluyveromyces lactis NRRL Y-11 Kluyveromyces lactis NRRL 1-11 Debaryomyces hansenii CBS767 Vanderwaltozyma polyspora DSM Ashbya gossypii ATCC 10895 Ogataea angusta Aspergillus kawachii IFO 4308 Trichophyton equinum CBS 127.9 Talaromyces stipitatus ATCC 10 Neosartorya fischeri NRRL 181 Candida glabrata CBS 138

(K218) and phosphorylated serine (S307) in *S cerevisiae* are marked. The black and red lines above the sequences denote the span of the PX and BAR domain in *S. cerevisiae*, respectively.



**Fig. S5.** Probing the conserved motif  ${}_{626}$ NLExW in Atg20. (*A*) The plasmids pCuGFP(426), pCuGFP-Atg20(426) or pCuGFP-Atg20[L627A/W630A](426) were transformed into MKO (YCY123) cells and co-expressed under the *CUP1* promotor with a plasmid encoding PA-Snx4 (pCuPA-Snx4; 424). Cells were cultured in SMD, and cell lysates were prepared and incubated with IgG-Sepharose for affinity purification. The proteins were separated by SDS-PAGE and detected with monoclonal antibody that recognizes GFP or PA. (*B*) PrApe1 processing assay. The *atg20* $\Delta$  (D3Y009) strain was transformed with the plasmid pCuGFP(426), pCuGFP-Atg20[L627A/W630A](426). The *atg11* $\Delta$  strain (SEY6210) was used as a negative control. Cells were cultured in rich selective medium and cell lysates were TCA precipitated. Proteins were detected by Ape1 and Pgk1 antibody after separation on SDS-PAGE.

			K	22										K75					
B B Ione	8±2H	R-NH3	B-H20	0.0	Y Ione	V±2H	V-MH3	V.H20 V		B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y
1 116.0	59.5	00.0	01120	N+1	2 372 1	1 196 6	2 355 1	2 354 1 22		1 58.0	29.5			G	3,603.7	1,802.4	3,586.7	3,585.7	32
2 217.1	109.0	200.1	199.1	T	2.257.1	1,129,1	2,333.1	2,334.1 21		2 173.1 3 287.1	87.0	270.1	269.1	D N	3,546.7	1,773.9	3,529.7	3,528.7	31
3 274.1	137.6	257.1	256.1	G	2,156.1	1,078.5	2,139.0	2,138.0 20		4 402.1	201.6	385.1	384.1	N+1	3,317.6	1,659.3	3,300.6	3,299.6	29
4 444.2	222.6	427.2	426.2	K+42	2,099.0	1,050.0	2,082.0	2,081.0 19		5 530.2 6 629.3	315.1	612.3	611.3	V	3.202.6	1.537.8	3,185.6	3,184.6	28
5 515.2	258.1	498.2	497.2	Α	1,928.9	965.0	1,911.9	1,910.9 18	13	7 758.3	379.7	741.3	740.3	E	2,975.4	1,488.2	2,958.4	2,957.4	26
6 644.3	322.6	627.3	626.3	E	1,857.9	929.4	1,840.9	1,839.9 17		9 988.4	430.2	971.4	970.4	E	2,846.4	1,423.7	2,829.4	2,828.4	25
7 741.3	371.2	724.3	723.3	P	1,728.8	864.9	1,711.8	1,710.8 16		0 1.101.5	551.3	1,084.5	1,083.5	L	2,616.3	1,308.7	2,599.3	2,598.3	23
8 838.4	419.7	821.4	820.4	P	1.631.8	816.4	1,614.8	1.613.8 15		1,200.6	669.3	1,320.6	1,319.6	н	2,503.2	1,202.6	2,387.1	2,485.2	21
9 9/5.5	488.2	958.4	957.4	H	1,534.7	101.9	1,51/./	1,516./ 14		3 1,438.7	719.8	1.421.7	1.420.7	T	2.267.1	1.134.0	2.250.1	2.249.1	20
10 1,032.5	510.7	1,015.4	1,014.5	G	1,397.7	670.9	1,380.7	1,3/9./ 13		1,509.7	811.9	1,492.7	1,491.7	L	2,095.0	1,083.5	2,149.0	2,148.0	19
17 1 234 6	617.9	1 217 5	1,115.5	T	1,340.7	620.3	1 222 6	1 221 6 11	1	1.735.9	868.4	1,718.9	1,717.9	L	1,981.9	991.5	1,964.9	1,963.9	17
13 1 363.6	682.3	1.346.6	1.345.6	F	1.138.6	569.8	1.121.5	1.120.6 10		2,035.0	1.018.0	2.018.0	2,017.0	K+42	1,868.8	870.4	1,851.8	1,850.8	15
14 1.526.7	763.8	1.509.6	1.508.7	Y	1.009.5	505.3	992.5	991.5 9	1	9 2,150.1	1.075.5	2,133.0	2,132.1	D	1,569.7	785.3	1,552.7	1,551.7	14
15 1.625.7	813.4	1.608.7	1.607.7	v	846.5	423.7	829.4	828.4 8		2.264.1	1.132.6	2.247.1	2.246.1	P	1.454.7	670.8	1.437.6	1,436.7	13
16 1,696.8	848.9	1,679.8	1,678.8	A	747.4	374.2	730.4	729.4 7	2	2 2,508.2	1,254.6	2,491.2	2,490.2	F	1,243.6	622.3	1,226.5	1,225.6	11
17 1,825.8	913.4	1,808.8	1,807.8	E	676.4	338.7	659.3	658.3 6	22	23 2,639.3 24 2,768.3	1.320.1	2,622.2	2,621.3	E	1,096.5	548.8 483.2	1,079.5	1,078.5	10 9
18 1,896.9	948.9	1,879.8	1,878.9	A	547.3	274.2	530.3	529.3 5	12	25 2,897.4	1,449.2	2,880.3	2,879.3	E	836.4	418.7	819.4	818.4	8
19 2,025.9	1,013.5	2,008.9	2,007.9	E	476.3	238.6	459.2	458.3 4	2	2,954.4	1,477.7	2,937.3	2,936.4	G	707.4 650.4	354.2	633.3	689.4	6
20 2,139.0	1,070.0	2,122.0	2,121.0	1	347.2	174.1	330.2	329.2 3	2	3,152.5	1.576.7	3,135.4	3,134.5	Ť	553.3	277.2	536.3	535.3	5
21 2,226.0	1,113.5	2,209.0	2,208.0	5	234.1	117.6	217.1	216.1 2	2	3,209.5 3 3,356.6	1,605.3	3,192.5	3,191.5	G	452.3	226.6	435.2	434.2	4
22 2.372.1	1.186.6	2.355.1	2.354.1	K	147.1	74.1	130.1	1	3	3,457.6	1,729.3	3,440.6	3,439.6	T	248.2	124.6	231.1	230.1	2
			17	210					3	32 3,603.7	1,802.4	3,586.7	3,585.7	к	147.1	74.1	130.1		1
			K	218															
B B Ions	B+2H	B-NH3	B-H20	AA	Y Ions	Y+2H	Y-NH3	Y-H20 Y					1	X226	5				
1 114.1	57.5			L	2,011.1	1,006.1	1,994.1	1,993.1 17											
2 261.2	131.1			F	1,898.0	949.5	1,881.0	1,880.0 16	В	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y
3 358.2	179.6			Р	1,751.0	876.0	1,733.9	1,733.0 15	1	116.0		99.0		N+1	1 271 6	636 3	1 254 6	1 253 6	12
4 505.2	253.1			M+16	1,653.9	827.5	1,636.9	1,635.9 14	2	270.4		262.1	261.1	v	1 156 6	570.0	1 130 6	1 130 6	11
5 606.3	303.7		588.3	T	1,506.9	753.9	1,489.9	1,488.9 13	2	220.4	-	240.4	240.4	-	1,130.0	107.2	070.0	075.5	10
6 719.4	360.2		701.4	L	1,405.8	703.4	1,388.8	1,387.8 12	2	330.1	050.0	319.1	318.1	G	993.5	497.5	9/0.5	9/5.5	10
7 832.5	416.7		814.5	I	1,292.7	646.9	1,275.7	1,274.7 11	4	506.2	253.6	489.2	488.2	K+42	936.5	468.8	919.5	918.5	9
8 929.5	465.3	_	911.5	Р	1,1/9./	590.3	1,162.6	1,161./ 10	5	593.3	297.1	576.2	575.2	5	766.4	383.7	749.4	748.4	8
9 1,026.6	513.8		1,008.6	P T	1,082.0	541.8	1,065.6	1,064.6 9	6	706.3	353.7	689.3	688.3	I	679.4	340.2	662.3	661.4	7
11 1 236 7	612.0		1,121.0	D	900.0	493.3	900.0 855.4	907.5 0	7	807.4	404.2	790.4	789.4	T	566.3	283.6	549.3	548.3	6
12 1.365.7	683.4		1.347.7	F	775.4	388.2	758.4	757.4 6	8	864.4	432.7	847.4	846.4	G	465.2		448.2	447.2	5
13 1.535.9	768.4	1.518.8	1.517.8	K+42	646.4	323.7	629.4	628.4 5	9	951.4	476.2	934.4	933.4	5	408.2		391.2	390.2	4
14 1,664.9	833.0	1,647.9	1,646.9	Q+1	476.3	238.6	459.2	458.3 4	10	1.038.5	519.7	1.021.4	1.020.5	5	321.2		304.2	303.2	3
15 1,751.9	876.5	1,734.9	1,733.9	5	347.2	174.1	330.2	329.2 3	11	1 1 25 5	5633	1 109 5	1 107 5	5	23/ 4		217.1	216.1	2
16 1,865.0	933.0	1,848.0	1,847.0	I	260.2	130.6	243.2	2	12	1,123.3	626.2	4 364 6	4 352 6	2	447.4		420.4	210.1	1
17 2,011.1	1,006.1	1,994.1	1,993.1	K	147.1	74.1	130.1	1	12	1,2/1.0	030.3	1,234.0	1,255.0	K	14/.1		100.1		1
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B B Ions	B+2H	B-NH3	B-H20	AA	Y Ions	Y+2H	Y-NH3	Y-H20 Y	-	Diar	B . 31	0.00/2	0.000		VIer	¥.21	VALO	V UDD	v
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3 346.2	173.6		328.2	T	1.836.0	918.5	1.818.9	1.818.0 15	2	235.1	118.1		217.1	F	2,651.3	1,326.1	2,634.2	2.633.2	21
4 475.2						060.0	1 717 9	4 746 0 14	3	330.2	108.0	100.0	318.1	1	2,504.2	1,252.6	2,481.2	2,480.2	20
41 3.2	238.1		457.2	E	1,734.9	000.0	1.1 11.5	1,/10.9 14				A 4 4 4	<b>M N N N</b>	-14		1.202.	2.300.1	2,303.1	17
5 622.3	238.1 311.6		457.2 604.3	F	1,734.9	803.4	1,588.8	1,587.9 13	5	563.3	223.0	433.2	4JZ.Z	T	2 280 1	1145.0	2 272 4	2 274 4	194
5 622.3 6 735.4	238.1 311.6 368.2		457.2 604.3 717.4	F	1,734.9 1,605.9 1,458.8	803.4 729.9	1,588.8	1,710.9 14 1,587.9 13 1,440.8 12	5	563.3	282.1	433.2 546.3 675.3	432.2 545.3 674.3	I	2,289.1	1,145.0	2,272.1	2,271.1	18
5 622.3 6 735.4 7 850.4	238.1 311.6 368.2 425.7	833.4	457.2 604.3 717.4 832.4	F L N+1	1,734.9 1,605.9 1,458.8 1,345.7	803.4 729.9 673.4	1,588.8 1,441.8 1,328.7	1,710.9 14 1,587.9 13 1,440.8 12 1,327.7 11	4 5 6 7	430.2 563.3 692.3 820.4	223.0 282.1 346.7 410.7	433.2 546.3 675.3 803.4	432.2 545.3 674.3 802.4	I E O	2,289.1 2,176.0 2,047.0	1,145.0 1,088.5 1,024.0	2,272.1 2,159.0 2,029.9	2,271.1 2,158.0 2,029.0	18 17 16
5 622.3 6 735.4 7 850.4 8 1.020.5	238.1 311.6 368.2 425.7 510.8	833.4 1,003.5	457.2 604.3 717.4 832.4 1,002.5	E F L N+1 K+42	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7	803.4 729.9 673.4 615.9	1,588.8 1,441.8 1,328.7 1,213.7	1,716.9         14           1,587.9         13           1,440.8         12           1,327.7         11           1,212.7         10	5 6 7 8	450.2 563.3 692.3 820.4 935.4	282.1 346.7 410.7 468.2	433.2 546.3 675.3 803.4 918.4	432.2 545.3 674.3 802.4 917.4	I E Q D	2,289.1 2,176.0 2,047.0 1,918.9	1,145.0 1,088.5 1,024.0 960.0	2,272.1 2,159.0 2,029.9 1,901.9	2,271.1 2,158.0 2,029.0 1,900.9	18 17 16 15
5 622.3 6 735.4 7 850.4 8 1.020.5 9 1.133.6	238.1 311.6 368.2 425.7 510.8 567.3	833.4 1,003.5 1,116.6	457.2 604.3 717.4 832.4 1,002.5 1,115.6	E F L N+1 K+42 L	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6	803.4 729.9 673.4 615.9 530.8	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6	1,716.9 14 1,587.9 13 1,440.8 12 1,327.7 11 1,212.7 10 1,042.6 9	7 6 7 8 9	430.2 563.3 692.3 820.4 935.4 1,098.5	223.0 282.1 346.7 410.7 468.2 549.7	433.2 546.3 675.3 803.4 918.4 1,081.4	432.2 545.3 674.3 802.4 917.4 1,080.5	I E Q D Y	2,289.1 2,176.0 2,047.0 1,918.9 1,803.9	1,145.0 1,088.5 1,024.0 960.0 902.4	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9	18 17 16 15 14
5 622.3 6 735.4 7 850.4 8 1.020.5 9 1.133.6 10 1.246.7	238.1 311.6 368.2 425.7 510.8 567.3 623.8	833.4 1,003.5 1,116.6 1,229.6	457.2 604.3 717.4 832.4 1,002.5 1,115.6 1,228.7	E F N+1 K+42 L L	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5	808.0 803.4 729.9 673.4 615.9 530.8 474.3	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5	1,710,9 14 1,587,9 13 1,440,8 12 1,327,7 11 1,212,7 10 1,042,6 9 929,5 8 916,4	4 5 6 7 8 9 10	430.2 563.3 692.3 820.4 935.4 1,098.5 1,268.6	223.0 282.1 346.7 410.7 468.2 549.7 634.8	433.2 546.3 675.3 803.4 918.4 1,081.4 1,251.6	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6	I Ε Q D Y K+42	2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8	18 17 16 15 14 13
5 622.3 6 735.4 7 850.4 8 1.020.5 9 1.133.6 10 1.246.7 11 1.347.7	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4	833.4 1,003.5 1,116.6 1,229.6 1,330.7	457.2 604.3 717.4 832.4 1,002.5 1,115.6 1,228.7 1,329.7	E F N+1 K+42 L L T	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4	803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 746.2	1,716.9 14 1,587.9 13 1,440.8 12 1,327.7 11 1,212.7 10 1,042.6 9 929.5 8 816.4 7 715.4 6	4 5 6 7 8 9 10 11	430.2 563.3 692.3 820.4 935.4 1,098.5 1,268.6 1,396.6	223.0 282.1 346.7 410.7 468.2 549.7 634.8 698.8	433.2 546.3 675.3 803.4 918.4 1,081.4 1,251.6 1,379.6	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6	I Ε Q D Y K+42 Q	2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7	18 17 16 15 14 13 12
5 622.3 6 735.4 7 850.4 8 1.020.5 9 1.133.6 10 1.246.7 11 1.347.7 12 1.461.8 13 1.590.8	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 795.9	833.4 1,003.5 1,116.6 1,229.6 1,330.7 1,444.7 1,573.8	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8	E F L K+42 L L T N F	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3	803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3	1,716.9 14 1,587.9 13 1,440.8 12 1,327.7 11 1,212.7 10 1,042.6 9 929.5 8 816.4 7 715.4 6 601.3 5	4 5 6 7 8 9 10 11 12	436.2 563.3 692.3 820.4 935.4 1,098.5 1,268.6 1,396.6 1,559.7	223.0 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4	433.2 546.3 675.3 803.4 918.4 1,081.4 1,251.6 1,379.6 1,542.7	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6 1,541.7	I E Q D Y K+42 Q Y	2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 <b>1,342.7</b>	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6	18 17 16 15 14 13 12 11
5 622.3 6 735.4 7 850.4 8 1.020.5 9 1.133.6 10 1.246.7 11 1.347.7 12 1.461.8 13 1.590.8 14 1.719.9	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 795.9 860.4	833.4 1,003.5 1,116.6 1,229.6 1,330.7 1,444.7 1,573.8 1,702.8	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8 1.701.8	E F L N+1 K+42 L L T N E E	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3 490.3	803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3	1,716.9 14 1,587.9 13 1,440.8 12 1,327.7 11 1,212.7 10 1,042.6 9 929.5 8 816.4 7 715.4 6 601.3 5 472.3 4	4 5 6 7 8 9 10 11 12 13	436.2 563.3 692.3 820.4 935.4 1.098.5 1.268.6 1.396.6 1.559.7 1.688.7	223.0 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9	433.2 546.3 675.3 803.4 918.4 1,081.4 1,251.6 1,379.6 1,542.7 1,671.7	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6 1,541.7 1,670.7	Π Ε Q D Y K+42 Q Y Ε	2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,179.6	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6	18 17 16 15 14 13 12 11 10
5 622.3 6 735.4 7 850.4 8 1.020.5 9 1.133.6 10 1.246.7 11 1.347.7 12 1.461.8 13 1.590.8 14 1.719.9 15 1.832.9	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 795.9 860.4 917.0	833.4 1,003.5 1,116.6 1,229.6 1,330.7 1,444.7 1,573.8 1,702.8 1,815.9	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8 1.701.8 1.814.9	E F L K+42 L L T N E E E I	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3 490.3 361.2	803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3 344.2	1,763         14           1,587.9         13           1,440.8         12           1,327.7         11           1,212.7         10           1,042.6         9           929.5         8           816.4         7           715.4         6           601.3         5           472.3         4           343.2         3	4 5 6 7 8 9 10 11 12 13 14	430.2 563.3 692.3 820.4 935.4 1,098.5 1,268.6 1,396.6 1,559.7 1,688.7 1,802.8	225.0 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9 901.9	433.2 546.3 675.3 803.4 918.4 1,081.4 1,251.6 1,379.6 1,542.7 1,671.7 1,785.8	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6 1,541.7 1,670.7 1,784.8	Π Ε Q D Y K+42 Q Y Ε Ν	2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,179.6 1,050.5	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,033.5	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5	18 17 16 15 14 13 12 11 10 9
5 622.3 6 735.4 7 850.4 8 1.020.5 9 1.133.6 10 1.246.7 11 1.347.7 12 1.461.8 13 1.590.8 14 1.719.9 15 1.832.9 16 1.934.0	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 795.9 860.4 917.0 967.5	833.4 1.003.5 1.116.6 1.229.6 1.330.7 1.444.7 1.573.8 1.702.8 1.815.9 1.917.0	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8 1.701.8 1.814.9 1.916.0	E F L N+1 L L L T E E I T	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3 490.3 361.2 248.2	803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1 124.6	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3 344.2 231.1	1,763,9         13           1,587,9         13           1,440,8         12           1,327,7         11           1,212,7         10           1,042,6         9           929,5         8           816,4         7           715,4         6           601,3         5           472,3         4           343,2         3           230,1         2	4 5 6 7 8 9 10 11 12 13 14 15	436.2 563.3 692.3 820.4 935.4 1,098.5 1,268.6 1,396.6 1,559.7 1,688.7 1,802.8 1,915.9	225.0 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9 901.9 901.9	433.2 546.3 675.3 803.4 918.4 1,081.4 1,251.6 1,379.6 1,542.7 1,671.7 1,785.8 1,898.8	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6 1,541.7 1,670.7 1,784.8 1,897.9	I Ε Q D Y K+42 Q Y E N L	2,483.1 2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,179.6 1,050.5 936.5	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8 468.8	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,033.5 919.5	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5 918.5	18 17 16 15 14 13 12 11 10 9 8
1         1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 731.4 731.4 967.5 1,040.5	833.4 1.003.5 1.116.6 1.229.6 1.330.7 1.444.7 1.573.8 1.702.8 1.815.9 1.917.0 2.063.1	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.329.7 1.443.8 1.572.8 1.701.8 1.814.9 1.916.0 2.062.1	E F L N+1 K+42 L L T N E E I T K	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3 490.3 361.2 248.2 147.1	808.0 803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1 124.6 74.1	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3 344.2 231.1 130.1	1,763         14           1,587.9         13           1,440.8         12           1,327.7         11           1,212.7         10           1,042.6         9           929.5         8           816.4         7           715.4         6           601.3         5           472.3         4           343.2         3           230.1         2           1         1	4 5 6 7 8 9 10 11 12 13 14 15 16	430.2 563.3 692.3 820.4 935.4 1,098.5 1,268.6 1,396.6 1,559.7 1,688.7 1,802.8 1,915.9 2,029.0	223.0 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9 901.9 958.4 1.015.0	433.2 546.3 675.3 803.4 918.4 1,081.4 1,251.6 1,379.6 1,542.7 1,671.7 1,785.8 1,898.8 2,011.9	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6 1,541.7 1,670.7 1,784.8 1,897.9 2,010.9 2,010.9	П Е Q D Y K+42 Q Y E N L L	2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,179.6 1,050.5 936.5 823.4	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8 468.8 412.2	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,033.5 919.5 806.4 602.2	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5 918.5 805.4 605.4	18 17 16 15 14 13 12 11 10 9 8 7
1         1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 795.9 860.4 917.0 967.5	833.4 1,003.5 1,116.6 1,229.6 1,330.7 1,444.7 1,573.8 1,702.8 1,815.9 1,917.0 2,063.1	457.2 604.3 717.4 832.4 1.002.5 1.415.6 1.228.7 1.329.7 1.329.7 1.343.8 1.572.8 1.701.8 1.814.9 1.916.0 2.062.1	E F L N+1 K+42 L T N E E E I T K	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3 490.3 361.2 248.2 147.1	808.0 803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1 124.6 74.1	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3 344.2 231.1 130.1	1,763.9         13           1,587.9         13           1,440.8         12           1,327.7         11           1,042.6         9           929.5         8           816.4         7           715.4         6           601.3         5           472.3         4           343.2         3           230.1         2	4 5 6 7 8 9 10 11 12 13 14 15 16 17 7	430.2 563.3 692.3 820.4 935.4 1.098.5 1.268.6 1.396.6 1.559.7 1.688.7 1.802.8 1.915.9 2.029.0 2.144.0 2.529.0	223.0 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9 901.9 958.4 1.015.0 1.072.5	433.2 546.3 675.3 803.4 918.4 1.081.4 1.251.6 1.542.7 1.671.7 1.785.8 1.898.8 2.011.9 2.127.0 2.243.6	432.2 545.3 674.3 802.4 917.4 1.080.5 1.250.6 1.378.6 1.541.7 1.670.7 1.784.8 1.897.9 2.010.9 2.1260. 2.344.0	I E Q D Y K+42 Q Y E N L L L D	2,289,1 2,176,0 2,047,0 1,918,9 1,803,9 1,640,8 1,470,7 1,342,7 1,179,6 1,050,5 936,5 823,4 710,3 595,5	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8 468.8 412.2 3557.2 208.2	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,162.6 1,033.5 919.5 806.4 693.3 678.2	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5 918.5 805.4 692.3	18 17 16 15 14 13 12 11 10 9 8 7 6
1         1	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 795.9 860.4 917.0 967.5 1,040.5	833.4 1,003.5 1,116.6 1,229.6 1,330.7 1,444.7 1,573.8 1,702.8 1,815.9 1,815.9 1,917.0 2,063.1	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8 1.701.8 1.814.9 1.916.0 2.062.1	E F L N+1 L L T N E E I T K	1.734.9 1.605.9 1.458.8 1.345.7 1.230.7 1.060.6 947.5 834.4 733.4 619.3 490.3 361.2 248.2 147.1	803.0 803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1 124.6 74.1	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3 344.2 231.1 130.1	1,76.9         13           1,587.9         13           1,440.8         12           1,327.7         11           1,042.6         9           929.5         8           816.4         7           715.4         6           601.3         5           472.3         4           343.2         3           230.1         2	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	430.2 563.3 692.3 820.4 935.4 1.098.5 1.268.6 1.396.6 1.559.7 1.688.7 1.802.8 1.915.9 2.029.0 2.144.0 2.259.0 2.316.0	223.6 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9 901.9 9058.4 1.015.0 1.072.5 1.130.0 1.150	433.2 546.3 675.3 803.4 918.4 1.081.4 1.251.6 1.542.7 1.671.7 1.674.7 1.785.8 1.898.8 2.011.9 2.127.0 2.220.0	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6 1,541.7 1,670.7 1,784.8 1,897.9 2,010.9 2,126.0 2,241.0 2,202.0	н Е Q D Y K+42 Q Y E N L L D N+11 C	2,289.1 2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,342.7 1,179.6 1,050.5 936.5 823.4 710.3 595.3 480.3	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8 468.8 412.2 355.7 298.7 298.2 249.6	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,033.5 919.5 806.4 693.3 578.3	2,271.1 2,158.0 2,029.0 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5 918.5 805.4 692.3	18 17 16 15 14 13 12 11 10 9 8 7 6 5 4
5         622.3           6         735.4           7         850.4           8         10.020.5           9         14.135.6           10         1.246.7           11         1.347.7           12         1.461.8           13         1.590.8           14         1.719.9           15         1.832.9           16         1.934.0           17         2.080.1	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 795.9 860.4 917.0 967.5 1,040.5	833.4 1,003.5 1,116.6 1,229.6 1,330.7 1,444.7 1,573.8 1,702.8 1,815.9 1,917.0 2,063.1	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8 1.701.8 1.814.9 1.916.0 2.062.1	E F L K+42 L T N E E I T K	1.734.9 1.605.9 1.458.8 1.345.7 1.230.7 1.060.6 947.5 834.4 733.4 619.3 490.3 361.2 248.2 147.1	803.0 803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1 124.6 74.1	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3 344.2 231.1 130.1	1,763,9 13 1,587,9 13 1,440,8 12 1,327,7 11 1,212,7 11 1,042,6 9 929,5 8 816,4 7 715,4 6 601,3 5 472,3 4 343,2 3 230,1 2 1	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	430.2 563.3 692.3 820.4 935.4 1.098.5 1.268.6 1.396.6 1.359.7 1.802.8 1.915.9 2.029.0 2.144.0 2.259.0 2.316.0 2.259.0 2.429.1	223.6 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 901.9 901.9 9058.4 1.015.0 1.072.5 1.130.0 1.158.5 1.235.1	433.2 546.3 675.3 803.4 918.4 1.081.4 1.251.6 1.542.7 1.671.7 1.765.8 1.898.8 2.011.9 2.127.0 2.242.0 2.242.0	432.2 545.3 674.3 802.4 917.4 1,080.5 1,250.6 1,378.6 1,541.7 1,670.7 1,784.8 1,897.9 2,010.9 2,126.0 2,241.0 2,241.0 2,241.1	П Е Q D Y K+42 Q Y E N L L L D N+1 G T	2,289.1 2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,342.7 1,179.6 1,050.5 936.5 823.4 710.3 595.3 480.3 423.3	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8 468.8 412.2 355.7 298.2 240.6 212.1	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,033.5 919.5 806.4 693.3 578.3 4663.3	2,271.1 2,158.0 2,029.0 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5 918.5 805.4 692.3	18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3
1         1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>	238.1 311.6 368.2 425.7 510.8 567.3 623.8 674.4 731.4 795.9 860.4 917.0 967.5 1,040.5	833.4 1,003.5 1,116.6 1,229.6 1,330.7 1,444.7 1,573.8 1,702.8 1,815.9 1,917.0 2,063.1	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8 1.443.8 1.572.8 1.701.8 1.572.8 1.701.8 1.916.0 2.062.1	E F N+1 K+42 L T N E E I T K	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3 490.3 361.2 248.2 147.1	808.0 803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1 124.6 74.1	1,588.8 1,441.8 1,328.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 473.3 344.2 231.1 130.1	1,76.3         1           1,587.9         13           1,440.8         12           1,327.7         11           1,212.7         10           1,042.6         9           929.5         8           816.4         7           715.4         6           601.3         5           472.3         4           343.2         3           230.1         2           1         1	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	430.2 563.3 692.3 820.4 935.4 1.098.5 1.268.6 1.396.6 1.396.6 1.396.6 1.559.7 1.888.7 1.802.8 1.915.9 2.029.0 2.144.0 2.259.0 2.316.0 2.429.1 2.592.2	223.6 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9 901.9 958.4 1.015.0 1.072.5 1.130.0 1.158.5 1.215.1 1.296.6	433.2 546.3 675.3 803.4 918.4 1.251.6 1.542.7 1.671.7 1.785.8 1.542.7 1.674.7 1.785.8 2.011.9 2.127.0 2.242.0 2.299.0 2.412.1 2.575.2	432.2 545.3 674.3 802.4 917.4 1.080.5 1.250.6 1.378.6 1.541.7 1.670.7 1.784.8 1.897.9 2.010.9 2.010.9 2.126.0 2.241.0 2.241.0 2.241.1 2.574.2	н Е Q D Y K+42 Q Y E N L L D N+1 G I Y	2,289.1 2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,050.5 936.5 936.5 936.5 823.4 710.3 595.3 480.3 423.3 310.2	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8 468.8 412.2 355.7 298.2 240.6 212.1 155.6	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,033.5 919.5 806.4 693.3 578.3 4663.3 406.2 293.1	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5 918.5 805.4 692.3	18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2
1         1.3.6           5         62.3           6         735.4           7         850.4           8         1.020.5           9         1.133.6           10         1.246.7           11         1.347.7           12         1.461.8           13         1.590.8           14         1.719.9           15         1.832.9           16         1.93.40           17         2.080.1	238.1 311.6 368.2 425.7 510.8 623.8 673.4 731.4 795.9 860.4 917.0 967.5 1,040.5	833.4 1.003.5 1.116.6 1.229.6 1.330.7 1.444.7 1.573.8 1.702.8 1.815.9 1.917.0 2.063.1	457.2 604.3 717.4 832.4 1.002.5 1.115.6 1.228.7 1.329.7 1.443.8 1.572.8 1.443.8 1.572.8 1.701.8 1.814.9 1.916.0 2.062.1	E F N+1 K+42 L T N E E I T K	1,734.9 1,605.9 1,458.8 1,345.7 1,230.7 1,060.6 947.5 834.4 733.4 619.3 490.3 361.2 248.2 147.1	803.4 729.9 673.4 615.9 530.8 474.3 417.7 367.2 310.2 245.6 181.1 124.6 74.1	1,588.8 1,541.8 1,528.7 1,213.7 1,043.6 930.5 817.4 716.3 602.3 344.2 231.1 130.1	1,763         1           1,587.9         13           1,440.8         12           1,327.7         11           1,042.6         9           929.5         8           816.4         7           715.4         6           601.3         5           472.3         4           343.2         3           230.1         2	4         5           6         7           8         9           10         11           12         13           14         15           16         17           18         19           20         21           22         22	430.2 563.3 692.3 820.4 935.4 1.098.5 1.268.6 1.396.6 1.396.6 1.559.7 1.688.7 1.88.7 1.802.8 1.915.9 2.029.0 2.144.0 2.259.0 2.316.0 2.429.1 2.59.2 2.59.2 2.59.3	223.6 282.1 346.7 410.7 468.2 549.7 634.8 698.8 780.4 844.9 901.9 9058.4 1.015.0 1.072.5 1.130.0 1.158.5 1.215.1 1.296.6 1.369.6	433.2 546.3 675.3 803.4 918.4 1.081.4 1.251.6 1.542.7 1.671.7 1.785.8 1.898.8 2.011.9 2.127.0 2.242.0 2.299.0 2.412.1 2.575.2 2.721.3	432.2 545.3 674.3 802.4 917.4 1.080.5 1.250.6 1.378.6 1.541.7 1.670.7 1.784.8 1.897.9 2.010.9 2.010.9 2.126.0 2.241.0 2.288.0 2.241.2 2.574.2 2.574.2 2.720.3	н Е Q D Y K+42 Q Y E N L L L D N+1 G I Y K	2,289.1 2,289.1 2,176.0 2,047.0 1,918.9 1,803.9 1,640.8 1,470.7 1,342.7 1,050.5 936.5 823.4 710.3 595.3 480.3 423.3 310.2 147.1	1,145.0 1,088.5 1,024.0 960.0 902.4 820.9 735.9 671.8 590.3 525.8 468.8 412.2 355.7 298.2 240.6 212.1 155.6 74.1	2,272.1 2,159.0 2,029.9 1,901.9 1,786.9 1,623.8 1,453.7 1,325.6 1,162.6 1,162.6 1,162.6 1,033.5 919.5 8064. 693.3 578.3 463.3 406.2 293.1 130.1	2,271.1 2,158.0 2,029.0 1,900.9 1,785.9 1,622.8 1,452.7 1,324.6 1,161.6 1,032.5 918.5 805.4 692.3	18           17           16           15           14           13           12           11           10           9           8           7           6           5           4           3           2           1

**Fig. S6.** Fragmentation tables as they appear in the Scaffold program for acetylated lysines (K22, K75, K218, K226, K277, and K372) in Atg20. The presence of acetylated lysine (K+42) is confirmed by b and/or y ions that are highlighted in red and blue color.

	K502											K532								
в	B Ions	8+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H20	YE	BIO	ns B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H20	Y
1	114.1	57.5			1	2 555 2	1.278.1	2 5 3 8 2	2.537.2	21	8	8.0 44.	5	70.0	5	2.430.2	1,215.6	2.413.1	2.412.2	23
2	243 1	122.1		225.1	F	2 442 1	1 221 6	2 4 25 1	2 424 1	20 3	27	25.1 113	1	207.1	н	2.343.1	1.172.1	2.326.1	2.325.1	22
3	314.2	157.6		296.2	A	2.313.1	1.157.0	2,296.0	2,295.0	19	32	26.1 163	.6	308.1	T	2.206.1	1.103.5	2.189.1	2.188.1	21
4	442.2	221.6	425.2	424.2	0	2 242 0	1 121 5	2,225.0	2,224.0	18	43	39.2 220	1	421.2	I	2.105.0	1.053.0	2.088.0	2.087.0	20
5	557.3	279.1	540.2	539.2	N+1	2114.0	1057.5	2 096 9	2 095 9	17	55	3.3 277	1 536.2	535.3	N	1,992.0	996.5	1.974.9	1,973,9	19
6	671.3	336.2	654.3	653.3	N	1.998.9	1.000.0	1.981.9	1,980.9	16 6	66	6.4 333	7 649.3	648.3	1	1.877.9	939.5	1.860.9	1.859.9	18
7	800.3	400.7	783.3	782 3	F	1 884 9	942.9	1.867.9	1.866.9	15	79	398	2 778.4	777.4	F	1.764.8	882.9	1.747.8	1.746.8	17
8	963.4	482.2	946.4	945.4	Y	1755.8	878.4	1,738.8	1,737.8	14 8	95	51.5 476	3 934.5	933.5	R	1.635.8	818.4	1.618.8	1.617.8	16
9	11335	567 3	1 116 5	1 115 5	K+47	1 592 8	796.9	1 575.8	1 574 8	13 9	1.0	48.6 524	8 1.031.5	1.030.5	P	1.479.7	740.3	1.462.7	1.461.7	15
10	1 248 5	624.8	1 231 5	1 230 5	D	1 422 7	711.8	14057	1 404 7	12 1	0 11	62.6 581	8 1.145.6	1 144 6	N	1.382.6	691.8	1 365.6	1 364 6	14
11	1 347 6	674 3	1 330.6	1 329 6	v	1 307 7	654 3	1 290.6	1,289.6	11 1	1 1.2	76.6 638	8 1,259.6	1,258,6	N	1,268.6	634.8	1,251.6	1,250.6	13
12	1 462 6	731.8	1 445 6	1 444 6	D	1 208 6	604.8	1 191 6	1 190 6	10 1	2 1.3	90.7 695	8 13737	1.372.7	N	1.154.5	577.8	1.137.5	1.136.5	12
13	1 590 7	795.9	1 573 7	1 572 7	K	1 093 6	547 3	10765	10755	9 1	3 14	91 7 746	4 14747	14737	т	1 040 5	520.8	10235	1 022 5	11
14	1703.8	852.4	1 686 8	1 685 8	I	965.5	483.2	948 4	947 5	8 1	4 1.5	48.8 774	9 15317	1,530.7	6	939.5	470.2	9224	921.4	10
15	1 916 0	000.0	1 700 0	1 709 0	T	952 A	405.2	935 A	934 4	7 1	5 16	35.2 219	4 16188	1 617 8	5	8824	4/0.2	865.4	864 A	9
16	1 031 0	966.5	1 01/ 0	1 013 0	D	730 3	370.1	7223	721 3	6 1	5 16	02.8 846	9 1675.8	1 674 8	G.	7954	308.2	778.4	777 4	8
17	20460	10235	2 0 2 8 0	2 0 28 0	N	624 3	3126	607.2	606.3	5 1	7 17	40.8 875	4 17328	1 731 8	G	738 4	360.7	721.4	720.4	7
18	2175.0	1 088 0	2 158 0	2157.0	F	510.2	255.6	493.2	492.2	4 1	8 1 9	19.9 960	5 1 902 9	1 901 9	K+42	681.4	341.2	664 3	663.3	6
19	2 322 0	1 161 5	2 305 0	2 304 0	M+16	381.2	101 1	364.2	363.2	3 1	9 20	07.0 1.00	1 989 9	1 989 0	S	511.3	256.1	494.2	493.2	5
20	2 400 1	1 205 0	2 302 0	2 304.0	5	234.1	117.6	217.1	216.1	2 2	0 21	70.0 1.08	5 21530	2 152 0	v	424.2	212.6	407.2	TUVIL	4
21	2,403.1	1 279 1	2,532.0	2,537.2		147.1	74.1	130.1	210.1	1 2	1 22	27.0 1.11	10 22100	2 200 0	G	261.2	131 1	244.1		3
	2,333,2	1,270.1	2,000,2	2,001.2	ĸ	147.1	/4.1	130.1		- 5	2 22	841 114	25 22670	2 266 1	6	204.1	102.6	187 1		2
										-	- 412		2120110	2120011		2041	102.0	101.1		-
										2	3 24	30.2 1.21	6 24131	24122	K	147 1	741	130 1		1
				K	590					2	3 2,4	30.2 1,21	5.6 2,413.1	2,412.2	K	147.1	74.1	130.1		1
в	B Ions	B+2H	B-NH3	К в-н20	.590 AA	Y Ions	Y+2H	Y-NH3	Y-H20	Y	3 2,4	30.2 1,21	5.6 2,413.1	2,412.2	к К61	147.1 3	74.1	130.1		1
B 1	B Ions 130.0	B+2H 65.5	B-NH3	К вн20 112.0	590 АА Е	Y Ions 2,787.4	Y+2H 1,394.2	Y-NH3 2,770.4	Y-H2O 2,769.4	Y 24	3 2,4	30.2 1,21	5.6 2,413.1	2,412.2	к К61	147.1 3	74.1	130.1		1
B 1 2	B Ions 130.0 243.1	B+2H 65.5 122.1	B-NH3	К в-н20 112.0 225.1	AA E I	Y Ions 2,787.4 2,658.4	Y+2H 1,394.2 1,329.7	Y-NH3 2,770.4 2,641.4	Y-H2O 2.769.4 2.640.4	Y 24 23	3 2,4	30.2 1,21	5.6 2,413.1	2,412.2	к К61	<u>147.1</u> 3	74.1	130.1		1
B 1 2 3	B Ions 130.0 243.1 372.2	B+2H 65.5 122.1 186.6	B-NH3	В-H20 112.0 225.1 354.2	AA E I E	Y Ions 2,787.4 2,658.4 2,545.3	Y+2H 1,394.2 1,329.7 1,273.2	Y-NH3 2.770.4 2,641.4 2,528.3	Y-H2O 2,769.4 2,640.4 2,527.3	Y 24 23 22	3 2,4	30.2 1,21	5.6 2,413.1	2,412.2	к К61:	147.1 3	74.1	130.1	V H2O	1
B 1 2 3 4	B Ions 130.0 243.1 372.2 500.2	B+2H 65.5 122.1 186.6 250.6	8-NH3 483.2	BH20 112.0 225.1 354.2 482.2 595.3	AA E I Q	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,298.2	Y+2H 1,394.2 1,329.7 1,273.2 1,208.6 1,144.6	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,274.2	Y-H2O 2,769.4 2,640.4 2,527.3 2,398.3 2,398.3	Y 24 23 22 21 8	3 2,4 B Io	130.2 1,21	8-NH3	2,412.2 B-H2O	к К61: АА	147.1 3 Y Ions	74.1 Y+2H	130.1 Y-NH3	Y-H20	1 Y
B 1 2 3 4 5 6	B Ions 130.0 243.1 372.2 500.2 613.3 700.4	B+2H 65.5 122.1 186.6 250.6 307.2 350.7	B-NH3 483.2 596.3 683.3	K BH20 112.0 225.1 354.2 482.2 595.3 682.3	AA E I Q L	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,288.2 2,175.1	Y+2H 1.394.2 1,329.7 1,273.2 1,208.6 1,144.6 1,088.1	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1	YH2O 2,769.4 2,640.4 2,527.3 2,398.3 2,270.2 2,157.1	Y 24 22 21 19	3 2,4 B Io 1 1:	ns B+2H 30.0 65	5.6 2,413.1 B-NH3 5	2,412.2 B-H20 112.0	к К61: АА Е	147.1 3 Y Ions 1,916.0	74.1 Y+2H 958.5	130.1 Y-NH3 1,899.0	Y-H2O 1,898.0	1 Y 15
B 1 2 3 4 5 6 7	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2	B-NH3 483.2 596.3 683.3 812.4	K B-H20 112.0 225.1 354.2 482.2 595.3 682.3 811.4	(590) AA E I E Q L S E	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,288.2 2,175.1 2,088.1	Y+2H 1.394.2 1.329.7 1.273.2 1.208.6 1.144.6 1.088.1 1.044.6	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 2,071.1	YH2O 2,769.4 2,640.4 2,527.3 2,398.3 2,270.2 2,157.1 2,070.1	Y 24 23 22 21 19 18	B Io 1 1: 2 28	ns B+2H 30.0 65. 56.2 143	B-№H3 5.6 269.1	2,412.2 B-H2O 112.0 268.1	к К613 АА Е R	147.1 3 Y Ions 1,916.0 1,786.9	74.1 Y+2H 958.5 894.0	130.1 Y-NH3 1,899.0 1,769.9	Y-H20 1,898.0 1,768.9	1 Y 15 14
B 1 2 3 4 5 6 7 8	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7	B-NH3 483.2 596.3 683.3 812.4 899.4	K BH20 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4	AA E I E Q L S E S	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,288.2 2,175.1 2,088.1 1,959.1	Y+2H 1,394.2 1,329.7 1,273.2 1,208.6 1,144.6 1,088.1 1,044.6 980.0	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 2,071.1 1,942.0	YH2O 2,769.4 2,640.4 2,527.3 2,398.3 2,270.2 2,157.1 2,070.1 1,941.0	Y 24 23 22 21 19 18 17	3 2,4 3 B Io 1 1: 2 28 3 4'	ns B+2H 30.0 65. 86.2 143 15.2 208	B-NH3 5.6 269.1 .1 398.2	2,412.2 B-H2O 112.0 268.1 397.2	K K61. AA E R E	147.1 3 Y Ions 1,916.0 1,786.9 1,630.8	74.1 Y+2H 958.5 894.0 815.9	130.1 Y-NH3 1,899.0 1,769.9 1,613.8	Y-H2O 1,898.0 1,768.9 1,612.8	1 Y 15 14 13
B 1 2 3 4 5 6 7 8 9	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 1.029.5	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 <b>458.7</b> 515.3	B-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5	K 8-H20 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5	AA E I E Q L S E S L	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,288.2 2,175.1 2,088.1 1,959.1 1,872.0	Y+2H 1.394.2 1,329.7 1,273.2 1,208.6 1,144.6 1,088.1 1,044.6 980.0 936.5	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 2,071.1 1,942.0 1,855.0	Y-H2O 2,769.4 2,640.4 2,527.3 2,398.3 2,270.2 2,157.1 2,070.1 1,941.0 1,854.0	Y 24 23 22 21 8 20 19 18 17 16	3 2,4 B Io 1 1: 2 28 3 4: 4 5:	ns B+2H 30.0 65. 86.2 143 15.2 208 14.3 257	B-№H3 5.6 269.1 .1 398.2 .6 497.2	2,412.2 B-H2O 112.0 268.1 397.2 496.3	K K61: AA E R E V	147.1 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8	74.1 Y+2H 958.5 894.0 815.9 751.4	130.1 Y-NH3 1,899.0 1,769.9 1,613.8 1,484.8	Y-H2O 1,898.0 1,768.9 1,612.8 1,483.8	1 Y 15 14 13 12
B 1 2 3 4 5 6 7 8 9 10	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 1.029.5 1.158.6	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 <b>458.7</b> 515.3 579.8	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.141.5	K BH20 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5 1.140.5	AA E I Q L S E S L E	Y Ions 2,787.4 2,658.4 2,416.3 2,288.2 2,175.1 2,088.1 1,959.1 1,872.0 1,758.9	Y+2H 1,394.2 1,329.7 1,273.2 1,208.6 1,144.6 980.0 936.5 880.0	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 2,071.1 1,942.0 1,855.0 1,741.9	Y-H2O 2,769.4 2,640.4 2,527.3 2,398.3 2,270.2 2,157.1 2,070.1 1,941.0 1,854.0 1,740.9	Y 24 23 22 21 8 20 19 19 18 17 16 15	B Io B Io 1 1: 2 28 3 4' 4 5' 5 6;	ns B+2H 30.0 65. 86.2 143 15.2 208 14.3 257 29.3 315	B-NH3 5 6 269.1 1 398.2 6 497.2 1 612.3	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3	K K61: AA E R E V D	147.1 3 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9	Y-NH3 1,899.0 1,769.9 1,613.8 1,484.8 1,385.7	Y-H2O 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7	1 Y 15 14 13 12 11
B 1 2 3 4 5 6 7 8 9 10 11	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 1.029.5 1.158.6 1.257.6 4.260.7	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 515.3 579.8 629.3	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.141.5 1.240.6	K 8+H20 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5 1.140.5 1.239.6	AA E I E Q L S E S L E V V	Y Ions 2,787.4 2,658.4 2,416.3 2,288.2 2,175.1 2,088.1 1,959.1 1,872.0 1,758.9 1,629.9	Y+2H 1.394.2 1.273.2 1.273.2 1.208.6 1.144.6 1.088.1 1.048.6 980.0 936.5 880.0 815.5 765.0	Y-NH3 2.770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,071.1 1,942.0 1,855.0 1,741.9 1,612.9 4,612.9	Y-H2O 2.769.4 2.527.3 2.527.3 2.270.2 2.157.1 2.070.1 1.941.0 1.854.0 1.740.9 1.611.9	Y 24 23 22 21 19 18 17 16 15 14 17	3 2,4 3 B Io 1 13 2 28 3 4 5 62 5 62 5 72	ns B+2H 30.0 65. 86.2 143 15.2 208 14.3 257 29.3 315 42.4 371	B-№H3 5.6 269.1 .1 398.2 .6 497.2 .1 612.3 .7 725.3	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3 724.4	K K61: AA E R E V D L	147.1 3 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,287.7	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4	130.1 Y-NH3 1,899.0 1,769.9 1,613.8 1,484.8 1,385.7 1,270.7	Y-H2O 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7 1,269.7	1 Y 15 14 13 12 11 10
B 1 2 3 4 5 6 7 8 9 10 11 11 12	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 1.029.5 1.158.6 1.257.6 1.257.6 1.358.7	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 515.3 579.8 629.3 679.8	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.141.5 1.240.6 1.341.6 1.470.2	K 8+H20 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 898.4 898.4 1.011.5 1.140.5 1.239.6 1.340.7 1.460.7	AA E I E Q L S E S L E V T	Y Ions 2,787.4 2,658.4 2,545.3 2,545.3 2,2416.3 2,288.2 2,175.1 2,088.1 1,959.1 1,872.0 1,872.0 1,872.0 1,758.9 1,629.9	Y+2H 1.394.2 1.273.2 1.273.2 1.208.6 1.144.6 1.088.1 1.044.6 980.0 936.5 880.0 815.5 765.9 745.4	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 2,071.1 1,942.0 1,855.0 1,741.9 1,612.9 1,612.9 1,613.8	Y-H2O 2,769,4 2,640,4 2,527,3 2,270,2 2,270,2 2,157,1 2,070,1 1,941,0 1,854,0 1,740,9 1,611,9 1,512,8 1,414,9	Y 224 222 221 19 19 18 17 16 15 14 13 12	3 2,4 3 B Io 1 13 2 28 3 4' 4 5' 5 6' 5 6' 7 8'	ns B+2H 30.0 65. 86.2 143 15.2 208 14.3 257 29.3 315 42.4 371 29.4 415	B-№H3 5.6 269.1 .1 398.2 .6 497.2 .1 612.3 .7 725.3 .2 812.4	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3 724.4 811.4	K K 61: AA E R E V D L S	147.1 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,287.7 1,174.6	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4 587.8	130.1 Y-NH3 1,899.0 1,769.9 1,613.8 1,484.8 1,385.7 1,270.7 1,157.6	Y-H2O 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7 1,269.7 1,156.6	1 Y 15 14 13 12 11 10 9
B 1 2 3 4 5 6 7 8 9 10 11 12 13 14	B lons 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 1.029.5 1.158.6 1.257.6 1.358.7 1.487.7 1.602.7	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 515.3 579.8 629.3 679.8 774.4 801.9	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.240.6 1.341.6 1.341.6 1.470.7 1.586.7	K 8-H20 112.0 225.1 354.2 482.2 595.3 881.4 898.4 1.011.5 1.239.6 1.340.7 1.469.7 1.584.7	AA E I E Q L S E S L E V T E N+1	Y Ions 2,787.4 2,658.4 2,658.4 2,2455.3 2,475.1 2,088.1 1,959.1 1,872.0 1,758.9 1,629.9 1,530.8 1,429.8 1,300.7	Y+2H 1.394.2 1.329.7 1.273.2 1.208.6 1.144.6 980.0 936.5 880.0 815.5 765.9 715.4 650.9	Y-NH3 2,770,4 2,641,4 2,528,3 2,399,2 2,271,2 2,158,1 2,071,1 1,942,0 1,855,0 1,741,9 1,612,9 1,513,8 1,412,8 1,283,7	Y-H2O 2.769.4 2.640.4 2.527.3 2.270.2 2.157.1 2.070.1 1.854.0 1.740.9 1.611.9 1.611.9 1.512.8 1.411.8 1.282.7	Y 24 22 22 22 20 19 19 18 17 16 15 14 11	3 2,4 3 B Io 1 1: 2 28 3 4' 4 5' 5 62 5 72 7 82 8 9!	ns B+2H 30.0 655 86.2 143 15.2 208 14.3 257 29.3 315 42.4 371 588.4 479	B-NH3 5.6 269.1 .1 398.2 .6 497.2 .1 612.3 .7 725.3 .2 812.4 .7 941.4	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3 724.4 811.4 940.4	K K61: AA E R E V D L S E	Y Ions 1,916.0 1,786.9 1,630.8 1,630.8 1,402.7 1,287.7 1,174.6 1,087.6	74.1 Y+2H 958.5 894.0 815.9 751.9 751.9 644.4 587.8 544.3	130.1 Y-NH3 1.899.0 1.769.9 1.613.8 1.484.8 1.385.7 1.270.7 1.157.6 1.070.6	Y-H2O 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7 1,269.7 1,156.6 1,069.6	1 Y 15 14 13 12 11 10 9 8
B 1 2 3 4 5 6 7 8 9 10 11 11 12 13 14 15	B lons 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 1.029.5 1.158.6 1.257.6 1.358.7 1.487.7 1.602.7 1.717.8	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 515.3 579.8 629.3 679.8 744.4 809.4 859.4 859.4	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.240.6 1.341.6 1.341.6 1.341.6 1.470.7 1.585.7 1.700.7	K B+H20 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5 1.239.6 1.340.7 1.469.7 1.699.8 1.699.8	AA E I E Q L S E S L E S V T E N+1 D	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,288.2 2,175.1 2,088.1 1,859.1 1,872.0 1,758.9 1,629.9 1,629.9 1,530.8 1,429.8 1,300.7 1,188.7	Y+2H 1,394.2 1,329.7 1,273.2 1,208.6 1,144.6 1,088.1 1,044.6 980.0 936.5 880.0 936.5 880.0 815.5 765.9 715.4 650.9 715.4	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 2,071.1 1,942.0 1,741.9 1,612.9 1,612.9 1,612.8 1,412.8 1,283.7 1,168.7	Y+H2O 2.769.4 2.640.4 2.527.3 2.398.3 2.270.2 2.157.1 2.070.1 1.941.0 1.854.0 1.740.9 1.611.9 1.611.9 1.282.8 1.411.8 1.282.7	Y 24 23 22 21 19 19 18 17 16 15 14 17 11 10	B Io B Io 1 1: 2 28 3 4 4 5 5 62 5 7 8 9 9 1,0	ns B+2H 30.0 65 86.2 143 15.2 208 14.3 257 29.3 315 22.4 37 129.4 415 58.4 475 58.4 475	B-NH3 5.6 269.1 1 398.2 6 497.2 1 612.3 7 725.3 .2 812.4 7 941.4 7 941.4 1 054.5	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3 724.4 811.4 811.4 814.4 940.4 1,053.5	K K61: AA E R E V D L S E I	Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,287.7 1,174.6 958.5	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4 587.8 544.3 479.8	130.1 Y-NH3 1.899.0 1.769.9 1.613.8 1.484.8 1.385.7 1.270.7 1.157.6 1.070.6 941.5	Y+H2O 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7 1,269.7 1,156.6 1,069.6 940.5	1 Y 15 14 13 12 11 10 9 8 7
B 1 2 3 4 5 6 7 8 9 10 11 11 12 13 14 15 16	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 916.4 1.029.5 1.158.6 1.257.6 1.358.7 1.487.7 1.602.7 1.717.8	B+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 515.3 579.8 629.3 679.8 679.8 744.4 801.9 859.4 915.9	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.240.6 1.341.6 1.341.6 1.341.6 1.341.6 1.343.8	K 8+420 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5 1.239.6 1.340.7 1.469.7 1.584.7 1.699.8 1.812.8	(590) AA E I E Q L S E S L E V T E N+1 D L	Y Ions 2,787.4 2,658.4 2,545.3 2,288.2 2,175.1 2,088.1 1,959.1 1,872.0 1,758.9 1,629.9 1,530.8 1,429.8 1,300.7 1,185.7	Y+2H 1,394.2 1,329.7 1,273.2 1,208.6 1,144.6 1,088.1 1,044.6 980.0 936.5 880.0 936.5 880.0 936.5 880.0 936.5 765.9 715.4 650.9 593.4 535.8	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 2,071.1 1,942.0 1,855.0 1,741.9 1,612.9 1,513.8 1,412.8 1,243.7 1,168.7 1,053.7	YH20 2,769,4 2,527,3 2,398,3 2,270,2 2,157,1 2,070,1 1,941,0 1,854,0 1,611,9 1,512,8 1,411,8 1,282,7 1,167,7 1,162,7	Y Y 24 23 22 21 15 15 15 15 15 15 15 15 15 1	3 BIO 1 1: 2 22 3 4' 4 5' 5 6' 5 74 7 8: 3 9! 9 1.0 0 1.1	ns B+2H 30.0 65, 56.2 143 15.2 208 14.3 255 29.3 315 42.4 371 29.4 415 58.4 475 771.5 536	B-NH3 5.6 269.1 1 398.2 1 612.3 7 725.3 2 812.4 7 941.4 3 1.054.5 8 1.167.6	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3 724.4 811.4 940.4 1.053.5 1.166.6	K K61: AA E R E V D L S E I L	147.1 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,287.7 1,174.6 1,087.6 958.5 845.5	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4 587.8 544.3 479.8 479.8 423.2	130.1 Y-NH3 1.899.0 1.769.9 1.613.8 1.484.8 1.385.7 1.270.7 1.157.6 1.070.6 941.5 828.4	YH20 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7 1,269.7 1,156.6 1,069.6 940.5 827.5	1 Y 15 14 13 12 11 10 9 8 7 6
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B 1 2 3 4 5 6 7 8 9 10 11 11 2 13 14 15 16 17 18 19 9 20	8 Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 9164 829.4 9164 1.029.5 1.158.6 1.257.6 1.257.6 1.358.7 1.487.7 1.602.7 1.487.7 1.602.7 1.487.8 1.959.9 2.059.0 2.172.0 2.059.0 2.172.0	8+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 515.3 579.8 629.3 679.8 679.8 679.8 679.8 744.4 801.9 859.4 915.9 980.4 1,030.0 1,086.5	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.240.6 1.341.6 1.470.7 1.585.7 1.700.7 1.813.8 1.942.9 2.041.9 2.155.0 2.404.9 2.155.0	K 8+H20 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5 1.239.6 1.340.7 1.584.7 1.584.7 1.584.7 1.699.8 1.812.8 1.911.8 1.941.9 2.040.9 2.154.0	590 AA E I E Q U L S S E E S S L E V T T E N+1 D L L E V V I	Y Ions 2,787.4 2,658.4 2,545.3 2,2476.3 2,288.2 2,175.1 2,088.1 1,959.1 1,872.0 1,758.9 1,520.9 1,530.8 1,429.8 1,300.7 1,185.7 1,070.7 957.6 828.6 729.5	Y+2H 1,394.2 1,327.2 1,273.2 1,208.6 1,144.6 1,088.1 1,088.1 1,044.6 980.0 936.5 880.0 815.5 765.9 715.4 650.9 593.4 535.8 479.3 414.8 365.2	Y-NH3 2,770.4 2,641.4 2,528.3 2,528.3 2,271.2 2,271.2 2,158.1 1,942.0 1,741.9 1,612.9 1,612.9 1,513.8 1,412.8 1,283.7 1,053.7 940.6 811.5 712.5	Y-H2O 2,769,4 2,527,3 2,398,3 2,270,2 2,157,1 2,070,1 1,941,0 1,740,9 1,611,9 1,512,8 1,411,8 1,282,7 1,167,7 1,052,7 939,6 810,5 711,5	Y Y 224 222 21 16 15 14 11 11 12 11 10 9 1 11 10 9 1 1 1 1 1 1 1 1 1 1 1 1 1	Blo Blo 1 11: 2 22 3 44 5 5 62 5 77 8 3 99 9 1.0 0 1.1 1 1.3 4 3 16	ns B+2H 30.0 65. 86.2 143 15.2 206 143 265 29.3 315 42.4 37 729.3 315 42.4 37 771.5 536 88.4 47 771.5 536 88.4 7 77 191.8 746 154.8 82	B-NH3 5.6 269.1 1. 398.2 6. 497.2 1. 612.3 7. 725.3 2. 812.4 3. 1.054.5 8. 1.167.6 9. 1.337.7 4. 1.474.8 9. 1.637.8	2,412.2 8-H20 112.0 268.1 397.2 496.3 611.3 724.4 811.4 940.4 1.053.5 1.166.6 1.336.7 1.473.8 1.636.8	K K61. AA E R E V D L S E I I L K+42 H Y	147.1 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,287.7 1,174.6 1,087.6 958.5 845.5 732.4 562.3 425.2	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4 587.8 544.3 479.8 423.2 366.7 281.6 213.1	130.1 Y-NH3 1.899.0 1.769.9 1.613.8 1.484.8 1.385.7 1.270.7 1.157.6 1.070.6 941.5 828.4 715.4 545.2 408.2	Y+H20 1,898.0 1,768.9 1,612.8 1,483.8 1,483.8 1,483.8 1,483.8 1,483.8 1,483.8 1,483.8 1,483.8 1,484.7 1,069.6 940.5 827.5 714.4 544.3 407.2	1 Y 15 14 13 12 11 10 9 8 7 6 5 5 4 3
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B 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 22	B Ions 130.0 243.1 372.2 500.2 613.3 770.4 829.4 916.4 1.029.5 1.158.6 1.257.6 1.358.7 1.487.7 1.602.7 1.717.8 1.830.8 1.959.9 2.059.0 2.172.0 2.259.1 2.429.2 2.528.2	B+2H 65.5 122.1 186.6 250.6 350.7 415.2 458.7 515.3 579.8 629.3 674.4 801.9 859.4 915.9 980.4 1,030.0 1,086.5 1,130.0 1,215.1	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.141.5 1.240.6 1.341.6 1.341.6 1.345.7 1.700.7 1.585.7 1.700.7 1.813.8 1.942.9 2.041.9 2.041.9 2.041.9 2.041.9 2.042.0 2.242.0 2.242.0 2.2412.2 2.511.2	K 8+420 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5 1.239.6 1.340.7 1.469.7 1.469.7 1.469.7 1.469.8 1.341.9 2.040.	590 AA E T E Q L L S E E V T T E N+1 D L L K+42 V V V V	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,288.2 2,175.1 1,872.0 1,629.9 1,530.8 1,429.8 1,300.7 1,185.7 1,429.8 1,300.7 1,185.7 1,070.7 957.6 828.6 729.5 616.4 529.4 359.3	Y+2H 1.394.2 1.329.7 1.273.2 1.208.6 1.144.6 1.048.6 1.048.6 980.0 936.5 880.0 815.5 765.9 715.4 650.9 593.4 535.8 479.3 414.8 365.2 308.7 265.2 180.1	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,158.1 1,942.0 1,855.0 1,741.9 1,612.9 1,513.8 1,243.7 1,668.7 1,412.8 1,283.7 1,168.7 1,053.7 940.6 811.5 712.5 599.4 512.3	YH20 2.769.4 2.627.3 2.527.3 2.398.3 2.270.2 2.070.1 1.941.0 1.854.0 1.611.9 1.611.9 1.611.9 1.612.8 1.411.8 1.282.7 1.167.7 1.165.7 939.6 810.5 598.4	Y Y 224 223 222 21 18 17 16 15 11 11 10 9 1 11 10 9 1 11 10 10 10 11 10 10 10 11 11	B Io B B Io 1 1: 2 24 3 40 4 57 5 62 5 77 8 3 99 9 1.0 0 1.1 1 1.3 2 1.4 3 1.6 4 1.7 5 5 5 10	ns         B+2H           30.2         1,21           ns         B+2H           30.0         65,           56,2         143           15,2         208           14,3         257           29,3         315           42,4         371           588,4         479           771,5         536           354,7         677           191,8         746           554,8         827           41,9         871           145,0         975	B-₩H3 5.6 269.1 1 398.2 6 269.1 1 398.2 6 497.2 1 612.3 7 725.3 2 812.4 7 941.4 3 1.054.5 8 1.167.6 9 1.337.7 4 1.474.8 9 1.637.8 4 1.724.8 5 1.909.0	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3 724.4 811.4 940.4 1,053.5 1,166.6 1,336.7 1,473.8 1,636.8 1,723.9	K K K K K K K K K K K K K K K K K K K	147.1 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,287.7 1,174.6 1,087.6 958.5 845.5 732.4 562.3 425.2 262.2 475.4	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4 587.8 544.3 479.9 423.2 366.7 281.6 213.1 131.6 88.1	130.1 Y-NH3 1,899.0 1,769.9 1,613.8 1,484.8 1,385.7 1,270.7 1,157.6 1,070.6 941.5 828.4 715.4 545.2 408.2 245.1 158.2	Y-H2O 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7 1,269.7 1,156.6 1,069.6 940.5 827.5 714.4 544.3 407.2 244.1	1 Y 15 14 13 12 11 10 9 8 7 6 5 5 4 3 2 1
B 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 916.4 1.029.5 1.158.6 1.257.6 1.358.7 1.487.7 1.717.8 1.830.8 1.257.6 1.457.9 2.059.0 2.172.0 2.259.1 2.429.2 2.528.2 2.528.2	8+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 515.3 579.8 629.3 679.8 744.4 801.9 859.4 915.9 859.4 915.9 859.4 1,030.0 1,086.5 1,130.0 1,215.1 1,264.6	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.141.5 1.240.6 1.341.6 1.341.6 1.470.7 1.700.7 1.813.8 1.942.9 2.041.9 2.041.9 2.155.0 2.242.0 2.412.2 2.511.2 2.624.3	K 8+120 112.0 225.1 354.2 482.2 595.3 682.3 811.4 898.4 1.011.5 1.239.6 1.340.7 1.584.7 1.699.8 1.812.8 1.941.9 2.040.9 2.154.0 2.241.1 2.411.1 2.411.2 2.510.2 2.561.2	590 AA E I Q Q L S E S L E V V T E N+11 D L E V V I I S S K+42 V I	Y Ions 2,787.4 2,658.4 2,545.3 2,416.3 2,288.2 2,175.1 1,859.1 1,872.0 1,758.9 1,629.9 1,530.8 1,429.8 1,300.7 1,185.7 1,070.7 957.6 828.6 729.5 616.4 529.4 359.3 260.2	Y+2H 1,394.2 1,329.7 1,273.2 1,208.6 1,144.6 1,084.6 980.0 936.5 880.0 815.5 765.9 715.4 650.9 593.4 650.9 593.4 650.9 593.4 650.9 593.4 1,308.6 2,65.2 1,808.7 2,65.2 1,80.6 1,308.6 1,308.7 1,308.6 1,308.6 1,308.7 1,308.6 1,308.7 1,308.6 1,308.7 1	Y-NH3 2,770.4 2,641.4 2,528.3 2,399.2 2,271.2 2,271.2 2,071.1 1,942.0 1,855.0 1,741.9 1,612.9 1,612.9 1,613.8 1,283.7 1,053.7 940.6 811.5 712.5 599.4 512.3 342.2 243.2	YH20 2.769.4 2.540.4 2.527.3 2.398.3 2.270.2 2.157.1 2.070.1 1.941.0 1.854.0 1.740.9 1.611.9 1.512.8 1.740.9 1.617.7 1.052.7 1.057.7 1.055.7 939.6 810.5 711.5 598.4	Y         Y           Y24         22           11         12           12         11           16         11           11         11           11         11           11         11           11         11           11         11           11         11           10         9           11         10           15         1           16         1           17         1           18         1           19         1           11         1           12         1           13         1           14         1           13         1           14         1           13         1           14         1           13         1           13         2	B Io           1           2           2           3           4           5           6           7           8           9           1	ns B+2H 30.0 65. 56.2 143 55.2 208 14.3 257 29.3 315 242.4 317 29.4 415 58.4 479 771.5 536 188.6 592 554.7 677 591.8 746 554.8 827 41.9 877 116.0 958	B-№H3 5.6 269.1 1 398.2 6 497.2 7 725.3 2 812.4 7 941.4 3 1.054.5 8 1.167.6 9 1.337.7 4 1.474.8 9 1.637.8 4 1.724.8 5 1.899.0	2,412.2 B-H2O 112.0 268.1 397.2 496.3 611.3 724.4 811.4 940.4 1.053.5 1.166.6 1.336.7 1.473.8 1.636.8 1.723.9 1.898.0	K K61: AA E R E V D L S S E I I L K+42 H Y S R	147.1 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,402.7 1,402.7 1,402.7 1,402.7 1,402.7 1,402.7 3,425.2 262.2 175.1	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4 587.8 544.3 479.8 423.2 366.7 281.6 213.1 131.6 88.1	130.1 Y-NH3 1.899.0 1.769.9 1.613.8 1.484.8 1.385.7 1.270.7 1.157.6 1.070.6 941.5 828.4 715.4 545.2 408.2 245.1 158.1	Y-H2O 1.898.0 1.768.9 1.612.8 1.483.8 1.384.7 1.269.7 1.156.6 1.069.6 940.5 827.5 714.4 544.3 407.2 244.1	1 Y 15 14 13 12 11 10 9 8 7 6 5 5 4 3 2 1
B 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	B Ions 130.0 243.1 372.2 500.2 613.3 700.4 829.4 9164 1.029.5 1.158.6 1.257.6 1.257.6 1.257.6 1.358.7 1.487.7 1.602.7 1.487.7 1.602.7 1.487.7 1.602.7 1.487.8 1.959.9 2.059.0 2.172.0 2.259.1 2.429.2 2.528.2	8+2H 65.5 122.1 186.6 250.6 307.2 350.7 415.2 458.7 579.8 629.3 679.8 679.8 7744.4 801.9 859.4 859.4 915.9 980.4 1,030.0 1,086.5 1,130.0 1,215.1 1,264.6 1,321.2 1,394.2	8-NH3 483.2 596.3 683.3 812.4 899.4 1.012.5 1.240.6 1.341.6 1.470.7 1.585.7 1.700.7 1.813.8 1.942.9 2.041.9 2.155.0 2.242.0 2.412.2 2.511.2 2.624.3 2.770.4	K 8+H20 112.0 225.1 354.2 482.2 595.3 811.4 898.4 1.011.5 1.230.7 1.584.7 1.584.7 1.699.8 1.812.8 1.941.9 2.040.9 2.154.0 2.241.1 2.411.2 2.510.2 2.623.3 2.768.4	590 AA E I C C C C C C C C C C C C C	Y Ions 2,787.4 2,658.3 2,416.3 2,288.2 2,175.1 2,088.1 1,959.4 1,872.0 1,758.9 1,629.9 1,629.9 1,530.8 1,429.8 1,300.7 1,185.7 1,070.7 957.6 828.6 729.5 616.4 529.4 359.3 260.2 147.1	Y+2H 1,394.2 1,329.4 1,273.2 1,208.6 1,144.6 1,088.1 1,044.6 980.0 936.5 880.0 815.5 765.9 715.4 650.9 593.4 535.8 479.3 414.8 365.2 308.7 265.2 180.1 130.6 54.1	Y-NH3 2,770,4 2,624,3 2,528,3 2,399,2 2,271,2 2,158,1 2,071,1 1,942,0 1,741,9 1,612,9 1,612,9 1,513,8 1,412,8 1,283,7 1,053,7 940,6 811,5 712,5 599,4 512,3 342,2 243,2 130,1	Y+120 2,769,4 2,527,3 2,398,3 2,270,2 2,157,1 2,070,1 1,941,0 1,740,9 1,611,9 1,854,0 1,740,9 1,611,9 1,1512,8 1,411,8 1,282,7 939,6 810,5 711,5 598,4	Y         24           23         22           21         1           18         17           15         14           11         10           9         1           10         9           11         10           9         1           10         10           11         10           12         1           13         1           11         1           12         1	B B Io B B Io I 11 2 21 3 41 5 56 7 7 82 3 99 9 1,0 0 1,1 1 1,3 2 1,4 3 1,6 4 1,7 5 1,9	ns B+2H 30.0 65. 86.2 143 56.2 143 57.2 208 14.3 257 29.3 315 42.4 371 29.4 415 88.4 475 191.8 746 554.7 677 191.8 746 554.8 827 141.9 871	B-NH3 5.6 269.1 1. 398.2 6. 497.2 1. 612.3 7. 725.3 2. 812.4 3. 1.054.5 8. 1.167.6 9. 1.337.7 4. 1.474.8 9. 1.637.8 4. 1.724.8 5. 1.899.0	2,412.2 B+H2O 112.0 268.1 397.2 496.3 611.3 724.4 811.4 940.4 1.053.5 1.166.6 1.336.7 1.473.8 1.636.8 1.723.9 1.898.0	K K K K K K K K K K K K K K K K K K K	147.1 Y Ions 1,916.0 1,786.9 1,630.8 1,501.8 1,402.7 1,287.7 1,174.6 958.5 845.5 732.4 562.3 425.2 262.2 175.1	74.1 Y+2H 958.5 894.0 815.9 751.4 701.9 644.4 587.3 423.2 366.7 281.6 213.1 131.6 88.1	130.1 Y-NH3 1.899.0 1.769.9 1.613.8 1.484.8 1.385.7 1.270.7 1.157.6 1.070.6 941.5 828.4 715.4 545.2 408.2 245.1 158.1	Y+H20 1,898.0 1,768.9 1,612.8 1,483.8 1,384.7 1,269.7 1,156.6 1,069.6 940.5 827.5 714.4 544.3 407.2 244.1	1 Y 15 14 13 12 11 10 9 8 7 6 5 5 4 3 2 1

**Fig. S7.** Fragmentation tables as they appear in the Scaffold program for acetylated lysines (K502, K532, K590, and K613) in Atg20. The presence of acetylated lysine (K+42) is confirmed by b and/or y ions that are highlighted in red and blue color.

	S45 , S49															S13	9				
											в	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y
В	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H20	Y	1	102.1	51.5		84.0	т	2,637.1	1.319.1	2,620.1	2,619.1	25
1	115.1		98.0		N	1,258.6	629.8	1,241.5	1,240.5	11	2	189.1	95.0		171.1	5	2,536.1	1,268.5	2,519.0	2,518.0	24
2	172.1		155.0		G	1,144.5	572.8	1,127.5	1,126.5	10	4	389.2	195.1		371.2	5	2.335.9	1.168.5	2.318.9	2.317.9	22
3	271.1		254.1		V	1,087.5	544.3	1,070.5	1,069.5	9	5	446.2	223.6		428.2	G	2,248.9	1,125.0	2,231.9	2,230.9	21
4	328.2		311.1		G	988.4	494.7	971.4	970.4	8	6	533.3	267.1		515.2	5	2,191.9	1.096.4	2,174.9	2,173.9	20
5	495.2	200 0	4/8.1	4//.1	5+80	931.4	466.2	914.4	913.4	1	8	760.4	323.7	743.4	742.4	N	1.991.8	996.4	1.974.7	1.973.8	18
7	592.2	290.0	5/5.2	5/4.2	P	104.4	382.7	141.4	640.2	0	9	927.4	464.2	910.4	909.4	5+80	1,877.7	939.4	1,860.7	1,859.7	17
8	040 4	424.7	034 4	030.4	N.	630.3	334.2	500.J	624.3	4	10	1.074.4	537.7	1,057.4	1,056.4	M+16	1,710.7	855.9	1,693.7	1,692.7	16
9	1 015 4	508.2	008.4	007 /	ET80	/11.2	2/0.1	30/ 1	303.2	3	12	1,188.5	623.2	1.228.5	1.227.5	G	1,503.7	725.3	1,340.7	1,545.7	14
10	1.112.5	556.7	1.095.4	1.094.4	P	244.2		227.1	JUJIL	2	13	1,374.5	687.8	1,357.5	1,356.5	E	1,392.6	696.8	1.375.6	1.374.6	13
11	1.258.6	629.8	1.241.5	1.240.5	K	147.1		130.1		1	14	1,475.6	738.3	1,458.5	1,457.6	T	1,263.6	632.3	1,246.6	1,245.6	12
											16	1,633.6	817.3	1,616.6	1,615.6	A	1,075.5	538.3	1,058.5	1,057.5	10
											17	1,720.7	860.8	1,703.6	1,702.7	5	1,004.5	502.7	987.4	986.5	9
				-	Г144						18	1.849.7	925.4	1,832.7	1,831.7	E	917.4	459.2	900.4	899.4	8
				1	1 1 7 7						20	2,075.8	1.038.4	2,058.8	2,057.8	P	659.3	330.2	642.3	641.3	6
в	Blons	B+2H	B-NH3	B-H20	AA	Y Ions	Y+2H	Y-NH3	Y-H20	Y	21	2,162.8	1.081.9	2,145.8	2,144.8	5	562.3	281.7	545.3	544.3	5
1	102.1	51.5		84.0	T	2.622.1	1.311.5	2.605.1	2.604.1	25	22	2,261.9	1,131.5	2,244.9	2,243.9	V	475.3	238.1	458.2	457.3	4
2	189.1	95.0		171.1	5	2,521.0	1,261.0	2,504.0	2,503.0	24	24	2,348.9	1.232.0	2,331.9	2,330.9	N	289.2	145.1	272.1	336.2	2
3	302.2	151.6		284.2	L	2,434.0	1,217.5	2,417.0	2,416.0	23	25	2,637.1	1,319.1	2,620.1	2,619.1	R	175.1	88.1	158.1		1
5	446.2	223.6		428.2	G	2,233.9	1,117.4	2,216.9	2,302.9	21	L										
6	533.3	267.1		515.2	5	2,176.9	1,088.9	2,159.8	2,158.9	20						014	-				
7	646.3	323.7	743.4	628.3	I	2,089.8	1,045.4	2,072.8	2,071.8	19						<b>S</b> 14	.5				
9	847.4	424.2	830.4	829.4	5	1,862.7	931.9	1,845.7	1,844.7	17	в	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y
10	978.5	489.7	961.4	960.4	м	1,775.7	888.3	1,758.7	1,757.7	16	1	102.1	51.5		84.0	Т	2,621.1	1.311.1	2,604.1	2,603.1	25
11	1,093.5	547.2	1,076.5	1.075.5	N+1	1,644.6	822.8	1,627.6	1,626.6	15	3	302.2	151.6		284.2	L	2,520.1	1.200.5	2,416.0	2,502.0	24
13	1.150.5	640.3	1,133.5	1.132.5	E	1,529.6	736.8	1,512.0	1,511.0	14	4	389.2	195.1		371.2	5	2,319.9	1,160.5	2,302.9	2,301.9	22
14	1,460.6	730.8	1,443.5	1,442.6	T+80	1,343.5	672.3	1,326.5	1,325.5	12	5	446.2 533.3	223.6		428.2	G	2,232.9	1.117.0	2,215.9	2,214.9	21
15	1,547.6	774.3	1,530.6	1,529.6	5	1,162.5	581.8	1.145.5	1,144.5	11	7	646.3	323.7		628.3	I	2,088.9	1.044.9	2,071.8	2,070.8	19
10	1,018.0	809.8	1,601.6	1,600.6	A S	1,075.5	538.3	1,058.5	1,057.5	9	8	760.4	380.7	743.4	742.4	N	1,975.8	988.4	1,958.7	1.957.8	18
18	1,834.7	917.9	1,817.7	1,816.7	E	917.4	459.2	900.4	899.4	8	10	978.5	489.7	961.4	960.4	M	1,774.7	887.9	1,757.7	1,756.7	16
19	1,963.7	982.4	1,946.7	1,945.7	E	788.4	394.7	771.4	770.4	7	11	1.092.5	546.8	1,075.5	1,074.5	N	1,643.7	822.3	1,626.6	1,625.6	15
20	2,060.8	1.030.9	2,043.8	2,042.8	S	659.3 562.3	281.7	545.3	641.3 544.3	5	13	1,149.5	639.8	1,132.5	1,151.5	E	1,529.0	736.8	1,455.6	1,511.0	13
22	2,246.9	1.124.0	2,229.9	2,228.9	V	475.3	238.1	458.2	457.3	4	14	1,379.6	690.3	1,362.6	1,361.6	Т	1,343.5	672.3	1,326.5	1,325.5	12
23	2,333.9	1,167.5	2,316.9	2,315.9	5	376.2	188.6	359.2	358.2	3	15	1,546.6	809.3	1,529.6	1,528.6	5+80 A	1,242.5	538.3	1,225.5	1,224.5	10
25	2,622.1	1,311.5	2,605.1	2,604.1	R	175.1	88.1	158.1		1	17	1,704.7	852.8	1,687.7	1,686.7	5	1,004.5	502.7	987.4	986.5	9
											18	1,833.7	917.4	1,816.7	1,815.7	E	917.4 788.4	459.2	900.4	899.4	8
					307						20	2,059.8	1.030.4	2,042.8	2,041.8	Р	659.3	330.2	642.3	641.3	6
					3307					_	21	2,146.8	1.073.9	2,129.8	2,128.8	S V	562.3	281.7	545.3 458.2	544.3	4
В	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y	23	2,332.9	1,167.0	2,315.9	2,314.9	5	376.2	188.6	359.2	358.2	3
2	102.1 189.1	51.5 95.0		84.0	5	3,514.6	1,757.8	3.497.6	3,496.6	30 29	24	2,447.0	1,224.0	2,430.0	2,429.0	N	289.2	145.1	272.1		2
3	302.2	151.6		284.2	I	3,326.5	1,663.8	3,309.5	3,308.5	28		192 III			2,000.1						
5	516.3	258.7		498.3	T	3,100.3	1,550.7	3,083.3	3,082.3	26											
6	631.3 778.4	316.2		613.3 760.4	D	2,999.3	1,500.2	2,982.3	2,981.3	25 24											
8	891.5	446.2		873.5	i	2,737.2	1,369.1	2,720.2	2,719.2	23											
9	1,006.5	503.8		988.5 1.085.6	P	2,624.1	1,312.6	2,607.1	2,606.1	22											
11	1.217.6	609.3	1.200.6	1.199.6	N	2.412.0	1.206.5	2.395.0	2.394.0	20											
12	1,331.6	666.3 734.9	1,314.6	1,313.6	N	2,298.0	1,149.5	2,281.0	2,280.0	19											
14	1,582.7	791.9	1,565.7	1,564.7	N	2,046.9	1,024.0	2,029.9	2,028.9	17											
15	1,768.8	953.4	1,751.8	1,750.8	H	1,932.9	966.9 873.9	1,915.8	1,914.8	16											
17	2,034.9	1.018.0	2,017.9	2,016.9	E	1,609.7	805.4	1,592.7	1,591.7	14											
19	2,281.1	1.141.0	2,165.0	2,263.1	V	1,333.6	667.3	1,316.6	1,315.6	12											
20	2,395.1	1,198.1	2,378.1	2,377.1	N	1,234.5	617.8	1,217.5	1,216.5	11											
22	2,649.1	1,325.1	2,632.1	2,631.1	5	953.5	477.3	936.5	935.5	9											
23	2,736.2	1,368.6	2,719.1	2.718.2	5 T	866.5 779.4	433.7	849.4	848.5	8											
25	2,984.3	1,492.6	2,967.3	2,966.3	F	678.4	339.7	661.4	660.4	6											
26	3,071.3	1,536.2	3,054.3	3,053.3	5	531.3	266.2	514.3 427.3	513.3 426.3	5											
28	3,271.4	1.636.2	3,254.4	3,253.4	L	357.2	179.1	340.2		3											
29 30	3,368.5	1,684.7	3,351.5	3,350.5	P	244.2	122.6	227.1		2											

**Fig. S8.** Fragmentation tables as they appear in the Scaffold program for phosphorylated serines and threonines (S45, S49, S139, T144, S145, and S307) in Atg20. The presence of

phosphorylated serine (S+80) or threonine (T+80) is confirmed by b and/or y ions that are highlighted in red and blue color.

				S	342										S3	43					
в	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H20	Y	в	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y
1	114.1	57.5			I	2,016.0	1,008.5	1,999.0	1,998.0	18	1	114.1				I	2,015.0	1,008.0	1,998.0	1,997.0	18
2	251.2	126.1			н	1,902.9	952.0	1,885.9	1,884.9	17	2	251.2	126.1			н	1,902.0	951.5	1,884.9	1,883.9	17
3	322.2	161.6			A	1,765.9	883.4	1,748.9	1,747.9	16	3	322.2	161.6			A	1,764.9	883.0	1,747.9	1,746.9	16
4	469.2	235.1			M+16	1,694.8	847.9	1,677.8	1,676.8	15	4	469.2	235.1			M+16	1,693.9	847.4	1,676.8	1,675.8	15
5	582.3	291.7			L	1,547.8	774.4	1,530.8	1,529.8	14	5	582.3	291.7			L	1,546.8	773.9	1,529.8	1,528.8	14
6	679.4	340.2			P	1,434.7	717.9	1,417.7	1,416.7	13	6	679.4	340.2			P	1,433.7	717.4	1,416.7	1,415.7	13
7	792.4	396.7			I	1,337.7	669.3	1,320.6	1,319.7	12	7	792.4	396.7			I	1,336.7	668.8	1,319.7	1,318.7	12
8	889.5	445.3			P	1,224.6	612.8	1,207.6	1,206.6	11	8	889.5	445.3			Р	1,223.6	612.3	1,206.6	1,205.6	11
9	946.5	473.8			G	1,127.5	564.3	1,110.5	1,109.5	10	9	946.5	473.8		difference of	G	1,126.6	563.8	1,109.5	1,108.5	10
10	1,033.6	517.3		1,015.5	5	1,070.5	535.8	1,053.5	1,052.5	9	10	1.033.6	517.3		1,015.5	5	1,069.5	535.3	1,052.5	1.051.5	9
11	1,200.5	600.8		1,182.5	5+80	983.5	492.2	966.5	965.5	8	11	1.120.6	560.8		1,102.6	5	982.5	491.8	965.5	964.5	8
12	1,287.6	644.3		1,269.6	5	816.5	408.7	799.5	798.5	7	12	1,287.6	644.3		1,269.6	5+80	895.5	448.2	878.4	877.5	7
13	1,416.6	708.8	1,399.6	1,398.6	Q+1	729.5	365.2	712.4		6	13	1,415.6	708.3	1,398.6	1,397.6	Q	728.5	364.7	711.4		6
14	1,529.7	765.4	1,512.7	1,511.7	L	600.4	300.7	583.4		5	14	1,528.7	764.9	1,511.7	1,510.7	L	600.4		583.4		5
15	1,642.8	821.9	1,625.8	1.624.8	L	487.3	244.2	470.3		4	15	1,641.8	821.4	1,624.8	1,623.8	L	487.3		470.3		4
16	1,755.9	878.4	1,738.8	1,737.9	L	374.2	187.6	357.2		3	16	1,754.9	877.9	1,737.9	1,736.9	L	374.2		357.2		3
17	1,869.9	935.5	1,852.9	1,851.9	N	261.2	131.1	244.1		2	17	1,868.9	935.0	1,851.9	1,850.9	N	261.2		244.1		2
18	2,016.0	1,008.5	1,999.0	1,998.0	K	147.1	74.1	130.1		1	18	2,015.0	1,008.0	1,998.0	1,997.0	K	147.1		130.1		1

	S361										T365										
в	B Ions	B+2H	B-NH3	B-H20	AA	Y Ions	Y+2H	Y-NH3	Y-H20	Y	в	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y
1	168.0	84.5		150.0	5+80	2,991.4	1,496.2	2,974.3	2,973.4	24	1	88.0	44.5		70.0	5	2.991.4	1.496.2	2.974.3	2.973.4	24
2	296.1	148.6	279.1	278.1	K	2,824.4	1,412.7	2,807.3	2,806.4	23	2	216.1	108.6	199.1	198.1	ĸ	2,904.3	1.452.7	2.887.3	2.886.3	23
3	383.1	192.1	366.1	365.1	5	2,696.3	1.348.6	2,679.2	2,678.3	22	3	303.2	152.1	286.1	285.2	5	2,776.2	1.388.6	2,759,2	2,758.2	22
4	530.2	265.6	513.2	512.2	F	2.609.2	1.305.1	2.592.2	2.591.2	21	4	450.2	225.6	433.2	432.2	F	2,689,2	1.345.1	2.672.2	2.671.2	21
5	631.2	316.1	614.2	613.2	T	2.462.2	1,231.6	2.445.1	2.444.2	20	5	631.2	316.1	614.2	613.2	T+80	2.542.1	1.271.6	2.525.1	2.524.1	20
6	745.3	373.1	728.3	727.3	N	2.361.1	1.181.1	2.344.1	2.343.1	19	6	745.3	373.1	728.3	727.3	N	2.361.1	1.181.1	2.344.1	2.343.1	19
7	858.4	429.7	841.3	840.4	I	2.247.1	1.124.0	2,230.1	2,229.1	18	7	858.4	429.7	841.3	840.4	I	2.247.1	1.124.0	2.230.1	2.229.1	18
8	987.4	494.2	970.4	969.4	F	2 134 0	1 067 5	2117.0	2 116 0	17	8	987.4	494.2	970.4	969.4	E	2.134.0	1.067.5	2.117.0	2.116.0	17
9	1 115 5	558.2	1 008 5	1 097 5	0	2 005 0	1 003 0	1 987 9	1 986 9	16	9	1.115.5	558.2	1.098.5	1.097.5	0	2.005.0	1.003.0	1.987.9	1.986.9	16
10	1 230 5	615.9	1 213 5	1 212 5	P D	1 976 0	030.0	1 950 0	1 050 0	15	10	1.230.5	615.8	1.213.5	1.212.5	D	1.876.9	939.0	1.859.9	1.858.9	15
11	1 303 6	607.3	1 376 5	1 375 6	v	1 761 0	004 4	1 744 0	1 743 0	14	11	1.393.6	697.3	1.376.5	1.375.6	Y	1.761.9	881.4	1.744.8	1.743.9	14
17	1,353.0	764.2	4 504 6	1,373.0		4 500.0	700.0	1,144.0	1,743.9	12	12	1.521.7	761.3	1.504.6	1.503.7	K	1.598.8	799.9	1.581.8	1.580.8	13
12	1,321.7	101.3	1,304.0	1,303.7	N	1,390.0	799.9	1,301.0	1,000.0	13	13	1.649.7	825.4	1.632.7	1.631.7	0	1.470.7	735.9	1.453.7	1.452.7	12
13	1,049.7	823.4	1,032.7	1,031./	Q	1,4/0./	674.0	1,453.7	1,452.7	11	14	1,812.8	906.9	1,795.8	1,794.8	Y	1,342.7	671.8	1.325.6	1.324.6	11
19	1,812.8	900.9	1,795.8	1,/94.8	Y	1,342.7	0/1.8	1,323.0	1,324.0	10	15	1,941.8	971.4	1,924.8	1,923.8	E	1,179.6	590.3	1,162.6	1,161.6	10
15	1,941.8	9/1.4	1,924.8	1,923.8	E	1,1/9.0	590.3	1,102.0	1,101.0	10	16	2,056.9	1.028.9	2,039.8	2,038.8	N+1	1,050.5	525.8	1.033.5	1.032.5	9
16	2,055.9	1.028.4	2,038.8	2,037.9	N	1,050.5	525.8	1,033.5	1,032.5	9	17	2,169.9	1.085.5	2,152.9	2,151.9	L	935.5	468.3	918.5	917.5	8
1/	2,169.0	1,085.0	2,151.9	2,150.9	L	936.5	468.8	919.5	918.5	8	18	2,283.0	1,142.0	2,266.0	2,265.0	L	822.4	411.7	805.4	804.4	7
18	2,282.0	1,141.5	2,265.0	2,264.0	L	823.4	412.2	806.4	805.4	7	19	2,398.0	1.199.5	2,381.0	2,380.0	D	709.4	355.2	692.3	691.3	6
19	2,397.1	1.199.0	2,380.0	2,379.1	D	710.3	355.7	693.3	692.3	6	20	2,512.1	1.256.5	2,495.1	2,494.1	N	594.3	297.7	577.3		5
20	2,512.1	1.256.5	2,495.1	2,494.1	N+1	595.3	298.2	578.3		5	21	2.569.1	1.285.1	2.552.1	2.551.1	G	480.3	240.6	463.3		4
21	2,569.1	1,285.1	2,552.1	2,551.1	G	480.3	240.6	463.3		4	22	2.682.2	1.341.6	2.665.2	2.664.2	I	423.3	212.1	406.2		3
22	2,682.2	1,341.6	2,665.2	2,664.2	I	423.3	212.1	406.2		3	23	2,845.3	1,423.1	2,828.2	2,827.2	Y	310.2	155.6	293.1		2
23	2,845.3	1.423.1	2,828.2	2,827.2	Y	310.2	155.6	293.1		2	24	2,991.4	1,496.2	2,974.3	2,973.4	к	147.1	74.1	130.1		1
24	2,991.4	1.496.2	2,974.3	2,973.4	K	147.1	74.1	130.1		1											
											_										
				S	363										T:	517					
B	R loos	B17H	R-NH3	B-H20	44	V Ione	V±2H	V.NH3	V-H20	v	в	B Ions	B+2H	B-NH3	B-H2O	AA	Y Ions	Y+2H	Y-NH3	Y-H2O	Y
	01010	0121	DIVID	70.0	nn	4 500 7	770.0	4 500.0	4 504 7	-	1	88.0	44.5		70.0	5	1,975.9	988.5	1,958.9	1,957.9	18
1	88.0	400.0	400.4	70.0	5	1,539.7	770.3	1,522.0	1,521.7	12	2	225.1	113.1		207.1	н	1,888.9	944.9	1,871.8	1,870.9	17
2	210.1	108.0	199.1	198.1	K	1,452.0	120.8	1,435.0	1,434.0	10	3	406.1	203.6		388.1	T+80	1,751.8	876.4	1,734.8	1,733.8	16
3	585.1	192.1	300.1	305.1	5+80	1,324.5	602.8	1,307.5	1,300.5	10	4	519.2	260.1		501.2	I	1,570.8	785.9	1,553.8	1,552.8	15
9	530.2	205.0	513.2	512.2	F	1,157.5	5/9.3	1,140.5	1,139.5	9	5	633.2	317.1	616.2	615.2	N	1,457.7	729.4	1,440.7	1,439.7	14
2	031.2	310.1	014.2	013.2		1,010.5	1.000	993.5	992.5	0	6	746.3	373.7	729.3	728.3	L	1,343.7	672.3	1,326.6	1,325.7	13
0	143.3	373.1	128.3	121.5	N	305.4	400.2	892.4	891.4	6	7	875.4	438.2	858.3	857.4	E	1,230.6	615.8	1,213.6	1,212.6	12
0	838.4	429.7	841.3	840.4	1	793.4	398.2	118.4	111.4	0 F	8	1,031.5	516.2	1,014.4	1,013.5	R	1,101.5	551.3	1,084.5	1,083.5	11
8	987.4	494.2	970.4	969.4	E	682.3	_	665.3	664.3	5	9	1,128.5	564.8	1,111.5	1,110.5	P	945.4	473.2	928.4	927.4	10
9	1.115.5	558.2	1,098.5	1.097.5	Q	553.3		536.2	535.3	4	10	1,242.6	621.8	1,225.5	1,224.6	N	848.4	424.7	831.4	830.4	9
10	1.230.5	615.8	1,213.5	1,212.5	D	425.2		408.2	407.2	3	11	1,356.6	6/8.8	1,339.6	1,338.6	N	734.3	367.7	717.3	716.3	8
11	1,393.6	697.3	1,3/6.5	1,375.6	Y	310.2		293.1		2	12	1,470.6	735.8	1,453.6	1,452.6	N	620.3	310.7	603.3	602.3	1
12	1,539.7	770.3	1,522.6	1,521.7	K	147.1		130.1		1	13	1,5/1.7	786.4	1,554.7	1,553.7	T	506.3	253.6	489.2	488.2	6
											14	1,028./	814.9	1,011./	1,010./	G	405.2	203.1	388.2	381.2	3
L											15	1,/15./	838.4	1,098./	1,09/./	5	348.2	1/4.0	331.2	330.2	4
											17	1.020.0	880.9	1,/00./	1,754.8	G	201.2	102.6	107 4		2
											12	1,829.8	915.4	1,812.8	1,811.8	G	147.1	74.4	187.1		1
											10	1,910.9	300.3	1,958.9	1,901.9	R	141.1	14.1	130.1		1

**Fig. S9.** Fragmentation tables as they appear in the Scaffold program for phosphorylated serines and threonines (S342, S343, S361, S363, T365, and T517) in Atg20. The presence of phosphorylated serine (S+80) or threonine (T+80) is confirmed by b and/or y ions that are

highlighted in red and blue color. Phosphorylation on Ser361 was confirmed by peptide mass only.



**Fig. S10.** Schematic representations of Atg20[10STA] and Atg20[4KR]. The representations depict which post-translational modifications were removed and which remained in the mutated Atg20[10STA] (*A*) and Atg20[4KR] (*B*) proteins.



**Fig. S11.** Structural analysis of the sorting nexins Atg20 and Snx4. (*A*) SDS-PAGE gel showing the capture of full-length Atg20 only as a heterodimer with full-length Snx4. The full-length Snx4 can also form homodimers, but no monomeric or dimeric Atg20 can be captured. (*B*) The AUC data for the Snx4<sub>421-423</sub> homodimer. The molecular mass determined by dynamic light scattering for this homodimer is 93.3 kDa, which is very similar to the expected molecular mass of 93.7 kDa.



## MFDp2

GREEN letters represent residues predicted as ordered RED letters correspond to predicted disordered residues

SEQ	Predicted	disorder	content:	35.47 %; #	of disord	er segmer	nts: 2
	10	20	30	40	50	60	70

MSDLNDVOEN         AKLNSETENT         GKAEPPHGTT         EVVAEAEISK         NGVGSPKKSP         KKGKVGKGNN         NKVETELVHT         ALLEKDNE           90         100         110         120         130         140         150         1           EEGPTGETKS         ALLETDGMRS         HNIKNPNEDY         EDDSEGLEDI         NOESNAETCE         TSLSGSTNSM         NGETSASEEP         SVSNRKKS           170         180         190         200         210         220         230         2           1HILEAKRVS         EGQGRAYIAY         VIQEENSTVQ         RRYSDFESLR         SLILIEPMT         LIPPIPEKOS         IKNYGKSITG         SSSKYLLP           250         260         270         280         290         300         310         3           GSGSVDLSLS         VHASVNNSD         EKLIRHRIRM         LTEFLNKLLT         NEETIKSTI         TDFLDPNHN         WHEFVNSSST         FSSLPKST           330         340         350         360         370         380         390         4	50
90         100         110         120         130         140         150         1           EEGPTGETKS ALLEIPGMRS HNLKNPNEDY EDDSEGLIPI NOESNAETCE TSLSGSINSM NGETSASEEP SVSNRKKS           170         180         190         200         210         220         230         2           INTERNA ENTRY RYSOFESLE SUBJECT TSLSGSINSM NGETSASEEP SVSNRKKS           270         180         190         200         210         220         230         2           INTERNA VIOFENSIVQ RRYSOFESLE SILIRLEPMI LIPPIEKQS IKNYGKSIIG SSKYLLF           250         260         270         280         290         300         310         33           GSGSVDLSLS VIHASVNNSD EKLIRHRIM LIEFLNKLLT NEEITKISII TDFLDPNNHN WHEEVNSSST FSSLPKSI           330         340         350         360         370         380         390         4	EM
EEGPTGFTKS ALLEIPGMRS HNLKNPNEDY EDDSEGLLPI NQESNAETCR TSLSGSINSM NGETSASEEP SVSNRKKS1701801902002102202302THIEAKRVS EGQGRAYIAY VIQFENSTVQ RRYSDFESLR SILIRLFPMT LIPPIPEKQS IKNYGKSITG SSSKYLLP2502602702802903003103GSGSVDLSLS VIHASVNNSD EKLIRHFIRM LTEFLNKLT NEEITKTSII TDFLDPNNHN WHEFVNSST FSSLPKSI3303403503603703803904	50
170         180         190         200         210         220         230         2           IHILEAKRYS EGOGRAYIAY VIQFENSTVQ RRYSDFESLR SILIRLEPMT LIPPIPEKQS IKNYGKSITG SSSKYLLP 250         260         270         280         290         300         310         3           GSGSVDLSLS VIHASVNNSD EKLIRHRIM LTEFLNKLLT NEEITKTSII TDFLDPNNHN WHEFVNSSST FSSLPKSI 330         340         350         360         370         380         390         4	AR
<b>THILEAK</b> RVS EGQGRAYIAY VIQFENSTVQ RRYSDFESLR SILIRLFPMT LIPPIPEKQS IKNYGKSITG SSSKYLLP2502602702802903003103GSGSVDLSLS VIHASVNNSD EKLIRHRIM LTEFLNKLLT NEEITKTSII TDFLDPNNHN WHEFVNSSST FSSLPKSI3303403503603703803904	10
250         260         270         280         290         300         310         3           GSGSVDLSLS         VIHASVNNSD         EKLIRHRIRM         LTEFLNKLLT         NEEITKTSII         TDFLDPNNHN         WHEFVNSSST         FSSLPKSI           330         340         350         360         370         380         390         4	SE
GSGSVDLSLS VIHASVNNSD EKLIRHRIRM LTEFLNKLLT NEEITKTSII TDFLDPNNHN WHEFVNSSST FSSLPKSI 330 340 350 360 370 380 390 4	20
330 340 350 360 370 380 390 4	LQ
	)0
CNPLDPTNTT RIHAMLPIPG SSSQLLLNKE SNDKKMDKER SKSFTNIEQD YKQYENLLDN GIYKYNRRTT KTYHDLKS	DΥ
410 420 430 440 450 460 470 4	30
NEIGEVFAQF AHEQAQVGEL AEQLSYLSNA FSGSSISLEK LVGRLYYNIN EPLNESVHMA TSARELIKYR KLKYLQNE	ΜΙ
490 500 510 520 530 540 550 5	50
KKSLNSKRAQ LEKLEAQNNE YKDVDKIIDN EMSKSHTINL ERPNNNTGSG GKSYGGKLFN GFNKLASMVK DSVK	DP
570 580 590 600 610 620 630 6	10
HTASINLKKE IEQLSESLEV TENDLEVISK VIKNDQLPKF SKEREVDLSE ILKHYSRYMR NYARQNLEIW KEVKRHQD	FA



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**Fig. S12.** Analysis of the amino acid sequence of Atg20 by predictors (SPINE-D, MFDp2, and s2D; (2-4)) for intrinsically disordered protein regions. The position of the putative amphipathic helix (AH) in Atg20 is indicated by a blue arrow.



**Fig. S13.** Comparison of predicted amphipathic helices in fungal Atg20 homologs and BAR domain-containing proteins. (*A*) AH in Atg20 of *K. lactis* and *C. glabrata* formed by amino acids sequences homologous to the amino acid sequence forming AH in Atg20 of *S. cerevisiae*. (*B*) AH in SH3GL2/endophilin A1 and Amph/mphiphysin (5) are shown for comparison with those in (*A*).



**Fig. S14.** Comparative bioinformatics analysis of the amino acids sequences of the BAR proteins that encompass a membrane-inducible AH. The consensus sequences for the BAR and PX domains, as determined by protein-protein BLAST, are indicated in blue and purple, respectively. The position of a particular AH within an IDPR determined by PONDR-FIT is shown in red. The results of the algorithms MoRFPred and ANCHOR (if any), which determine the position of a foldable element (termed molecular recognition feature or ANCHOR disordered binding domain) within an IDPR, is indicated in red for each BAR protein under the corresponding diagram.



**Fig. S15.** Analysis of mutations in the PX, BAR, and BAR-GAP domains of Atg20. (*A*) The structural mutants of Atg20 are defective in the Cvt pathway. The *atg20* $\Delta$  strain (D3Y009) was transformed with the plasmid pCuGFP(426), pCuGFP-Atg20(426), pCuGFP-Atg20[Y177E Y180/E](426), pCuGFP-Atg20[I382E Y385E](426), pCuGFP-Atg20[Y469E L472E](426) or pCuGFP-Atg20[F539E F542E](426). The *atg11* $\Delta$  (SEY6210) strain was used as a negative control. GFP, Ape1 and Pgk1 (loading control) were detected from the cell lysate by immunoblotting. Columns are averages and error bars represent standard deviation from 3 independent experiments. Statistical significance was tested by unpaired two-tailed Student's t-test. The p values less than 0.005 were considered to be significant (\*\*\*). (*B*) PA-Snx4 coprecipitates all variants of GFP-Atg20. The plasmids pCuGFP(426), pCuGFP-Atg20(426), pCuGFP-Atg20(Y177E Y180/E](426), or pCuGFP-Atg20[F539E F542E](426) were transformed into MKO (YCY123) cells and co-expressed under the *CUP1* promotor with the pCuPA-Snx4(424) plasmid. Cells were cultured in SMD, and cell lysates were prepared and incubated

with IgG-Sepharose for affinity purification. The proteins were separated by SDS-PAGE and detected with monoclonal antibody that recognizes GFP or PA. The F539E F542E mutation in MoRF5/BR10 does not weaken the interaction between Atg20 and Snx4.



**Fig. S16.** Analysis of the microsomes and protein input for the *in vitro* membrane-binding assay. Upper panel, western blots showing the presence of Atg20 and His-Snx4 in the recombinant purified heterodimer and the presence of the endoplasmic reticulum marker protein Dpm1 in microsomes isolated from  $snx4\Delta$   $atg20\Delta$  (SEY6210) cells; lower panel, western blots showing an equal input of purified heterodimers (wild-type or mutant) that were used in the reconstitution experiment.

Name	Genotype	Reference
CWY230	SEY6210 vac8Δ::KAN	(6)
D3Y009	SEY6210 atg20 $\Delta$ ::HIS	This study
HPY017	SEY6210 atg24 $\Delta$ ::HIS, atg20 $\Delta$ ::LEU2	This study
HPY063	$WLY176 atg20\Delta$ ::LEU2	This study
HPY079	$CWY230 atg20\Delta$ ::HIS3	This study
HPY081	W303-1B vac8∆::URA3	This study
HPY082	W303-1B vac8Δ::URA3 atg20Δ::KAN	This study
SEY6210	MAT $\alpha$ leu2-3,112 ura3-52 his3- $\Delta$ 200 trp1- $\Delta$ 901 lys2-801 suc2- $\Delta$ 9	(7)
	GAL	
W303-1B	MATα leu2-3,112 ura3-1 his3-11,15 trp1-1, ade2-1 can1-100	(8)
WLY176	SEY6210 pho13 $\Delta$ pho8 $\Delta$ 60	This study
YAB87	ZFY202 atg20 $\Delta$ ::KAN	This study
YCY123	SEY6210	(9)
	atg1Δ, 2Δ, 3Δ, 4Δ, 5Δ, 6Δ, 7Δ, 8Δ, 9Δ, 10Δ, 11Δ, 12Δ, 13Δ, 14Δ,	
	16Δ, 17Δ, 18Δ, 19Δ, 20Δ, 21Δ, 23Δ, 24Δ, 27Δ, 29Δ,	
YTS147	SEY6210 atg11 $\Delta$ ::LEU2	This study
ZFY202	W303-1B <i>pho13</i> Δ <i>pho8</i> Δ60	This study

**Table S1.** S. cerevisiae strains used in this study.

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