

# Supplementary Materials for

## **Structure of the hexameric fungal plasma membrane proton pump in its auto-inhibited state**

**Authors:** Sabine Heit, Maxwell M.G. Geurts, Bonnie J. Murphy, Robin A. Corey, Deryck J. Mills, Werner Kühlbrandt, Maike Bublitz\*

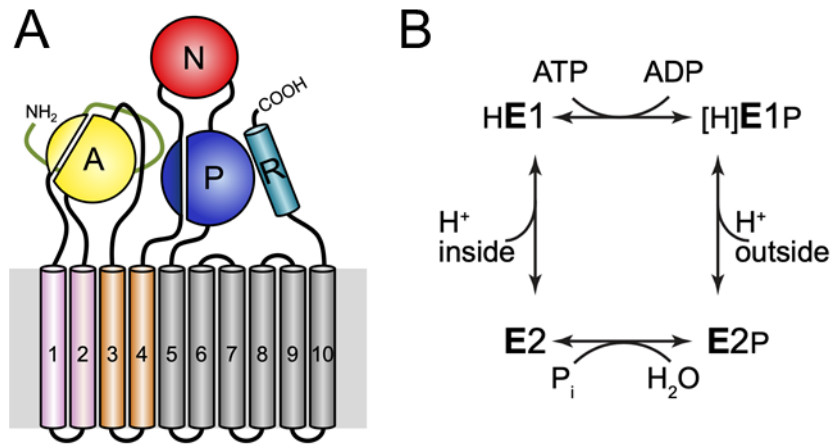
\*Corresponding author. Email: [maike.bublitz@bioch.ox.ac.uk](mailto:maike.bublitz@bioch.ox.ac.uk)

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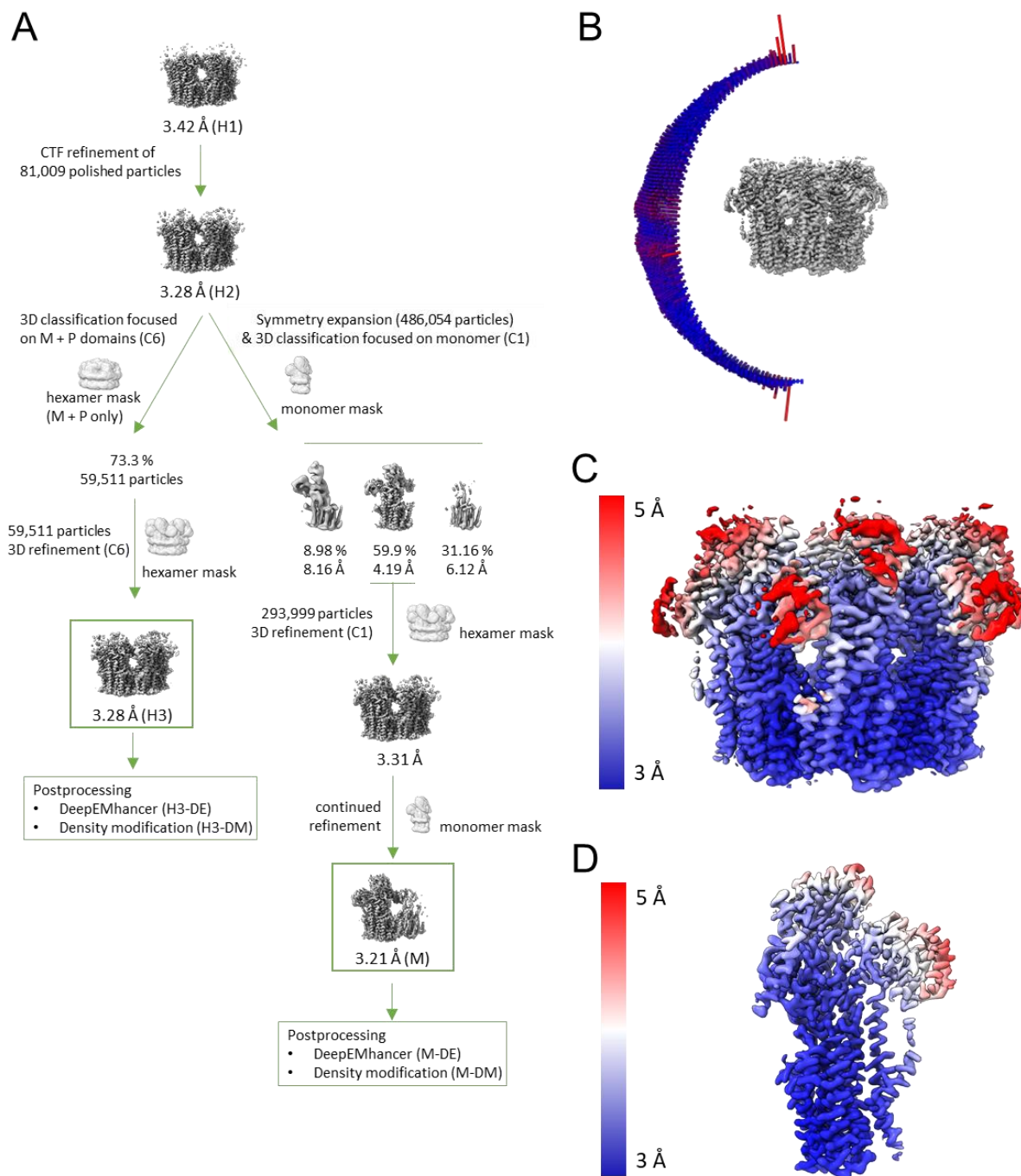
Figs. S1 to S14

Tables S1 to S6

References (45–82)

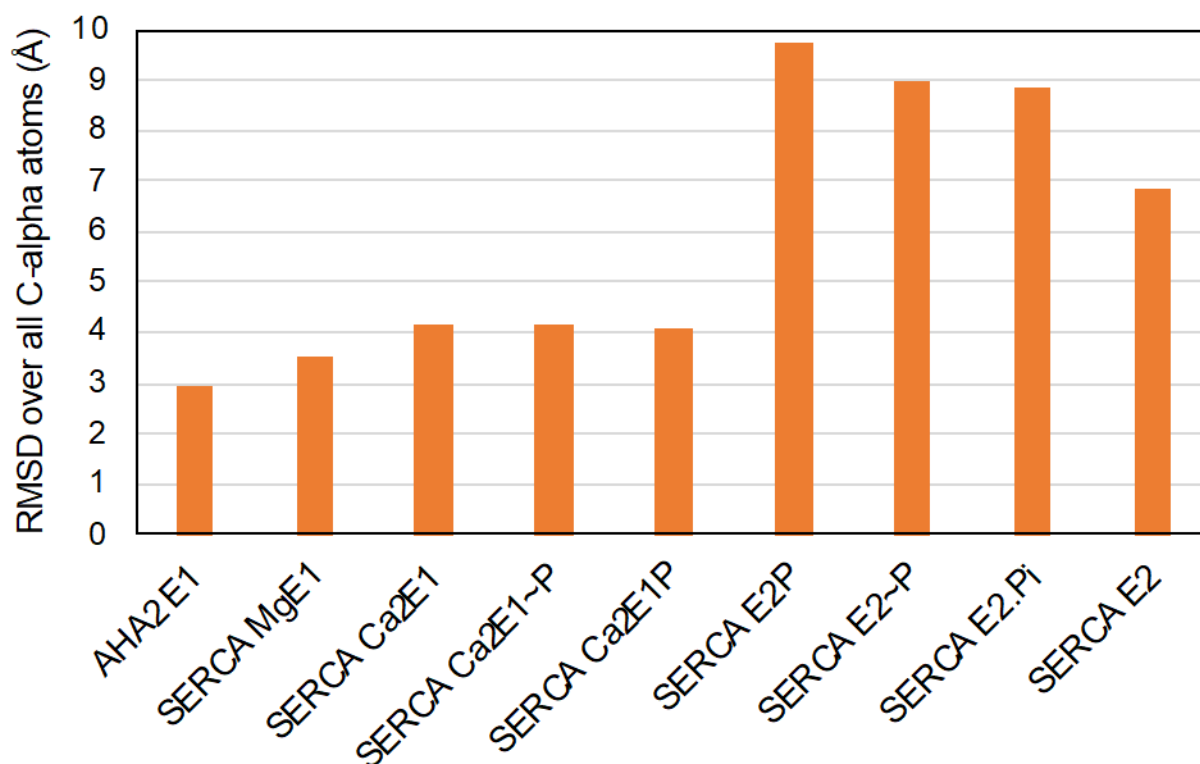


**Fig. S1: Topology diagram and E1/E2 scheme of Pma1.** (A) Overall Pma1 topology. Nucleotide-binding (N) domain red, actuator (A) domain yellow, phosphorylation (P) domain blue, regulatory (R) domain cyan, N-terminal extension (green), M1-2 pink, M3-4 gold, and M6-10 grey. (B) Canonical E1-E2 catalytic cycle for proton pumping by Pma1 with transient phosphorylation.



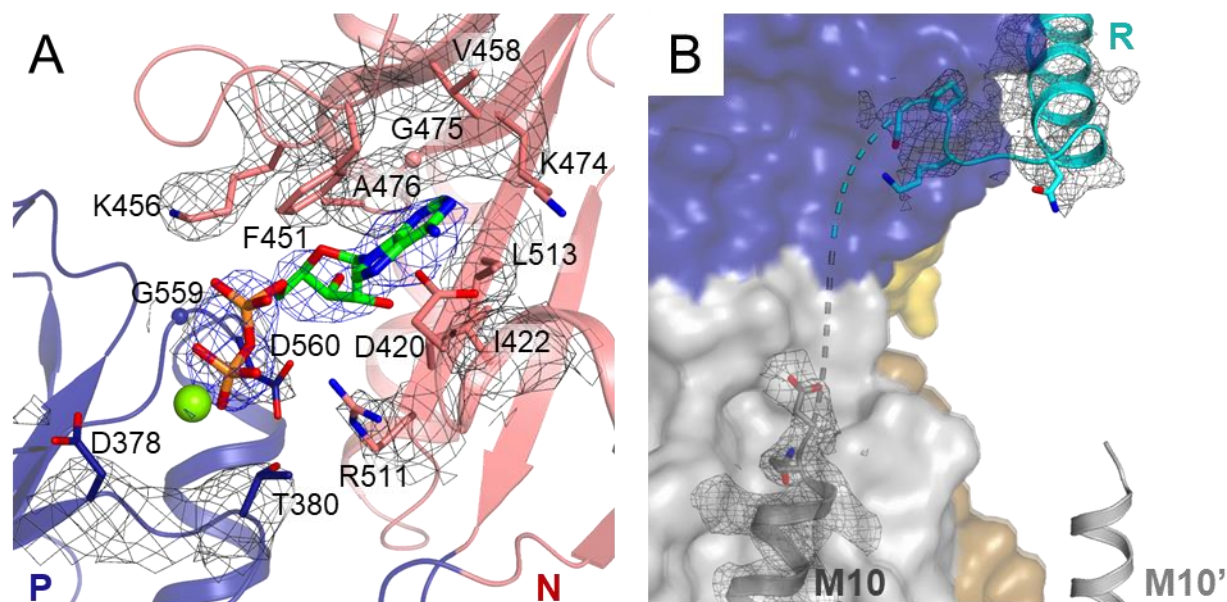
**Fig. S2: Overview of the refinement of the Pma1 hexamer and monomer cryo-EM maps.**

(A) Schematic representation of the refinement workflow resulting in the final hexamer map H3 and the final focused monomer map M. Masks for 3D classification and refinement are shown in white. (B) Angular distribution plot of all particles that contributed to the final hexamer map H3. The height of the bars is proportional to the number of particles in those views. (C) Local resolution of the final hexamer map H3 and (D) for the final monomer map M. Resolution estimates from Relion 3Drefine (51), maps shown are H3-DE and M-DE.



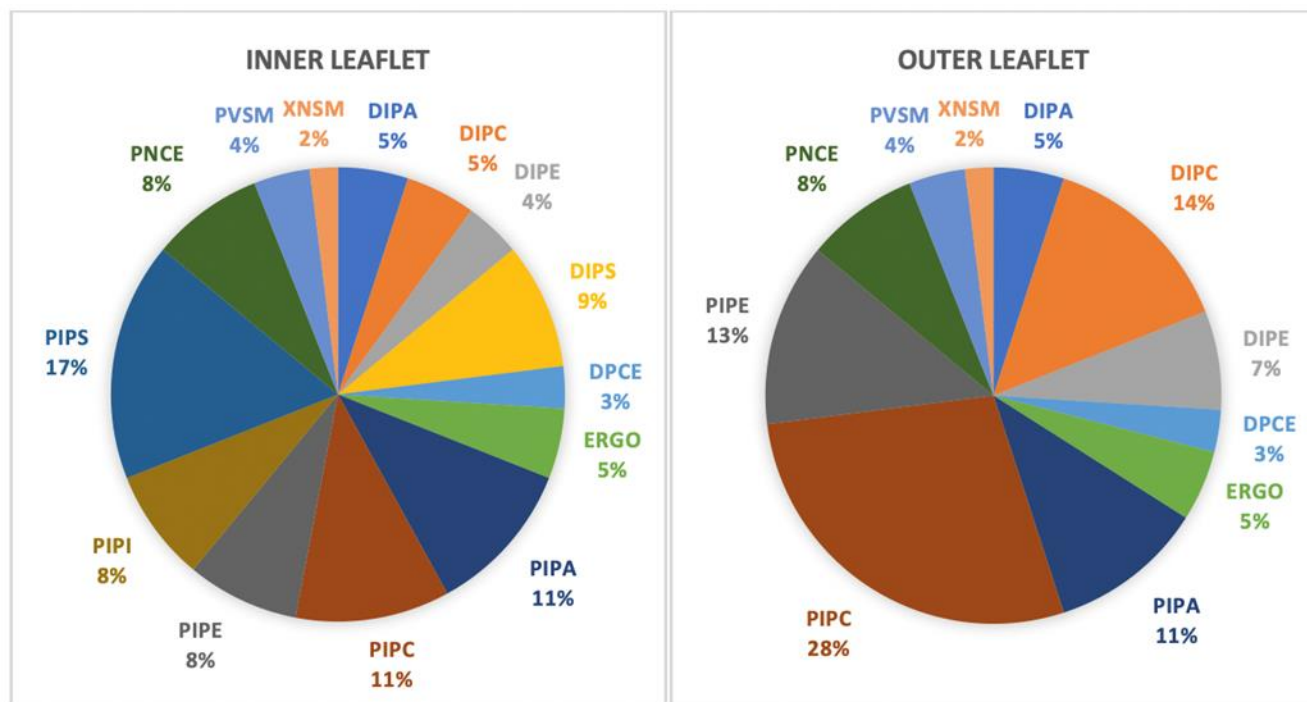
**Fig. S3: Structural state comparison of Pma1 with related P-type ATPases.** RMSD (root mean square deviation) calculated over all C-alpha atoms of Pma1 (*E1*) compared to the crystal structures of AHA2 (*E1*) and SERCA in different states along the catalytic cycle using PyMOL(82). PDB entries: 5KSD (AHA2 *E1*), 4HW1 (SERCA Mg*E1*), 3N8G (SERCA Ca2*E1*), 1T5T (SERCA Ca2*E1*~P), 3BA6 (SERCA Ca2*E1*P), 3B9B (SERCA *E2*P), 3N5K (SERCA *E2*~P), 1WPJ (SERCA *E2*.Pi), 3NAL (SERCA *E2*).



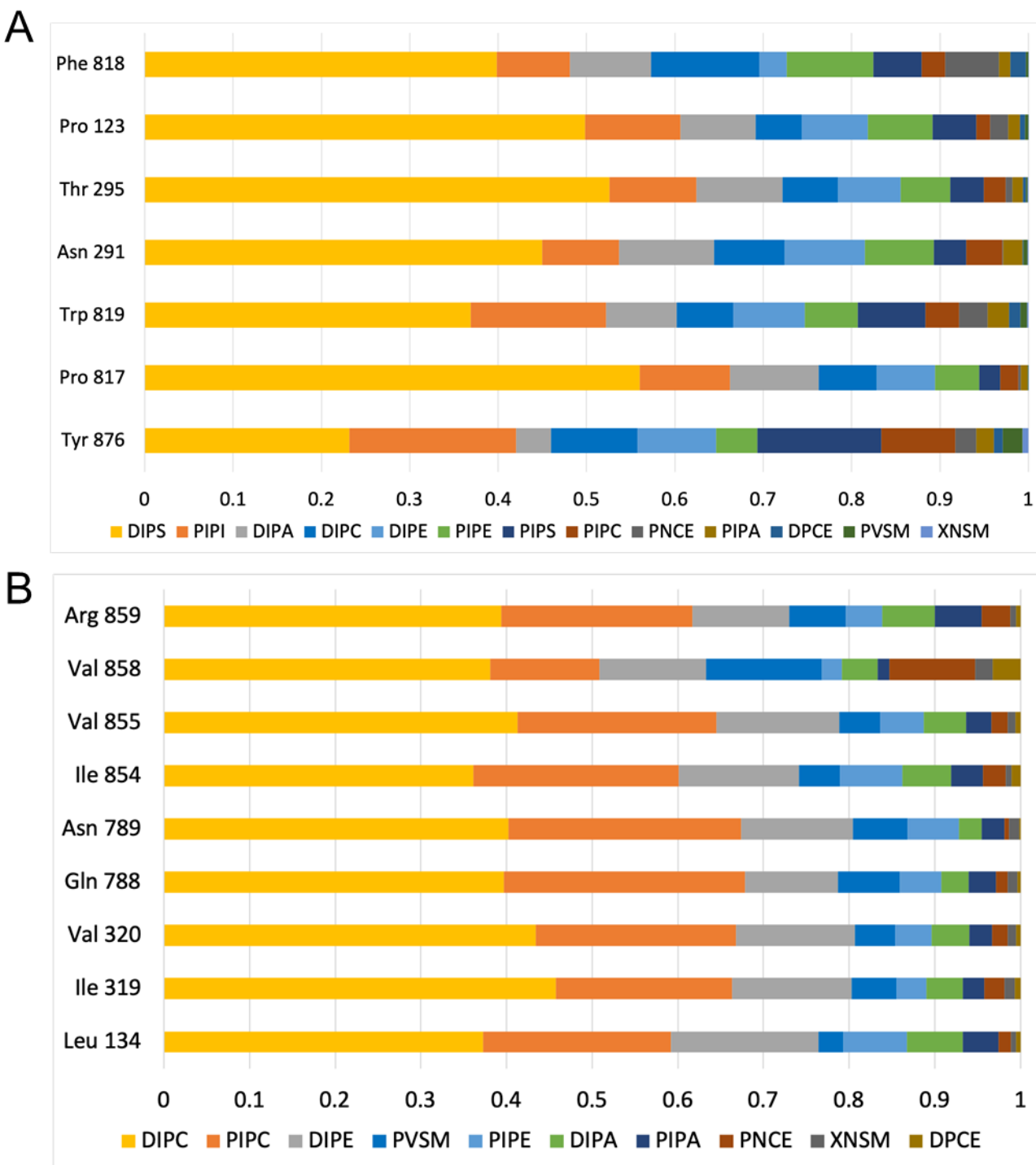


**Fig. S4: Nucleotide-binding site and assignment of the R domain to its respective monomer.**

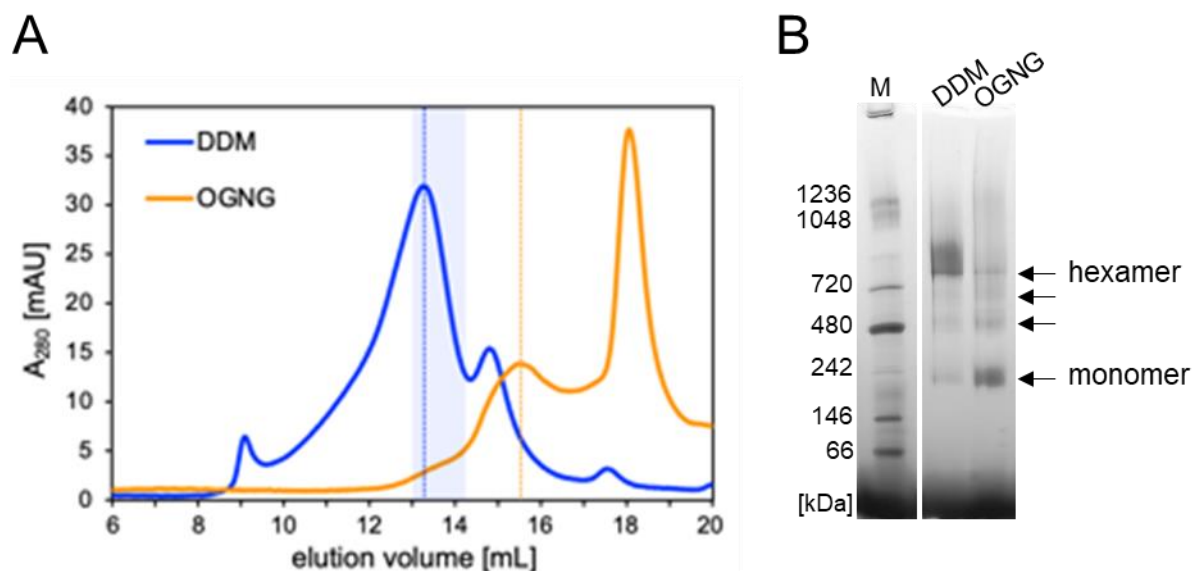
(A) ADP is bound at the nucleotide-binding site between the P (blue) and N (light red) domains. ADP, residues involved in its coordination and Asp378 are shown as sticks (spheres for glycine) with C-atoms coloured in green (ADP) or according to their domain, a  $Mg^{2+}$  ion is shown as a light green sphere. The cryo-EM map (M-DM) is shown as blue or black mesh for MgADP and the protein, respectively, with a higher contour level for MgADP. Polar contacts are indicated by yellow dashes. (B) The distance from the helical part of the R domain to M10 and M10' (shown as cartoon) is very similar, the assignment is based on a short extension at the N terminus of the R-helix that points towards M10. The cryo-EM map (M-DM) is shown as grey mesh, residues of the non-helical part of R and M10 are shown in stick representation.



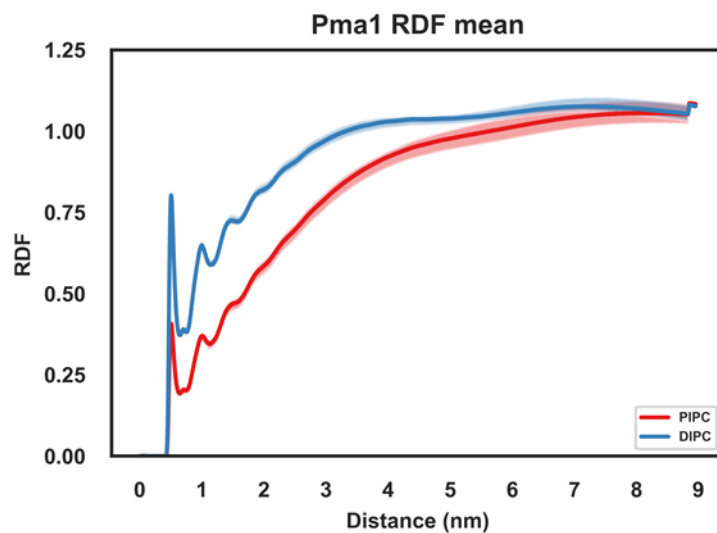
**Fig. S5.** Membrane lipid composition used in the coarse grained MD simulations of Pma1. For details on the lipids, refer to **Table S6**.



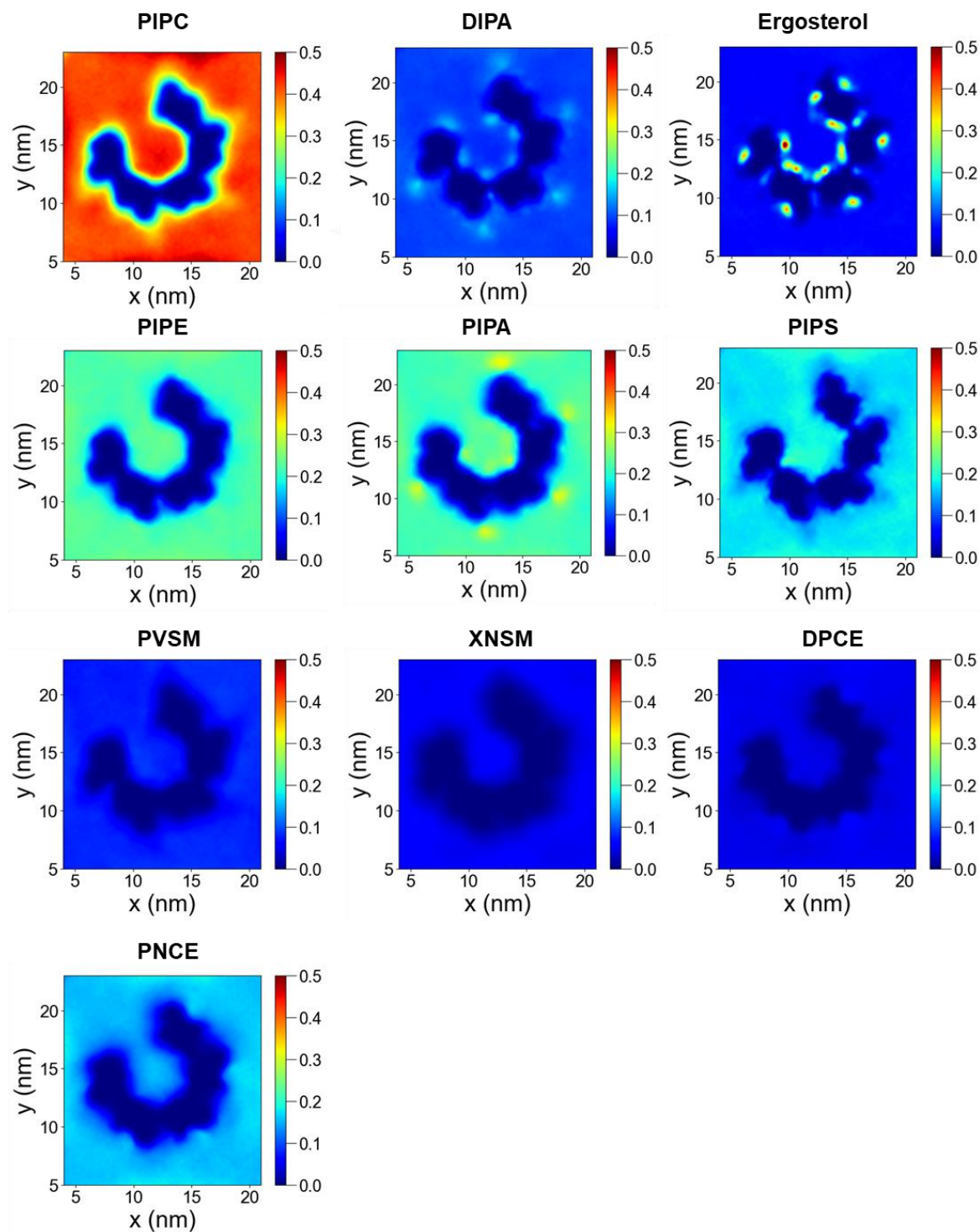
**Fig. S6.** Fractional interaction times of all lipids with Pma1 residues surrounding (A) Site I and (B) Site II, defined as the number of frames in which a lipid is within 0.6nm of a given residue. For details on the lipids, refer to **Table S6**.



**Fig. S7: Monomerisation of Pma1 with OGNG.** (A) Size-exclusion chromatography of Pma1 in DDM (blue; highlighted fractions used for cryo-EM) or OGNG (orange). SEC column: Superose 6 Increase 10/300 (GE Healthcare). (B) Native PAGE of Pma1 in DDM or OGNG (samples in 0.2 M ammonium acetate buffer for native MS). Unlabelled arrows indicate uncharacterised Pma1 oligomers (potentially dimers and tetramers). Protein ladder (M): NativeMark™ (Invitrogen), gel: 3-12% NativePAGE™ (Invitrogen).

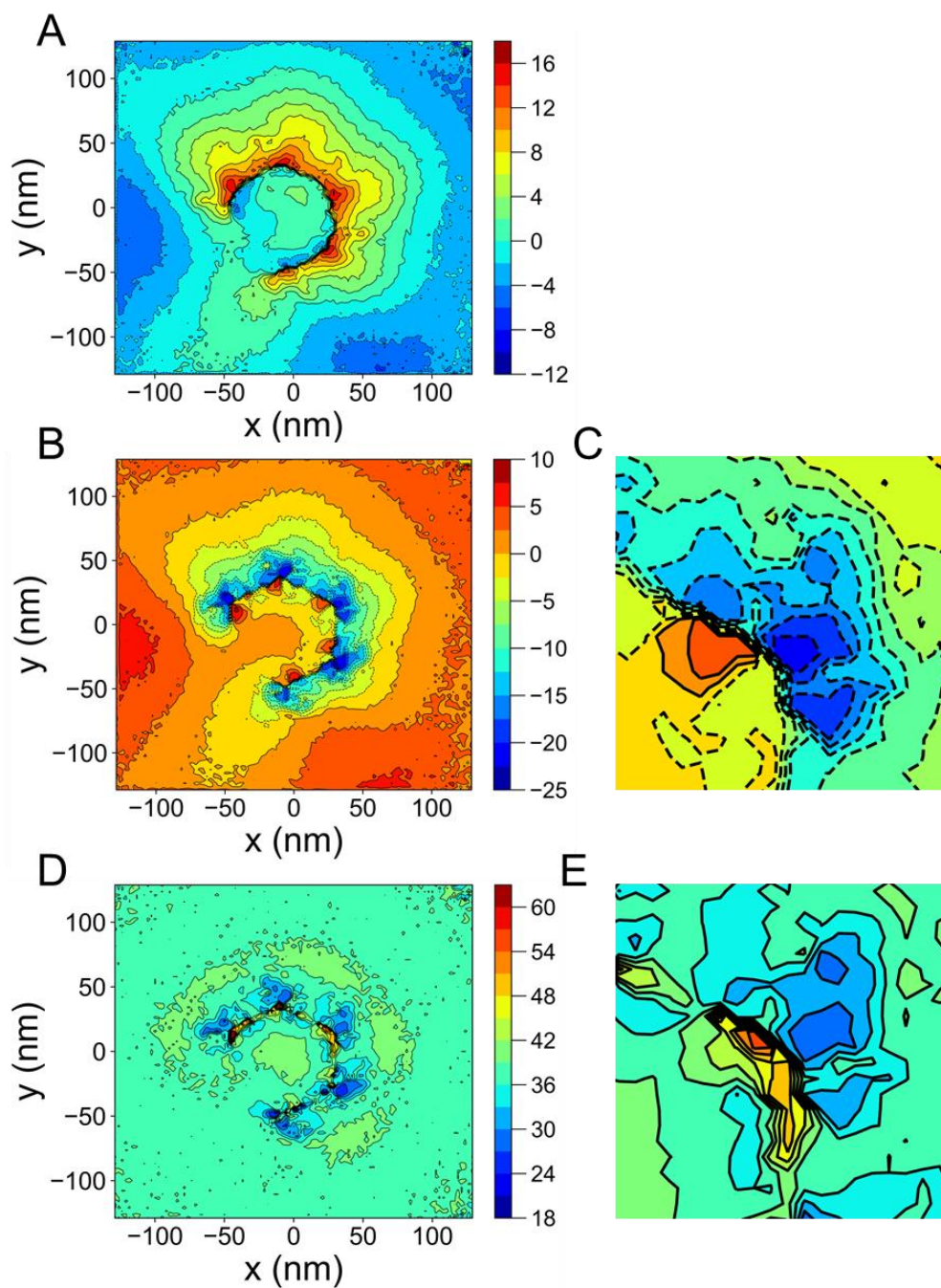


**Fig. S8. Radial distribution functions of PIP and DIPC in the coarse grained simulation of a PIP/DIPC-only membrane.** The distribution confirms a preferential binding of Pma1 to double-unsaturated lipids. For details on the lipids, refer to **Table S6**.

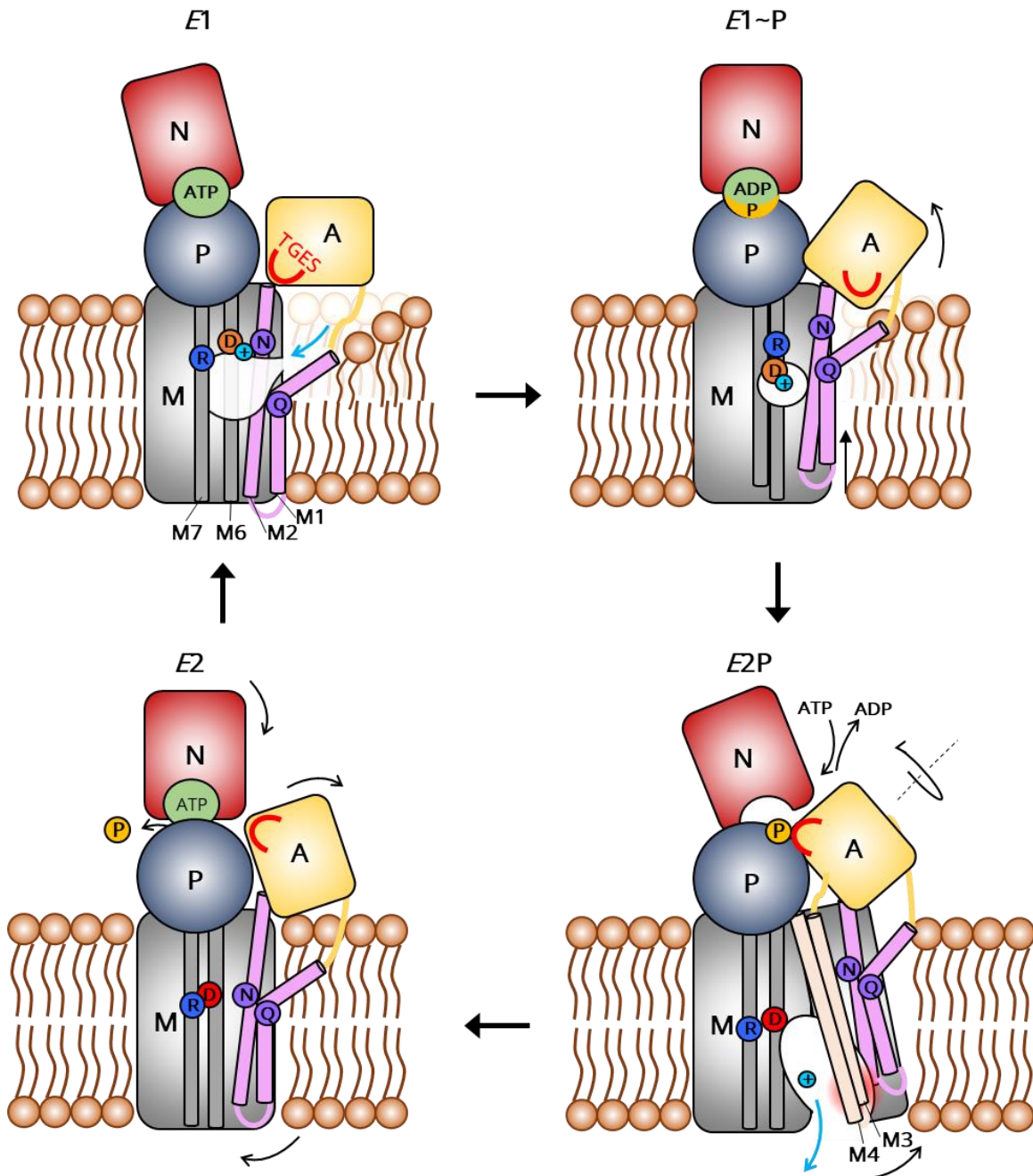


**Fig. S9. Lipid density maps for PIPC, DIPA, Ergsterol, PIPE, PIPA, PIPS, PVSM, XNSM, DPCE, and PNCE.** Values correspond to average numbers of molecules per nm<sup>3</sup> and do not account for the respective membrane composition fraction. For details on the lipids, refer to **Table S6**.



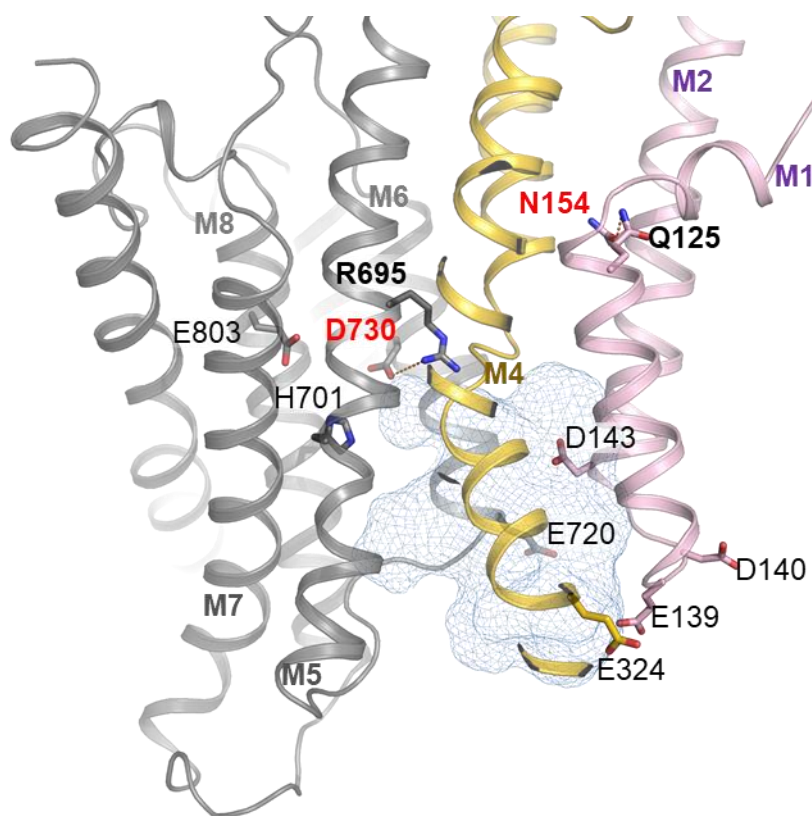


**Fig. S10. Quantitative bilayer deformation analysis.** Average z-height position of lipid headgroup-phosphates in (A) the outer leaflet, and (B) the inner leaflet. Values represent the z-height difference in Ångström relative to the value at coordinate -50, 110 (assumed to represent a membrane region unperturbed by protein or boundary effects). (C) Zoom of (B) on the region of one Pma1 monomer. (D) Average leaflet thickness between phosphates (inner leaflet minus outer leaflet) at each x, y coordinate. Scale is in Ångström. (E) Zoom of (D) on the region of one monomer.

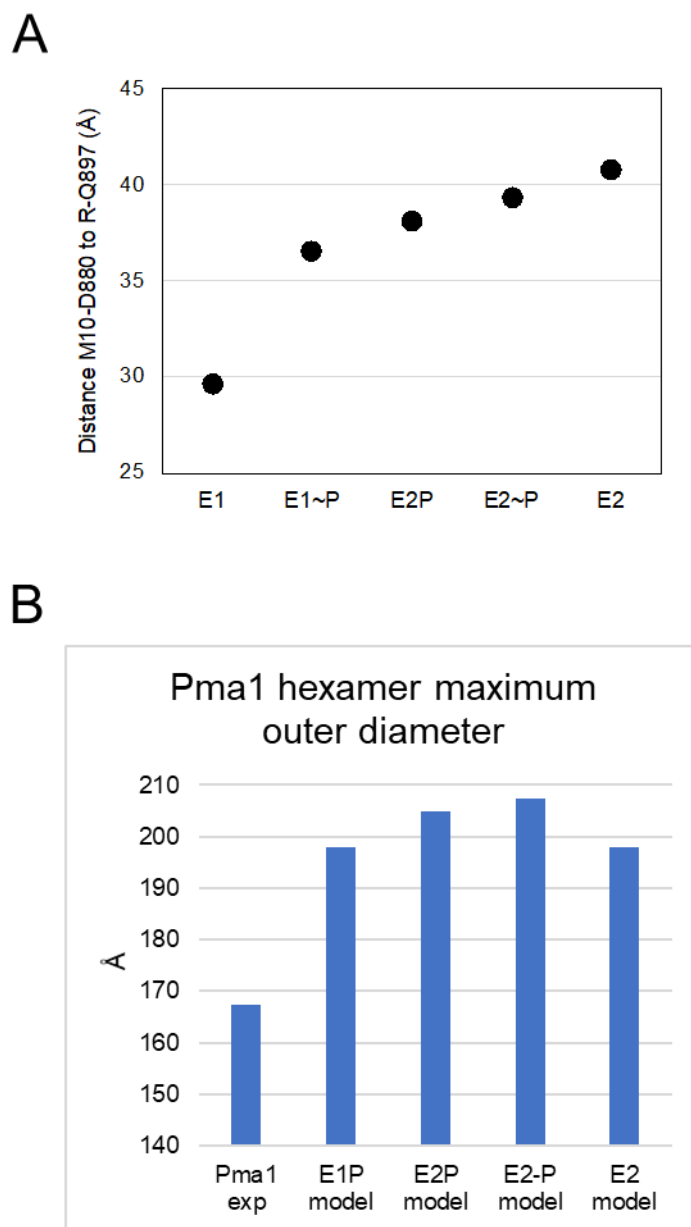


**Fig. S11. Proposed model of proton transport mechanism in Pma1, based on homology models with SERCA.** In the E1 state, a proton enters from the cytosol and binds between D730 and N154, facilitated by a local membrane depression. The proton gets occluded by a concerted upward movement of M1-2. The side chain of R695 in M7 appears to shield the protonated D730 from the former ion entry region. A large conformational change is expected to follow phosphoryl transfer to the P domain, leading to the transient opening of the extracellular proton exit pathway in the E2P state. In this state, N154 in M2 could interact with Q125 at the M1 kink to stabilise the bundle, and R695 can form a salt bridge with D730, favouring its deprotonation. A cluster of negatively charged residues (red shaded area) facilitates proton exit. In the subsequent dephosphorylation reaction, the exit pathway closes, leading to the E2 state, from which the pump cycles back to open up to the cytosol once again. Residues shown as coloured circles are: D (orange): protonated D730; D (red): deprotonated D730, N (purple): Asn154; Q (purple): Q125; R (blue): Arg695.



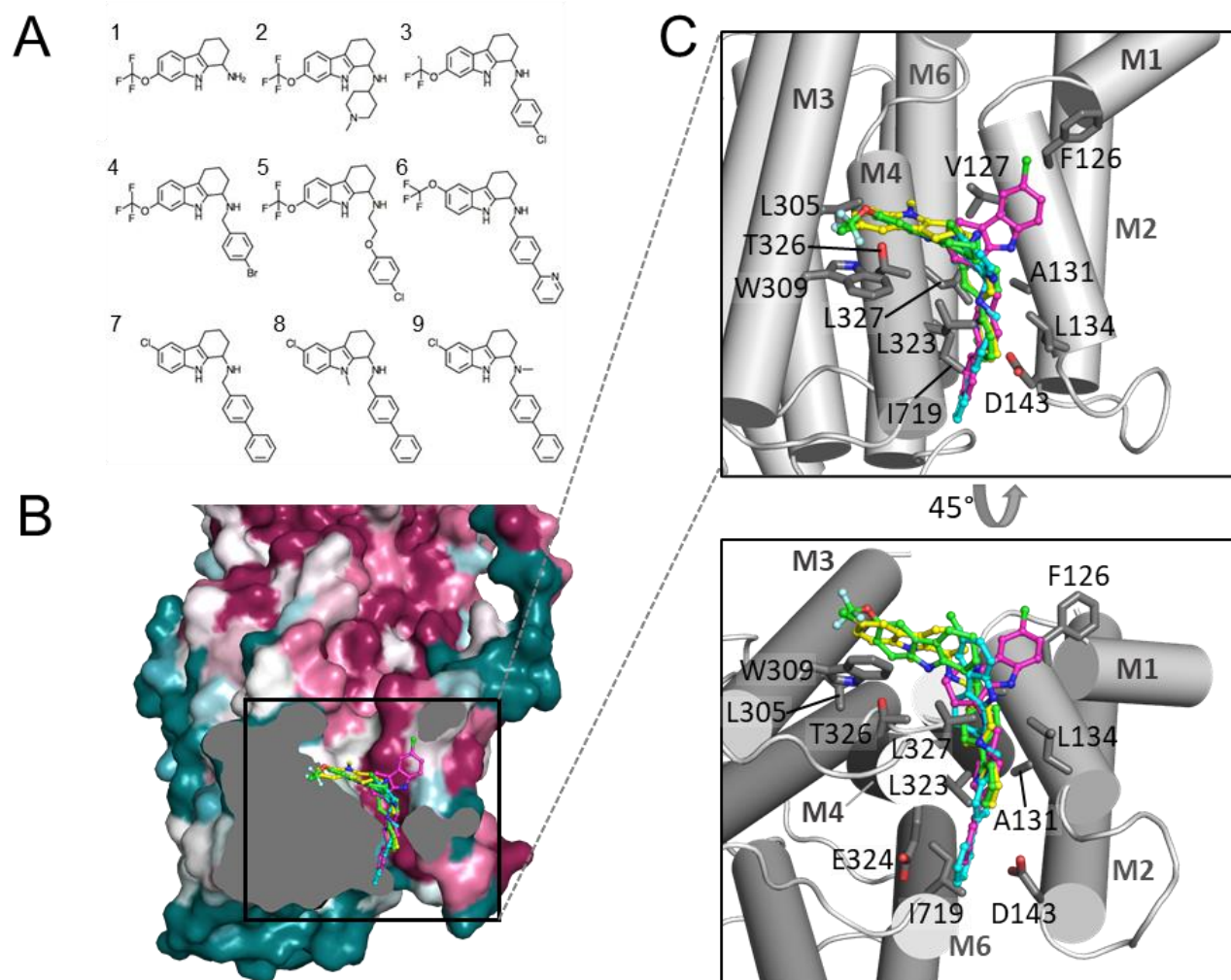


**Fig. S12: Proton exit funnel in the open-to outside *E2P* homology model.** Aqueous cavity representing the proton exit funnel between M1, M4 and M6. Important residues for proton transport are shown as sticks. M1-2 are coloured pink, M3-4 gold and M5-10 grey. The proton acceptor/donor Asp730 (labelled in red) at the inner end of the funnel lies in bonding distance to Arg695 (C-alpha distance: 7.3 Å; indicated bond: 4.9 Å), presuming a small side chain rotation of the latter. The *E1*-interaction partner of Asp730, Asn154 (labelled in red), has moved away and forms a putative hydrogen bond with Gln125 (2.8 Å). Putative bonds indicated as orange dashes. There is a clustering of negatively charged residues (Glu139, Asp140, Asp143, Glu324 and Glu720) at the extracellular end of the exit funnel.



**Fig. S13: Distance between M10 and the R helix, and hexamer homology model diameters**

(A) Distance between the C-alpha atoms of the last residue of M10 (Asp880) and the first residue of the R-helix (Gln897) in the autoinhibited *E1* structure and homology models throughout the catalytic *E1/E2* cycle. The R-helix was placed into the homology models in its relative position to the P domain as observed in *E1*. The homology models were generated with SWISS-MODEL based on a structural alignment and SERCA crystal structures with the PDB entries 1T5T (*E1~P*), 3B9B (*E2P*), 3N5K (*E2~P*), and 3NAL (*E2*). (B) Maximal outer diameter of the autoinhibited Pma1 *E1* structure and homology models in states *E1P*, *E2P*, *E2~P*, and *E2*.



**Fig. S14: Compound docking into Pma1.** (A) Chemical structure of the docked tetrahydrocarbazole compounds. (B) Tetrahydrocarbazole compounds docked into Pma1 in the autoinhibited *E1* state giving estimated affinities stronger than -9 kcal/mol (only one representative mode with the highest affinity score shown per compound): 6/S (green), 7/R (blue), 7/S (pink), 8/R (yellow). The protein surface is coloured according to conservation with proton pumps from human- and plant-pathogenic fungi from purple (conserved) to bluegreen (variable) (calculated with ConSurf (42)). (C) Enlarged view of the putative inhibitor binding site with the protein shown as grey cartoon. Residues involved in binding of most compounds are shown as sticks.

**Table S1. Cryo-EM data collection, refinement and validation statistics.**

<b>Data collection</b>		
Instrument	FEI Titan Krios / Gatan K3	
Magnification	105'000	
Voltage (kV)	300	
Electron dose (e <sup>-</sup> /Å <sup>2</sup> )	42	
Defocus range (μm)	-1.3 to -2.5	
Calibrated pixel size (Å)	0.837	
<b>Map values</b>	<b>hexamer</b>	<b>monomer</b>
Map ID	H3	M
EMDB ID	EMD-12644	EMD-12638
No. of particles	59'511	293'999
Map symmetry	C6	C1
Map resolution (Å)	3.28	3.21
FSC threshold 0.143		
<b>Model</b>		
PDB ID	7NY1	7NXF
Protein residues	4'974	829
Ligands (no.)	K (6), Mg (6), ADP (6)	K (1), Mg (1), ADP (1)
<b>Model validation</b>		
Map CC (ligands)	0.76 (0.70)	0.80 (0.79)
MolProbity score	2.08	1.96
Clash score	12.01	8.99
Bond length rmsd (Å)	0.007	0.006
Bond angle rmsd (°)	1.142	0.816
B factor (Å <sup>2</sup> ) (min/max/mean)		
Protein	19.28/155.87/82.25	
ligands	61.94/109.49/107.30	
Rotamer outliers (%)	0	
Cβ outliers (%)	0	
Ramachandran Plot		
Favoured/allowed/outliers (%)	92.1 / 7.9 / 0	

**Table S2:** Residues involved in intra- and intermolecular contacts mediated via the R domain.

R – P		R – P'		R – R' / R'' – R	
Pro893	G589	Phe905	Val562	Leu902	Ser892
Lys 894	M592	Leu909	Gly563		Pro893
Arg900	G594	Val912	Arg566		
Glu903	Ser595	Ser913	Asn577		
Asp904	Tyr598	Thr914	Ile578		
Val907	Asp599	His916	Tyr579		
Arg911	Glu602	Glu917	Arg583		
	Arg625		Asp500		
			Phe600		

**Table S3:** Residues involved in the intermolecular contact within the M domain.

M3 / M4	M7 / L7-8	M10
Thr295	Ile772	Ile862
Ile299	Thr775	Phe863
Ile302	Thr776	Cys869
Leu306	/	Ile870
Trp309	Gly784	Tyr876
Val310	Gly785	Ile877
Phe313	Ile786	
Tyr314	Gln788	
/		
Pro318		
Ile319		

**Table S4: Alignment of *Neurospora crassa* Pma1 with the plasma membrane proton pumps of human-pathogenic (above black line) and plant-pathogenic (below black line) fungi.**

Sequences are sorted in decending order according to their identity with Pma1. Accession codes: *N. crassa* (sp|P07038), *Sporothrix schenckii* (tr|A0A0F2M765), *Histoplasma capsulatum* (sp|Q07421), *Coccidioides immitis* (tr|A0A0E1RVX1), *Blastomyces dermatitidis* (tr|T5BWH0), *Acremonium chrysogenum* (tr|A0A4Y6GP7), *Trichophyton rubrum* (tr|A0A022W272), *Candida glabrata* (tr|Q6FXU5), *Candida auris* (tr|A0A2H0ZKV9), *Candida albicans* (sp|P28877), *Pneumocystis jirovecii* (tr|A0A0W4ZIS2), *Aspergillus fumigatus* (tr|Q96TH7), *Talaromyces marneffeii* (tr|A0A093Y2U3), *Syncephalastrum racemosum* (ORZ00574.1), *Rhizopus stolonifera* (RCI02493.1), *Lichtheimia corymbifera* (CDH55078.1), *Cryptococcus gattii* (tr|A0A0D0U934), *Cryptococcus neoformans* (tr|O74242), *Claviceps purpurea* (CCE32805.1), *Colletotrichum gloeosporioides* (KAF3800644.1), *Magnaporthe oryzae* (ELQ65709.1), *Fusarium oxysporum* (RKL39108.1), *Botrytis cinerea* (EMR90163.1), *Fusarium graminearum* (PCD22889.1), *Aspergillus niger* (GAQ33769.1), *Blumeria graminis* (AAK94188.1), *Sclerotinia sclerotiorum* (tr|A7F838), *Mycosphaerella graminicola* (XP\_003852209.1), *Cochliobolus heterostrophus* (tr|M2TMB0), *Rhizoctonia solani* (tr|A0A0B7FM75), *Ustilago maydis* (), *Puccinia graminis* (tr|A0A5B0P5Y0)

<i>Neurospora crassa</i>	-----MADHSASGAPALSTN-----IESGKFDEKAAEAA-----A-30
<i>Sporothrix schenckii</i>	-----MAESTSAAPALHTD-----IPGGNFDEKAGAGE-----AA30
<i>Histoplasma capsulatum</i>	-----MAHSA-----ASGA-----ASAAHFDEKKT-----EV22
<i>Coccidioides immitis</i>	-----MAEPGTG-STRPQGEVPPNHLGTT-----VPSGGFEGHDEKAH-----APAS41
<i>Blastomyces dermatitidis</i>	-----MSD-PT-ASGPQGHGIPPNHLGTTN-----FPSGDFSEKAT-----EP35
<i>Acremonium chrysogenum</i>	-----MADNKAAGAPALDTN-----IESGGFDEKRAQQD-----AP31
<i>Trichophyton rubrum</i>	-----MADH-AAQGQGGQVPPNHLGTA-----VPSGGFEGGHHKDEVQQHQQHQQQT44
<i>Candida glabrata</i>	-----MSDVES06
<i>Candida auris</i>	-----MSATEP06
<i>Candida albicans</i>	-----MSATEP06
<i>Pneumocystis jirovecii</i>	-----MDEKTEYVVRKDTVYVNYVSSFEEL-----DKELK30
<i>Aspergillus fumigatus</i>	-----MAE-----RRI-----S-----YAADVENGQTN-----18
<i>Talaromyces marneffeii</i>	-----00
<i>Syncephalastrum racemosum</i>	-----00
<i>Rhizopus stolonifera</i>	-----00
<i>Lichtheimia corymbifera</i>	-----MSAKN-----D06
<i>Cryptococcus gattii</i>	MSD-----HEKVGHTTEVPPTKESS-----LENK-----V24
<i>Cryptococcus neoformans</i>	MSD-----HEKVGHTTEVPPTKESS-----LENK-----V24
<i>Claviceps purpurea</i>	-----MADNKGAPALDTN-----IESGGFDEKSRQA-----27
<i>Colletotrichum gloeosporioides</i>	-----MAESNAAAPAINTP-----IEGHRFDEKAPVEA-----PA30
<i>Magnaporthe oryzae</i>	-----MADSTQEGAGPAINTP-----IESGKFDEKGEGLAH-----NP33
<i>Fusarium oxysporum</i>	-----MAEEKKAAGAPALDTN-----IETGGFDEKRGQA-----28
<i>Botrytis cinerea</i>	MSHLPQGDIHLHGTTGAESSNHSSDTPPNHLRTN-----IETGGFDEKNGGVQ-----HT51
<i>Fusarium graminearum</i>	-----MAEEKAVGAPALDTN-----IETGGFDEKRGQA-----28
<i>Aspergillus niger</i>	-----MSFTYPK-----DMD-----IETPEVEYEK-----I19
<i>Blumeria graminis</i>	-----MAQNG-----05
<i>Sclerotinia sclerotiorum</i>	-----MAA-----PRV-----M-----AHDDVENGASA-----12
<i>Mycosphaerella graminicola</i>	-----MAA-----PRV-----SF-----SDKDLENGEGG-----19
<i>Cochliobolus heterostrophus</i>	-----00
<i>Rhizoctonia solani</i>	MSSE-----PIVEKEAGPPAAAAPT-----T19
<i>Ustilago maydis</i>	-----00
<i>Puccinia graminis</i>	MSD-----PDPDPQLQPEKQSTH-----D19

<i>Neurospora crassa</i>	-----YQPKPKV-EDDEDEDID-----AL-----IEDLE-----SHDGH-----D59
<i>Sporothrix schenckii</i>	PAAPAPPKVKPVEEEDDEDID-----AL-----IEDLE-----SHDGH-----G65
<i>Histoplasma capsulatum</i>	AHE-----EKKPLPEEEDDEDMD-----AL-----IEELE-----SQDGH-----I55
<i>Coccidioides immitis</i>	EAH-----FEKKPIPPDDDEEEDMD-----AL-----IEELE-----SQDGH-----I74
<i>Blastomyces dermatitidis</i>	VFN-----EKKPPVPEDDDEDMD-----AL-----IEELE-----SQDGH-----I68
<i>Acremonium chrysogenum</i>	PADTAPPKAAAPVEEEDDEDMD-----AL-----IEDLE-----SHDGH-----D66
<i>Trichophyton rubrum</i>	SAAFDKKKGAMPEEEDDEDMD-----QL-----IADLE-----SQDGH-----I79
<i>Candida glabrata</i>	NNEKPPQDVYFDEEMSEDDID-----AL-----IEELQ-----SHHGM-----G41
<i>Candida auris</i>	TNEKIDKAV-----ESDDEDEDID-----QL-----IIDLQ-----SNHNL-----D38
<i>Candida albicans</i>	TNEKVDKIV-----SDEDEDID-----QL-----VADLQ-----SNPGA-----G37
<i>Pneumocystis jirovecii</i>	DLEKGTGEGVCSLEDEDEDIDIN-----AL-----IDELD-----SQDGD-----Q65
<i>Aspergillus fumigatus</i>	-----KFWYA05
<i>Talaromyces marneffeii</i>	-TRT-----SADINN DGPA LDEY TALN RY ISTAR DRRR GSTSSAGGLNEGEKPKKRWN71
<i>Syncephalastrum racemosum</i>	-----MPPGRDPGKPN SAQWVD16
<i>Rhizopus stolonifera</i>	-----MSD-QEQSAKITGDLHQITVEDLYD24
<i>Lichtheimia corymbifera</i>	PGDKVLEGT-----I-----EMKAEVTNEK-PLNRNTRDLPDIKNLTVEEDLYD47
<i>Cryptococcus gattii</i>	QGEVVPATG-----TDEPKKKR-----EYKEMEHKTE-GDLHAKVDMNTIQFTAADLYD72
<i>Cryptococcus neoformans</i>	QGEVVPAAA-----AADDEEPKKR-----EYKEMEHKTE-GDLHAKVDMNTIQFTAADLYD74
<i>Claviceps purpurea</i>	PAENAPKKVPVAVDDDEDDEDID-----AL-----IEDLE-----SQDGH-----D62
<i>Colletotrichum gloeosporioides</i>	AS-----KAKVEEEDDEDDEDID-----AL-----IEDLE-----SQDGH-----I60
<i>Magnaporthe oryzae</i>	AAK-----PKVADDEEDEDDEDID-----AL-----IEDLE-----SVGGH-----G63
<i>Fusarium oxysporum</i>	PPPTHA PKAPVAEDEEPDEMD-----AL-----IEDLE-----SEDGH-----A63
<i>Botrytis cinerea</i>	SADA-----IKHEEEDDEDDEDMD-----AL-----IEDLE-----SQDGH-----A82
<i>Fusarium graminearum</i>	P-ATHNPKAPVAEDEEPDEMD-----AL-----IEDLE-----SEDGH-----E62
<i>Aspergillus niger</i>	AREAKAPTDIHNDEGEDEDEDID-----AL-----IVELE-----SVGGG-----A54
<i>Blumeria graminis</i>	-----ATVFEDEKLGEGYGNLVRYSINFKDGRMTSGAS-I-LDL PQKKWYQ52
<i>Sclerotinia sclerotiorum</i>	-----ARPEYDEKLGEGYGNLVRYSISKYKGRGEGEKGAASE-EENAPKKKGLFS60
<i>Mycosphaerella graminicola</i>	-PERS-----RKWSAGPNIEDLDEY TALQKXYISTYRDPKLAQQDEVANA-HAESQKKKFWQ74
<i>Cochliobolus heterostrophus</i>	-----MDEY TALQKXYILFYRDAKVNPHA-----TPTVQVKKWQ34
<i>Rhizoctonia solani</i>	PGAAGATPT-----EEKKR-----EYKDFGHDEE-KATHAKVDMAQIELKAEEDLYD64
<i>Ustilago maydis</i>	-----MSDVE-----HQQEKKVTKH-----RDI DEEHANS-GPKHALVDMSTIELKAEEDLYD46
<i>Puccinia graminis</i>	P-TSITPTE-----KASDASKKPG-----RFDKTFESEE-KPVHALVDMSLIQLKAEEDLYD68



Table S4: continued

<i>Neurospora crassa</i>	A	E	E	E	---	E	E	E	A	T	P	G	G	G	R	V	V	P	E	D	M	---	L	Q	T	D	T	R	V	G	L	T	S	E	V	V	Q	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	H	F	L	K	115			
<i>Sporothrix schenckii</i>	A	D	E	D	E	E	E	E	S	N	V	H	G	G	R	V	I	P	E	D	M	---	L	Q	T	D	T	R	I	G	L	T	D	H	E	V	V	A	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	L	I	L	K	123		
<i>Histoplasma capsulatum</i>	D	I	E	D	---	D	E	D	G	E	P	G	G	A	R	V	V	P	E	L	---	L	T	D	T	R	H	G	L	T	D	A	E	V	V	A	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	L	V	L	K	111				
<i>Coccidioides immitis</i>	Y	E	D	---	E	D	T	G	E	P	G	G	A	R	V	V	P	E	L	---	L	Q	T	D	T	R	M	G	L	T	D	Q	E	V	T	T	R	R	R	K	F	G	L	N	Q	M	K	E	E	K	E	N	M	I	L	K	130				
<i>Blastomyces dermatitidis</i>	D	V	E	D	---	E	E	D	G	E	P	G	G	A	R	V	V	P	E	L	---	L	N	T	D	T	R	Q	G	L	T	D	A	E	V	L	V	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	L	V	L	K	124			
<i>Acremonium chrysogenum</i>	A	F	D	E	E	---	E	E	T	Q	I	G	G	G	R	V	V	P	E	D	M	---	L	Q	T	D	P	R	V	G	L	T	D	A	E	V	N	N	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	L	V	L	K	122		
<i>Trichophyton rubrum</i>	D	E	I	D	E	---	E	D	E	D	Q	P	G	G	E	R	V	V	P	E	L	---	L	Q	T	D	T	R	T	G	L	T	D	A	E	V	T	T	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	L	I	L	K	136		
<i>Candida glabrata</i>	D	D	D	D	S	E	D	E	G	H	H	T	G	S	A	R	V	V	P	E	E	Y	---	L	Q	T	D	P	S	Y	G	L	T	S	D	E	V	A	H	R	R	R	K	Y	G	L	N	Q	M	A	D	E	R	E	S	M	I	V	K	099	
<i>Candida auris</i>	D	D	E	E	S	D	E	---	A	N	A	G	S	F	K	A	V	P	E	L	---	L	Q	T	D	P	E	V	G	L	T	D	D	E	V	T	K	R	R	R	K	Y	G	L	N	Q	M	A	E	E	Q	E	N	L	V	L	K	095			
<i>Candida albicans</i>	D	E	E	---	E	E	E	---	E	N	D	S	S	F	K	A	V	P	E	L	---	L	Q	T	D	P	R	V	G	L	T	D	D	E	V	T	K	R	R	R	K	Y	G	L	N	Q	M	A	E	E	Q	E	N	L	V	L	K	092			
<i>Pneumocystis jirovecii</i>	E	D	N	M	---	---	E	D	T	C	P	Q	S	H	R	A	V	P	E	L	---	L	A	T	D	T	R	I	G	L	T	S	Q	E	V	I	N	R	R	R	K	Y	G	H	N	K	M	K	E	E	K	E	N	M	V	V	K	120			
<i>Aspergillus fumigatus</i>	F	W	R	K	D	---	A	E	T	---	---	G	G	A	F	V	C	P	D	E	W	---	L	E	T	D	L	R	T	G	L	S	A	S	E	I	E	T	R	R	R	K	G	W	N	E	L	T	T	E	K	T	N	F	F	V	Q	059			
<i>Talaromyces marneffeii</i>	F	G	G	S	S	T	T	T	S	---	---	N	E	P	F	V	A	P	D	D	W	---	V	D	T	D	I	R	A	G	L	K	G	S	D	I	E	I	R	R	R	K	T	G	Y	N	E	L	V	T	E	K	T	N	L	F	V	Q	126		
<i>Syncephalastrum racemosum</i>	K	---	---	---	---	---	---	---	---	---	E	L	P	P	E	L	E	P	Y	---	L	Q	T	P	P	V	T	G	L	T	D	E	Q	A	S	E	R	L	E	R	F	G	R	N	E	L	K	Y	K	R	N	K	I	L	H	061					
<i>Rhizopus stolonifera</i>	K	D	K	Y	D	---	---	---	---	---	L	S	T	M	E	Q	D	V	M	Q	L	L	Q	T	P	E	G	L	T	S	Q	E	V	N	N	R	I	E	K	F	G	R	N	K	L	E	T	K	E	V	N	P	I	L	Q	076					
<i>Lichtheimia corymbifera</i>	K	D	K	Y	D	---	---	---	---	---	L	S	T	M	E	P	G	D	V	F	L	L	Q	T	S	S	E	G	L	T	S	N	E	A	A	A	R	V	E	K	F	G	Y	N	K	L	E	H	K	E	Q	N	P	F	L	Q	099				
<i>Cryptococcus gattii</i>	K	D	K	Y	D	---	---	---	---	---	I	E	H	V	M	E	E	V	Y	Q	L	L	Q	C	T	D	A	G	L	T	E	A	E	A	T	D	R	I	G	I	F	G	P	N	K	L	E	E	K	S	E	N	V	I	L	Q	124				
<i>Cryptococcus neoformans</i>	K	D	K	Y	D	---	---	---	---	---	I	E	H	V	M	E	E	V	Y	Q	L	L	Q	C	T	D	A	G	L	T	E	A	E	A	T	D	R	I	G	I	F	G	P	N	K	L	E	E	K	S	E	N	V	L	L	Q	126				
<i>Claviceps purpurea</i>	A	F	E	E	E	---	E	E	E	G	A	P	G	G	G	R	V	V	P	E	E	M	---	L	Q	T	D	S	R	V	G	L	T	E	S	E	V	T	A	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	L	V	L	K	119	
<i>Colletotrichum gloeosporioides</i>	D	E	E	---	E	E	D	T	T	P	G	T	G	R	V	V	P	E	D	Q	---	L	Q	T	D	T	R	M	G	L	T	E	A	E	V	L	N	R	R	K	K	W	G	R	N	E	M	A	E	A	K	E	N	L	V	L	K	115			
<i>Magnaporthe oryzae</i>	D	L	E	E	---	E	E	E	A	P	G	A	A	R	V	I	P	E	D	L	---	L	Q	T	S	T	R	T	G	L	T	E	Q	E	V	Q	A	R	R	R	K	Y	G	L	N	Q	M	K	E	E	K	E	N	L	I	M	K	120			
<i>Fusarium oxysporum</i>	F	D	---	E	---	E	E	E	T	Q	P	G	G	G	R	V	V	P	E	D	Q	---	L	Q	T	D	S	R	V	G	L	T	E	A	E	V	I	N	R	R	R	K	W	G	L	N	Q	M	K	E	E	R	E	N	M	I	L	K	118		
<i>Botrytis cinerea</i>	E	D	E	A	E	---	E	E	G	P	A	Q	E	R	V	V	P	E	D	L	---	L	Q	T	D	T	R	I	G	L	T	D	S	E	V	Q	A	R	R	R	K	W	G	L	N	Q	M	K	E	E	K	E	N	L	F	L	K	139			
<i>Fusarium graminearum</i>	I	D	---	D	---	D	E	E	A	T	P	G	G	G	R	V	V	P	E	D	Q	---	L	Q	T	D	S	R	V	G	L	T	E	A	E	V	I	A	R	R	R	K	W	G	L	N	A	M	K	E	E	Q	E	N	M	I	L	K	117		
<i>Aspergillus niger</i>	E	L	N	T	---	Q	E	S	H	Q	T	G	R	L	R	P	I	A	D	N	L	---	L	Q	T	D	P	M	T	G	L	D	E	T	A	I	L	R	R	R	K	F	G	S	N	E	M	K	E	E	K	E	N	L	A	L	K	110			
<i>Blumeria graminis</i>	F	G	K	T	E	Q	---	---	---	A	D	G	F	Y	E	P	V	E	W	---	L	Q	T	D	W	K	N	G	L	T	T	E	V	E	A	R	R	R	K	Y	G	F	N	E	L	T	T	E	K	N	M	F	L	T	Q	106					
<i>Sclerotinia sclerotiorum</i>	K	K	K	I	---	G	S	---	---	D	G	S	G	F	E	P	D	D	W	---	L	N	T	G	M	R	Q	G	L	S	A	H	E	V	E	A	R	R	R	K	T	G	W	N	E	L	T	T	E	N	E	S	L	F	V	K	113				
<i>Mycosphaerella graminicola</i>	F	W	K	K	A	---	P	K	A	E	D	D	G	A	M	V	V	P	E	D	W	---	L	N	A	D	I	R	Q	G	I	T	N	A	D	V	E	S	R	R	R	K	F	G	W	N	E	I	S	T	D	K	E	N	L	F	I	K	131		
<i>Cochliobolus heterostrophus</i>	F	W	K	S	G	---	S	T	T	A	T	P	V	A	D	A	G	L	V	P	E	D	L	---	L	N	T	E	L	R	T	G	L	S	E	V	E	E	R	R	R	K	Y	G	F	N	E	I	T	S	E	K	T	N	L	L	K	Q	092		
<i>Rhizoctonia solani</i>	K	D	K	Y	D	---	---	---	---	---	L	E	T	V	L	L	D	D	V	F	T	L	L	Q	C	S	E	E	G	L	T	E	V	E	S	K	R	R	L	E	L	F	G	P	N	K	L	E	S	K	E	Q	N	P	F	L	Q	116			
<i>Ustilago maydis</i>	K	A	K	Y	D	---	---	---	---	---	I	E	A	I	E	L	E	D	V	W	T	L	L	Q	C	N	E	G	G	L	S	E	E	E	C	S	R	R	R	A	I	F	G	P	N	K	I	E	T	E	P	N	P	I	L	Q	098				
<i>Puccinia graminis</i>	K	D	K	Y	D	---	---	---	---	---	L	E	Q	V	E	L	D	D	V	W	L	L	Q	C	T	E	E	G	L	T	E	A	E	A	Q	R	R	L	E	I	F	G	P	N	K	L	E	T	K	E	I	N	P	F	L	Q	120				
<i>Neurospora crassa</i>	F	L	G	F	F	V	G	P	I	Q	F	V	M	E	G	A	A	V	L	A	A	G	L	---	---	---	---	---	---	E	D	W	V	D	F	G	V	I	C	G	L	L	L	L	N	A	V	V	G	F	V	Q	E	F	O	A	G	S	I	168	
<i>Sporothrix schenckii</i>	F	L	G	Y	F	V	G	P	I	Q	F	V	M	E	A	A	A	V	L	A	A	G	L	---	---	---	---	---	---	E	D	W	V	D	F	G	V	I	A	I	A	L	L	L	L	N	A	A	V	G	F	V	Q	E	F	O	A	G	S	I	176
<i>Histoplasma capsulatum</i>	F	L	S	Y	F	V	G	P	I	Q	F	V	M	E	A	A	A	I	L	A	A	G	L	---	---	---	---	---	---	E	D	W	V	D	F	G	V	I	C	A	L	L	L	L	N	A	C	V	G	F	V	Q	E	F	O	A	G	S	I	164	
<i>Coccidioides immitis</i>	F	L	S	Y	F	V	G	P	I	Q	F	V	M	E	A	A	A	V	L	A	A	G	L	---	---	---	---	---	---	E	D	W	V	D	F	G	V	I	C	G	L	L	L	L	N	A	C	V	G	F	I	Q	E	F	O	A	G	S	I	183	
<i>Blastomyces dermatitidis</i>	F	L	S	Y	F	V	G	P	I	Q	F	V	M	E	A	A	A	I	L	A	A	G	L	---	---	---	---	---	---	E	D	W	V	D	F	G	V	I	C	G	L	L	L	L	N	A	C	V	G	F	I	Q	E	F	O	A	G	S	I	177	
<i>Acremonium chrysogenum</i>	F	L	G	F	F	V	G	P	I	Q	F	V	M	E	A	A	A	V	L	A	A	G	L	---	---	---	---	---	---	E	D	W	V	D	F	G	V	I	C	G	L	L	L	L	N	A	C	V	G	F	V	Q	E	F	O	A	G	S	I	175	
<i>Trichophyton rubrum</i>	F	F	S	Y	F	V	G	P	I	Q	F	V	M	E	A	A	A	I	L	A	A	G	L	---	---	---	---	---	---	R	D	W	V	D	F	G																									



Table S4: continued

<i>Neurospora crassa</i>	VDELKKTALAKAVVLRDGTLEIEAPEVVPGDILQVEEGTIIPADGRIVTD-----	219
<i>Sporothrix schenckii</i>	VDELKKTALAKAVVLRDGTLEIEAPEVVPGDILQVEEGTIIPADGRIVTE-----	227
<i>Histoplasma capsulatum</i>	VDELKKTALAKAVVLRNGRLTEVEAPEVVPGDILQVEEGTIIPADGRIVTE-----	215
<i>Coccidioides immitis</i>	VDELKKTALAKAVVLRNGRLSEIEAPEVVPGDILQVEEGTIIPADGRIVTE-----	234
<i>Blastomyces dermatitidis</i>	VDELKKTALAKAVVLRNGRLAEIEAPEVVPGDILQVEEGTIIPADGRIVTE-----	228
<i>Acremonium chrysogenum</i>	VDELKKTALAKAVVLRDGGQLREVEAPDVPVPGDILQVEEGTIIPADGRIVTE-----	226
<i>Trichophyton rubrum</i>	VDELKKTALAKAVVLRNGRLVEVEAPEVVPGDILQVEEGTIIPADGRIVTE-----	240
<i>Candida glabrata</i>	VDELKKTALANVAVVIRDGGQLVEVPANEVVPGDILQLEDGTIIPADGRIVTE-----	203
<i>Candida auris</i>	VDELKKTALANTANVVRNGQLVEVQANEIVPGDILQLEDGTIIPADGRIVSE-----	199
<i>Candida albicans</i>	VDELKKTALANSALVVRNGQLVEIIPANEVVPGDILQLEDGTIIPADGRIVSE-----	196
<i>Pneumocystis jirovecii</i>	VDELKKTALAKKATVLRDGRILEIEASEVVPGDILQLEEGSIVPADGRIVTE-----	224
<i>Aspergillus fumigatus</i>	VASLKGDIAMKAVVIRDGGQEQEILARELVTDGIIVVEEGTVIPADIRLICDYDKPEMFET	172
<i>Talaromyces marneffe</i>	VASLKGDIAMRAVVRDGGSEQEQILARELVVGDIVILEEGQVVPADVRLICDYEQPGDFDK	239
<i>Syncephalastrum racemosum</i>	VAAALQSLLALRTCKKRAAGQLREMPSGDIAVGDILVLRLLGDIVPADARLLDMD-----	166
<i>Rhizopus stolonifera</i>	VKALMDSLAPACKVRRDGEWKTLEASELVPGDIIISIKLGDVVPADGRLLKA-----	187
<i>Lichtheimia corymbifera</i>	VKALMEALAPACKVRRDGEWQTMEEAANLVPGDIIISIKLGDVVPADGRLLTA-----	210
<i>Cryptococcus gattii</i>	VKALMDSLAPKARVRRDGGWKEIESSELVPGDLIAFKHGDVCPSCDRLVEA-----	235
<i>Cryptococcus neoformans</i>	VKALMDSLAPKARVRRDGGWKEIESSELVPGDLIAFKHGDVCPSCDRLVEA-----	237
<i>Claviceps purpurea</i>	VDELKKTALAKAVVLRDGTLEIEAPEVVPGDILQVEEGTIIPADGRIVTE-----	223
<i>Colletotrichum gloeosporioides</i>	VDELKKTALAKAVVLRDGTLEIEAPEVVPGDILQVEEGTIIPADGRIVTE-----	219
<i>Magnaporthe oryzae</i>	VDELKKTALAKAVVLRDGTLEIEAPEVVPGDILQVEEGTIIPADGRIVTD-----	224
<i>Fusarium oxysporum</i>	VDELKKTALAKAVVLRDGTLEIEAPEVVPGDILQVEEGTIIPADGRIVTE-----	222
<i>Botrytis cinerea</i>	VDELKKTALAKAVVLRDGRLEYIEAPEVVPGDILQIEEGTIIPADGRIVTD-----	243
<i>Fusarium graminearum</i>	VDELKKTALAKAVVLRDGTLEIEAPEVVPGDILQVEEGTIIPADGRIVTE-----	221
<i>Aspergillus niger</i>	VKELKKSIALRAVVRDGMADVDAAELVPGDIVKVDEGTIIPADGRVMTN-----	214
<i>Blumeria graminis</i>	VASLKGDIALRTTVIRDGGQYEQIKARELVPGDIVIVEDGNVVPADCRISAYDNPNGWAE	219
<i>Sclerotinia sclerotiorum</i>	VASLKGDIALKATVVRDGAEEVILARELVPGDIVIVEDGNVVPADARIIICAYDDPNNGYET	226
<i>Mycosphaerella graminicola</i>	VASLKGDIAMKATVVRDGGQEQDIKARELVPGDIVVIEEGQSVPADARLICDYEHPEDFEK	244
<i>Cochliobolus heterostrophus</i>	VASLKGDIAMKATVVRDNGQQTILARELVPGDIVVIEEGQTVPGDARLICSYDHPEDFEL	205
<i>Rhizoctonia solani</i>	VKALMDSLAPKAKVRRDGGWSEIESDLDVPGDMVAFKIGDVVPADCRLEA-----	227
<i>Ustilago maydis</i>	VKALMDSLAPKARCKRDGKWEIESDLDVPGDVIAFKIGDIVPGDCRLFDFA-----	209
<i>Puccinia graminis</i>	VAAALMDSLAPKAKVRRDGSWKEIESQLVPGDIVAFKIGDVVPADNRLVYDA-----	231

<i>Neurospora crassa</i>	-----DAFLQVDQSALTGESLAVDKHKGD	243
<i>Sporothrix schenckii</i>	-----DAFLQVDQSALTGESLAVDKHKSD	251
<i>Histoplasma capsulatum</i>	-----EAFLLQVDQSALTGESLAVDKHKGD	239
<i>Coccidioides immitis</i>	-----GAFLLQVDQSALTGESLAVDKHKGD	258
<i>Blastomyces dermatitidis</i>	-----EAFLLQVDQSALTGESLAVDKHKGD	252
<i>Acremonium chrysogenum</i>	-----DAFLQVDQSALTGESLAVDKHKGD	250
<i>Trichophyton rubrum</i>	-----DAFLQVDQSALTGESLAVDKHKGD	264
<i>Candida glabrata</i>	-----NCFLQVDQSALTGESLAVDKGYGD	227
<i>Candida auris</i>	-----NALLQVDQSALTGESLAVDKRHGD	223
<i>Candida albicans</i>	-----DCLLQVDQSALTGESLAVDKRS GD	220
<i>Pneumocystis jirovecii</i>	-----EAYLLQVDQSALTGESLAVDKKRGD	248
<i>Aspergillus fumigatus</i>	YKELYLATANDDTLTK--EKDD--DDDEDGGIEARVGVSLIAVDQSALTGESLAVDKYMAD	226
<i>Talaromyces marneffe</i>	YKELYLATMAEDDTLTK--EKGE--DDDE--EEHHTGHSIIVAVDQSALTGESLAVDKYMGD	291
<i>Syncephalastrum racemosum</i>	-----VLLGGKPPQADFLVDQSSLTGESLVLVKKRAGD	196
<i>Rhizopus stolonifera</i>	-----HGDVSIQQAALTGESLPGVKEEGD	211
<i>Lichtheimia corymbifera</i>	-----HGAVSIQQAALTGESLPGVKEVGD	234
<i>Cryptococcus gattii</i>	-----I-DVSMDAQAALTGESLPGVKKHGD	258
<i>Cryptococcus neoformans</i>	-----I-DVSMDAQAALTGESLPGVKKHGD	260
<i>Claviceps purpurea</i>	-----DAFLQVDQSALTGESLAVDKHKGD	247
<i>Colletotrichum gloeosporioides</i>	-----DAFLQVDQSALTGESLAVDKHQN	243
<i>Magnaporthe oryzae</i>	-----DAYLLQVDQSALTGESLAVDKHKGD	248
<i>Fusarium oxysporum</i>	-----GCFVQVDQSALTGESLAVDKHAGD	246
<i>Botrytis cinerea</i>	-----DAFLQVDQSALTGESLAVDKHKGD	267
<i>Fusarium graminearum</i>	-----GCFVQVDQSALTGESLAVDKHAGD	245
<i>Aspergillus niger</i>	-----SPIQVDQSSVTGESLAVDKHKGD	237
<i>Blumeria graminis</i>	YQRELEAQAGESN--NEXD--DDDEIGEKHGSQYALLAIDQSAMTGESLAVDKYVAD	272
<i>Sclerotinia sclerotiorum</i>	YQRELLNQRSHLSLSEKEDD--EDDAHGGKHGSQYALLAIDQSAMTGESLAVDKYVAD	282
<i>Mycosphaerella graminicola</i>	YKELREQHALNPEE--DPAGESEDAEGEEGEGIQHQGHHSIIAADQSSITGESLAVDKYMGD	302
<i>Cochliobolus heterostrophus</i>	YMKLKAEDKFDHADPEDEKDDVDDEKFPDEENPIITQGHPLVACDQSSITGESLAVDKYMGD	265
<i>Rhizoctonia solani</i>	-----I-NVSIQQAALTGESLPGVKKKTGD	250
<i>Ustilago maydis</i>	-----I-NVSIQQAALTGESLPGVKKKLGD	232
<i>Puccinia graminis</i>	-----I-NVSIQQAALTGESLPGVKKKVG	254

Table S4: continued

<i>Neurospora crassa</i>	QVFAS	SAV	KRGEAF	VVITAT	GDNT	FVGR	AAALVNAAS	GGSGHFT	EVNLGIGT	ILLILVIF	303
<i>Sporothrix schenckii</i>	QCYASS	SAV	KRGEAF	VVVVAT	GDNT	FVGR	AAALVNAAS	SGTG	GHFT	EVNLGIGT	311
<i>Histoplasma capsulatum</i>	TCYASS	SAV	KRGEAF	MVITAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	299
<i>Coccidioides immitis</i>	TCYASS	SAV	KRGEAF	MVITAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	318
<i>Blastomyces dermatitidis</i>	TCYASS	SAV	KRGEAF	MVITAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	312
<i>Acremonium chrysogenum</i>	NCFSSS	SAV	KRGEAF	IVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	310
<i>Trichophyton rubrum</i>	HCYASS	SAV	KRGEAF	MVVST	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	324
<i>Candida glabrata</i>	QFSSST	TV	KRGEAF	MVVAT	GDNT	FVGR	AAALVNAAS	GGQG	GHFT	EVNLGIGT	287
<i>Candida auris</i>	SYSSST	TV	KRGEAF	MIVTAT	GDNT	FVGR	AAALVNAAS	GGSG	GHFT	EVNLGIGT	283
<i>Candida albicans</i>	SCYSSS	TV	KRGEAF	MIVTAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	280
<i>Pneumocystis jirovecii</i>	SIYSSS	TV	KRGEAF	MIVTAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	308
<i>Aspergillus fumigatus</i>	TCYTTT	GC	KRGEAF	AVVAT	AKQS	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	285
<i>Talaromyces marneffeii</i>	TCYTTT	GC	KRGEAF	AVVAT	AKQS	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	350
<i>Syncephalastrum racemosum</i>	LVSST	CI	VKQGL	AVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	255
<i>Rhizopus stolonifera</i>	EVFGST	TV	KRGEAF	AVVIGT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	271
<i>Lichtheimia corymbifera</i>	EVFGST	TV	KRGEAF	AVVIGT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	294
<i>Cryptococcus gattii</i>	ECFSGS	TC	KRGEAF	GVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	318
<i>Cryptococcus neoformans</i>	ECFSGS	TC	KRGEAF	GVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	320
<i>Claviceps purpurea</i>	NCYASS	SAV	KRGEAF	VVVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	307
<i>Colletotrichum gloeosporioides</i>	SCYASS	SAV	KRGEAF	IVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	303
<i>Magnaporthe oryzae</i>	QCYASS	SAV	KRGEAF	VVITAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	308
<i>Fusarium oxysporum</i>	NCYASS	SAV	KRGEAF	IVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	306
<i>Botrytis cinerea</i>	TCYASS	SAV	KRGEAF	MVITAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	327
<i>Fusarium graminearum</i>	NCYASS	SAV	KRGEAF	IVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	305
<i>Aspergillus niger</i>	VYASSS	TV	KRGEAF	IVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	297
<i>Blumeria graminis</i>	VYIYTT	GC	KRGEAF	AVVAT	AKQS	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	331
<i>Sclerotinia sclerotiorum</i>	VYIYTT	GC	KRGEAF	AVVAT	AKQS	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	341
<i>Mycosphaerella graminicola</i>	TVYIYTT	GC	KRGEAF	AVVAT	AKQS	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	361
<i>Cochliobolus heterostrophus</i>	VAYYTT	GC	KRGEAF	AVVAT	AKQS	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	324
<i>Rhizoctonia solani</i>	QCFSGS	TC	KRGEAF	GVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	310
<i>Ustilago maydis</i>	QCFSGS	TC	KRGEAF	GVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	292
<i>Puccinia graminis</i>	QCFSGS	TC	KRGEAF	GVVAT	GDNT	FVGR	AAALVNAAS	AGTG	GHFT	EVNLGIGT	314

<i>Neurospora crassa</i>	TLLI	---	VWVSFF	RSNP	---	---	---	IVQILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	349
<i>Sporothrix schenckii</i>	TNLI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	357
<i>Histoplasma capsulatum</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	345
<i>Coccidioides immitis</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	364
<i>Blastomyces dermatitidis</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	358
<i>Acremonium chrysogenum</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	356
<i>Trichophyton rubrum</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	370
<i>Candida glabrata</i>	TLLG	---	VWVSFF	RSNP	---	---	---	IVKILRFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	333
<i>Candida auris</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVPILRFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	329
<i>Candida albicans</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVPILRFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	326
<i>Pneumocystis jirovecii</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	354
<i>Aspergillus fumigatus</i>	WILA	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	338
<i>Talaromyces marneffeii</i>	FILA	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	403
<i>Syncephalastrum racemosum</i>	LAVV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	310
<i>Rhizopus stolonifera</i>	FLVV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	388
<i>Lichtheimia corymbifera</i>	FVVL	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	341
<i>Cryptococcus gattii</i>	FVLL	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	365
<i>Cryptococcus neoformans</i>	FVLL	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	367
<i>Claviceps purpurea</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	353
<i>Colletotrichum gloeosporioides</i>	TLLI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	349
<i>Magnaporthe oryzae</i>	TNLI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	357
<i>Fusarium oxysporum</i>	TLLI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	352
<i>Botrytis cinerea</i>	TNLI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	373
<i>Fusarium graminearum</i>	TLLI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	351
<i>Aspergillus niger</i>	TLLV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	343
<i>Blumeria graminis</i>	FILA	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	384
<i>Sclerotinia sclerotiorum</i>	WILI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	394
<i>Mycosphaerella graminicola</i>	WILV	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	414
<i>Cochliobolus heterostrophus</i>	FILL	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	380
<i>Rhizoctonia solani</i>	FVLL	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	357
<i>Ustilago maydis</i>	FIVL	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	339
<i>Puccinia graminis</i>	FILI	---	VWVSFF	RSNP	---	---	---	IVTILEFT	LAIT	IIGVPVGLP	AVVTTT	MAVG	361

Table S4: continued

<i>Neurospora crassa</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLHDPYTVAAA--GVDPEDLML406
<i>Sporothrix schenckii</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVEPEDLML414
<i>Histoplasma capsulatum</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVDPEDLML402
<i>Coccidioides immitis</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVDPEDLML421
<i>Blastomyces dermatitidis</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLADPYCVAAA--GVDPEDLML415
<i>Acremonium chrysogenum</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPFYTVAAA--GVDPEDLML413
<i>Trichophyton rubrum</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVDPEDLML427
<i>Candida glabrata</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVSADDLML390
<i>Candida auris</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVEADDLML386
<i>Candida albicans</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVEADDLML383
<i>Pneumocystis jirovecii</i>	AAAYLAKKKAIVQRLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GISCDLML411
<i>Aspergillus fumigatus</i>	AAAYLAKKKAIVQKLSAIESLAGVDILCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA395
<i>Talaromyces marneffeii</i>	AAAYLAKKKAIVQKLSAIESLAGVDVLCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWLFMA460
<i>Syncephalastrum racemosum</i>	AKQLAKKQVVIKRLTAVEELSSVSLCSDKTGTLTNNKLSLSEPYTVAAA--HYTKDDIL367
<i>Rhizopus stolonifera</i>	AKQLAKKKAIVTRITAIEMAAVTILCSDKTGTLTNNKLSLSEPYTVAAA--GVDGDAVIQ378
<i>Lichtheimia corymbifera</i>	AKQLAKKKAIVTRITAIEMAAVTILCSDKTGTLTNNKLSLSEPYTVAAA--GVDGDAVIQ400
<i>Cryptococcus gattii</i>	AQQLAKKKAIVTRITAIELAGVTILCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA424
<i>Cryptococcus neoformans</i>	AQQLAKKKAIVTRITAIELAGVTILCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA426
<i>Claviceps purpurea</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVDPEDLML410
<i>Colletotrichum gloeosporioides</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVDPEDLML406
<i>Magnaporthe oryzae</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVEPEDLML411
<i>Fusarium oxysporum</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVEPEDLML409
<i>Botrytis cinerea</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVEPEDLML430
<i>Fusarium graminearum</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVEPEDLML408
<i>Aspergillus niger</i>	AAAYLAKKKAIVQKLSAIESLAGVEILCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA400
<i>Blumeria graminis</i>	AAAYLAKKKAIVQKLSAIESLAGVDVLCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA441
<i>Sclerotinia sclerotiorum</i>	AAAYLAKKKAIVQKLSAIESLAGVDVLCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA451
<i>Mycosphaerella graminicola</i>	AAAYLAKKKAIVQKLSAIESLAGVDVLCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA471
<i>Cochliobolus heterostrophus</i>	AAAYLAKKKAIVQKLSAIESLAGVDVLCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA437
<i>Rhizoctonia solani</i>	AQQLAKKKAIVTRITAIELAGVTILCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA416
<i>Ustilago maydis</i>	AQQLAKKKAIVTRITAIELAGVTILCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA399
<i>Puccinia graminis</i>	AQQLAKKKAIVTRITAIELAGVTILCSDKTGTLTNNKLSLSEPYTVAAA--GVDVNWMMMA420

<i>Neurospora crassa</i>	TACLAASRKKKGI DAIDKAF LKS-LKYYPRAKSVLSK-YKVLQFHFPDPVSKKVAVAVE-463
<i>Sporothrix schenckii</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLSK-YKVINFFFPDPVSKKVTAIVE-471
<i>Histoplasma capsulatum</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVSAVAV-459
<i>Coccidioides immitis</i>	TACLAASRKKKGI DAIDKAF LKS-LKYYPRAKSVLTQ-YKVLQFHFPDPVSKKVSAIVE-478
<i>Blastomyces dermatitidis</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVSAVAV-472
<i>Acremonium chrysogenum</i>	TACLAASRKKKGI DAIDKAF LKA-LKYYPRAKSVLSK-YKVLQFHFPDPVSKKVQAVVE-470
<i>Trichophyton rubrum</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVSAVAV-484
<i>Candida glabrata</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVTAIVE-447
<i>Candida auris</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVTAIVE-443
<i>Candida albicans</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVTAIVE-440
<i>Pneumocystis jirovecii</i>	TACLAASRKKKGI DAIDKAF LKA-LRNYPAARSALSK-YRVIKFYFPDPVSKKVTAIVE-468
<i>Aspergillus fumigatus</i>	VAAIASHNHVKNLDPIDKVFILTL-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVTAIVE-453
<i>Talaromyces marneffeii</i>	VAAIASHNHVKNLDPIDKVFILTL-LRYYPRAKSVLTQ-YKVLQFHFPDPVSKKVTAIVE-518
<i>Syncephalastrum racemosum</i>	YAHLACETT--AQDPIELAVRDAAEKHYHPOITQEYVHGFTVQTFTPFNPVSKKVTAIVE-425
<i>Rhizopus stolonifera</i>	LAYAAARTE--NQDAIDFCIVNS-LPEPSLA---RGITELEFFKPFNPVSKKVTAIVE-431
<i>Lichtheimia corymbifera</i>	ISSYASRTE--NQDAIDFCIVNS-LPDSKQA---REGIEELEFFKPFNPVSKKVTAIVE-453
<i>Cryptococcus gattii</i>	LAAAYASRTE--NQDAIDGCVVGT-LPDPQA---RAGIKLLDFKPFNPVSKKVTAIVE-477
<i>Cryptococcus neoformans</i>	LAAAYASRTE--NQDAIDGCVVGT-LPDPQA---RAGIKLLDFKPFNPVSKKVTAIVE-479
<i>Claviceps purpurea</i>	TACLAASRKKKGI DAIDKAF LKA-LKYYPRAKSVLSK-YKVLQFHFPDPVSKKVQALVE-467
<i>Colletotrichum gloeosporioides</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVTAIVE-463
<i>Magnaporthe oryzae</i>	TACLAASRKKKGI DAIDKAF LKS-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVTAIVE-468
<i>Fusarium oxysporum</i>	TACLAASRKKKGI DAIDKAF LKA-LKYYPRAKSVLSK-YKVLQFHFPDPVSKKVQAVVE-466
<i>Botrytis cinerea</i>	TACLAASRKKKGI DAIDKAF LKA-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVQAVVE-487
<i>Fusarium graminearum</i>	TACLAASRKKKGI DAIDKAF LKA-LKYYPRAKSVLSK-YKVLQFHFPDPVSKKVQAVVE-465
<i>Aspergillus niger</i>	TACLAASRKKKGI DAIDKAF LKA-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVQAVVE-457
<i>Blumeria graminis</i>	VAAIASHNHVKNLDPIDKVFILTL-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVTAIVE-499
<i>Sclerotinia sclerotiorum</i>	VAAIASHNHVKNLDPIDKVFILTL-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVTAIVE-509
<i>Mycosphaerella graminicola</i>	CALASSHNHVKNLDPIDKVFILTL-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVTAIVE-529
<i>Cochliobolus heterostrophus</i>	VAAIASHNHVKNLDPIDKVFILTL-LRYYPRAKSVLSK-YKVLQFHFPDPVSKKVTAIVE-495
<i>Rhizoctonia solani</i>	LAAAYASRTE--NQDAIDGCVVGT-LDDPARA---RAGIKLLDFKPFNPVSKKVTAIVE-469
<i>Ustilago maydis</i>	LAAAYASRTE--NQDAIDGCVVGT-LDDPARA---RAGIKLLDFKPFNPVSKKVTAIVE-452
<i>Puccinia graminis</i>	LAAAYASRTE--NQDAIDGCVVGT-LDDPARA---RAGIKLLDFKPFNPVSKKVTAIVE-472



**Table S4: continued**

<i>Neurospora crassa</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	E	V	D	Q	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	519					
<i>Sporothrix schenckii</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	E	V	D	Q	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	527					
<i>Histoplasma capsulatum</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	D	V	S	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	515						
<i>Coccidioides immitis</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	R	T	V	E	E	D	H	P	I	P	E	E	I	D	A	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	534					
<i>Blastomyces dermatitidis</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	E	V	D	N	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	528					
<i>Acronium chrysogenum</i>	SP	-	Q	G	E	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	D	I	K	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	522							
<i>Trichophyton rubrum</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	D	I	D	A	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	540					
<i>Candida glabrata</i>	SP	-	E	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	D	V	H	E	N	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	503					
<i>Candida auris</i>	SP	-	E	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	D	V	H	E	N	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	499					
<i>Candida albicans</i>	SP	-	E	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	D	V	H	E	N	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	496					
<i>Pneumocystis jirovecii</i>	SP	-	S	G	E	K	I	V	C	K	G	A	P	L	F	V	L	R	T	V	E	D	D	H	P	V	S	E	D	I	Q	N	A	Y	K	D	K	V	A	E	F	A	T	R	G	F	R	S	L	G	I	A	R	I	---	524							
<i>Aspergillus fumigatus</i>	-	C	-	D	G	V	R	Y	V	C	A	K	G	A	P	A	I	L	N	M	S	Q	---	---	---	---	---	---	---	---	---	C	S	E	E	E	A	A	K	F	R	E	K	A	E	F	A	R	G	F	R	S	L	G	V	A	V	O	K	---	504		
<i>Talaromyces marneffei</i>	-	C	-	D	G	V	R	Y	T	C	A	K	G	A	P	A	I	L	N	S	E	---	---	---	---	---	---	---	---	---	---	C	S	E	E	E	A	R	L	Y	D	K	A	E	F	A	R	G	F	R	S	L	G	V	A	V	O	K	---	569			
<i>Syncephalastrum racemosum</i>	L	G	-	T	Q	K	T	F	T	A	A	K	G	A	P	O	V	I	G	L	C	G	G	H	A	---	---	---	---	---	---	---	E	A	E	V	V	E	D	M	A	S	R	G	L	R	C	L	G	V	A	T	V	---	473								
<i>Rhizopus stolonifera</i>	E	A	-	D	G	K	T	Y	R	V	T	K	G	M	S	H	T	V	L	D	L	C	T	R	K	---	---	---	---	---	T	D	A	T	I	K	A	L	N	D	V	D	E	F	A	R	G	L	R	A	L	A	V	A	I	D	E	T	P	S	---	488	
<i>Lichtheimia corymbifera</i>	L	S	-	D	G	K	V	M	R	A	T	K	G	M	S	A	F	I	M	D	L	C	T	R	N	---	---	---	---	---	T	D	Q	I	K	Q	L	E	D	V	D	E	F	A	R	G	L	R	S	L	A	V	A	V	D	E	T	P	S	---	510		
<i>Cryptococcus gattii</i>	D	M	D	G	G	K	L	K	R	A	T	K	G	M	T	G	I	I	E	L	C	S	R	G	K	---	---	---	---	---	T	N	E	L	E	D	Q	L	E	A	D	V	E	E	F	A	R	G	L	R	A	L	A	V	A	V	E	D	V	L	S	---	535
<i>Cryptococcus neoformans</i>	E	M	D	G	G	K	L	K	R	A	T	K	G	M	T	G	I	I	E	I	C	T	R	N	K	---	---	---	---	---	T	N	E	L	E	D	Q	L	E	A	D	V	E	E	F	A	R	G	L	R	A	L	A	V	A	F	E	D	V	A	G	---	537
<i>Claviceps purpurea</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	A	V	D	K	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	523					
<i>Colletotrichum gloeosporioides</i>	SP	-	A	G	E	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	I	D	A	Q	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	519						
<i>Magnaporthe oryzae</i>	SP	-	Q	G	E	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	A	V	D	Q	D	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	524						
<i>Fusarium oxysporum</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	E	V	D	A	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	522					
<i>Botrytis cinerea</i>	SP	-	Q	G	E	K	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	E	I	D	A	Q	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	543				
<i>Fusarium graminearum</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	A	P	L	F	V	L	K	T	V	E	E	D	H	P	I	P	E	E	V	D	S	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	R	---	521					
<i>Aspergillus niger</i>	SP	-	Q	G	E	R	I	T	C	V	K	G	S	P	L	F	V	L	K	T	V	O	O	D	H	Q	I	P	E	D	I	E	Q	A	Y	K	N	K	V	A	E	F	A	T	R	G	F	R	S	L	G	V	A	R	K	---	513						
<i>Blumeria graminis</i>	-	K	-	D	G	V	T	Y	T	C	A	K	G	A	P	A	I	L	N	S	N	---	---	---	---	---	---	---	---	---	C	S	K	E	D	A	E	M	Y	K	S	K	V	T	E	F	A	R	G	F	R	S	L	G	V	A	V	O	K	---	550		
<i>Sclerotinia sclerotiorum</i>	-	K	-	D	G	V	T	Y	T	C	A	K	G	A	P	A	I	L	N	S	E	---	---	---	---	---	---	---	---	---	C	S	A	E	V	A	G	M	Y	K	A	K	A	G	E	F	A	R	G	F	R	S	L	G	V	A	V	O	K	---	560		
<i>Mycosphaerella graminicola</i>	-	L	-	G	R	D	R	F	T	C	A	K	G	A	P	A	V	L	N	T	E	---	---	---	---	---	---	---	---	---	C	S	K	E	T	A	D	M	F	K	D	A	T	E	F	A	R	G	F	R	S	L	G	V	A	V	O	K	---	580			
<i>Cochliobolus heterostrophus</i>	-	M	-	G	G	D	K	Y	V	C	A	K	G	A	P	A	I	V	N	L	N	---	---	---	---	---	---	---	---	---	C	D	E	V	T	A	T	L	Y	E	K	A	E	F	A	R	G	F	R	S	L	G	V	A	V	O	K	---	546				
<i>Rhizoctonia solani</i>	E	S	-	S	G	R	L	K	R	V	T	K	G	M	T	G	I	I	E	L	C	T	R	N	K	---	---	---	---	---	T	D	E	V	E	N	Q	L	E	A	D	V	T	E	F	A	G	R	G	L	R	A	L	A	V	A	E	E	L	D	H	---	526
<i>Ustilago maydis</i>	E	A	-	T	G	K	M	K	R	V	T	K	G	M	T	S	I	I	D	L	C	K	R	N	K	---	---	---	---	---	T	E	A	Q	N	A	L	E	A	D	V	E	E	F	A	R	G	L	R	A	L	A	V	A	F	E	E	V	P	S	---	509	
<i>Puccinia graminis</i>	E	A	-	T	G	K	M	K	R	V	T	K	G	M	T	G	V	I	E	L	C	S	R	N	K	---	---	---	---	---	T	E	A	D	V	E	N	Q	L	E	A	D	V	E	E	F	A	R	G	L	R	A	L	A	V	A	F	E	V	P	S	---	522

<i>Neurospora crassa</i>	---	G	E	G	S	W	E	I	L	G	M	P	C	M	D	P	P	R	H	D	T	A	K	T	V	C	E	A	K	T	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	574			
<i>Sporothrix schenckii</i>	---	G	E	G	A	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	S	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	582			
<i>Histoplasma capsulatum</i>	---	G	E	G	S	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	T	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	570			
<i>Coccidioides immitis</i>	---	G	E	G	S	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	T	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	589			
<i>Blastomyces dermatitidis</i>	---	G	E	G	S	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	T	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	583			
<i>Acremonium chrysogenum</i>	---	G	E	G	A	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	K	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	581			
<i>Trichophyton rubrum</i>	---	G	E	G	S	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	V	N	E	A	K	T	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	595			
<i>Candida glabrata</i>	---	G	E	G	H	W	E	I	L	G	M	P	C	M	D	P	P	R	D	T	A	E	T	V	N	E	A	R	R	L	G	L	R	V	K	M	L	T	G	D	A	V	G	I	A	K	E	T	C	R	Q	L	G	L	558				
<i>Candida auris</i>	---	G	E	G	H	W	E	I	L	G	M	P	C	M	D	P	P	R	D	T	A	Q	T	V	N	E	A	R	R	L	G	L	S	V	K	M	L	T	G	D	A	V	G	I	A	K	E	T	C	R	Q	L	G	L	554				
<i>Candida albicans</i>	---	G	E	G	H	W	E	I	L	G	M	P	C	M	D	P	P	R	D	T	A	A	T	V	N	E	A	R	R	L	G	L	R	V	K	M	L	T	G	D	A	V	G	I	A	K	E	T	C	R	Q	L	G	L	551				
<i>Pneumocystis jirovecii</i>	---	G	N	-	S	H	W	E	I	L	G	M	P	C	S	D	P	P	R	C	D	T	A	R	T	I	S	E	A	I	R	L	G	L	R	I	K	M	L	T	G	D	A	V	G	I	A	K	E	T	A	R	Q	L	G	L	579		
<i>Aspergillus fumigatus</i>	---	E	G	-	E	P	W	Q	L	L	G	M	P	M	F	D	P	P	R	E	D	T	A	H	T	I	A	E	A	Q	H	L	G	L	S	V	K	M	L	T	G	D	A	I	A	I	A	K	E	T	C	K	M	L	A	L	559		
<i>Talaromyces marneffei</i>	---	E	G	-	E	P	W	Q	L	L	G	M	P	M	F	D	P	P	R	E	D	T	A	H	T	I	E	A	Q	N	L	G	L	S	V	K	M	L	T	G	D	A	I	A	I	A	K	E	T	C	K	M	L	A	L	624			
<i>Syncephalastrum racemosum</i>	---	N	D	-	N	-	Q	W	L	V	L	G	L	T	F	L	D	P	P	R	-	D	S	A	T	L	N	E	C	A	N	N	G	I	A	V	K	M	I	T	G	D	Q	A	A	I	A	S	E	T	A	G	R	L	G	528			
<i>Rhizopus stolonifera</i>		G	D	V	E	G	D	G	I	G	F	K	L	V	G	L	P	I	Y	D	P	P	R	S	D	K	E	T	I	D	R	A	I	A	L	G	V	S	V	K	M	I	T	G	D	Q	L	A	I	A	K	E	T	G	R	R	L	G	548
<i>Lichtheimia corymbifera</i>		G	D	P	E	G	E	G	L	F	R	L	V	G	L	P	I	Y	D	P	P	R	S	D	K	E	T	I	D	R	A	I	A	L	G	V	Q	V	K	M	I	T	G	D	Q	L	A	I	A	K	E	T	G	R	R	L	G	570	
<i>Cryptococcus gattii</i>		D	D	P	S	A	E	G	N	G	F	E	L	V	G	L	S	I	F	D	P	P	R	S	D	K	K	T	I	D	D	A	M	A	L	G	V	K	V	K	M	V	T	G	D	Q	L	A	I	A	K	E	T	G	R	R	L	G	595
<i>Cryptococcus neoformans</i>		D	D	P	S	A	E	G	N	G	F	E	L	V	G	L	S	I	F	D	P	P	R	S	D	K	K	T	I	D	D	A	M	A	L	G	V	K	V	K	M	V	T	G	D	Q	L	A	I	A	K	E	T	G	R	R	L	G	597
<i>Claviceps purpurea</i>	---	G	E	G	A	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	578				
<i>Colletotrichum gloeosporioides</i>	---	G	E	H	G	A	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	V	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	575		
<i>Magnaporthe oryzae</i>	---	G	E	G	A	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	N	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	579			
<i>Fusarium oxysporum</i>	---	G	E	G	A	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	R	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	577			
<i>Botrytis cinerea</i>	---	G	E	G	Q	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	T	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	598			
<i>Fusarium graminearum</i>	---	G	E	G	A	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	N	E	A	K	R	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	576			
<i>Aspergillus niger</i>	---	G	D	-	G	W	E	I	L	G	M	P	C	S	D	P	P	R	H	D	T	A	K	T	I	K	E	A	Q	T	L	G	L	S	I	K	M	L	T	G	D	A	V	G	I	A	R	E	T	S	R	Q	L	G	L	568			
<i>Blumeria graminis</i>	---	G	D	-	G	D	W	Q	L	L	G	M	P	M	F	D	P	P	R	E	D	T	A	H	T	I	E	A	Q	V	L	G	L	S	V	K	M	L	T	G	D	A	I	A	I	A	K	E	T	C	K	M	L	A	L	605			
<i>Sclerotinia sclerotiorum</i>	---	G	N	-	G	P	W	Q	L	L	G	M	P	M	F	D	P	P	R	E	D	T	A	A	T	I	E	A	Q	V	L	G	L	S	V	K	M	L	T	G	D	A	I	A	I	A	K	E	T	C	K	M	L	A	L	615			
<i>Mycosphaerella graminicola</i>	---	N	D	-	N	D	P	W	L	V	L	G	M	S	M	F	D	P	P	R	E	D	T	A	Q	T	I	E	A	Q	L	G	V	P	V	K	M	L	T	G	D	A	I	A	I	A	K	E	T	C	K	M	L	A	L	635			
<i>Cochliobolus heterostrophus</i>	---	N	D	-	N	D	-	G	W	I	L	L	G	M	S	M	F	D	P	P	R	E	D	T	A	Q	T	I	E	A	Q	L	G	V	P	V	K	M	L	T	G	D	A	I	A	I	A	K	E	T	C	K	M	L	A	L	601		
<i>Rhizoctonia solani</i>	D	N	H	E	G	E	G	N	G	F	E	L	I	G	L	L	A	I	F	D	P	P	R	D	T	K	Q	T	I	D	D	A	I	A	L	G	V	K	V	K	M	V	T	G	D	Q	L	A	I	A	K	E	T	G	R	R	L	G	586
<i>Ustilago maydis</i>		G	E	V	E	A	E	G	N	G	F	E	L	L	G	L	A	I	F	D	P	P	R	H	D	T	K	E	L	D	N	A	Q	A	L	G	V	R	V	K	M	V	T	G	D	Q	L	A	I	A	K	E	T	G	R	R	L	G	569
<i>Puccinia graminis</i>	N	D	K	D	A	G	N	G	F	E	L	I	G	L	L	A	I	F	D	P	P	R	H	D	T	Q	Q	T	I	D	D	A	M	L	L	G	V	R	V	K	M	V	T	G	D	Q	L	A	I	A	K	E	T	G	R	R	L	G	581

Table S4: continued

<i>Neurospora crassa</i>	G	T	N	I	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	630					
<i>Sporothrix schenckii</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	638					
<i>Histoplasma capsulatum</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	626					
<i>Coccidioides immitis</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	D	I	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	645					
<i>Blastomyces dermatitidis</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	639					
<i>Acremonium chrysogenum</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	S	V	V	E	I	L	Q	R	G	Y	L	V	A	637					
<i>Trichophyton rubrum</i>	G	T	N	I	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	D	I	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	651					
<i>Candida glabrata</i>	G	T	N	I	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	L	A	D	F	V	E	N	A	D	G	F	A	E	V	F	P	Q	H	K	Y	K	V	V	E	I	L	Q	N	R	G	Y	L	V	A	614				
<i>Candida auris</i>	G	T	N	I	Y	D	A	E	R	L	G	L	G	G	G	D	M	A	G	S	---	---	E	I	A	D	F	V	E	N	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	A	V	E	I	L	Q	A	R	G	Y	L	V	A	610				
<i>Candida albicans</i>	G	T	N	I	Y	D	A	E	R	L	G	L	G	G	G	D	M	A	G	S	---	---	E	I	A	D	F	V	E	N	A	D	G	F	A	E	G	F	T	N	K	Y	N	A	V	E	I	L	S	R	G	Y	L	V	A	607						
<i>Pneumocystis jirovecii</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	635					
<i>Aspergillus fumigatus</i>	S	T	K	V	Y	D	S	E	R	L	I	H	G	G	---	---	L	A	G	S	---	---	A	Q	H	D	L	V	E	K	A	D	G	F	A	E	V	F	P	E	H	K	Y	Q	V	V	E	M	L	Q	R	G	H	L	T	A	612					
<i>Talaromyces marneffeii</i>	G	T	K	V	Y	N	S	E	R	L	I	H	G	G	---	---	L	T	G	S	---	---	R	Q	H	D	L	V	E	R	A	D	G	F	A	E	V	F	P	E	H	K	Y	Q	V	V	E	M	L	Q	R	G	H	L	T	A	677					
<i>Syncephalastrum racemosum</i>	G	Q	M	I	L	D	A	D	Y	I	A	N	P	A	---	---	R	S	E	D	---	---	E	V	Y	D	F	V	E	D	C	L	R	A	D	G	F	A	R	V	I	P	E	H	K	Y	R	V	V	E	L	L	S	R	G	Y	F	V	A	581		
<i>Rhizopus stolonifera</i>	G	D	M	F	L	S	K	T	L	K	E	G	P	---	---	P	A	G	S	---	---	G	Y	T	D	V	D	Q	M	V	L	H	A	D	G	F	A	G	V	Y	P	E	H	K	Y	E	I	V	E	R	L	Q	A	M	G	Y	M	V	A	604		
<i>Lichtheimia corymbifera</i>	G	D	M	F	L	S	K	T	L	K	E	G	P	---	---	P	P	G	S	---	---	G	Y	T	T	V	D	D	L	V	L	K	C	D	G	F	A	G	V	Y	P	E	H	K	Y	E	I	V	E	R	L	Q	A	M	G	H	M	T	A	626		
<i>Cryptococcus gattii</i>	G	D	H	M	Y	P	A	K	V	L	K	E	G	P	---	---	E	P	G	S	---	---	K	H	A	N	L	D	E	M	I	M	D	A	D	G	F	A	G	V	F	P	E	H	K	Y	E	I	V	K	R	L	Q	N	L	G	H	L	C	A	651	
<i>Cryptococcus neoformans</i>	G	D	H	M	Y	P	A	K	V	L	K	E	G	P	---	---	E	P	G	S	---	---	K	H	A	N	L	D	E	M	I	M	D	A	D	G	F	A	G	V	F	P	E	H	K	Y	E	I	V	K	R	L	Q	N	L	G	H	L	C	A	653	
<i>Claviceps purpurea</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	634					
<i>Colletotrichum gloeosporioides</i>	G	T	N	I	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	631					
<i>Magnaporthe oryzae</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	635					
<i>Fusarium oxysporum</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	633					
<i>Botrytis cinerea</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	654					
<i>Fusarium graminearum</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	Q	H	K	Y	N	V	V	E	I	L	Q	R	G	Y	L	V	A	632					
<i>Aspergillus niger</i>	G	T	N	V	Y	A	E	R	L	G	L	G	G	G	G	D	M	P	G	S	---	---	E	V	Y	D	F	V	E	A	A	D	G	F	A	E	V	F	P	E	H	K	Y	N	V	V	D	I	L	Q	R	G	Y	L	V	A	624					
<i>Blumeria graminis</i>	G	T	K	V	Y	N	S	E	R	L	I	H	G	G	---	---	L	S	G	T	---	---	T	Q	H	D	L	V	E	K	A	D	G	F	A	E	V	F	P	E	H	K	Y	Q	V	V	E	M	L	Q	R	G	H	L	T	A	658					
<i>Sclerotinia sclerotiorum</i>	G	T	K	V	Y	N	S	E	R	L	I	H	G	G	---	---	L	S	G	T	---	---	T	Q	H	D	L	V	E	R	A	D	G	F	A	E	V	F	P	E	H	K	Y	Q	V	V	E	M	L	Q	R	G	H	L	T	A	668					
<i>Mycosphaerella graminicola</i>	G	T	K	V	Y	N	S	E	R	L	I	H	G	G	---	---	L	S	G	T	---	---	T	Q	H	D	L	V	E	R	A	D	G	F	A	E	V	F	P	E	H	K	Y	Q	V	V	E	M	L	Q	R	G	H	L	T	A	688					
<i>Cochliobolus heterostrophus</i>	G	T	K	V	Y	N	S	E	R	L	I	H	G	G	---	---	L	S	G	T	---	---	T	Q	H	D	L	V	E	R	A	D	G	F	A	E	V	F	P	E	H	K	Y	Q	V	V	E	M	L	Q	R	G	H	L	T	A	654					
<i>Rhizoctonia solani</i>	G	D	H	M	Y	P	A	K	V	L	Q	D	G	P	---	---	P	P	G	S	---	---	K	H	L	S	L	D	E	M	I	M	D	A	D	G	F	A	G	V	F	P	E	H	K	Y	E	I	V	K	R	L	Q	G	L	G	H	L	C	A	642	
<i>Ustilago maydis</i>	G	D	R	M	F	N	S	K	V	L	V	E	G	V	---	---	L	P	A	G	S	---	---	P	Y	K	S	L	D	E	M	I	L	D	V	D	G	F	A	G	V	F	P	E	H	K	Y	E	I	V	K	R	L	Q	G	L	G	H	L	T	A	626
<i>Puccinia graminis</i>	G	D	H	M	Y	P	A	K	V	L	K	D	G	P	---	---	E	P	G	S	---	---	K	H	L	T	L	D	E	M	I	L	D	A	D	G	F	A	G	V	F	P	E	H	K	Y	E	I	V	K	R	L	Q	G	L	G	H	L	C	A	645	

<i>Neurospora crassa</i>	M	T	G	D	G	V	N	D	A	P	S	L	K	K	A	D	T	G	I	A	V	E	G	S	D	A	A	R	S	A	A	D	I	V	F	L	A	P	G	L	G	A	I	D	A	L	K	T	S	R	Q	I	F	H	R	M	Y	A	690
<i>Sporothrix schenckii</i>	M	T	G	D	G	V	N	D	A	P	S	L	K	K	A	D	T	G	I	A	V	E	G	S	D	A	A	R	S	A	A	D	I	V	F	L	A	P	G	L	G	A	I	D	A	L	K	T	S	R	Q	I	F	H	R	M	Y	A	698
<i>Histoplasma capsulatum</i>	M	T	G	D	G	V	N	D	A	P	S	L	K	K	A	D	T	G	I	A	V	E	G	S	D	A	A	R	S	A	A	D	I	V	F	L	A	P	G	L	S	A	I	D	A	L	K	T	S	R	Q	I	F	H	R	M	Y	A	686
<i>Coccidioides immitis</i>	M	T	G	D	G	V	N	D	A	P	S	L	K	K	A	D	T	G	I	A	V	E	G	S	D	A	A	R	S	A	A	D	I	V	F	L	A	P	G	L	S	A	I	D	A	L	K	T	S	R	Q	I	F	H	R	M	Y	A	705
<i>Blastomyces dermatitidis</i>	M	T	G	D	G	V	N	D	A	P	S	L	K	K	A	D	T	G	I	A	V	E	G	S	D	A	A	R	S	A	A	D	I	V	F	L	A	P	G	L	S	A	I	D	A	L	K	T	S	R	Q	I	F	H	R	M	Y	A	699
<i>Acremonium chrysogenum</i>	M	T	G	D	G	V	N	D	A	P	S	L	K	K	A	D	T	G	I	A	V	E	G	S	D	A	A	R	S	A	A	D	I	V	F	L	A	P	G	L	G	A	I	D	A	L	K	T	S	R	Q	I	F	H	R	M	Y	A	697
<i>Trichophyton rubrum</i>	M	T	G	D	G	V	N	D	A	P	S	L	K	K	A	D	T	G	I	A	V	E	G	S	D	A	A	R																															

Table S4: continued

<i>Neurospora crassa</i>	YVVYRIALSIHLEIFLGLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPYSQTTPVKW	750
<i>Sporothrix schenckii</i>	YVVYRIALSIHLEIYLGWLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSKTPVKW	758
<i>Histoplasma capsulatum</i>	YVVYRIALSLHLEIFLGLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSKTPVKW	746
<i>Coccidioides immitis</i>	YVVYRIALSLHLEIFLGLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSKTPVKW	765
<i>Blastomyces dermatitidis</i>	YVVYRIALSLHLEIFLGLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSKTPVKW	759
<i>Acremonium chrysogenum</i>	YVVYRIALSLHMEIFLGLWIAILNRSNLNLIVFIAIFADVATLAIAYDNAPYSQTTPVKW	757
<i>Trichophyton rubrum</i>	YVVYRIALSLHLEIFLGLWIAILNRSNLQLVVFIAIFADVATLAIAYDNAPFSKTPVKW	771
<i>Candida glabrata</i>	YVVYRIALSLHLEIFLGLWIAILNHSLDIELVVFIAIFADVATLAIAYDNAPFSQTTPVKW	734
<i>Candida auris</i>	YVVYRIALSLHLEIFLGLWIAILDRSLNIDLIVFIAIFADVATLAIAYDNAPYDPKTPVKW	730
<i>Candida albicans</i>	YVVYRIALSLHLEIFLGLWIAILNRSLDINLIVFIAIFADVATLAIAYDNAPYDPKTPVKW	727
<i>Pneumocystis jirovecii</i>	YVVYRIALSLHLEIFLGLWIVIFNHLMLIELVVFIAIFADVATLAIAYDNAPYSLFPVKW	755
<i>Aspergillus fumigatus</i>	YIQYRIALCLHLEIYLVTSMIIDETLNSLVLVFIALFADLATAIAYDNAPYEMRPVEW	732
<i>Talaromyces marneffeii</i>	YIQYRIALCLHLEIYLVTSMIIDETIPSDMIVFIALFADLATAIAYDNAPYEQRPVEW	797
<i>Syncephalastrum racemosum</i>	YALYRIITSTIHFLLFVVFVLAEDWQMPPIFLILISVLNDAAATLMAVDNVPKSPSPDMW	701
<i>Rhizopus stolonifera</i>	YSIYTCSTIRIVGFSILIWAFQDFDPPFMVLIAMLNDGTIMTISKDRVRPSPYPDAW	724
<i>Lichtheimia corymbifera</i>	YSIYTCSTIRIVGFAIMCFAFEDFPPFLVLIIAVINDGTIMTISKDRVRPSPFPDSW	746
<i>Cryptococcus gattii</i>	YAIYACAVTIRIVCFAIMVFAWQDFDPPFMVLIIVLNDGTIMTSLSDRVLPSTTPDSW	771
<i>Cryptococcus neoformans</i>	YAIYACAVTIRIVCFAIMVFAWQDFDPPFMVLIIVLNDGTIMTSLSDRVLPSTTPDSW	773
<i>Claviceps purpurea</i>	YVVYRIALSLHMEIFLGLWIAILNRSNLQLVVFIAIFADVATLAIAYDNAPFSQTTPVKW	754
<i>Colletotrichum gloeosporioides</i>	YVVYRIALSLHLEIYLGWLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSKTPVKW	751
<i>Magnaporthe oryzae</i>	YVVYRIALSIHLEIYLGWLWIAILNRSNLINLIVFIAIFADVATLAIAYDNAPYKSPVKW	755
<i>Fusarium oxysporum</i>	YVVYRIALSLHMEIFLGLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSKTPVKW	753
<i>Botrytis cinerea</i>	YVVYRIALSIHLEIFLGLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSKTPVKW	774
<i>Fusarium graminearum</i>	YVVYRIALSLHMEIFLGLWIAILNRSNLIELVVFIAIFADVATLAIAYDNAPFSQTTPVKW	752
<i>Aspergillus niger</i>	YVVYRIALSLHLEIFLGLWIAILNRSNLQLVVFIAIFADVATLAIAYDNAPFSKTPVKW	744
<i>Blumeria graminis</i>	YIQYRIALCLHLEIYLVTSMIILNETIRVDELIVFLALFADLATAIAYDNAPYEQRPVEW	778
<i>Sclerotinia sclerotiorum</i>	YIQYRIALCLHLEIYLVTSMIILNETIRVDELIVFLALFADLATAIAYDNAPYEQRPVEW	788
<i>Mycosphaerella graminicola</i>	YIQYRIALCLHLEIYLVTSMIILNETIRVDELIVFLALFADLATAIAYDNAPYEQRPVEW	808
<i>Cochliobolus heterostrophus</i>	YIQYRIALCLHLEIYLVTSMIILNETIRVDELIVFLALFADLATAIAYDNAPYEQRPVEW	774
<i>Rhizoctonia solani</i>	YAIYACAVTIRIVCFAILAFAYQDFDPPFMVLIIVLNDGTIMTSLSDRVLPSTTPDAW	762
<i>Ustilago maydis</i>	YAAAYAAITIRVVGFALLAFIWKSDFPFMVLIIVLNDGSIIMTSLSDTVKPALEPQHW	746
<i>Puccinia graminis</i>	YSIYACAVTIRIVGFAVLVFAVKDFDPPFMVLIIVLNDGTIMTSLSDRVLPSTTPDHW	765

<i>Neurospora crassa</i>	NLPKLWGMSSVLLGVVLAAGTWITVTTMYAQG-----ENGGIVQNFGNMDE	795
<i>Sporothrix schenckii</i>	NLPKLWGMSSVLLGVVLAAGTWITVTTMYAHG-----ENGGIVQNFGNLDE	803
<i>Histoplasma capsulatum</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTMLVGS-----ENGGIVQNFGRTHP	791
<i>Coccidioides immitis</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTMLVGT-----EDGGIVQNFQVGRDE	810
<i>Blastomyces dermatitidis</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTMLVGS-----ENGGIVQNFQVGRDE	804
<i>Acremonium chrysogenum</i>	NLPKLWGMSSVLLGVVLAAGTWICLTLYVGG-----ENGGIVQNRGDIIDE	802
<i>Trichophyton rubrum</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTMLVGG-----KDEGGIVQNFQVGRDE	816
<i>Candida glabrata</i>	NLPKLWGMSSVLLGVVLAAGTWICLTMLFL-----PRGGIVQNFQVGRDE	777
<i>Candida auris</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTMFM-----SKGGIVQNFQVGRDE	773
<i>Candida albicans</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTMLL-----PKGGIVQNFQVGRDE	770
<i>Pneumocystis jirovecii</i>	NLPKLWGLSLLGVVLAAGTWIAATTTIYVND-----NAYGIVQNKYGNIDS	800
<i>Aspergillus fumigatus</i>	QLPKIWIIVSVLLGVVLAAGTWIMRASLFL-----NDGGIVQNFQVGRDE	775
<i>Talaromyces marneffeii</i>	QLPKIWIIVSVLLGVVLAAGTWIVRGAMFM-----ANGGIVQNFQVGRDE	840
<i>Syncephalastrum racemosum</i>	RRLRLIVLSCVLAAGTWISL-----ISFGHYI-----LRDVIKVSAGQLNT	741
<i>Rhizopus stolonifera</i>	NLREIFSYAIVYGLYLTAATVAVAVCLKTTFFNRAFGQLFT-----DNDYVLHS	776
<i>Lichtheimia corymbifera</i>	NLFEIFSYAIVYGLYLTAATVAVAVCLKTTFFNRAFGQLFT-----DNDYVLHS	798
<i>Cryptococcus gattii</i>	DLAIEVFSFGVAYGVYLSASTIALYATMENTTFFEDRFGVEPLK-----GNSYGGHM	822
<i>Cryptococcus neoformans</i>	DLAIEVFSFGVAYGVYLSASTIALYATMENTTFFEDRFGVEPLK-----GNSYGGHM	824
<i>Claviceps purpurea</i>	NLPKLWGMSSVLLGVVLAAGTWIALTTMFAAG-----ENGGIVQNFGNMDE	799
<i>Colletotrichum gloeosporioides</i>	NLPKLWGMSSVLLGVVLAAGTWITVTTMYAHG-----PDGGIVQNFGNMDE	796
<i>Magnaporthe oryzae</i>	NLPKLWGMSSVLLGVVLAAGTWITITITMFAVG-----EDGGIVQNFQVGRDE	800
<i>Fusarium oxysporum</i>	NLPKLWGMSSVLLGVVLAAGTWIALTTMYANS-----EDGGIVQNFQVGRDE	798
<i>Botrytis cinerea</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTMFIAR-----EDGGIVQNFQVGRDE	819
<i>Fusarium graminearum</i>	NLPKLWGMSSVLLGVVLAAGTWIALTTMLANS-----EDGGIVQNFQVGRDE	797
<i>Aspergillus niger</i>	NLPKLWGMSSVLLGVVLAAGTWITLTTILTAG-----ENGGIVQNFQVGRDE	789
<i>Blumeria graminis</i>	QLPKIWIIVSVLLGVVLAAGTWIILGLFL-----PNGGIVQNFQVGRDE	821
<i>Sclerotinia sclerotiorum</i>	QLPKIWIIVSVLLGVVLAAGTWIILGLFL-----PNGGIVQNFQVGRDE	831
<i>Mycosphaerella graminicola</i>	QLPKIWIIVSVLLGVVLAAGTWIILGLFL-----PNGGIVQNFQVGRDE	851
<i>Cochliobolus heterostrophus</i>	QLPKIWIIVSVLLGVVLAAGTWIILGLFL-----PNGGIVQNFQVGRDE	817
<i>Rhizoctonia solani</i>	DLAIEIFAFAYAYGLYLTLASTIALYATMENTTFFEDRFGVSLLESPLDANGRKDHNDRLHM	822
<i>Ustilago maydis</i>	DLAIEIFAFAYAYGLYLTLASTIALYATMENTTFFEDRFGVSLLESPLDANGRKDHNDRLHM	799
<i>Puccinia graminis</i>	DLAIEIFAFAYAYGLYLTLASTIALYATMENTTFFEDRFGVSLLESPLDANGRKDHNDRLHM	817



**Table S4: continued**

<i>Neurospora crassa</i>	V	L	F	L	Q	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	I	F	L	V	D	I	L	A	T	C	F	T	I	W	G	W	F	E	H	S	D	-	-	-	851	
<i>Sporothrix schenckii</i>	V	V	F	L	E	V	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	T	G	A	I	L	V	D	I	L	A	T	F	F	T	L	F	G	F	F	Q	H	G	-	-	-	859			
<i>Histoplasma capsulatum</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	I	L	V	D	I	A	T	L	F	T	I	F	G	W	F	V	G	G	-	-	-	847				
<i>Coccidioides immitis</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	A	G	A	I	L	V	D	I	V	A	T	F	F	T	L	F	G	W	F	V	G	G	-	-	-	866			
<i>Blastomyces dermatitidis</i>	V	L	F	L	Q	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	A	G	A	I	L	V	D	I	A	T	F	F	T	L	F	G	W	F	V	G	G	-	-	-	860				
<i>Acronium chrysogenum</i>	I	V	F	L	Q	V	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	A	G	A	V	L	V	D	I	A	T	L	F	A	V	F	G	W	F	R	G	Y	E	-	-	-	855			
<i>Trichophyton rubrum</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	I	L	V	D	I	A	T	L	F	T	I	F	G	W	F	V	G	G	-	-	-	862				
<i>Candida glabrata</i>	V	L	F	L	Q	I	S	L	T	E	N	W	L	F	I	T	R	A	V	G	P	F	W	S	S	-	I	P	S	W	Q	L	A	G	A	V	F	A	V	D	I	A	T	M	F	T	L	F	G	W	S	Q	N	-	-	-	832				
<i>Candida auris</i>	I	L	F	L	Q	I	S	L	T	E	N	W	L	F	I	T	R	A	G	P	F	W	S	S	-	I	P	S	W	Q	L	A	G	A	V	L	V	D	I	A	T	C	F	L	T	F	G	W	S	Q	N	-	-	-	828						
<i>Candida albicans</i>	I	L	F	L	Q	I	S	L	T	E	N	W	L	F	I	T	R	A	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	V	L	V	D	I	A	T	C	F	L	T	F	G	W	S	Q	N	-	-	-	825						
<i>Pneumocystis jirovecii</i>	V	M	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	L	P	S	W	Q	L	F	G	A	V	F	L	V	D	I	A	T	L	F	C	I	F	G	W	F	T	G	T	K	E	H	G	859		
<i>Aspergillus fumigatus</i>	M	I	F	L	E	V	A	L	T	E	N	W	L	F	I	T	R	G	G	K	T	-	-	-	-	-	-	-	W	P	S	W	Q	L	V	G	A	I	F	V	D	V	L	A	T	L	F	C	V	F	G	W	L	S	G	D	Y	R	G	830	
<i>Talaromyces marneffei</i>	I	M	F	L	E	V	A	L	T	E	N	W	L	F	I	T	R	G	G	K	T	-	-	-	-	-	-	-	Y	P	S	W	Q	L	V	G	A	I	F	V	D	V	L	A	T	L	F	C	V	F	G	W	L	T	Q	P	E	H	G	895	
<i>Syncephalastrum racemosum</i>	L	M	L	Y	L	H	I	S	S	A	P	H	F	V	I	P	T	R	V	E	T	F	C	W	Q	E	-	I	P	S	W	P	F	L	G	V	I	G	T	Q	V	V	A	L	V	L	S	V	G	M	F	Y	Q	S	N	I	E	800			
<i>Rhizopus stolonifera</i>	V	V	Y	L	E	V	S	T	I	S	Q	G	L	I	F	I	T	R	S	R	G	P	P	F	E	-	R	P	S	I	L	L	V	C	S	P	I	A	Q	L	V	A	T	F	I	A	V	A	N	G	F	T	S	I	G	835					
<i>Lichtheimia corymbifera</i>	V	I	Y	L	Q	V	A	I	S	Q	G	L	I	F	V	T	R	S	H	G	F	F	F	E	-	R	P	S	T	L	L	M	C	A	F	V	A	Q	I	V	A	T	F	I	S	I	V	A	Q	F	G	F	T	I	D	G	855				
<i>Cryptococcus gattii</i>	V	I	Y	L	Q	V	A	I	S	Q	A	L	I	F	V	T	R	S	H	G	P	S	W	T	E	-	R	P	S	V	A	L	M	A	F	C	L	A	Q	L	V	S	S	I	A	A	Y	A	D	W	S	F	S	Q	V	H	S	881			
<i>Cryptococcus neoformans</i>	V	I	Y	L	Q	V	A	I	S	Q	A	L	I	F	V	T	R	S	H	G	P	S	W	T	E	-	R	P	S	V	A	L	M	A	F	C	L	A	Q	L	V	S	S	I	A	A	Y	A	D	W	S	F	S	Q	V	H	S	883			
<i>Claviceps purpurea</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	I	L	V	D	I	A	T	F	F	C	L	F	G	W	F	V	H	N	T	-	-	-	855			
<i>Colletotrichum gloeosporioides</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	I	L	V	D	I	L	A	T	L	F	C	I	F	G	W	F	Q	H	N	-	-	-	852			
<i>Magnaporthe oryzae</i>	V	V	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	T	G	A	I	F	V	D	I	A	T	S	C	F	A	I	W	G	W	F	V	G	N	K	-	-	-	856		
<i>Fusarium oxysporum</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	I	L	V	D	I	L	A	T	L	F	C	I	F	G	W	F	V	G	-	-	-	855				
<i>Botrytis cinerea</i>	V	V	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	L	P	S	W	Q	L	T	G	A	I	L	V	D	I	A	T	F	F	T	L	F	G	W	F	V	G	-	-	-	874					
<i>Fusarium graminearum</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	A	N	G	P	F	W	S	S	-	I	P	S	W	Q	L	S	G	A	I	L	V	D	I	L	A	T	L	F	C	I	F	G	W	F	V	G	-	-	-	852				
<i>Aspergillus niger</i>	V	L	F	L	E	I	S	L	T	E	N	W	L	F	I	T	R	S	D	G	A	F	A	W	K	R	-	R	P	S	W	K	L	I	G	A	I	A	V	D	L	V	A	T	C	F	C	V	F	G	W	F	A	G	-	-	-	846			
<i>Blumeria graminis</i>	M	L	F	L	Q	I	S	L	T	E	N	W	L	F	I	V	T	R	G	D	E	T	-	-	-	-	-	-	Y	P	A	F	A	L	V	A	I	F	G	D	V	L	A	T	L	F	C	I	F	G	W	L	T	G	G	A	G	Q	876		
<i>Sclerotinia sclerotium</i>	M	L	F	L	V	S	L	T	E	N	W	L	F	I	V	T	R	G	G	N	T	-	-	-	-	-	-	-	W	P	S	W	Q	L	V	I	A	I	F	L	V	D	I	A	T	L	F	C	V	F	G	W	L	C	G	G	A	G	P	Q	886
<i>Mycosphaerella graminicola</i>	I	L	F	L	E	I	A	L	T	E	N	W	L	F	I	T	R	G	A	K	T	-	-	-	-	-	-	-	L	P	S	W	Q	L	V	G	A	I	L	V	D	I	L	A	T	L	F	C	I	F	G	W	L	N	S	S	I	Y	906		
<i>Cochliobolus heterostrophus</i>	I	L	F	L	E	V	A	L	T	E	N	W	L	F	I	V	T	R	G	G	K	T	-	-	-	-	-	-	L	P	S	W	Q	L	V	A	I	L	G	V	D	A	L	A	T	I	F	L	T	G	W	M	S	G	A	P	Y	T	872		
<i>Rhizoctonia solani</i>	I	V	Y	L	Q	V	A	I	S	Q	A	L	I	F	V	T	R	S	H	G	F	F	F	E	-	R	P	S	T	A	L	L	G	A	F	A	I	A	Q	L	V	S	S	I	A	A	Y	A	D	W	G	F	T	D	I	H	S	881			
<i>Ustilago maydis</i>	I	M	Y	L	Q	V	A	I	S	Q	A	L	I	F	V	T	R	S	H	G	F	S	W	M	E	-	R	P	S	F	A	L	M	G	A	F	C	L	A	Q	L	S	S	I	A	A	Y	G	D	W	G	F	T	N	V	H	S	858			
<i>Puccinia graminis</i>	I	I	Y	L	Q	V	A	I	S	Q	A	L	I	F	V	T	R	S	H	G	F	F	M	E	-	R	P	S	F	A	L	M	G	A	F	C	L	A	Q	L	S	S	I	A	A	Y	G	N	W	G	F	T	Q	V	E	G	877				

<i>Neurospora crassa</i>	--	--	--	--	--	--	--	--	--	--	T	S	I	V	A	V	R	I	W	I	F	S	F	G	I	F	C	I	M	G	V	Y	Y	I	L	Q	D	S	V	G	F	D	N	L	M	H	G	K	S	P	-	K	894					
<i>Sporothrix schenckii</i>	--	--	--	--	--	--	--	--	--	Q	T	S	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	I	M	G	V	Y	Y	L	L	Q	D	S	V	G	F	D	N	L	M	H	G	K	S	P	-	K	903					
<i>Histoplasma capsulatum</i>	--	--	--	--	--	--	--	--	--	--	T	S	I	V	A	V	R	I	W	I	F	S	F	G	F	C	V	L	G	G	L	Y	Y	L	L	Q	G	S	A	G	F	D	N	M	M	H	G	K	S	P	-	K	890					
<i>Coccidioides immitis</i>	--	--	--	--	--	--	--	--	--	--	T	S	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	V	M	G	V	Y	Y	I	L	Q	G	S	T	G	F	D	N	M	M	H	G	K	S	P	-	K	909					
<i>Blastomyces dermatitidis</i>	--	--	--	--	--	--	--	--	--	--	T	S	I	V	A	V	R	I	W	I	F	S	F	G	F	C	V	L	G	G	L	Y	Y	L	L	Q	G	S	T	G	F	D	N	M	M	H	G	K	S	P	-	K	903					
<i>Acromonium chrysogenum</i>	--	--	--	--	--	--	--	--	N	R	V	N	I	V	G	V	R	V	W	I	F	S	F	G	V	F	A	V	M	G	L	Y	Y	F	M	Q	G	S	T	G	F	D	N	L	M	H	G	K	S	P	-	K	900					
<i>Trichophyton rubrum</i>	--	--	--	--	--	--	--	--	--	--	T	S	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	V	L	G	G	I	Y	Y	L	L	Q	G	S	T	G	F	D	N	M	M	H	G	K	S	P	-	K	902				
<i>Candida glabrata</i>	--	--	--	--	--	--	--	--	W	T	D	I	V	T	V	V	K	I	Y	I	S	F	G	V	F	C	V	L	G	G	F	Y	I	M	S	Q	S	V	V	F	D	R	L	M	N	G	K	P	-	L	876							
<i>Candida auris</i>	--	--	--	--	--	--	--	--	W	T	D	I	V	T	V	R	I	W	I	F	S	F	G	V	F	C	V	M	G	A	Y	L	M	S	Q	S	E	A	F	D	F	C	N	G	R	R	-	K	872									
<i>Candida albicans</i>	--	--	--	--	--	--	--	--	W	T	D	I	V	T	V	R	I	W	I	F	S	F	G	V	F	C	V	M	G	A	Y	L	M	S	T	S	E	A	F	D	N	F	C	N	G	R	K	P	-	Q	869							
<i>Pneumocystis jirovecii</i>	--	--	--	--	--	--	--	--	L	E	P	T	S	I	V	T	V	R	V	W	L	F	S	F	G	V	F	C	I	M	A	G	I	Y	L	L	S	D	S	V	A	F	D	N	I	M	H	G	K	S	V	-	K	905				
<i>Aspergillus fumigatus</i>	--	S	P	P	-	S	H	A	E	F	S	V	N	G	D	D	I	V	T	V	V	I	L	G	S	I	G	V	T	I	I	A	V	Y	I	L	T	I	P	A	L	D	N	L	G	R	K	T	R	S	-	K	886					
<i>Talaromyces marneffei</i>	T	H	P	A	-	D	P	A	Q	F	S	S	D	G	R	T	S	I	V	T	V	I	L	W	A	Y	S	I	G	V	T	I	V	V	A	T	Y	A	I	L	T	D	I	P	W	L	D	N	L	G	R	Q	T	R	S	-	K	952
<i>Syncephalastrum racemosum</i>	--	--	--	--	--	--	--	--	--	S	I	G	W	P	L	G	L	V	V	A	--	--	I	S	L	F	L	L	I	D	V	I	K	V	-	V	T	-	I	R	L	D	R	Y	T	Q	H	R	R	L	A	843						
<i>Rhizopus stolonifera</i>	--	--	--	--	--	--	--	--	C	G	W	H	--	--	--	A	G	V	A	V	W	N	F	I	W	F	A	P	L	D	L	V	K	F	A	M	O	Y	F	F	E	P	K	T	S	H	Q	H	N	P	--	--	877					
<i>Lichtheimia corymbifera</i>	--	--	--	--	--	--	--	--	S	G	W	L	--	--	--	A	G	I	A	V	W	N	F	V	W	F	P	P	L	D	L	W	L	K	F	A	M	O	R	V	F	R	E	K	T	A	A	A	I	Q	--	--	899					
<i>Cryptococcus gattii</i>	--	--	--	--	--	--	--	--	V	S	G	W	--	--	--	I	G	I	V	W	W	N	I	V	W	F	P	L	D	A	I	K	F	I	M	K	--	T	V	I	A	L	Q	R	R	K	A	K	A	G	925							
<i>Cryptococcus neoformans</i>	--	--	--	--	--	--	--	--	V	S	G	W	--	--	--	I	G	I	V	W	W	N	I	V	W	F	P	L	D	A	I	K	F	I	M	K	--	T	V	I	A	L	Q	R	R	K	A	K	A	G	927							
<i>Claviceps purpurea</i>	--	--	--	--	--	--	--	--	--	--	Q	T	S	I	V	A	V	R	I	W	I	F	S	F	G	I	F	A	V	M	G	L	Y	Y	L	M	Q	G	S	A	G	F	D	N	L	M	H	G	K	S	P	-	K	899				
<i>Colletotrichum gloeosporioides</i>	--	--	--	--	--	--	--	--	--	--	Q	T	S	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	V	A	G	Y	Y	M	L	D	S	K	G	F	D	N	L	M	H	G	K	S	P	-	K	896						
<i>Magnaporthe oryzae</i>	--	--	--	--	--	--	--	--	M	T	H	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	I	M	G	L	Y	Y	I	L	Q	D	S	Q	G	F	D	N	L	M	H	G	K	S	P	-	K	900						
<i>Fusarium oxysporum</i>	--	--	--	--	--	--	--	--	--	--	Q	T	S	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	V	M	G	L	Y	Y	F	M	Q	G	S	T	G	F	D	N	L	M	H	G	K	S	P	-	K	897				
<i>Botrytis cinerea</i>	--	--	--	--	--	--	--	--	--	--	Q	T	S	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	I	M	G	V	Y	Y	L	L	Q	D	S	S	G	F	D	N	L	M	H	G	K	S	P	-	K	918				
<i>Fusarium graminearum</i>	--	--	--	--	--	--	--	--	--	--	Q	T	S	I	V	A	V	R	I	W	I	F	S	F	G	V	F	C	V	M	G	L	Y	Y	F	M	Q	G	S	T	G	F	D	N	L	M	H	G	K	S	P	-	K	896				
<i>Aspergillus niger</i>	--	--	--	--	--	--	--	--	--	--	T	S	W	P	T	I	L	R	I	Y	V	F	S	F	G	V	F	C	I	M	G	L	Y	Y	L	L	Q	G	S	K	S	F	D	N	I	M	H	G	K	S	P	-	V	889				
<i>Blumeria graminis</i>	S	D	P	A	T	-	L	N	A	L	S	T	D	G	R	T	S	I	V	T	I	V	W	C	Y	S	I	A	V	T	I	V	I	A	V	H	I	M	N	K	A	A	L	D	N	L	G	R	F	K	R	S	-	K	934			
<i>Sclerotinia sclerotiorum</i>	S	D	P	A	T	-	K	N	V	L	L	S	E	N	G	H	T	S	I	V	T	V	I	V	W	G	F	S	I	G	V	T	I	I	A	V	Y	Y	L	M	N	Q	W	S	W	L	D	N	L	G	R	A	R	S	-	H	944	
<i>Mycosphaerella graminicola</i>	P	L	P	S	P	M	S	T	F	Q	T	A	N	G	H	T	D	V	T	V	V	V	W	M	F	S	I	G	M	V	M	I	A	T	Y	Y	L	N	K	I	P	G	L	A	D	L	G	R	Q	N	R	S	-	L	965			
<i>Cochliobolus heterostrophus</i>	N	-	P	E	T	-	I	N	S	R	F	R	D	D	G	W	D	I	V	T	V	V	I	W	A	Y	S	I	G	V	T	I	I	A	V	Y	L	M	N	R	I	E	W	L	D	T	L	G	R	K	D	R	S	-	K	929		
<i>Rhizoctonia solani</i>	--	--	--	--	--	--	--	--	--	--	I	S	G	W	--	--	--	I	G	I	V	W	W	N	I	V	W	F	F	P	L	D	W	I	K	F	A	M	K	A	T	V	I	K	W	F	R	R	R	E	R	K	A	925				
<i>Ustilago maydis</i>	--	--	--	--	--	--	--	--	--	--	I	E	G	W	--	--	--	I	G	I	V	W	W	N	I	V	W	F	F	P	M	D	L	V	K	F	F	A	K	F	L	L	R	N	I	R	S	K	K	T	P	--	--	898				
<i>Puccinia graminis</i>	--	--	--	--	--	--	--	--	--	--	I	S	G	W	--	--	--	I	G	I	V	W	W	N	I	V	W	F	L	P	M	D	F	I	K	F	S	V	K	Y	G	T	R	A	W	N	A	K	R	G	V	P	--	--	922			

**Table S4: continued**

Species	Sequence	Score
<i>Neurospora crassa</i>	GNQ-KQRSLEDFVVS LQRVST	915
<i>Sporothrix schenckii</i>	GNQ-KQRSLEDFVVS LQRVST	924
<i>Histoplasma capsulatum</i>	KNQ-KQRSLEDFVVS LQRVSTQHEKSS	916
<i>Coccidioides immitis</i>	KSQ-KQRSLEDFVVS LQRVSTQHEKSA	935
<i>Blastomyces dermatitidis</i>	KNQ-KQRSLEDFVVS LQRVSTQHEKST	929
<i>Acremonium chrysogenum</i>	RSQ-KQRSLEDFVVS LQRVST	924
<i>Trichophyton rubrum</i>	KSQ-KQRSLEDFGKPLPFPN ILYTSIQLLMSSSSCLPPTCLYP	959
<i>Candida glabrata</i>	EKSSTRSVEDFLAAMQRVSTQHEKEN	902
<i>Candida auris</i>	KEGRDRRSLEDFMVSMARVSTQHEKSS	899
<i>Candida albicans</i>	QHHTDKRSLEDFLVSMQRVSTQHEKST	895
<i>Pneumocystis jirovecii</i>	KNT-KQRSLEDFVVALQRVSTKHEKGE	931
<i>Aspergillus fumigatus</i>	ADTKIENMIAHLSKLAIEHETDNNGKSYITLGARAEVEE	921
<i>Talaromyces marneffei</i>	ADTAIENMIGHLSKLAIEHEQDRATGNSRYVIAAPRAPEE	999
<i>Syncephalastrum racemosum</i>	AAIKKQKMTTRATLFOKK--QESRSG--YDRAQRRRESVS	878
<i>Rhizopus stolonifera</i>	EAKASASRRASAVSGTSARYYANRTRSLRSFERPQNFGKKLLGMNKK--MDAKE	930
<i>Lichtheimia corymbifera</i>	GAGAPRSRRGSIVSTSAARYYANRTRSLRALERPRNFGRRLLGLNKKLLSMDPTE	954
<i>Cryptococcus gattii</i>	PVVP--EAGLRAPSRHESLYSNRTNFLTTRANRLR--GG--AKISMSQNE	970
<i>Cryptococcus neoformans</i>	PAVA--DAALHRAPSRHESLYSNRTNFLTTRANRLR--GG--AKISMSQNE	972
<i>Claviceps purpurea</i>	KDQ-KQRSLEDFVVS LQRVST	920
<i>Colletotrichum gloeosporioides</i>	GSQ-KQRSLEDFANCFSTRFP--AACLYPA	924
<i>Magnaporthe oryzae</i>	GNQ-KQRSLEDFVVS LQRVST	921
<i>Fusarium oxysporum</i>	QND-KQRSLEDFVVS LQRVST	918
<i>Botrytis cinerea</i>	KTQ-KQRSLEDFVVS LQRVST	939
<i>Fusarium graminearum</i>	QND-KQRSLEDFVVS LQRVST	917
<i>Aspergillus niger</i>	RTA-KQRSIEDFMVMQRVSSQHVTSSLKGMESGQVTRGV	928
<i>Blumeria graminis</i>	ADTQMENIIMHLSKIAIQHERDENGNSRFALVPKALEAE	974
<i>Sclerotinia sclerotiorum</i>	ADTQLENIIAHLSKVAIEHSQV--DGVHRYHIVQKQAEVE	983
<i>Mycosphaerella graminicola</i>	HDTQMENIIGHLSKALKHERDENGDARWTLATKATDDE	005
<i>Cochliobolus heterostrophus</i>	KPAIENMIAALSLSLEHGTDKHGTTRYVLAPRAVEEE	969
<i>Rhizoctonia solani</i>	EVARATGGEVPLTRTTSRAASIHESLYSNRVSFLKRAARRAG--FG--DKRRVRMSQGE	979
<i>Ustilago maydis</i>	AAAHESLRTTSRADSMYSNRTSFLKRAARRAG--FGGEKKVHMSNTE	944
<i>Puccinia graminis</i>	LKLVDEATGIPLR--TASRHEESLYSNHATWIKRAARRVG--LK-KGT-TIDPTE	969



**Table S5: Alignment of *Neurospora crassa* Pma1 with plasma membrane proton pumps of selected plants.**

Sequences are sorted in decending order according to their identity with Pma1. Accession codes: *N. crassa* (sp|P07038), *Coffea eugenoides* (XP\_027176212.1), *Spinacia oleracea* (XP\_021865157.1), *Cucumis sativus* (XP\_004152192.1), *Hordeum vulgare* (KAE8805265.1:29-858), *Jatropha curcas* (XP\_012068768.1:37-846), *Triticum aestivum* (P83970.1:29-858), *Ananas comosus* (XP\_020090190.1), *Chenopodium quinoa* (XP\_021755229.1:32-855), *Carica papaya* (XP\_021899224.1), *Ricinus communis* (XP\_015572514.1:34-875), *Punica granatum* (XP\_031378860.1), *Nicotiana tabacum* (NP\_001312285.1), *Brassica napus* (XP\_022556197.1), *Gossypium australe* (KAA3489374.1:33-874), *Arabidopsis thaliana* (NP\_194748.1), *Manihot esculenta* (XP\_021598156.1:34-875), *Malus domestica* (XP\_008372282.1:35-876), *Camellia sinensis* (XP\_028098451.1:32-870), *Zea mays* (AQK46772.1:25-866), *Theobroma cacao* (EOY29625.1), *Sesamum indicum* (XP\_011084025.1), *Hevea brasiliensis* (XP\_021654241.1:37-846), *Glycine max* (XP\_003549696.1:32-903)

<i>Neurospora crassa</i>	MADHSSASGAPALSTNIEESGKPFDEKAAEAAAYQPKPVDEDEDEDIDALIEDLESHDHG	60
<i>Coffea eugenoides</i>	-----MASDLS	06
<i>Spinacia oleracea</i>	-----MASKLE	06
<i>Cucumis sativus</i>	-----MTDIS	05
<i>Hordeum vulgare</i>	-----	00
<i>Jatropha curcas</i>	-----	00
<i>Triticum aestivum</i>	-----	00
<i>Ananas comosus</i>	-----MGGDNALS	08
<i>Chenopodium quinoa</i>	-----	00
<i>Carica papaya</i>	-----MASDIS	06
<i>Ricinus communis</i>	-----	00
<i>Punica granatum</i>	-----MASSNTDILT	09
<i>Nicotiana tabacum</i>	-----MASNLS	06
<i>Brassica napus</i>	-----MADIEA	06
<i>Gossypium australe</i>	-----	00
<i>Arabidopsis thaliana</i>	-----MS	03
<i>Manihot esculenta</i>	-----	00
<i>Malus domestica</i>	-----	00
<i>Camellia sinensis</i>	-----	00
<i>Zea mays</i>	-----	00
<i>Theobroma cacao</i>	-----MASDGDTS	08
<i>Sesamum indicum</i>	-----MASNIS	06
<i>Hevea brasiliensis</i>	-----	00
<i>Glycine max</i>	-----	00

<i>Neurospora crassa</i>	EEEEEEATPGGGRVVPEDM--LQTDTRVGLTSEEVVQRRRKYGGLNQMKKEKENHFLKFLG	118
<i>Coffea eugenoides</i>	LEEIKKNEQVDLENIPVEEVFKLKC	066
<i>Spinacia oleracea</i>	EACEAAEDLDLENVPVEEVFSLQC	066
<i>Cucumis sativus</i>	LQEIKNENIDLERIPVEEVFEQLKC	065
<i>Hordeum vulgare</i>	-----TRQGLTSDDEGAQRVEIFGLNKLEEKKE	035
<i>Jatropha curcas</i>	-----SREGLSSEDAEVRLLKIFGP	035
<i>Triticum aestivum</i>	-----TRQGLTSDDEGAQRVEIFGLNKLEEKKE	035
<i>Ananas comosus</i>	LEEIKKNEQVDLERIPVDEVFQQLKC	068
<i>Chenopodium quinoa</i>	-----TRNGLSSDEVEQRIAKYGYNKLEEKKE	035
<i>Carica papaya</i>	LEEIKKNEQVDLERIPVDEVFQQLKC	066
<i>Ricinus communis</i>	-----SREGLSSEEGTNRLLQVFGPNKLEEKKE	035
<i>Punica granatum</i>	LEEIKKNEQVDLENIPVEEVFKLKC	069
<i>Nicotiana tabacum</i>	LEDIKNEQVDLENIPVEEVFKLKC	066
<i>Brassica napus</i>	LKAITTESIDLENVPVEEVFQHLKC	066
<i>Gossypium australe</i>	-----TKEGLTTEEGLKRLQIFGPNKLEEKKE	035
<i>Arabidopsis thaliana</i>	LEDIKNETVDLEKIPVEEVFKLKC	063
<i>Manihot esculenta</i>	-----TREGLTSEEGANRLQVFGPNKLEEKKE	035
<i>Malus domestica</i>	-----SREGLSSEEGQRLEIFGPNKLEEKKE	035
<i>Camellia sinensis</i>	-----TRDGLSSEEGENRLQIFGPNKLEEKKE	035
<i>Zea mays</i>	-----TREGLSSEEGQRLEIFGPNKLEEKKE	035
<i>Theobroma cacao</i>	LEGIKNETVDLERIPVEEVFKLKC	068
<i>Sesamum indicum</i>	LEDIKNETVDLENIPVEEVFKLKC	066
<i>Hevea brasiliensis</i>	-----SRAGLSTEDAEVRLKIFGLNKLEEKKE	035
<i>Glycine max</i>	-----TREGLTSEEGEKRLQIFGPNKLEEKKE	035

<i>Neurospora crassa</i>	FFVGGPIQFVMEGAAVLAAGL-----EDWVDFGVICGLLLLNNAVGVFVQEFQAGSIVDE	171
<i>Coffea eugenoides</i>	FMWNPPLSWVMEAAAVMAIVLANGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	126
<i>Spinacia oleracea</i>	FMWNPPLSWVMEAAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	126
<i>Cucumis sativus</i>	FMWNPPLSWVMEAAAIMAIVLANGGGQPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	125
<i>Hordeum vulgare</i>	FMWNPPLSWVMEAAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Jatropha curcas</i>	FMWNPPLSWVMEAAAVMAIVLANGGGEGPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Triticum aestivum</i>	FMWNPPLSWVMEAAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Ananas comosus</i>	FMWNPPLSWVMEAAAVMAIALAHGGGQAPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	128
<i>Chenopodium quinoa</i>	FMWNPPLSWVMEIAALMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Carica papaya</i>	FMWNPPLSWVMEAAAIMAIVLANGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	126
<i>Ricinus communis</i>	FMWNPPLSWVMEAAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Punica granatum</i>	FMWNPPLSWVMECAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	129
<i>Nicotiana tabacum</i>	FMWNPPLSWVMEAAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	126
<i>Brassica napus</i>	FMWNPPLSWVMEAAALMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	126
<i>Gossypium australe</i>	FMWNPPLSWVMEIAAVMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Arabidopsis thaliana</i>	FMWNPPLSWVMEAAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	123
<i>Manihot esculenta</i>	FMWNPPLSWVMEAAAIMAIVLANGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Malus domestica</i>	FMWNPPLSWVMEAAAIMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Camellia sinensis</i>	FMWNPPLSWVMECAAIMAIVLANGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Zea mays</i>	FMWNPPLSWVMEAAAVMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Theobroma cacao</i>	FMWNPPLSWVMEAAAIMAIVLANGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	128
<i>Sesamum indicum</i>	FMWNPPLSWVMEAAAIMAIVLANGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	129
<i>Hevea brasiliensis</i>	FMWNPPLSWVMEAAAVMAIALAHGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095
<i>Glycine max</i>	FMWNPPLSWVMEVAAAIMAIVMANGGGKPPDWQDFVGIIVLLLNINSTISFIEENNAGNAAAA	095

Table S5: continued

<i>Neurospora crassa</i>	L K K T L A L K A V V L R D G T L K E I E A F E V V P G D I L Q V E E G T I I P A D G R I V T D D A F L Q V D Q S A L T	231
<i>Coffea eugenoides</i>	L M A G L A P K K T K V L R D G K W E E D A A I L V P G D I S V K L G D I P A D A R L L E G D A - L K I D Q S A L T	185
<i>Spinacia oleracea</i>	L M A R L A P K A K V Q R D G S W N E E D A A R L V P G D I S I K L G D I V P A D A R L L N G D F - L K I D Q S A L T	185
<i>Cucumis sativus</i>	L M A G L A P K K T K V L R D G R W C E E E A A I L V P G D V I S V K L G D I P A D A R L L E G D F - L K I D Q S A L T	184
<i>Hordeum vulgare</i>	L M A N L A P K T K V L R D G R W G E E A A I L V P G D I S I K L G D I V P A D A R L L E G D F - L K I D Q S G L T	154
<i>Jatropha curcas</i>	L M A H L A P K T K V L R D G R W K E E D A A I L V P G D I S I K L G D I P A D A R L L E G D F - L K I D Q S A L T	154
<i>Triticum aestivum</i>	L M A N L A P K T K V L R D G R W G E E A A I L V P G D I S I K L G D I V P A D A R L L E G D F - L K I D Q S G L T	154
<i>Ananas comosus</i>	L M A N L A P K T K V L R D G Q W S E E E A A I L V P G D I S I K L G D I V P A D A R L L E G D F - L K I D Q S A L T	187
<i>Chenopodium quinoa</i>	L M A R L A P K A K V L R N G E W N E D D A I R L V P G D I S I K L G D I V P A D A R L L N G D F - L K I D Q S A L T	154
<i>Carica papaya</i>	L M A G L A P K T K V L R D G K W S E E E A A I L V P G D V I S I K L G D I V P A D A R L L E G D F - L K I D Q S A L T	185
<i>Ricinus communis</i>	L M A G L A P K T K V L R D G R W T E E E A A I L V P G D I S I K L G D I P A D A R L L E G D F - L K I D Q S A L T	154
<i>Punica granatum</i>	L M A G L A P K T K V L R D G K W S E E E A A I L V P G D V I S V K L G D I P A D A R L L E G D F - L K I D Q S A L T	188
<i>Nicotiana tabacum</i>	L M A N L A P K T K I L R D G K W S E E D A A I L V P G D I S I K L G D I V P A D A R L L E G D F - L K I D Q A A L T	185
<i>Brassica napus</i>	L M A Q L A P K A K A I R D K K W N E I D A S E L V P G D I S I K L G D I P A D A R L L E G D F - L K I D Q S A L T	185
<i>Gossypium australe</i>	L M A G L A P K T K V L R D G K W C E E E A A I L V P G D I S I K L G D I P A D A R L L E G D A - L K V D Q S A L T	154
<i>Arabidopsis thaliana</i>	L M A G L A P K T K V L R D G K W S E E E A A I L V P G D I S I K L G D I P A D A R L L E G D F - L K V D Q S A L T	182
<i>Manihot esculenta</i>	L M A G L A P K T K V L R D G R W T E E E A A I L V P G D I S I K L G D I P A D A R L L E G D F - L K V D Q S A L T	154
<i>Malus domestica</i>	L M A G L A P K T K V L R D G K W S E E D A A I L V P G D I S I K L G D I V P A D A R L L E G D F - L K I D Q S A L T	154
<i>Camellia sinensis</i>	L M A G L A P K T K V L R D G K W S E E E A A I L V P G D I S V K L G D I P A D A R L L E G D F - L K I D Q S A L T	154
<i>Zea mays</i>	L M A N L A P K T K V L R D G R W S E E E A A I L V P G D I S I K L G D I V P A D A R L L E G D F - L K V D Q S A L T	154
<i>Theobroma cacao</i>	L M A G L A P K T K V L R D G K W S E E D A A I L V P G D V I S V K L G D I P A D A R L L E G D A - L K I D Q S A L T	187
<i>Sesamum indicum</i>	L M A G L A P K T K V L R D G K W S E E D A A I L V P G D I S V K L G D I P A D A R L L E G D F - L K I D Q S A L T	185
<i>Hevea brasiliensis</i>	L M A H L A P K T K V L R D G Q W Q E E D A A I L V P G D I S I K L G D I P A D A R L L K G D F - L K I D Q S A L T	154
<i>Glycine max</i>	L M A G L A P K T K V L R D G K W S E E E E A A L L V P G D I S I K L G D I V P A D A R L L E G D F - L K I D Q S A L T	154

<i>Neurospora crassa</i>	G E S L A V D K H K G D Q V F A S A V K R G E A F V V I T A T G D N T F V G R A A A L V N A A S G G S G H F T E V L N	291
<i>Coffea eugenoides</i>	G E S L P V T K N P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N H V G H F Q K V L T	244
<i>Spinacia oleracea</i>	G E S L P V T K H P G S Q V Y S G S T C K Q G E I E A V V I A T G I N T F F G K A A H L V E N T - H H V G H F Q K V L T	244
<i>Cucumis sativus</i>	G E S L P V T R S G D E V F S G S T V K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	243
<i>Hordeum vulgare</i>	G E S L P V T K N P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	213
<i>Jatropha curcas</i>	G E S L A V T K R T G D E V F S G S T C K H G E I E A V V I A T G V N T F F G K A A H L V D S T - I V V G H F Q Q V L T	213
<i>Triticum aestivum</i>	G E S L P V T K N P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q Q V L T	213
<i>Ananas comosus</i>	G E S L P V T K N P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	246
<i>Chenopodium quinoa</i>	G E S L P V T K H P G N Q V Y S G S T C K Q G E I E A V V I A T G I N T F F G K A A H L V E N T - N H V G H F Q K V L T	213
<i>Carica papaya</i>	G E S L P V T K E P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N N V G H F Q K V L T	244
<i>Ricinus communis</i>	G E S L P V T K N P S D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	213
<i>Punica granatum</i>	G E S L P V T K H P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	247
<i>Nicotiana tabacum</i>	G E S L P V T K F P G A E V F S G S T V K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	244
<i>Brassica napus</i>	G E S L P V T K N P G S S V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - T H V G H F Q K V L T	244
<i>Gossypium australe</i>	G E S L P V N K N P G D G V Y S G S T V K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N N V G H F Q K V L T	213
<i>Arabidopsis thaliana</i>	G E S L P V T K H P G Q E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	241
<i>Manihot esculenta</i>	G E S L P V T K N P S D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	213
<i>Malus domestica</i>	G E S L P V T K H P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	213
<i>Camellia sinensis</i>	G E S L P V T K H P G D G V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q K V L T	213
<i>Zea mays</i>	G E S L P V T K G P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N Q V G H F Q Q V L T	213
<i>Theobroma cacao</i>	G E S L P V T K N P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N N V G H F Q K V L T	246
<i>Sesamum indicum</i>	G E S L A V T K H P G D E V F S G S T C K Q G E I E A V V I A T G V H T F F G K A A H L V D S T - N N V G H F Q K V L T	244
<i>Hevea brasiliensis</i>	G E S L P V T K R T G D E V F S G S T C K H G E I E A V V I A T G V N T F F G K A A H L V D S T - E V V G H F Q K V L T	213
<i>Glycine max</i>	G E S L P V T K N P G S E V F S G S T C K Q G E I E A I V I A T G V H T F F G K A A H L V D S T - N N V G H F Q K V L T	213

<i>Neurospora crassa</i>	G I G T I L L I L V I F T L L I V W V S S F Y - R S N P I V Q I L E F T L A I T I I G V P V G L P A V V T T T M A V G A	350
<i>Coffea eugenoides</i>	A I G N F C I C S I G L G M V I E V V M Y P V Q H R K Y R E G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	304
<i>Spinacia oleracea</i>	S I G N F C I C S I A V G M L I E I I V I Y A L H Q R P Y R V G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	304
<i>Cucumis sativus</i>	A I G N F C I C S I A G M V I E I V V M Y P I Q H R R Y R D G I N L L V L L I G G I P I A M P T V L S V T M A I G S	303
<i>Hordeum vulgare</i>	A I G N F C I C S I A V G I V I E I V M F P I Q H R R Y R A G I E N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Jatropha curcas</i>	S I G N F C I C S I A V G M L E I I V M F P I Q H R S Y R D G I N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Triticum aestivum</i>	A I G N F C I V S I A V G I V I E I V M F P I Q H R R Y R A G I E N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Ananas comosus</i>	A I G N F C I C S I A I G I V E I I V M F P I Q H R A Y R S G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	306
<i>Chenopodium quinoa</i>	S I G N F C I C S I A V G M L I E I I V I Y A L H Q R P Y R V G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Carica papaya</i>	A I G N F C I C S I G I G M L I E I V I M Y P I Q H R R Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	304
<i>Ricinus communis</i>	A I G N F C I C S I A V G I I E I V M Y P I Q H R R Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Punica granatum</i>	A I G N F C I C S I A I G M L V E I I V M Y P I Q H R R Y R E G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	307
<i>Nicotiana tabacum</i>	A I G N F C I C S I A V G M V I E I V M Y P I Q H R R Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	304
<i>Brassica napus</i>	S I G N F C I C S I A V G M A I E I V I Y G L Q K R A Y R V G I D N L L V L L I G G I P I A M P T V L S V T M A I G A	304
<i>Gossypium australe</i>	A I G N F C I C S I A V G M L V E I V V M Y P I Q H R R Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Arabidopsis thaliana</i>	A I G N F C I C S I A I G M V I E I V M Y P I Q H R R Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	301
<i>Manihot esculenta</i>	A I G N F C I C S I A V G I V I E I V M Y P I Q H R R Y R Q G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Malus domestica</i>	A I G N F C I C S I A I G M L I E I V M Y P I Q H R R Y R S G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Camellia sinensis</i>	S I G N F C I C S I G V G M V I E I V M Y P I Q N R R Y R E G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Zea mays</i>	A I G N F C I C S I A V G I V E I I V M F P I Q H R R Y R S G I E N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Theobroma cacao</i>	A I G N F C I C S I A V G M L I E I V M Y P I Q H R R Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	306
<i>Sesamum indicum</i>	A I G N F C I C S I A L G M I E I V M Y P I Q H R R Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	304
<i>Hevea brasiliensis</i>	S I G N F C I C S I A V G M I L E I I V M F P I Q H R S Y R D G I N L L V L L I G G I P I A M P T V L S V T M A I G S	273
<i>Glycine max</i>	S I G N F C I C S I A V G M L I E I I V M F P I Q R A Y R D G I D N L L V L L I G G I P I A M P T V L S V T M A I G S	273



Table S5: continued

Neurospora crassa	A	Y	L	A	K	K	A	I	V	O	K	L	S	A	I	E	S	L	A	G	V	E	I	L	C	S	D	K	T	G	T	L	T	N	K	L	S	L	H	D	P	Y	T	--	V	A	G	V	D	P	E	D	L	M	L	T	407			
Coffea eugenioides	H	R	L	S	E	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	Q	M	I	E	V	F	P	K	N	M	D	K	S	D	V	L	Y	364	
Spinacia oleracea	H	R	L	A	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	N	L	I	E	V	F	S	K	G	V	D	K	M	V	V	L	364		
Cucumis sativus	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	S	M	I	E	V	F	V	R	D	V	D	K	D	N	L	V	L	363	
Hordeum vulgare	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	L	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	K	N	L	V	E	V	F	A	K	G	V	D	K	E	H	V	L	L	333	
Jatropha curcas	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	R	N	L	I	E	V	F	N	K	E	M	D	K	M	I	V	L	333		
Triticum aestivum	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	L	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	K	N	L	V	E	V	F	A	K	G	V	D	K	E	H	V	L	L	333	
Ananas comosus	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	R	N	L	V	E	V	F	A	K	G	V	D	K	E	H	V	L	L	366	
Chenopodium quinoa	H	R	L	A	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	R	N	L	I	E	V	F	A	K	G	V	D	K	M	V	V	L	333		
Carica papaya	H	R	L	S	E	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	S	L	I	E	V	F	P	K	G	I	D	K	D	T	V	V	L	364	
Ricinus communis	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	R	T	L	I	E	V	F	V	K	G	V	D	K	E	Y	V	L	L	333	
Punica granatum	H	R	L	S	E	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	S	L	I	E	V	F	P	K	D	M	D	K	D	L	M	L	367		
Nicotiana tabacum	H	R	L	A	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	N	L	I	E	V	F	P	K	D	A	D	K	D	T	M	V	L	364	
Brassica napus	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	K	N	L	I	E	I	F	K	K	G	I	D	K	D	M	A	V	L	364	
Gossypium australe	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	S	M	V	E	V	F	T	K	D	V	D	K	E	M	L	L	L	333	
Arabidopsis thaliana	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	K	N	L	V	E	V	F	C	K	G	V	E	K	D	Q	V	L	F	361	
Manihot esculenta	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	R	T	L	I	E	V	F	A	K	G	V	D	K	E	Y	V	L	L	333	
Malus domestica	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	L	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	K	N	L	I	E	V	F	A	K	G	V	E	N	E	H	V	L	L	333	
Camellia sinensis	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	R	T	L	I	E	V	F	P	K	D	V	D	K	D	I	V	V	L	333	
Zea mays	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	S	V	D	K	N	L	V	E	V	F	C	K	G	V	D	K	D	H	V	L	L	333	
Theobroma cacao	H	R	L	S	E	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	S	L	I	E	V	F	A	S	G	I	D	K	D	T	L	M	L	366	
Sesamum indicum	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	N	L	I	E	V	F	P	K	N	A	D	K	D	T	V	V	L	364	
Hevea brasiliensis	H	R	L	S	O	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	R	N	L	I	E	V	F	N	K	E	M	D	K	E	I	V	L	L	333	
Glycine max	H	R	L	S	E	O	G	A	I	T	K	R	M	T	A	I	E	E	M	A	G	M	D	V	L	C	S	D	K	T	G	T	L	T	N	K	L	T	V	D	K	S	L	I	E	V	F	P	T	G	M	D	R	D	T	L	V	L	Y	333

Neurospora crassa	A	C	L	A	A	S	R	K	K	G	I	D	A	I	D	K	A	F	L	K	S	L	K	Y	P	P	R	A	K	S	V	L	S	K	Y	K	V	L	Q	F	H	P	F	D	P	V	S	K	N	V	A	V	V	E	S	P	Q	467	
Coffea eugenioides	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	A	S	I	V	N	M	L	S	--	--	D	P	K	E	A	R	A	G	I	T	E	L	H	F	L	P	F	N	P	V	E	K	R	T	A	I	T	Y	I	D	S	N	G	419
Spinacia oleracea	S	A	R	A	--	S	R	I	E	N	Q	D	A	I	D	G	A	I	V	S	M	L	S	--	--	D	P	K	E	A	R	A	G	I	K	E	V	H	F	L	P	F	N	P	T	D	K	R	T	A	L	T	Y	T	D	E	A	G	419
Cucumis sativus	G	A	R	A	--	S	R	V	E	N	Q	D	A	I	D	A	C	I	V	G	M	L	G	--	--	D	P	K	E	A	R	E	G	I	K	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	I	T	F	I	D	N	D	G	418
Hordeum vulgare	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	A	C	M	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	V	H	F	L	P	F	N	P	T	D	K	R	T	A	L	T	Y	I	D	A	E	G	388
Jatropha curcas	A	A	R	A	--	S	R	L	E	N	Q	D	A	I	D	A	A	I	V	N	M	L	A	--	--	D	P	K	E	A	R	A	N	I	K	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	I	T	Y	I	D	S	D	G	388
Triticum aestivum	A	A	R	A	--	S	R	V	E	N	Q	D	A	I	D	A	C	M	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	V	H	F	L	P	F	N	P	T	D	K	R	T	A	L	T	Y	I	D	A	E	G	388
Ananas comosus	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	A	A	M	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	I	H	F	F	P	N	P	V	D	K	R	T	A	L	T	Y	I	D	A	D	G	421	
Chenopodium quinoa	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	G	A	I	V	S	M	L	P	--	--	D	S	K	Q	A	R	E	G	I	K	E	V	H	F	L	P	F	N	P	T	D	K	R	T	A	L	T	Y	I	D	E	A	G	388
Carica papaya	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	A	S	I	V	G	M	L	S	--	--	D	P	K	E	A	R	A	G	I	S	E	O	H	F	L	P	F	N	P	V	D	K	R	T	A	I	T	Y	I	D	N	K	G	419
Ricinus communis	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	A	A	I	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	L	H	F	L	P	F	N	P	V	D	K	R	T	A	L	T	Y	I	D	S	D	G	388
Punica granatum	A	A	R	A	--	S	R	V	E	N	Q	D	A	I	D	A	S	I	V	G	M	L	N	--	--	D	P	K	E	A	R	A	G	I	T	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	I	T	Y	I	D	S	N	G	422
Nicotiana tabacum	A	A	R	A	--	S	R	V	E	N	Q	D	A	I	D	A	C	I	V	S	M	L	G	--	--	D	P	K	E	A	R	A	G	I	G	E	V	H	F	L	P	F	N	P	V	E	K	R	T	A	I	T	Y	I	D	D	K	G	419
Brassica napus	A	A	R	A	--	A	R	L	E	N	Q	D	A	I	D	T	A	I	V	S	M	L	S	--	--	D	P	K	E	A	R	A	G	I	K	E	L	H	F	L	P	F	S	P	A	N	R	R	T	A	L	T	Y	L	D	G	E	G	419
Gossypium australe	A	A	R	A	--	S	R	V	E	N	Q	D	A	I	D	A	C	I	V	G	M	L	G	--	--	D	P	K	E	A	R	E	G	I	T	E	V	H	F	F	P	N	P	V	D	K	R	T	A	M	T	Y	I	D	S	D	G	388	
Arabidopsis thaliana	A	A	M	A	--	S	R	V	E	N	Q	D	A	I	D	A	A	M	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	L	T	Y	I	D	G	S	G	416
Manihot esculenta	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	A	A	I	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	L	T	Y	I	D	S	N	G	388
Malus domestica	A	A	R	S	--	S	R	T	E	N	Q	D	A	I	D	A	A	M	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	L	T	Y	I	D	N	D	G	388
Camellia sinensis	A	A	R	A	--	S	R	I	E	N	Q	D	A	I	D	A	S	I	V	G	M	L	G	--	--	D	P	K	E	A	R	A	G	I	T	E	V	H	F	L	P	F	N	P	V	E	K	R	T	A	I	T	Y	F	D	S	N	D	388
Zea mays	A	A	R	A	--	S	R	T	E	N	Q	D	A	I	D	A	A	M	V	G	M	L	A	--	--	D	P	K	E	A	R	A	G	I	R	E	I	H	F	L	P	F	N	P	V	D	K	R	T	A	L	T	Y	I	D	A	D	G	388
Theobroma cacao	A	A	R	A	--	S	R	V	E	N	Q	D	A	I	D	A	S	I	V	G	M	L	G	--	--	D	P	K	E	A	R	A	G	I	T	E	V	H	F	F	P	N	P	V	D	K	R	T	A	I	T	Y	I	D	S	D	G	421	
Sesamum indicum	A	A	R	A	--	S	R	I	E	N	Q	D	A	I	D	A	S	I	V	N	M	L	G	--	--	D	P	K	E	A	R	A	G	I	E	V	H	F	L	P	F	N	P	V	E	K	R	T	A	I	T	Y	Y	D	S	N	G	419	
Hevea brasiliensis	A	A	R	A	--	S	R	L	E	N	Q	D	A	I	D	A	A	I	V	N	M	L	A	--	--	D	P	K	E	A	R	A	N	I	K	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	I	T	Y	I	D	S	D	G	388
Glycine max	A	A	R	A	--	S	R	I	E	N	Q	D	A	I	D	A	S	I	V	G	M	L	G	--	--	D	P	K	E	A	R	A	G	I	T	E	V	H	F	L	P	F	N	P	V	D	K	R	T	A	I	T	Y	I	D	G	G	388	

Table S5: continued

<i>Neurospora crassa</i>	GEGSWEIFLGLPFCMDPPRHDTYKTVCEAKTLGLSLMLTGDAVGIARETSKQLGLGTNIY	579
<i>Coffea eugenioides</i>	AGGPWFIFGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	535
<i>Spinacia oleracea</i>	LGGPWQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	535
<i>Cucumis sativus</i>	AGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	534
<i>Hordeum vulgare</i>	AGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Jatropha curcas</i>	PGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Triticum aestivum</i>	PGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Ananas comosus</i>	PGAPWQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	537
<i>Chenopodium quinoa</i>	PGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Carica papaya</i>	SGSPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	535
<i>Ricinus communis</i>	PGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Punica granatum</i>	EGEPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	538
<i>Nicotiana tabacum</i>	DGGPWQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	535
<i>Brassica napus</i>	DGGPWQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	535
<i>Gossypium australe</i>	PGSPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Arabidopsis thaliana</i>	PGAPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	532
<i>Manihot esculenta</i>	PGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Malus domestica</i>	AGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Camellia sinensis</i>	AGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Zea mays</i>	PGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Theobroma cacao</i>	AGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	537
<i>Sesamum indicum</i>	AGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	535
<i>Hevea brasiliensis</i>	PGGPWFQFVGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Glycine max</i>	AGEWEIFLGLPLFDPPRHDSAEITIKKALDLGVSVKMITGDLAIGKETGRRLLGMGTNNY	504
<i>Neurospora crassa</i>	N AERLGLGGG--GDMPGSEVYDFVEAADGFAEVFPQHKKYNVVEILQORGYLVAMTGDGVN	637
<i>Coffea eugenioides</i>	PSSSLGQSKDES-IAISIPFDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	594
<i>Spinacia oleracea</i>	PSSALGDNKDNRNPDMPVQVELIESADGFAGVFPEHKKYNIVKILQERKHIVGMTGDGVN	595
<i>Cucumis sativus</i>	PSSSLGQSKDES-IAISLPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	593
<i>Hordeum vulgare</i>	PSSALGQSKDGS-LESPLVDELIEKADGFAGVFPEHKKYIVKRLQERKHIVGMTGDGVN	563
<i>Jatropha curcas</i>	PSSSLGGRDKDEN--EVLVDELIEKADGFAGVFPEHKKYIVKILQERKHIVGMTGDGVN	562
<i>Triticum aestivum</i>	PSSALGQSKDGS-LESPLVDELIEKADGFAGVFPEHKKYIVKRLQERKHIVGMTGDGVN	563
<i>Ananas comosus</i>	PSSALGQDKDAS-LDALVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	596
<i>Chenopodium quinoa</i>	PSSTLGDNDKDS-RSDMPFTELIEKADGFAGVFPEHKKYNIVKILQERKHIVGMTGDGVN	563
<i>Carica papaya</i>	PSSSLGQSKDES-IAISLPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	594
<i>Ricinus communis</i>	PSSSLGQDKDAS-IAISLPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	563
<i>Punica granatum</i>	PSSSLGQSKDAS-VASLPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	597
<i>Nicotiana tabacum</i>	PSSALGQSKDAS-IAISLPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	594
<i>Brassica napus</i>	PSSSLGSDNHT--TISLDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	591
<i>Gossypium australe</i>	PSSALGHNKDEK-VDTIDVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	563
<i>Arabidopsis thaliana</i>	PSSALGTHKDNAN-LASIPVEELIEKADGFAGVFPEHKKYIVKRLQERKHIVGMTGDGVN	591
<i>Manihot esculenta</i>	PSSSLGQDKDAS-IAAIPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	563
<i>Malus domestica</i>	PSSALGQSKDAS-IAAIPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	563
<i>Camellia sinensis</i>	PSSSLGQSKDQS-ISSIPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	563
<i>Zea mays</i>	PSSALGQNKDAS-LEALVDELIEKADGFAGVFPEHKKYIVKRLQERKHIVGMTGDGVN	563
<i>Theobroma cacao</i>	PSSSLGQSKDEA-IAAIPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	596
<i>Sesamum indicum</i>	PSSSLGQSKDES-IAISIPVEELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	594
<i>Hevea brasiliensis</i>	PSSSLGGRDKDEY--EALVDELIEKADGFAGVFPEHKKYIVKILQERKHIVGMTGDGVN	562
<i>Glycine max</i>	PSSSLGQSKDPA-IAISIPVDELIEKADGFAGVFPEHKKYIVKRLQERKHICGMTGDGVN	563
<i>Neurospora crassa</i>	DAPSLKKADTGIAVEGS DAARSASADIVFLA PGLGAIIDALKTSRQIFHRMYAVVYVRIA	697
<i>Coffea eugenioides</i>	DAPALKKADIGIAVADATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	654
<i>Spinacia oleracea</i>	DAPALKKADIGIAVDDSTDAARSASADIVLTPGLSVIVSAVLTSTRSIFORMKNYTIYAVS	655
<i>Cucumis sativus</i>	DAPALKKADIGIAVADATDAARGASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	653
<i>Hordeum vulgare</i>	DAPALKKADIGIAVDDATDAARSASADIVLTPGLSVIVSAVLTSTRCIFORMKNYTIYAVS	623
<i>Jatropha curcas</i>	DAPALKKADIGIAVADSTDAARNADLVLTEPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	622
<i>Triticum aestivum</i>	DAPALKKADIGIAVDDATDAARSASADIVLTPGLSVIVSAVLTSTRCIFORMKNYTIYAVS	623
<i>Ananas comosus</i>	DAPALKKADIGIAVADATDAARGASADIVLTPGLSVIVSAVLTSTRCIFORMKNYTIYAVS	656
<i>Chenopodium quinoa</i>	DAPALKKADIGIAVDDSTDAARSASADIVLTPGLSVIVSAVLTSTRSIFORMKNYTIYAVS	623
<i>Carica papaya</i>	DAPALKKADIGIAVADATDAARGASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	654
<i>Ricinus communis</i>	DAPALKKADIGIAVADATDAARGASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	623
<i>Punica granatum</i>	DAPALKKADIGIAVADATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	657
<i>Nicotiana tabacum</i>	DAPALKKADIGIAVDDATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	654
<i>Brassica napus</i>	DAPALKKADIGIAVDDATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	651
<i>Gossypium australe</i>	DAPALKKADIGIAVDDATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	623
<i>Arabidopsis thaliana</i>	DAPALKKADIGIAVADATDAARGASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	651
<i>Manihot esculenta</i>	DAPALKKADIGIAVADATDAARGASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	623
<i>Malus domestica</i>	DAPALKKADIGIAVADATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	623
<i>Camellia sinensis</i>	DAPALKKADIGIAVADATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	623
<i>Zea mays</i>	DAPALKKADIGIAVADATDAARSASADIVLTPGLSVIVSAVLTSTRCIFORMKNYTIYAVS	623
<i>Theobroma cacao</i>	DAPALKKADIGIAVADATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	656
<i>Sesamum indicum</i>	DAPALKKADIGIAVADATDAARGASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	654
<i>Hevea brasiliensis</i>	DAPALKKADIGIAVADSTDAARSADLVLTEPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	622
<i>Glycine max</i>	DAPALKKADIGIAVADATDAARSASADIVLTPGLSVIVSAVLTSTRAIIFORMKNYTIYAVS	623



Table S5: continued

<i>Neurospora crassa</i>	L S I H E I F L G L W I A I L N R S L N I E L V V F I A I F A D V A T L A I A Y D N A P Y S Q K P V K W N L P K L W G	757
<i>Coffea eugenioides</i>	I T I R I V L G F L L I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P V P D S W K L K E I F A	714
<i>Spinacia oleracea</i>	I T I R I V L G F M L L C V I W K F D F S P F M L V I A I L N D G T I M T I S K D R V K P S P S P D R W N L K E I F A	715
<i>Cucumis sativus</i>	I T I R I V L G F M L I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L R E I F A	713
<i>Hordeum vulgare</i>	I T I R I V L G F L L I A I L W K F D F A P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L N E I F A	683
<i>Jatropha curcas</i>	I T I R I V L G F V L L A I L W E Y D F P F M V L I A I L N D G T I M T I S Q D R V K P S P R P D S W K L P E I F A	682
<i>Triticum aestivum</i>	I T I R I V L G F M L I A I L W K F D F A P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L N E I F A	683
<i>Ananas comosus</i>	I T I R I V L G F M L I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F A	716
<i>Chenopodium quinoa</i>	I T I R I V L G F M M L C V I W K F D F P P T M I L V I A I L N D G T I M T I S K D R V K P S P P D R W N L K E I F A	683
<i>Carica papaya</i>	I T I R I V L G F M L V A I L W K F D F A P F M V L I A I L N D G T I M T I S K D R V K P S P V P D S W K L K E I F A	714
<i>Ricinus communis</i>	I T I R I V L G F L F I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F S	683
<i>Punica granatum</i>	I T I R I V L G F L L I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P V P D S W K L N E I F A	717
<i>Nicotiana tabacum</i>	I T I R I V M G F M L I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F A	714
<i>Brassica napus</i>	I T I R I V L G F M L L C V F W E F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D C W K L K E I F A	711
<i>Gossypium australe</i>	I T I R I V L G F M L L A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P M P D S W K L K E I F A	683
<i>Arabidopsis thaliana</i>	I T I R I V F G F M L I A I L W E Y D F S P F M V L I A I L N D G T I M T I S K D R V K P S P P D S W K L K E I F A	711
<i>Manihot esculenta</i>	I T I R I V L G F M F I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F S	683
<i>Malus domestica</i>	I T I R I V L G F M F I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F A	683
<i>Camellia sinensis</i>	I T I R I V M G F M L I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P V P D S W K L K E I F A	683
<i>Zea mays</i>	I T I R I V L G F M L I A I L W Q Y D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F A	683
<i>Theobroma cacao</i>	I T I R I V M G F M L V A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P M P D S W K L N E I F A	716
<i>Sesamum indicum</i>	I T I R I V M G F M L I A I L W K F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F A	714
<i>Hevea brasiliensis</i>	I T I R I V L G F V L L A I L W E Y D F P F M V L I A I L N D G T I M T I S Q D R V K P S P R P D S W K L P E I F A	682
<i>Glycine max</i>	I T I R I V L G F M L V A I L W R F D F S P F M V L I A I L N D G T I M T I S K D R V K P S P L P D S W K L K E I F A	683
<i>Neurospora crassa</i>	M S V L L G V V L A V G T - - - W I A V T T M Y A Q G E N G - - G I - - - - - V Q N F G N M D E V L F	798
<i>Coffea eugenioides</i>	T G V V L G T Y L A V M T V V F F Y L A A D T D F F S N I F K V R S I R G H - - - - - P D E L T A A L Y	761
<i>Spinacia oleracea</i>	T G I A I G S Y L A T M T V V F Y W A A Y D T S F F A Q K F G V R D M N Q Y K H N L S A P G V E K D L K E R M A S A V Y	775
<i>Cucumis sativus</i>	T G V V L G S Y L A V M T V V F F W I A N A T D F F S D K F G V H S I R G N - - - - - D G E L T A A V Y	760
<i>Hordeum vulgare</i>	T G V V L G T Y L A L M T V V F F W I H R T D F F T N K F G V R S I R E N - - - - - E T E K M S A L Y	730
<i>Jatropha curcas</i>	T G I V I G T Y L A L I T V L F Y W V V I D T D F F E N T F N V R S L S S N - - - - - T E E V S S A V Y	729
<i>Triticum aestivum</i>	T G V V L G T Y L A L V T V V F F W I H K T D F F T N K F G V E S I R N T - - - - - E F K E M S A L Y	730
<i>Ananas comosus</i>	T G V I L G G Y L A L M T V I F F W A M K E T N F F P D K F S V R S L R D N - - - - - D H E M M A A L Y	763
<i>Chenopodium quinoa</i>	T G I V L G S Y L A T M T I V F Y W A A Y D T S F F A E K F G V R D L N Q Y K H N L S A P G V E K D L K E R M A S A I Y	743
<i>Carica papaya</i>	T G V V L G T Y M A L V T V L F F W L A H D T D F F S E K F G V R S I R E S - - - - - E E L M A A L Y	761
<i>Ricinus communis</i>	T G V V L G G Y L A L M T V I F F W A M E E T D F F S D K F G V R S L H N S - - - - - E G E M M A A L Y	730
<i>Punica granatum</i>	T G V V I G T Y L A L M S V L F F W L A H D T D F F S N V F G V R S I S H N - - - - - V D E L T A A L Y	764
<i>Nicotiana tabacum</i>	T G V V L G T Y Q A I M T V V F F Y L A A D T D F F S E N F H V R S I R S N - - - - - P E L T A A L Y	761
<i>Brassica napus</i>	T G V V L G A Y L A I M T V V F F W A A Y E T N F F P N I F D V R N F N Q H H F N M R D K A V A A N L N E Q M A S A V Y	771
<i>Gossypium australe</i>	T G I V L G T Y L A C M T V V F F W A A N S D F F S D K F G V K S I R Y S - - - - - Q D E L T A A V Y	730
<i>Arabidopsis thaliana</i>	T G V V L G G Y Q A I M T V I F F W A A H K T D F F S D T F G V R S I R D N - - - - - N H E L M G A V Y	758
<i>Manihot esculenta</i>	T G V V L G G Y L A L M T V I F F W A M N N T N F F S D K F G V R S L H G R - - - - - E H E M M A A L Y	730
<i>Malus domestica</i>	T G I V L G G Y L A L M T V I F F W L I K E T D F F S D Q F G V R S L R E T - - - - - P E E L M A A L Y	730
<i>Camellia sinensis</i>	T G I V L G T Y L A L I T V I F F W L A A D T D F F S K T F G V R S I R G H - - - - - T D E L T A A L Y	730
<i>Zea mays</i>	T G I V L G S Y L A L M T V I F F W A M H K T D F F S D K F G V R S I R D S - - - - - E H E M M S A L Y	730
<i>Theobroma cacao</i>	T G I V L G A Y M A I S V L F F W L A H D T D F F S T E K F G V R P I H D N - - - - - I D E L T S A L Y	763
<i>Sesamum indicum</i>	T G I V L G T Y M A I M T V V F F Y L A S D T D F F S D T F K V R S I R N N - - - - - F E E L T A A L Y	761
<i>Hevea brasiliensis</i>	T G I V I G T Y L A L V T V L F Y W L L I G T N F F E R T F H V R S L S S N - - - - - S E E V S S A V Y	729
<i>Glycine max</i>	T G V V L G A Y M A I I T V V F F F L V H D T D F F T R V F G V E P I V D S - - - - - E Q L N S A L Y	730
<i>Neurospora crassa</i>	L Q I S L T E N W L I F I T R A N G F W S S I P S W Q L S G A I F L V D I L A T C F T - - - I W G W F E H S D T S I V	855
<i>Coffea eugenioides</i>	L Q V S I I S Q A L I F V T R S R S W S F V E R P G L W L V T A F F I A Q L V A T F F A V Y A N W S F A R I Q G G I G W G	821
<i>Spinacia oleracea</i>	L Q V S I I S Q A L I F V T R A R G W S F T E R P G F L L V A F L I A Q L I A S I I S A E A S W Q I A G I R K I G W G	835
<i>Cucumis sativus</i>	L Q V S T V S Q A L I F V T R S R S W S F V E R P G L L L V A F F V A Q L V A T L I A V Y A N W G F A E M K G I G W G	820
<i>Hordeum vulgare</i>	L Q V S I V S Q A L I F V T R S R S W S F V E R P G F L L V I A F L L A Q L V A T L I A V Y A N W G F A R I S G I G W G	790
<i>Jatropha curcas</i>	L Q V S I I S Q A L I F V T R S Q S W S F M E R P G T L L M C A F I V A Q L V A T L I A V Y A H I S F A Y I S G I G W G	789
<i>Triticum aestivum</i>	L Q V S I V S Q A L I F V T R S R S W S F V E R P G F L L V T A F L L A Q L V A T L I A V Y A N W D F A R I K G I G W G	790
<i>Ananas comosus</i>	L Q V S I V S Q A L I F V T R S R S W S F V E R P G L L L V S A F M V A Q L V A T L I A V Y A N W G F A R I K G I G W G	823
<i>Chenopodium quinoa</i>	L Q V S I I S Q A L I F V T R A R S W S F T E R P G F L L V A F L I A Q L I A S I I S A E A N K W D L G G I R K I G W G	803
<i>Carica papaya</i>	L Q V S I I S Q A L I F V T R S R S W S Y V E R P G F L L M I A F L I A Q L L A T I I A V Y A N W G F A R I K G C G W G	821
<i>Ricinus communis</i>	L Q V S I V S Q A L I F V T R S R S W S F V E R P G L L L I G A F I A A Q L I A T V I A V Y A N W G F A R I E G C G W G	790
<i>Punica granatum</i>	L Q V S I I S Q A L I F V T R S R S W S F V E R P G L L L V G A F I A A Q L V A T V I A V Y A N W L F A R I E G I G W G	824
<i>Nicotiana tabacum</i>	L Q V S I I S Q A L I F V T R S R S W S F V E R P G L M L V G A F F A A Q L V A T V L A V Y A N W E F A R I K G V G W G	821
<i>Brassica napus</i>	L Q V S T I S Q A L I F V T R S R S W S F V E R P G F L L V I A F L I A Q L V A S V I A A M A T W F F A G I R S I G W G	831
<i>Gossypium australe</i>	L Q V S I V S Q A L I F V T R S R S W S F I E R P G L L L V A F L I A Q L V A T V L A V Y A N W G F A R I K G I G W G	790
<i>Arabidopsis thaliana</i>	L Q V S I I S Q A L I F V T R S R S W S F V E R P G A L L M I A F L I A Q L I A T L I A V Y A N W E F A R I K I R G I G W G	818
<i>Manihot esculenta</i>	L Q V S I V S Q A L I F V T R S R S W S Y V E R P G L L L V S A F I V A Q L V A T L I A V Y A N W G F A R I K G C G W G	790
<i>Malus domestica</i>	L Q V S I V S Q A L I F V T R S R S W S F S F M E R P G M L L L G A F L I A Q L I A T L I A V Y A N W S F A R I K G C G W G	790
<i>Camellia sinensis</i>	L Q V S I V S Q A L I F V T R S R S W S L I E R P G L L L V G A F L A A Q L V A T A I A V Y A N W E F A R I Q G I G W G	790
<i>Zea mays</i>	L Q V S I V S Q A L I F V T R S R S W S F V E R P G L L L V T A F L L A Q L V A T F L A V Y A N W G F A R I K G I G W G	790
<i>Theobroma cacao</i>	L Q V S I I S Q A L I F V T R S R S W S F V E R P G L L L I G A F I A A Q L V A T L I A V Y A N W G F A R I Q G I G W G	823
<i>Sesamum indicum</i>	L Q V S I I S Q A L I F V T R S R S W S F I E R P G L L L V G A F L I A Q L L A T I I A V Y A H W E F A R I R G I G W G	821
<i>Hevea brasiliensis</i>	L Q V S I I S Q A L I F V T R S Q S W S F M E R P G V L L M C A F V V A Q L V A T L I A V Y A H I S F A Y I R G I G W G	789
<i>Glycine max</i>	L Q V S I I S Q A L I F V T R S R S W S Y V E R P G I L L I T A F F A A Q L V A T V I A V Y A H W D F A R I N G V G W G	790

Table S5: continued

<i>Neurospora crassa</i>	AVVRIWIF	SFGIFCIMG	GGVY	--	YILQDSV	GFDNLMH	GKSPKGNQ	QRSLED	--	FVV	907
<i>Coffea eugenioides</i>	WG	GVIWIF	SIVTYFPLD	ILKFIIRYAL	-SGKAWDSMI	QNRTAFT	TKKDYGR	EEREQAQWAL			880
<i>Spinacia oleracea</i>	WTG	VWILYNIV	TYMFLDPLKFAVR	YAL-SGRAWHHMF	NEKTAFTD	KKSF	GKGEREA	AWAA			894
<i>Cucumis sativus</i>	WAG	VWILYISV	FYIPLDVLFAT	RYAL-SGKAWNMI	QNRTAFTS	KKDYGI	GEREAQWAA				879
<i>Hordeum vulgare</i>	WAG	VWILYISV	FYIPLDIFKFFIR	FVL-SGRAWDNLL	QNKT						830
<i>Jatropha curcas</i>	WAG	VWILYISL	FYIPLDIIKF								810
<i>Triticum aestivum</i>	WAG	VWILYISV	FYIPLDIFKFFIR	FVL-SGRAWDNLL	QNKT						830
<i>Ananas comosus</i>	WAG	VWILYISV	FYIPLDWIKFAIR	YIL-SGRAWDNLL	QNKT	AFT	TKKDYGR	EEREQAQWAL			882
<i>Chenopodium quinoa</i>	WTG	VWILYNIV	TYMFLDPLK								824
<i>Carica papaya</i>	WAG	VWILYISV	ITYIPLDVLFKFIIR	YAL-SGKAWDNLL	QNKT	AFT	TKKDYGR	GEREAQWAL			880
<i>Ricinus communis</i>	WAG	VWILYISV	TYVPLDLLKFAIR	YIL-SGKAWDNLL	ENKTAFT	TKKDYGR	EE				842
<i>Punica granatum</i>	WAG	AIWVFSI	VTYLPLDVLFKFIIR	YSL-SGKAWDNLF	QHTAFT	STKKDYGR	NEREAQWAQ				883
<i>Nicotiana tabacum</i>	WAA	VWILYIT	ITYIPLDILKFIIR	FAL-SGRAWDSMI	QNKT	AFT	TKKDYGR	GEREAQWAL			880
<i>Brassica napus</i>	WTG	VWILYNIV	TYMFLDPLKFLVR	YALISGKSWNRIVE	QRTALNG	NNFGK	DERMAAWAT				891
<i>Gossypium australe</i>	WAG	VWILYISV	FYIPLDVLFKFIIR	YAL-SGKAWDNLL	QNKT	AFT	TKKDYGR	EE			842
<i>Arabidopsis thaliana</i>	WAG	VWILYISV	ITYFPLDVLFKFIIR	YIL-SGKAWLNLF	ENKTAFT	MKKDYGR	EEREQAQWAL				877
<i>Manihot esculenta</i>	WAG	VWILYISL	TYVPLDLLKFAIR	YVL-SGKAWDNLL	ENKTAFT	TKKDYGR	EE				842
<i>Malus domestica</i>	WAG	VWILYISV	FYIPLDLMKFAIR	YIL-SGKAWLNLL	ENKTAFT	TKKDYGR	EE				842
<i>Camellia sinensis</i>	WAG	AIWVFSV	VTYFPLDVLFKFIIR	YAL-SGKAWDNMI	EDKATFT	NKDY					839
<i>Zea mays</i>	WAG	VWILYISV	FYIPLDILKFIIR	FVL-SGRAWDNLL	ENKTAFT	TKKDYGR	EE				842
<i>Theobroma cacao</i>	WAG	VWILYISL	ITYIPLDVLFKFIIR	YSL-SGKAWDNLL	QNKT	AFT	TKKDYGR	GEREAQWAA			882
<i>Sesamum indicum</i>	WG	GVIWILYISV	ITYIPLDVLFKFIIR	FAL-SGKAWDSMI	QNRTAFT	TKKDYGR	GEREAQWAM				880
<i>Hevea brasiliensis</i>	WAG	VWILYISL	FYIPLDIIKF								810
<i>Glycine max</i>	WAG	AIWVFSI	VTYIPLDILKFLIR	MGL-SGKAWDNML	DNKTAFT	TKKDYGR	GEREAQWAV				849
<i>Neurospora crassa</i>	SL	--	QRVS								920
<i>Coffea eugenioides</i>	AQRT	TLHG	LQTPES	-AGLFND	-KHYREL	SEIAEQAKRR	AEVARL	RELH	TLKG	HVESVVKLK	938
<i>Spinacia oleracea</i>	DRW	TERGG	GNSEDMR	GLFS	DRHS	FREL	NSMAEEARRR	ADIARL	REEQ	SGRSQDKFPQPSN	953
<i>Cucumis sativus</i>	AQRT	TLHG	LQPPET	-SELFND	ATNYREL	SEIAEQAKRR	AEVARL	RELH	TLKG	HVESVVKLK	938
<i>Hordeum vulgare</i>											830
<i>Jatropha curcas</i>											810
<i>Triticum aestivum</i>											830
<i>Ananas comosus</i>	AQRT	TLHG	LQPPET	-STLFSD	DKSSYREL	SEIAEQAKRR	AEVARL	RELH	TLKG	HVESVVKLK	941
<i>Chenopodium quinoa</i>											824
<i>Carica papaya</i>	AQRT	TLHG	LQPPET	-ALFNDK	-NSYREL	SEIAEQAKRR	AEVARL	RELH	TLKG	HVESVVKLK	938
<i>Ricinus communis</i>											842
<i>Punica granatum</i>	AQRT	TLHG	LKHHA	--DALFQD	-KNYREL	SELADQAKRR	AEAKMTTQA				926
<i>Nicotiana tabacum</i>	AQRT	TLHG	LQTPEN	-TGLFND	-KNYREL	SEIAEQAKRR	AEVARL	RELH	TLKG	HVESVVKLK	938
<i>Brassica napus</i>	EMR	TLHG	LETGQK	--PHYER	NGATELS	SLAD					920
<i>Gossypium australe</i>											842
<i>Arabidopsis thaliana</i>	AQRT	TLHG	LQPK	EA-VNIF	PEKGSYREL	SEIAEQAKRR	AEIARL	RELH	TLKG	HVESVVKLK	936
<i>Manihot esculenta</i>											842
<i>Malus domestica</i>											842
<i>Camellia sinensis</i>											839
<i>Zea mays</i>											842
<i>Theobroma cacao</i>	AQRT	TLHG	LSPPET	-IL--ND	-KSYHEL	SEIAEQAKRR	AEVARL	RELH	TLKG	HVESVVKLK	938
<i>Sesamum indicum</i>	AQRT	TLHG	LSTTET	-PG--NE	-NSYKEL	SEIAEQAKRR	AEVARL	RELH	TLKG	HVESVVKLK	936
<i>Hevea brasiliensis</i>											810
<i>Glycine max</i>	AQRT	TLHG	LQVGES	-NKAKQ	--HEQSE						872
<i>Neurospora crassa</i>											920
<i>Coffea eugenioides</i>	GLD	IE	TI	QQHY	TV						951
<i>Spinacia oleracea</i>											953
<i>Cucumis sativus</i>	GLD	IE	TI	QQHY	TV						951
<i>Hordeum vulgare</i>											830
<i>Jatropha curcas</i>											810
<i>Triticum aestivum</i>											830
<i>Ananas comosus</i>	GLD	ID	TI	QQHY	TV						954
<i>Chenopodium quinoa</i>											824
<i>Carica papaya</i>	GLD	IE	TI	QQHY	TV						951
<i>Ricinus communis</i>											842
<i>Punica granatum</i>											926
<i>Nicotiana tabacum</i>	GLD	IE	TI	QQHY	TV						951
<i>Brassica napus</i>											920
<i>Gossypium australe</i>											842
<i>Arabidopsis thaliana</i>	GLD	IE	TI	QQHY	TV						948
<i>Manihot esculenta</i>											842
<i>Malus domestica</i>											842
<i>Camellia sinensis</i>											839
<i>Zea mays</i>											842
<i>Theobroma cacao</i>	GLD	ID	TI	QQHY	TV						951
<i>Sesamum indicum</i>	GLD	IE	TI	QQHY	TV						949
<i>Hevea brasiliensis</i>											810
<i>Glycine max</i>											872

**Table S6. Lipid composition used in the coarse-grained molecular dynamics simulations.**

<b>Lipid name</b>		<b>Head group</b>	<b>Tail</b>	<b>Net charge</b>	<b>Content in inner leaflet (%)</b>	<b>Content in outer leaflet (%)</b>
PIPC		Phosphatidylcholine	C16:0/18:2	0	11	28
DIPC		Phosphatidylcholine	di-C16:2-C18:2	0	5	14
PIPE		Phosphatidylethanolamine	C16:0/18:2	0	8	13
DIPE		Phosphatidylethanolamine	di-C16:2-C18:2	0	4	7
PIPA		Phosphatidic acid	C16:0/18:2	-2	11	11
DIPA		Phosphatidic acid	di-C16:2-C18:2	-2	5	5
PIPS		Phosphatidylserine	C16:0/18:2	-1	17	0
DIPS		Phosphatidylserine	di-C16:2-C18:2	-1	9	0
PIPI		Phosphatidylinositol	C16:0/18:2	-1	8	0
XNSM		Sphingomyelin	C(d24:1/24:1)	0	2	2
PVSM		Sphingomyelin	C(d18:1/18:1)	0	4	4
DPCE		Ceramide	C(d18:1/18:0)	0	3	3
PNCE		Ceramide	C(d18:1/24:1)	0	8	8
ERGO		Ergosterol	–	0	5	5