Supplemental data for EMBO reports paper:

Genome-wide analysis of mRNAs targeted to yeast mitochondria

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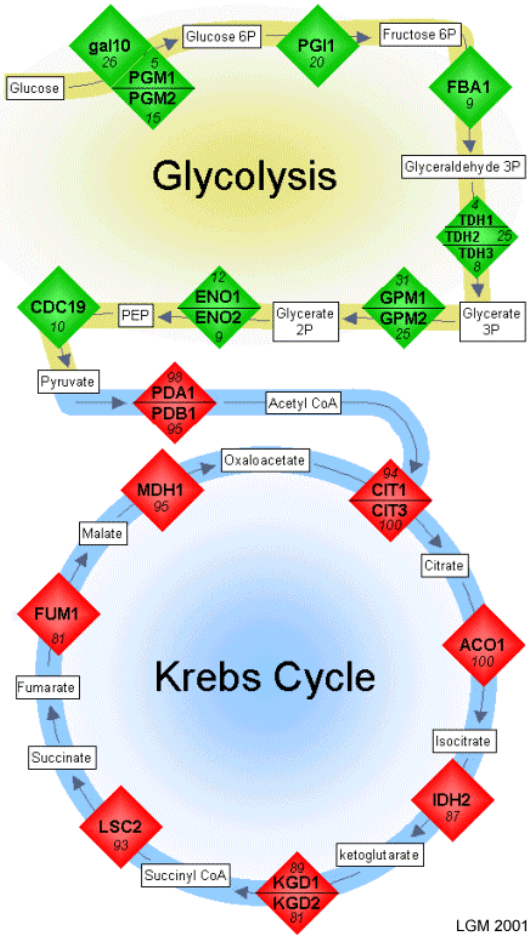
Search interface and additional information are also available in website companion at
http://www.biologie.ens.fr/fr/genetiqu/puces/publications/mitoloc/

Supplemental information available in this document :

Last updated november 27th 2001

Supplemental figure 6:

The asymmetric localisation of mRNAs is connected with biochemical functions.



The red and green colours reflect respectively mRNA associated with mitochondrion-bound polysomes (MLR>80) or free polysomes (MLR<30). The enzymes of the glycolytic pathway are translated from free cytosolic polysomes whereas the enzymes of the TCA cycle, which are into mitochondria, are translated from mitochondrion-bound polysomes . Other cases of mitochondrial functions have more composite MLR values in agreement with their dual, prokaryotic and eukaryotic origin .

Polysome purification

Buffers and media

'galactose rich' Media

- Bactopeptone 1% (50g) (10g/l)
- Yeast exctract 1% (50g) (10g/l)
- galactose 2% (100g) (20g/l)
- KH_2PO_4 0,1% (5g) (1g/l)
- $(NH_4)_2SO_4$ 0,12% (6g) (1,2g/l)

Spheroblasts regeneration buffer: same as 'galactose rich' but with 1M sorbitol

Spheroplasts wash buffer: same as 'galactose rich' but w/o galactose and with 1M sorbitol

Polysomes buffer (1l):

- 0,6M mannitol (110g)
- 30 mM TrisHCl pH7,6 (30 mL de 1M)
- 5 mM MgAc (0,8-0,9g)
- 100 mM KCl (7,4g)

After autoclaving, just before use:

- 5 mM de β-mercaptoéthanol
- 200 µg/mL de cycloheximide
- 500 µg/mL d'héparine
- proteases inhibitor

Sorbitol-cycloheximide ice cubes (1M sorbitol+ 200µg/ml cycloheximide): Store at –20°C. Prepare half regeneration buffer volume.

Day 1

1. Grow cells in Galactose rich medium in order to be in log phase when you start purification. We usually start from 5x1 litres of culture.

Day 2

1. Harvest cells and wash twice in 0.15M NaCl

2. Resuspend cells in 2.5 mM DTT, 50 mM Tris HCl pH 9.3. Incubate 20 min at 28°C with shaking.

1. Dilute cells 4 x with 1.35M sorbitol and centrifuge to harvest.

2. Wash cells once with 1,35M sorbitol et 20mM KH_2PO_4 and centrifuge.

3. Weight cells. Dilute cells in 1.35M sorbitol and 20 mM KH_2PO_4. (OD about 0.6-0.7). Add 1000 units/g of cells of zymolyase. Incubate cells about 2h at 28°C with shaking. This step should turn most cells into spheroplasts.

4. Wash once with 'spheroplasts wash buffer'.

5. Regeneration step: Resuspend cells with regeneration buffer. Incubate 3h at 28°C with shaking.

6. Add 300 μg/mL cycloheximide and incubate 10 more minutes at 28°C with shaking.

7. Add sorbitol-cycloheximide ice-cubes.

From here, every step is performed at 0°C.

8. Harvest spheroplasts and wash twice with 1M sorbitol + 200 μg/mL cycloheximide.

9. Add 10 mL 'mannitol-polysome' buffer to the pellet and break cells with potter. Centrifuge 5000 rpm/10 min. Harvest supernatant. Repeat this step once. Centrifuge again and harvest supernatant to eliminate broken cells and nuclei. Supernatant is centrifuged (15000 rpm, 30 min) to harvest mitochondria (red/brown pellet) and cytoplasm (yellow supernatant).

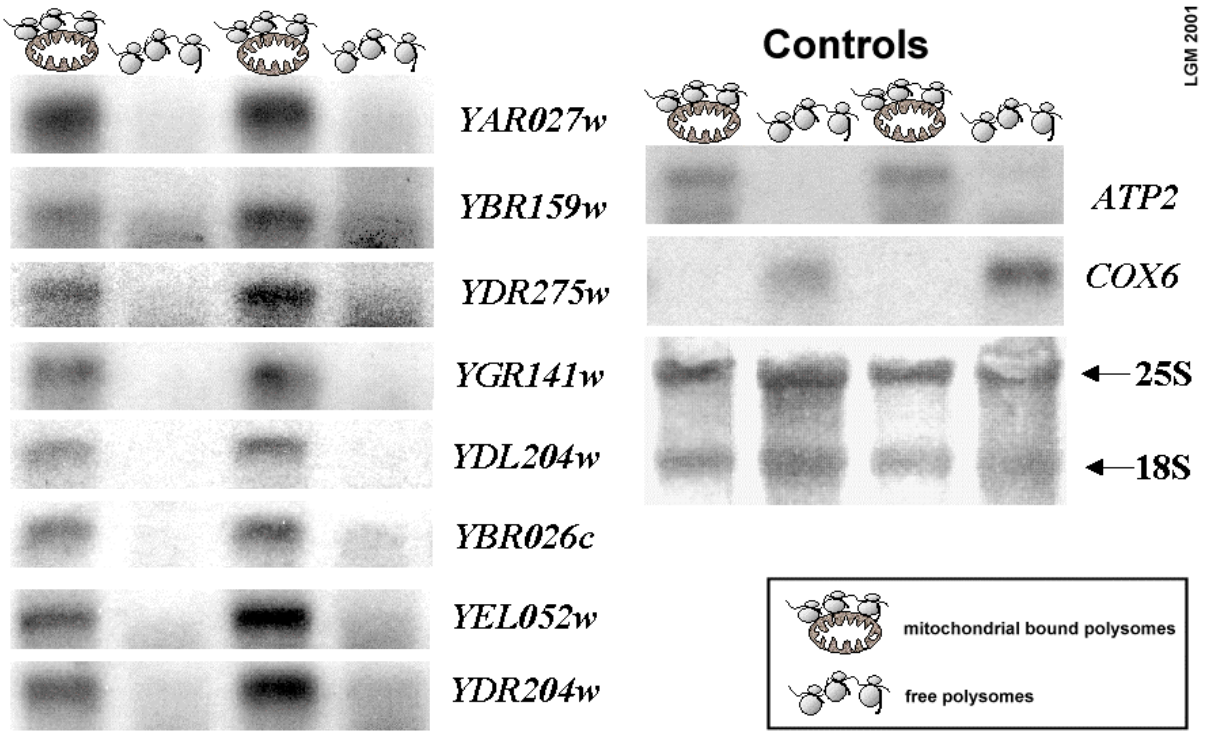
10. The free polysomes fraction is loaded onto a sucrose gradient (in the buffer Mannitol-polysomes + héparine + cycloheximide + β-mercaptoéthanol) : 3,77 mL of 2M sucrose + 1,1 mL of 0,5M sucrose. Then, free polysomes are spun down by centrifugation at 185000 g for at least 18h at 4°C.

Day 3

1. Dry free polysome pellet.
2. Next step: RNA extraction

fractionation test

ATP2 & COX6 northern blots and Northern blot analysis with probes corresponding to uncharacterized ORFs tested in green RNA.



Complete dataset

Complete dataset is available at:
http://www.biologie.ens.fr/fr/genetiqu/puces/publications/mitoloc/download.html
details of the result file(tabulated text):

- *orf, gene, process, function, sgdid* from SGD (version september 11th 2001)
- *MLR*: localisation indice, see article for details
- *measured*: number of experiments that gave a significant signal for this ORF
- *std_dev*: standard deviation observed across measured classe
- *purif1* -> *purif6* : classe affected to the gene (from 1 to 101) for each experiment (cf article for details)

List of the 467 ORFs found to have a MLR>80 in this study

A database containing the whole dataset is available at: http://www.biologie.ens.fr/fr/genetiqu/puces/publications/mitoloc/publimito.php

ORF name	Gene name	MLR	process (SGD11 september 2001)	function (SGD11 september 2001)
YLR304C	ACO1	100	tricarboxylic acid cycle*	aconitate hydratase
YPR001W	CIT3	99.5	tricarboxylic acid cycle*	citrate (SI)-synthase
YOL084W	PHM7	99.5	biological_process unknown	molecular_function unknown
YNL071W	LAT1	99.5		dihydrolipoamide S-acetyltransferase
YJL225C		99	biological_process unknown	molecular_function unknown
YGL228W	SHE10	98.7	biological_process unknown	
YDL066W	IDP1	98.7	glutamate biosynthesis*	isocitrate dehydrogenase (NADP+)
YBL099W	ATP1	98.7	ATP synthesis coupled proton transport	hydrogen-transporting two-sector ATPase
YDL204W		98.5	biological_process unknown	molecular_function unknown
YDR033W	MRH1	98.3	biological_process unknown	molecular_function unknown
YML128C	MSC1	98.2	biological_process unknown	molecular_function unknown
YJR121W	ATP2	98.2	ATP synthesis coupled proton transport	hydrogen-transporting two-sector ATPase
YML132W	COS3	98	biological_process unknown	molecular_function unknown
YDR497C	ITR1	98	transport	
YDR176W	NGG1	98		
YCR016W		98	biological_process unknown	molecular_function unknown
YBR054W	YRO2	98	biological_process unknown	
YHR092C	HXT4	97.8	transport	
YOR108W		97.5	biological_process unknown	molecular_function unknown
YGR282C	BGL2	97.5	cell wall organization and biogenesis	glucan 1,3-beta-glucosidase
YBR286W	APE3	97.5	vacuolar protein degradation	aminopeptidase
YBR221C	PDB1	97.5		pyruvate dehydrogenase (lipoamide)
YNL160W	YGP1	97.2	stress response*	molecular_function unknown
YML110C	COQ5	97.2	ubiquinone metabolism	
YHR139C	SPS100	97.2		
YHR096C	HXT5	97.2	transport	
YPR149W	NCE102	97		molecular_function unknown
YPL187W	MF(ALPHA)1	97	pheromone response	pheromone
YMR297W	PRC1	97		carboxypeptidase C
YLR390W-A	CCW14	97	biological_process unknown	cell wall structural protein
YLR081W	GAL2	97	galactose metabolism*	galactose transporter
YJL089W	SIP4	97		transcription factor
YBR026C	MRF1'	97	respiration	DNA binding
YAL023C	PMT2	97	O-linked glycosylation	dolichyl-phosphate-mannose--protein
YPL154C	PEP4	96.8		saccharopepsin
YBL045C	COR1	96.8		ubiquinol-cytochrome-c reductase
YDR452W	PHM5	96.7		
YDR077W	SED1	96.7	cell wall organization and biogenesis	cell wall structural protein
YOR374W	ALD4	96.2	ethanol metabolism	aldehyde dehydrogenase (NAD+)
YPL057C	SUR1	96	mannose-inositol-P-ceramide (MIPC) metabolism	

YML120C	NDI1	96	complex I (NADH to ubiquinone)	
YKL046C		96	biological_process unknown	molecular_function unknown
YJL045W		96		
YIL164C	NIT1	96	biological_process unknown	nitrilase
YGL160W		96	biological_process unknown	molecular_function unknown
YGL027C	CWH41	96	cell wall organization and biogenesis	mannosyl-oligosaccharide glucosidase (processing A-
YDR245W	MNN10	96	actin filament organization*	alpha-1,6-mannosyltransferase
YDL128W	VCX1	96	transport	
YCL045C		96	biological_process unknown	molecular_function unknown
YDR483W	KRE2	95.5	O-linked glycosylation*	alpha-1,2-mannosyltransferase
YCL043C	PDI1	95.5		protein disulfide isomerase
YDL218W		95.4	biological_process unknown	molecular_function unknown
YDR040C	ENA1	95.3	transport	
YKL085W	MDH1	95.2	tricarboxylic acid cycle*	malic enzyme
YDR345C	HXT3	95.2	transport	
YOL119C		95	biological_process unknown	molecular_function unknown
YKL150W	MCR1	95		cytochrome b5 reductase
YKL107W		95	biological_process unknown	molecular_function unknown
YJL214W	HXT8	95	transport	
YIL039W		95	biological_process unknown	molecular_function unknown
YGR286C	BIO2	95		biotin synthase
YGR191W	HIP1	95	transport	
YER178W	PDA1	95		pyruvate dehydrogenase (lipoamide)
YEL023C		95	biological_process unknown	molecular_function unknown
YDR194C	MSS116	95	RNA splicing	RNA helicase
YDL035C	GPR1	95	pseudohyphal growth*	G-protein coupled receptor
YBR039W	ATP3	95	ATP synthesis coupled proton transport	hydrogen-transporting two-sector ATPase
YLL041C	SDH2	94.8	tricarboxylic acid cycle*	succinate dehydrogenase
YKR013W	PRY2	94.8	biological_process unknown	molecular_function unknown
YNL194C		94.7	biological_process unknown	molecular_function unknown
YNL115C		94.7	biological_process unknown	molecular_function unknown
YJL219W	HXT9	94.7	transport	
YHR094C	HXT1	94.5	transport	
YGR296W	YRF1-3	94.5	biological_process unknown	
YDR039C	ENA2	94.5	transport	
YPR204W		94.3	biological_process unknown	DNA helicase
YEL077C		94.3	biological_process unknown	molecular_function unknown
YDR481C	PHO8	94.3		alkaline phosphatase
YOR161C		94.2	biological_process unknown	molecular_function unknown
YKR066C	CCP1	94.2		cytochrome c peroxidase
YPR030W	CSR2	94	cell wall organization and biogenesis	molecular_function unknown
YOR187W	TUF1	94		
YOL156W	HXT11	94	transport	

YOL083W		94	biological_process unknown	molecular_function unknown
YNR001C	CIT1	94	tricarboxylic acid cycle*	citrate (SI)-synthase
YLR120C	YPS1	94		
YKL133C		94	biological_process unknown	molecular_function unknown
YGR284C	ERV29	94		molecular_function unknown
YFL067W		94	biological_process unknown	molecular_function unknown
YER086W	ILV1	94		threonine dehydratase
YBR096W		94	biological_process unknown	molecular_function unknown
YBL112C		94	biological_process unknown	molecular_function unknown
YBR027C		94	biological_process unknown	molecular_function unknown
YAR062W		94	biological_process unknown	molecular_function unknown
YHR140W		93.8	biological_process unknown	molecular_function unknown
YHL050C		93.8	biological_process unknown	molecular_function unknown
YDR342C	HXT7	93.8	transport	
YIL162W	SUC2	93.5	sucrose catabolism	beta-fructofuranosidase
YDR536W	STL1	93.3	transport	
YDR055W	PST1	93.2	biological_process unknown	molecular_function unknown
YDR019C	GCV1	93.2		aminomethyltransferase
YLR250W	SSP120	93		molecular_function unknown
YLR203C	MSS51	93	protein biosynthesis*	molecular_function unknown
YLL066C		93	biological_process unknown	molecular_function unknown
YKL217W	JEN1	93	transport	lactate transporter
YKL077W		93	biological_process unknown	molecular_function unknown
YJR120W		93	biological_process unknown	molecular_function unknown
YHR039C-A	VMA10	93	vacuolar acidification	hydrogen-transporting two-sector ATPase
YDR307W		93	biological_process unknown	molecular_function unknown
YDR262W		93	biological_process unknown	molecular_function unknown
YDR007W	TRP1	93	amino acid metabolism	phosphoribosylanthranilate isomerase
YDL046W		93	biological_process unknown	molecular_function unknown
YBL101C	ECM21	93		molecular_function unknown
YGR244C	LSC2	92.8	tricarboxylic acid cycle*	succinate--CoA ligase (ADP-forming)
YBR241C		92.8	biological_process unknown	molecular_function unknown
YAR027W		92.8	biological_process unknown	molecular_function unknown
YGR279C	SCW4	92.6		
YBR068C	BAP2	92.6	transport	
YNL192W	CHS1	92.5	cytokinesis	chitin synthase
YMR191W		92.5	biological_process unknown	molecular_function unknown
YJL002C	OST1	92.5	N-linked glycosylation	dolichyl-diphosphooligosaccharide-protein
YFL056C	AAD6	92.5	biological_process unknown	molecular_function unknown
YBR263W	SHM1	92.5		glycine hydroxymethyltransferase
YGL055W	OLE1	92.4	mitochondrion inheritance*	stearoyl-CoA desaturase
YDL222C		92.3	biological_process unknown	molecular_function unknown
YFL068W		92.2	biological_process unknown	molecular_function unknown

YCR021C	HSP30	92.2	stress response*	heat shock protein
YOR356W		92		
YOR316C	COT1	92	zinc ion transport*	di-, tri-valent inorganic cation transporter*
YMR200W	ROT1	92		molecular function unknown
YLL067C		92	biological process unknown	molecular function unknown
YKL195W		92	biological process unknown	molecular function unknown
YJL163C		92	biological process unknown	molecular function unknown
YIR044C		92	biological process unknown	molecular function unknown
YHR099W	TRA1	92	biological process unknown	molecular function unknown
YDL174C	DLD1	92	carbohydrate metabolism*	D-lactate dehydrogenase (cytochrome)
YBR036C	CSG2	92	sphingolipid metabolism	
YIL170W	HXT12	91.8	transport	
YLR466W	YRF1-4	91.7	biological process unknown	
YJR117W	STE24	91.7		
YJL160C		91.7	biological process unknown	molecular function unknown
YGL008C	PMA1	91.7		
YER141W	COX15	91.7	cytochrome c oxidase biogenesis	molecular function unknown
YDR038C	ENA5	91.6	transport	
YGR055W	MUP1	91.5	sulfur amino acid transport	L-methionine porter
YBR207W	FTH1	91.5	biological process unknown	molecular function unknown
YIL171W	HXT12	91.3		
YPL053C	KTR6	91	cell wall organization and biogenesis*	mannosylphosphate transferase
YOR245C	DGA1	91	biological process unknown	molecular function unknown
YOR023C	AHC1	91	nucleosome disassembly	molecular function unknown
YNL104C	LEU4	91		2-isopropylmalate synthase
YNL009W	IDP3	91	fatty acid beta-oxidation*	isocitrate dehydrogenase (NADP+)
YMR008C	PLB1	91		lysophospholipase
YJR080C		91	biological process unknown	molecular function unknown
YIL046W	MET30	91	ubiquitin-dependent protein degradation*	ubiquitin--protein ligase*
YGR149W		91	biological process unknown	molecular function unknown
YER060W-A	FCY22	91	transport	
YDR221W		91	biological process unknown	molecular function unknown
YDR273W		91	biological process unknown	molecular function unknown
YDR123C	INO2	91	phospholipid biosynthesis	transcription factor
YDL178W	DLD2	91	biological process unknown	D-lactate dehydrogenase (cytochrome)
YCR068W	CVT17	91		molecular function unknown
YBR007C		91	biological process unknown	molecular function unknown
YDR233C		90.8	biological process unknown	molecular function unknown
YCL064C	CHA1	90.8		threonine dehydratase
YMR272C	SCS7	90.7	fatty acid metabolism	
YMR011W	HXT2	90.7	transport	
YHR028C	DAP2	90.7		
YGR231C	PHB2	90.7	proteolysis and peptidolysis*	molecular function unknown

YDR545W	YRF1-1	90.7	biological_process unknown	
YOR099W	KTR1	90.5	O-linked glycosylation*	alpha-1,2-mannosyltransferase
YGR157W	CHO2	90.5	phosphatidylcholine biosynthesis	methylene-fatty-acyl-phospholipid synthase
YDR284C	DPP1	90.5	phospholipid metabolism	
YDL095W	PMT1	90.5	O-linked glycosylation	dolichyl-phosphate-mannose--protein
YJL172W	CPS1	90.3		gly-X carboxypeptidase
YGR032W	GSC2	90.3	cell wall organization and biogenesis*	1,3-beta-glucan synthase
YDR294C	DPL1	90.3	phospholipid metabolism	
YCL049C		90.3	biological_process unknown	molecular_function unknown
YLR089C		90.2		
YPR026W	ATH1	90	stress response*	alpha,alpha-trehalase
YNL121C	TOM70	90	mitochondrial translocation	protein transporter
YMR044W	IOC4	90	biological_process unknown	molecular_function unknown
YLR259C	HSP60	90	protein folding*	heat shock protein*
YLR108C		90	biological_process unknown	molecular_function unknown
YJL222W	VTH2	90		molecular_function unknown
YIL042C		90	biological_process unknown	molecular_function unknown
YGL255W	ZRT1	90	high-affinity zinc ion transport	high affinity zinc uptake transporter
YGL167C	PMR1	90	transport	
YDR264C	AKR1	90	endocytosis*	molecular_function unknown
YDR109C		90	biological_process unknown	molecular_function unknown
YNL322C	KRE1	89.8		
YGR106C		89.8	biological_process unknown	molecular_function unknown
YHR007C	ERG11	89.7	ergosterol biosynthesis	lanosterol 14-alpha-demethylase
YFL018C	LPD1	89.7	serine biosynthesis*	dihydrolipoamide dehydrogenase
YCL017C	NFS1	89.7		molecular_function unknown
YBL022C	PIM1	89.7	heat shock response*	ATP-dependent peptidase
YLR378C	SEC61	89.5	SRP-dependent, co-translational membrane targeting,	transporter
YDL070W	BDF2	89.5	biological_process unknown	molecular_function unknown
YBL113C		89.5	biological_process unknown	molecular_function unknown
YIL155C	GUT2	89.4	carbohydrate metabolism	glycerol-3-phosphate dehydrogenase
YIL125W	KGD1	89.4	tricarboxylic acid cycle*	oxoglutarate dehydrogenase (lipoamide)
YPL222W		89.3	biological_process unknown	molecular_function unknown
YIL047C	SYG1	89.3	signal transduction	molecular_function unknown
YAR031W	PRM9	89.3	mating (sensu Saccharomyces)	molecular_function unknown
YFR044C		89.2	biological_process unknown	molecular_function unknown
YDR204W	COQ4	89.2	ubiquinone metabolism	
YOR317W	FAA1	89		long-chain-fatty-acid-CoA-ligase
YOL027C		89	biological_process unknown	molecular_function unknown
YMR243C	ZRC1	89	zinc ion transport*	di-, tri-valent inorganic cation transporter*
YML054C	CYB2	89		L-lactate dehydrogenase (cytochrome)
YLR023C		89	biological_process unknown	molecular_function unknown
YKL175W	ZRT3	89	zinc ion transport*	zinc ion transporter

YIL138C	TPM2	89	establishment of cell polarity (sensu Saccharomyces)*	actin lateral binding
YIL030C	SSM4	89	mRNA polyadenylation	molecular_function unknown
YGL139W		89	biological_process unknown	molecular_function unknown
YGL051W		89	biological_process unknown	molecular_function unknown
YER060W	FCY21	89	transport	
YEL002C	WBP1	89		dolichyl-diphosphooligosaccharide-protein
YBR165W	UBS1	89		
YNL190W		88.8	biological_process unknown	molecular_function unknown
YHR219W		88.8	biological_process unknown	molecular_function unknown
YER150W	SPI1	88.8	biological_process unknown	molecular_function unknown
YDR343C	HXT6	88.8	transport	
YBR014C		88.8	biological_process unknown	molecular_function unknown
YNL195C		88.7	biological_process unknown	molecular_function unknown
YLR356W		88.7	biological_process unknown	molecular_function unknown
YFL041W	FET5	88.7	iron transport	multicopper ferroxidase iron transport mediator
YIL136W	OM45	88.6		
YPR156C		88.5	biological_process unknown	
YHL048W	COS8	88.5	biological_process unknown	molecular_function unknown
YDR062W	LCB2	88.5		serine C-palmitoyltransferase
YOL030W		88.3	biological_process unknown	molecular_function unknown
YDR256C	CTA1	88.3	oxygen and radical metabolism	catalase
YBL015W	ACH1	88.3	acetate metabolism*	acetyl-CoA hydrolase
YPL078C	ATP4	88.2	ATP synthesis coupled proton transport	hydrogen-transporting two-sector ATPase
YPL036W	PMA2	88.2		
YPL176C		88	biological_process unknown	molecular_function unknown
YOL048C		88	biological_process unknown	molecular_function unknown
YMR015C	ERG5	88	ergosterol biosynthesis	C-22 sterol desaturase
YIL090W		88	biological_process unknown	molecular_function unknown
YHR133C		88	biological_process unknown	molecular_function unknown
YGR089W		88	biological_process unknown	molecular_function unknown
YGL203C	KEX1	88		carboxypeptidase D
YGL022W	STT3	88	protein glycosylation	
YDR041W	RSM10	88		
YDL212W	SHR3	88		
YCL038C	AUT4	88	autophagy*	molecular_function unknown
YBR205W	KTR3	88	cell wall organization and biogenesis*	mannosyltransferase
YBR159W		88	biological_process unknown	molecular_function unknown
YBR046C	ZTA1	88	biological_process unknown	molecular_function unknown
YKL148C	SDH1	87.8	tricarboxylic acid cycle*	succinate dehydrogenase
YBR086C	IST2	87.8	biological_process unknown	molecular_function unknown
YGR033C		87.5	biological_process unknown	molecular_function unknown
YFL011W	HXT10	87.4	transport	
YDL245C	HXT15	87.4	transport	

YCL009C	ILV6	87.4		acetolactate synthase
YMR302C	PRP12	87.3	rRNA processing*	exonuclease
YOR221C	MCT1	87	fatty acid metabolism	
YOR136W	IDH2	87	tricarboxylic acid cycle*	isocitrate dehydrogenase (NAD+)
YOR008C	SLG1	87	establishment of cell polarity (sensu Saccharomyces)*	molecular_function unknown
YOL073C		87	biological_process unknown	molecular_function unknown
YNL333W	SNZ2	87	biological_process unknown	molecular_function unknown
YNL130C	CPT1	87	phosphatidylcholine biosynthesis	diacylglycerol cholinephosphotransferase
YML100W	TSL1	87		alpha,alpha-trehalose-phosphate synthase (UDP-
YML048W	GSF2	87		molecular_function unknown
YIL088C		87	biological_process unknown	molecular_function unknown
YHR042W	NCP1	87		NADPH--ferrihemoprotein reductase
YGL114W		87	biological_process unknown	molecular_function unknown
YEL042W	GDA1	87		guanosine-diphosphatase
YDR503C	LPP1	87	phospholipid metabolism	
YDR456W	NHX1	87	vacuolar acidification*	monovalent inorganic cation transporter
YDR116C		87	biological_process unknown	molecular_function unknown
YDL045C	FAD1	87		FMN adenylyltransferase
YCR034W	FEN1	87	fatty acid biosynthesis*	molecular_function unknown
YBR078W	ECM33	87		molecular_function unknown
YAL030W	SNC1	87	endocytosis*	v-SNARE
YKL164C	PIR1	86.8	cell wall organization and biogenesis	cell wall structural protein
YJL159W	HSP150	86.8	cell wall organization and biogenesis	cell wall structural protein
YBR139W		86.8	biological_process unknown	molecular_function unknown
YFL062W	COS4	86.5	biological_process unknown	molecular_function unknown
YCR069W	CPR4	86.5	stress response	peptidylprolyl isomerase
YBL100C		86.5	biological_process unknown	molecular_function unknown
YLR151C	PCD1	86.3	biological_process unknown	
YLR056W	ERG3	86.3	ergosterol biosynthesis	C-5 sterol desaturase
YBR283C	SSH1	86.2	co-translational membrane targeting	protein transporter
YMR307W	GAS1	86	biological_process unknown	
YML039W		86		
YLR251W		86	biological_process unknown	molecular_function unknown
YKL151C		86	biological_process unknown	molecular_function unknown
YKL178C	STE3	86	signal transduction of mating signal (sensu	mating-type a-factor pheromone receptor
YKL034W		86	biological_process unknown	molecular_function unknown
YJL174W	KRE9	86	cell wall organization and biogenesis*	molecular_function unknown
YHL021C		86	biological_process unknown	molecular_function unknown
YGR141W		86	biological_process unknown	molecular_function unknown
YGR143W	SKN1	86		
YGL168W		86	biological_process unknown	molecular_function unknown
YEL052W	AFG1	86	biological_process unknown	adenosinetriphosphatase
YDR331W	GPI8	86		

YBR220C		86	biological_process unknown	molecular_function unknown
YBR092C	PHO3	86	thiamin transport	acid phosphatase
YDR508C	GNP1	85.8	transport	
YBL111C		85.8	biological_process unknown	molecular_function unknown
YBL064C		85.8	biological_process unknown	molecular_function unknown
YLL023C		85.5	biological_process unknown	molecular_function unknown
YGR224W	AZR1	85.5	transport	transporter
YBR296C	PHO89	85.5	phosphate metabolism	
YLR312C		85.3	biological_process unknown	molecular_function unknown
YEL021W	URA3	85.3		orotidine-5'-phosphate decarboxylase
YDR329C	PEX3	85.3	protein-peroxisome targeting*	molecular_function unknown
YDL010W		85.3	biological_process unknown	molecular_function unknown
YHR199C		85.2	biological_process unknown	molecular_function unknown
YHR218W		85.2	biological_process unknown	molecular_function unknown
YEL001C		85.2	biological_process unknown	molecular_function unknown
YOR196C	LIP5	85	fatty acid metabolism	
YMR319C	FET4	85	low affinity iron transport	iron transporter
YMR290C	HAS1	85	biological_process unknown	RNA helicase
YML091C	RPM2	85		ribonuclease P
YLR414C		85	biological_process unknown	molecular_function unknown
YLR311C		85	biological_process unknown	molecular_function unknown
YJR051W	OSM1	85	metabolism	fumarate reductase (NADH)
YJL117W	PHO86	85	transport	
YHR100C		85	biological_process unknown	molecular_function unknown
YGR125W		85	biological_process unknown	molecular_function unknown
YGR031W		85	biological_process unknown	molecular_function unknown
YGL200C	EMP24	85	vesicle organization and biogenesis	molecular_function unknown
YEL043W		85	biological_process unknown	molecular_function unknown
YDR100W		85	biological_process unknown	molecular_function unknown
YDL027C		85	biological_process unknown	molecular_function unknown
YCR005C	CIT2	85	glutamate biosynthesis*	citrate (SI)-synthase
YCL052C	PBN1	85		
YBR280C		85	biological_process unknown	molecular_function unknown
YAL007C	ERP2	85		molecular_function unknown
YAL022C	FUN26	85	biological_process unknown	molecular_function unknown
YNL305C		84.5	biological_process unknown	molecular_function unknown
YDR182W	CDC1	84.5	mating (sensu Saccharomyces)*	molecular_function unknown
YDR057W		84.5	biological_process unknown	molecular_function unknown
YBR023C	CHS3	84.5	cytokinesis*	chitin synthase
YFL066C		84.4	biological_process unknown	molecular_function unknown
YOL016C	CMK2	84.3	protein phosphorylation*	calcium/calmodulin-dependent protein kinase
YDR275W		84.2	biological_process unknown	molecular_function unknown
YPL101W	TOT7	84	biological_process unknown	molecular_function unknown

YOL096C	COQ3	84	ubiquinone metabolism	hexaprenyldihydroxybenzoate methyltransferase
YNR019W	ARE2	84		sterol O-acyltransferase
YNL219C	ALG9	84	protein glycosylation	mannosyltransferase
YMR050C		84		
YLR399C	BDF1	84	sporulation (sensu Saccharomyces)	transcription factor
YLR174W	IDP2	84	glutamate biosynthesis*	isocitrate dehydrogenase (NADP+)
YLR202C		84	biological_process unknown	molecular_function unknown
YLR019W	PSR2	84	stress response	protein phosphatase
YJR142W		84	biological_process unknown	molecular_function unknown
YJR075W	HOC1	84	cell wall mannoprotein biosynthesis*	alpha-1,6-mannosyltransferase
YIL140W	AXL2	84	axial budding*	molecular_function unknown
YHR076W		84	biological_process unknown	molecular_function unknown
YGR238C	KEL2	84	biological_process unknown	molecular_function unknown
YGR121C	MEP1	84	transport	
YFR041C		84	biological_process unknown	molecular_function unknown
YGL012W	ERG4	84	ergosterol biosynthesis	sterol C-24(28) reductase
YER166W	DNF1	84	biological_process unknown	molecular_function unknown
YEL050C	RML2	84	protein biosynthesis*	structural protein of ribosome
YDR434W	GPI17	84	biological_process unknown	molecular_function unknown
YDL248W	COS7	84	biological_process unknown	molecular_function unknown
YBR184W		84	biological_process unknown	molecular_function unknown
YAL042W	ERV46	84	biological_process unknown	molecular_function unknown
YPR191W	QCR2	83.8		ubiquinol-cytochrome-c reductase
YGR236C	SPG1	83.8		molecular_function unknown
YDL015C	TSC13	83.8	very long chain fatty acid metabolism	oxidoreductase
YBR287W		83.8	biological_process unknown	molecular_function unknown
YKL082C		83.7	biological_process unknown	molecular_function unknown
YPL147W	PXA1	83.5	transport	
YML115C	VAN1	83.5		mannosyltransferase
YJL158C	CIS3	83.5	cell wall organization and biogenesis	cell wall structural protein
YER024W	YAT2	83.5	biological_process unknown	molecular_function unknown
YGR197C	SNG1	83.3		molecular_function unknown
YPR125W		83	biological_process unknown	
YOR273C		83	biological_process unknown	molecular_function unknown
YNL094W		83	biological_process unknown	molecular_function unknown
YMR193W	MRPL24	83	protein biosynthesis	structural protein of ribosome
YLR138W	NHA1	83		
YKL146W		83	biological_process unknown	molecular_function unknown
YKL163W	PIR3	83	cell wall organization and biogenesis	cell wall structural protein
YJR065C	ARP3	83	actin filament organization	structural protein of cytoskeleton*
YJL144W		83	biological_process unknown	molecular_function unknown
YIL022W	TIM44	83	mitochondrial translocation	protein transporter
YHR054C		83	biological_process unknown	molecular_function unknown

YGL089C	MF(ALPHA)2	83	pheromone response	pheromone
YER002W	NOP16	83	biological_process unknown	molecular_function unknown
YDL054C		83	biological_process unknown	molecular_function unknown
YDL072C		83	biological_process unknown	molecular_function unknown
YCR099C		83	biological_process unknown	molecular_function unknown
YBR110W	ALG1	83	protein glycosylation	
YBR015C	MNN2	83	protein glycosylation	
YBL011W	SCT1	83	biological_process unknown	
YAL053W		83	biological_process unknown	molecular_function unknown
YIR043C		82.8	biological_process unknown	molecular_function unknown
YBR199W	KTR4	82.8	N-linked glycosylation	mannosyltransferase
YLR355C	ILV5	82.7		ketol-acid reductoisomerase
YGR046W		82.7	biological_process unknown	molecular_function unknown
YPR148C		82.5	biological_process unknown	molecular_function unknown
YJR016C	ILV3	82.5		dihydroxy-acid dehydratase
YGR147C	NAT2	82.5		peptide alpha-N-acetyltransferase
YER014W	HEM14	82.5		protoporphyrinogen oxidase
YDL140C	RPO21	82.5	transcription from Pol II promoter	DNA-directed RNA polymerase II
YBR075W		82.5	biological_process unknown	molecular_function unknown
YJL079C	PRY1	82.3	biological_process unknown	molecular_function unknown
YGR026W		82.3	biological_process unknown	molecular_function unknown
YGR295C	COS6	82.2	biological_process unknown	molecular_function unknown
YFL016C	MDJ1	82.2	protein folding*	heat shock protein
YNL277W	MET2	82		homoserine O-acetyltransferase
YML088W	UFO1	82		molecular_function unknown
YKL064W	MNR2	82		molecular_function unknown
YJL088W	ARG3	82	arginine biosynthesis*	ornithine carbamoyltransferase
YHR195W	NVJ1	82		molecular_function unknown
YHR132C	ECM14	82		molecular_function unknown
YHR048W		82	biological_process unknown	
YGR281W	YOR1	82	transport	
YGR150C		82	biological_process unknown	molecular_function unknown
YGL010W		82	biological_process unknown	molecular_function unknown
YDL024C	DIA3	82	pseudohyphal growth*	acid phosphatase
YCR094W	CDC50	82		
YCR037C	PHO87	82	transport	
YBL098W		82	biological_process unknown	molecular_function unknown
YAR073W	IMD1	82		IMP dehydrogenase
YBL017C	PEP1	82	protein-vacuolar targeting*	vacuolar assembly
YMR145C		81.7	biological_process unknown	molecular_function unknown
YIL094C	LYS12	81.7	lysine biosynthesis	
YGL039W		81.7	biological_process unknown	molecular_function unknown
YER080W		81.7	biological_process unknown	molecular_function unknown

YDR046C	BAP3	81.7	transport	
YLR149C		81.5	biological_process unknown	molecular_function unknown
YLR152C		81.5	biological_process unknown	molecular_function unknown
YKR042W	UTH1	81.5		molecular_function unknown
YJL137C	GLG2	81.5	glycogen metabolism	
YJL034W	KAR2	81.5	protein folding*	adenosinetriphosphatase*
YDR056C		81.5	biological_process unknown	molecular_function unknown
YIL123W	SIM1	81.3	cell cycle	molecular_function unknown
YGL219C	MMM2	81.3	biological_process unknown	molecular_function unknown
YDR003W		81.3	biological_process unknown	molecular_function unknown
YPL063W		81	biological_process unknown	
YOL129W		81	biological_process unknown	molecular_function unknown
YLR241W		81	biological_process unknown	
YLR196W	PWP1	81	biological_process unknown	molecular_function unknown
YLR017W	MEU1	81		
YJR015W		81	biological_process unknown	molecular_function unknown
YIR039C	YPS6	81		aspartic-type endopeptidase
YIL121W		81	biological_process unknown	molecular_function unknown
YHL032C	GUT1	81		glycerol kinase
YGL036W	MTC2	81	biological_process unknown	molecular_function unknown
YGL072C		81	biological_process unknown	molecular_function unknown
YER077C		81	biological_process unknown	molecular_function unknown
YEL071W	DLD3	81	lactate metabolism	D-lactate dehydrogenase (cytochrome)
YEL020C		81	biological_process unknown	molecular_function unknown
YNL336W	COS1	80.8	biological_process unknown	molecular_function unknown
YJR008W		80.8	biological_process unknown	molecular_function unknown
YDR148C	KGD2	80.8	tricarboxylic acid cycle*	dihydrolipoamide S-succinyltransferase
YNL280C	ERG24	80.7	ergosterol biosynthesis	C-14 sterol reductase
YMR107W		80.7	biological_process unknown	molecular_function unknown
YGR138C		80.7	biological_process unknown	
YAL061W		80.7	biological_process unknown	molecular_function unknown
YPL262W	FUM1	80.5	tricarboxylic acid cycle*	fumarate hydratase
YPL134C	ODC1	80.5	transport	
YNL294C		80.5	biological_process unknown	molecular_function unknown
YBR132C	AGP2	80.5	fatty acid metabolism	hydrogen:amino acid symporter
YGR189C	CRH1	80.4	biological_process unknown	molecular_function unknown
YGR023W	MTL1	80.4		molecular_function unknown
YER182W		80.3	biological_process unknown	molecular_function unknown
YDR018C		80.3	biological_process unknown	molecular_function unknown
YLR300W	EXG1	80.2		glucan 1,3-beta-glucosidase