Table S1 Metabolic reaction list for *E. coli*

No	Gene	Reaction
1	Biomass formation	0.14176 Glyc3P + 26.2949 ATP + 0.60097 Ala + 0.10124 Cys + 0.26647 Asp + 0.30747 Glu + 0.2048 Phe + 0.67725 Gly + 0.10473 His + 0.32116 Ile + 0.37935 Lys + 0.49804 Leu + 0.16989 Met + 0.26647 Asn + 0.24436 Pro + 0.29091 Gln + 0.32698 Arg + 0.38031 Ser + 0.28044 Thr + 0.46778 Val + 0.062835 Trp + 0.15244 Tyr + 0.1489 rATP + 0.18319 rGTP + 0.11366 rCTP + 0.12273 rUTP + 0.023904 dATP + 0.024582 dGTP + 0.024582 dCTP + 0.023904 dTTP + 0.28352 avg_FS + 0.0069264 UDPGlc + 0.010368 CDPEth + 0.010368 OH_myr_ac + 0.010368 C14_0_FS + 0.010368 CMP_KDO + 0.010368 NDPHep + 0.0069264 TDPGlcs + 0.01656 UDP_NAG + 0.01656 UDP_NAM + 0.01656 di_am_pim + 0.0924 ADPGlc ==> Biomass
2	Nitrogen uptake	==> N
3	CO2 exchange	CO2 <==>
4	Sulfur uptake	4 ATP + 4 NADPH ==> S
5	*pts*	PEP + GLC ==> G6P + Pyr
6	*glk*	ATP + GLC ==> G6P
7	Succinate exchange	Succ ==>
8	*gps*	DHAP + NADH <==> Glyc3P
9	Lactate exchange	Lac ==>
10	Ethanol exchange	Eth ==>
11	Acetate exchange	Ac ==>
12	Formate exchange	Form ==>
13	*pgi*	G6P <==> F6P
14	*fbp*	F16P ==> F6P
15	*fba*	F16P <==> DHAP + G3P
16	*tpi*	DHAP <==> G3P
17	*gap*	G3P <==> DPG + NADH
18	*pgk*	DPG <==> 3PG + ATP
19	*Gpm*	3PG <==> 2PG
20	*eno*	2PG <==> PEP
21	*pyk*	PEP ==> Pyr + ATP
22	*pps*	Pyr + 2 ATP ==> PEP
23	*lpd*	Pyr ==> AcCoA + NADH + CO2
24	*glt*	AcCoA + OxA ==> Cit
25	*acn*	Cit <==> ICit
26	*icd*	ICit <==> alKG + NADPH + CO2
27	*sucAB*	alKG ==> SuccCoA + NADH + CO2
28	*sucCD*	SuccCoA <==> Succ + ATP
29	*sdh*	Succ ==> Fum + QuiH2
30	*frd*	Fum + QuiH2 ==> Succ
31	*Fum*	Fum <==> Mal
32	*mdh*	Mal <==> OxA + NADH
33	*aceA*	ICit ==> Succ + Glyox
34	*aceB*	AcCoA + Glyox ==> Mal
35	*zwf*	G6P <==> PGlac + NADPH
36	*adh*	AcCoA + NADH <==> Adh

Table S1 (continued)

37	*adh*	NADH + Adh <==> Eth
38	*pgl*	PGlac ==> PGluc
39	*gnd*	PGluc ==> Rl5P + NADPH + CO2
40	*rpe*	Rl5P <==> X5P
41	*rpi*	Rl5P <==> R5P
42	*tktAB*	R5P + X5P <==> G3P + S7P
43	*tal*	G3P + S7P <==> F6P + E4P
44	*tktAB*	E4P + X5P <==> F6P + G3P
45	*edd*	PGluc ==> KetoPGluc
46	*eda*	KetoPGluc <==> G3P + Pyr
47	*pck*	OxA + ATP ==> PEP + CO2
48	*ppc*	PEP + CO2 ==> OxA
49	*pta*	AcCoA <==> AcP
50	*ack*	AcP <==> ATP + Ac
51	*pfl*	Pyr ==> AcCoA + Form
52	*ldh*	Pyr + NADH <==> Lac
53	*nuo*	NADH <==> QuiH2 + 2 H_ex
54	*pntA*	NADH + H_ex <==> NADPH
55	ATP Synthesis	3 H_ex <==> ATP
56	ATPdrain	ATP ==>
57	*aro*	2 PEP + E4P + ATP + NADPH ==> Chor
58	*prsA*	R5P + 2 ATP ==> PRPP
59	*met*	ATP + NADPH <==> MTHF
60	*alaB*	Pyr + Glu ==> alKG + Ala
61	*avt*	2 Pyr + NADPH + Glu ==> alKG + CO2 + Val
62	*ilv*	2 Pyr + AcCoA + NADPH + Glu ==> alKG + NADH + 2 CO2 + Leu
63	*asn*	2 ATP + N + Asp ==> Asn
64	*asp*	OxA + Glu ==> alKG + Asp
65	*Lys*	di_am_pim ==> CO2 + Lys
66	*met*	SuccCoA + ATP + 2 NADPH + MTHF + Cys + Asp ==> Pyr + Succ + N + Met
67	*thr*	2 ATP + 2 NADPH + Asp ==> Thr
68	*ilv*	Pyr + NADPH + Glu + Thr ==> alKG + CO2 + N + Ile
69	*his*	ATP + PRPP + Gln ==> alKG + 2 NADH + His
70	*gab*	alKG + NADPH + N ==> Glu
71	*gln*	ATP + N + Glu ==> Gln
72	*pro*	ATP + 2 NADPH + Glu ==> Pro
73	*arg*	AcCoA + 4 ATP + NADPH + CO2 + N + Asp + 2 Glu ==> alKG + Fum + Ac + Arg
74	*trp*	Chor + PRPP + Gln + Ser ==> G3P + Pyr + CO2 + Glu + Trp
75	*tyr*	Chor + Glu ==> alKG + NADH + CO2 + Tyr
76	*phe*, *tyr*	Chor + Glu ==> alKG + CO2 + Phe
77	*ser*	3PG + Glu ==> alKG + NADH + Ser
78	*gly*	Ser ==> MTHF + Gly
79	*cys*	AcCoA + S + Ser ==> Ac + Cys
80	rATP_Synth	5 ATP + CO2 + PRPP + 2 MTHF + 2 Asp + Gly + 2 Gln ==> 2 Fum + NADPH + 2 Glu + rATP

Table S1 (continued)

81	rGTP_Synth	6 ATP + CO2 + PRPP + 2 MTHF + Asp + Gly + 3 Gln ==> 2 Fum + NADH + NADPH + 3 Glu + rGTP
82	rCTP_Synth	ATP + Gln + rUTP ==> Glu + rCTP
83	rUTP_Synth	4 ATP + N + PRPP + Asp ==> NADH + rUTP
84	dATP_Synth	NADPH + rATP ==> dATP
85	dGTP_Synth	NADPH + rGTP ==> dGTP
86	dCTP_Synth	NADPH + rCTP ==> dCTP
87	dTTP_Synth	2 NADPH + MTHF + rUTP ==> dTTP
88	avg_FS_Synth	8.24 AcCoA + 7.24 ATP + 13.91 NADPH ==> avg_FS
89	UDPGlc_Synth	G6P + ATP ==> UDPGlc
90	CDPEth_Synth	3PG + 3 ATP + NADPH + N ==> NADH + CDPEth
91	OH_myr_ac_Synth	7 AcCoA + 6 ATP + 11 NADPH ==> OH_myr_ac
92	C14_0_FS_Synth	7 AcCoA + 6 ATP + 12 NADPH ==> C14_0_FS
93	CMP_KDO_Synth	PEP + R5P + 2 ATP ==> CMP_KDO
94	NDPHep_Synth	1.5 G6P + ATP ==> 4 NADPH + NDPHep
95	TDPGlcs_Synth	F6P + 2 ATP + N ==> TDPGlcs
96	UDP_NAG_Synth	F6P + AcCoA + ATP + Gln ==> Glu + UDP_NAG
97	UDP_NAM_Synth	PEP + NADPH + UDP_NAG ==> UDP_NAM
98	di_am_pim_Synth	Pyr + SuccCoA + ATP + 2 NADPH + Asp + Glu ==> alKG + Succ + di_am_pim
99	ADPGlc_Synth	G6P + ATP ==> ADPGlc
100	Glucose uptake	==> GLC
101	Glycerol exchange	Glyc ==>
102	*glp*	Glyc3P ==> ATP + Glyc
103	*pfk*	F6P + ATP ==> F16P
104	*mae*	Mal ==> Pyr + NADPH + CO2
105	*Oxygen uptake*	==> O2
106	*cyc*	QuiH2 + 0.5 O2 ==> 2 H_ex
107	*Asnb*	2 ATP + Asp + Gln ==> Glu + Asn
108	*gltBD*	alKG + NADPH + Gln ==> 2 Glu
109	*Cys*	S + ASER ==> Ac + Cys
110	*ilvB*	2 Pyr ==> CO2 + ACLAC
111	*ilvC*	NADPH + ACLAC ==> DHVAL
112	*ilvD*	DHVAL ==> OIVAL
113	*proB*	ATP + Glu ==> GLUP
114	*proA*	NADPH + GLUP ==> GLUGSAL
115	*aroF*	PEP + E4P ==> 3DDAH7P
116	*aroB*	3DDAH7P ==> DQT
117	*aroD*	DQT <==> DHSK
118	*aroE*	NADPH + DHSK <==> SME
119	*aroL*	ATP + SME ==> SME5P
120	*aroC*	PEP + SME5P ==> 3PSME
121	*thrA*	ATP + Asp <==> BASP
122	*asd*	2 NADPH + BASP <==> HSER
123	*metL*	ATP + HSER ==> PHSER
124	*sera*	3PG ==> NADH + PHP
125	*serC*	Glu + PHP ==> alKG + 3PSER

Table S1 (continued)

126	*pheA*	Chor ==> PHEN
127	*pheA2*	PHEN ==> CO2 + PHPYR
128	*trpDE*	Chor + Gln ==> Pyr + Glu + AN
129	*trpD*	PRPP + AN ==> NPRAN
130	*trpC*	NPRAN ==> CPAD5P
131	*trpC2*	CPAD5P ==> CO2 + IGP
132	*tyrA*	PHEN ==> NADH + CO2 + HPHPYR
133	*argA*	AcCoA + Glu ==> NAGLU
134	*argB*	ATP + NAGLU ==> NAGLUYP
135	*argC*	NADPH + NAGLUYP <==> NAGLUSAL
136	*argD*	Glu + NAGLUSAL <==> alKG + NAARON
137	*argE*	NAARON ==> Ac + ORN
138	*carAB*	2 ATP + CO2 + Gln ==> Glu + CAP
139	*argFI*	ORN + CAP <==> CITR
140	*argG*	2 ATP + Asp + CITR ==> ARGSUCC
141	*ilvA*	Thr ==> N + OBUT
142	*ilvBN*	Pyr + OBUT ==> CO2 + ABUT
143	*ilvC2*	NADPH + ABUT ==> DHMVA
144	*ilvD2*	DHMVA ==> OMVAL
145	*hisG*	ATP + PRPP ==> PRBATP
146	*hisI*	PRBATP ==> PRBAMP
147	*hisE*	PRBAMP ==> PRFP
148	*hisA*	PRFP ==> PRLP
149	*hisF*	Gln + PRLP ==> Glu + DIMGP
150	*hisB*	DIMGP ==> IMACP
151	*hisC*	Glu + IMACP ==> alKG + HISOLP
152	*hisB2*	HISOLP ==> HISOL
153	*metA*	SuccCoA + HSER ==> OSLHSER
154	*metB*	Cys + OSLHSER ==> Succ + LLCT
155	*metC*	LLCT ==> Pyr + N + HCYS
156	*metF*	NADH + METTHF ==> MTHF
157	*leuA*	AcCoA + OIVAL ==> CBHCAP
158	*leuCD*	CBHCAP <==> IPPMAL
159	*leuB*	IPPMAL ==> NADH + CO2 + OICAP

Metabolites list:

2PG	2-Phosphoglycerate
3DDAH7P	3-Deoxy-d-arabino heptulosonate-7-phosphate
3PG	3-Phosphoglycerate
3PSER	3-Phosphoserine
3PSME	3-Phosphate-shikimate
ABUT	2-Aceto-2-hydroxy butyrate
Ac	Acetate
AcCoA	Acetyl-CoA
ACLAC	Acetolactate
AcP	Acetyl phosphate
Adh	Acetaldehyde
ADPGlc	ADPglucose

Ala	Alanine
alKG	alpha-Ketoglutarate
AN	Antranilate
Arg	Arginine
ARGSUCC	L-Arginio succinate
ASER	O-Acetylserine
Asn	Asparagine
Asp	Aspartate
ATP	Adenosintriphosphate
avg_FS	average fatty acid
BASP	b-Aspartyl phosphate
Biomass	Biomass
C14_0_FS	C_14:0_Fatty_acid
CAP	Carbamoyl phosphate
CBHCAP	3-Carboxy-3-hydroxy-isocaproate
CDPEth	CDP ethanolamine
Chor	Chorismate
Cit	Citrate
CITR	L-Citrulline
CMP_KDO	CMP-3-deoxy-D-manno-octulosonate
CO2	Carbon dioxide
CPAD5P	1-O-Carboxyphenylamino 1-deoxyribulose-5-phosphate
Cys	Cysteine
dATP	ATP for DNA synthesis
dCTP	CTP for DNA synthesis
dGTP	GTP for DNA synthesis
DHAP	Dihydroxyacetone phosphate
DHMVA	2,3-Dihydroxy-3-methyl-valerate
DHSK	Dehydroshikimate
DHVAL	Dihydroxy-isovalerate
di_am_pim	Diaminopimelate
DIMGP	D-Erythro imidazoleglycerol-phosphate
DPG	Diphosphoglycerate
DQT	3-Dehydroquinate
dTTP	TTP for DNA synthesis
E4P	D-Erythrose 4-phosphate
Eth	Ethanol
F16P	Fructose 1,6-bisphosphate
F6P	Fructose 6-phosphate
Form	Formate
Fum	Fumarate
G3P	Glyceraldehyde 3-phosphate
G6P	Glucose 6-phosphate
GLC	Glucose
Gln	Glutamine
Glu	Glutamate
GLUGSAL	L-Glutamate g-semialdehyde
GLUP	Glutamyl phosphate
Gly	Glycine
Glyc	Glycerol
Glyc3P	Glycerol 3-phosphate
Glyox	Glyoxylate
H_ex	External Hydrogen
HCYS	Homocysteine
His	Histidine
HISOL	Histidinol

HISOLP	L-Histidinol-phosphate
HPHPYR	para-Hydroxy phenyl pyruvate
HSER	Homoserine
ICit	Isocitrate
IGP	Indole glycerol phosphate
Ile	Isoleucine
IMACP	Imidazole acetyl-phosphate
IPPMAL	3-Isopropylmalate
KetoPGluc	2-keto-3-deoxy-D-gluconate 6-phosphate
Lac	Lactate
Leu	Leucine
LLCT	L-Cystathionine
Lys	Lysine
Mal	Malate
Met	Methionine
METTHF	5,10-Methylene tetrahydrofolate
MTHF	Methylen-Tetrahydrofolate
N	Nitrogen(NH4)
NAARON	N-a-Acetyl ornithine
NADH	Nicotinamide adenine dinucleotide - reduced
NADPH	Nicotinamide adenine dinucleotide phosphate - reduced
NAGLU	N-Acetyl glutamate
NAGLUSAL	N-Acetyl glutamate semialdehyde
NAGLUYP	N-Acetyl glutamyl -phosphate
NDPHep	NDP Heptose
NPRAN	N-5-phosphoribosyl-antranilate
O2	Oxygen
OBUT	Oxobutyrate or 2-ketobutyrate
OH_myr_ac	OH myristic Acid
OICAP	2-Oxoisocaproate
OIVAL	Oxoisovalerate
OMVAL	Oxomethylvalerate
ORN	Ornithine
OSLHSER	O-Succinyl-l-homoserine
OxA	Oxaloacetate
PEP	Phosphoenolpyruvate
PGlac	6-Phospho-Gluconolactone
PGluc	6-Phospho-Gluconate
Phe	Phenylalanine
PHEN	Prephenate
PHP	3-Phosphohydroxypyruvate
PHPYR	Phenyl pyruvate
PHSER	O-Phospho-l-homoserine
PRBAMP	Phosphoribosyl -AMP
PRBATP	Phosphoribosyl-ATP
PRFP	Phosphoribosyl-formimino-AICAR-phosphate
PRLP	Phosphoribulosyl- formimino-AICAR-phosphate
Pro	Proline
PRPP	5-Phospho-alpha-D-ribose 1-diphosphate
Pyr	Pyruvate
QuiH2	Ubichinon_red
R5P	Ribose 5-phosphate
rATP	ATP for RNA synthesis
rCTP	CTP for RNA synthesis
rGTP	GTP for RNA synthesis
Rl5P	Ribulose 5-phosphate

rUTP	UTP for RNA synthesis
S	Sulfur(SO4)
S7P	Sedoheptulose 7-phosphate
Ser	Serine
SME	Shikimate
SME5P	Shikimate-5-phosphate
Succ	Succinate
SuccCoA	Succinyl-CoA
TDPGlcs	TDP-glucosamine
Thr	Threonine
Trp	Tryptophan
Tyr	Tyrosine
UDP_NAG	UDP acetylglucosamine
UDP_NAM	UDP N-acetylmuramic acid
UDPGlc	UDP glucose
Val	Valine
X5P	Xylolose-5-Phosphate

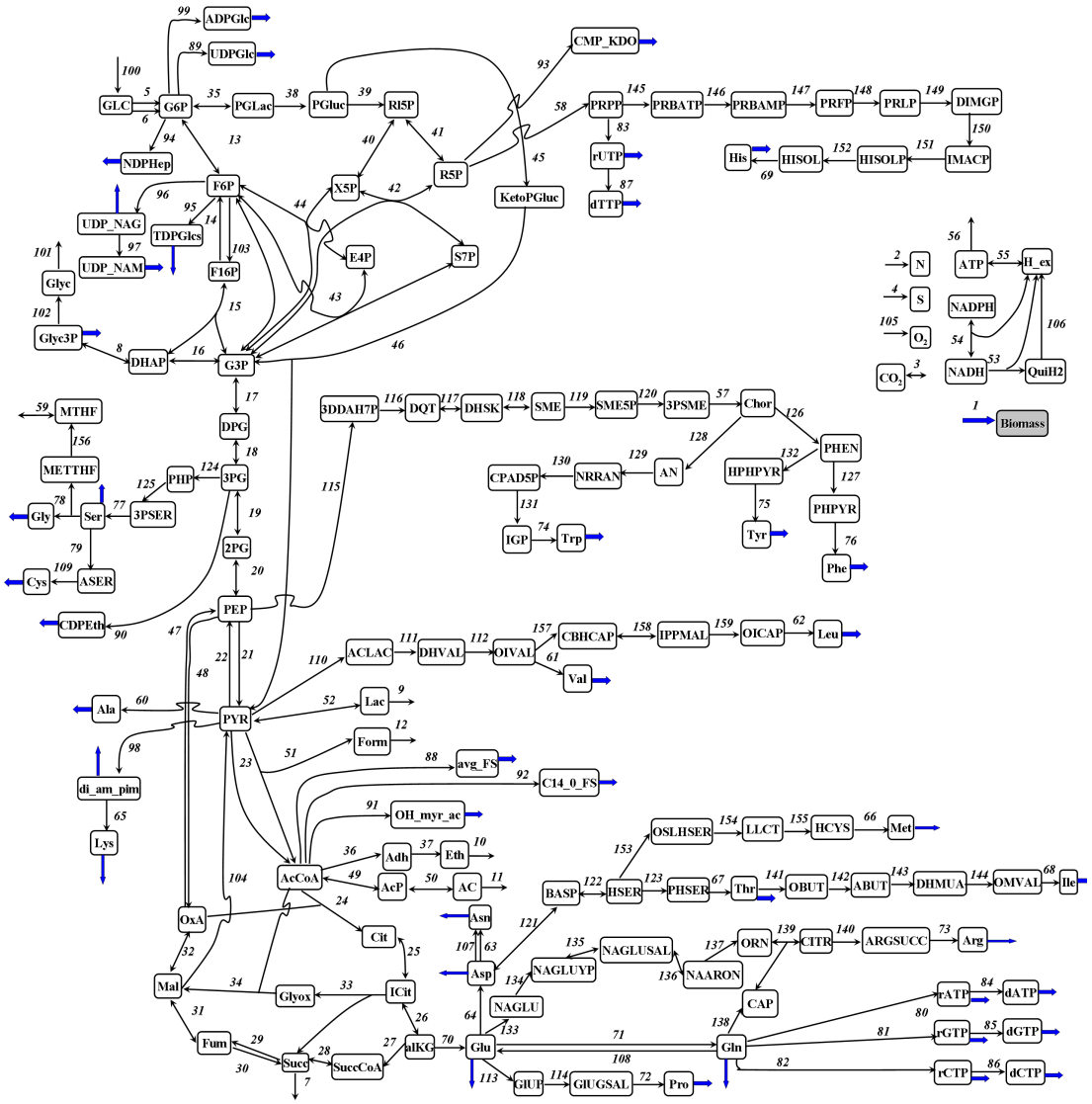

Figure S1 – Metabolic network map for *E. coli*

Details of the metabolic reactions and metabolites of *E. coli* are shown in **Table S1**.

Table S2 Metabolic reaction models for *S. Cerevisiae*

Gene	Enzyme	Reaction
1Put1m	Proline oxidase (NAD)	NADMIT + PRO ==> NADHMIT + 1PYR5C
AAT2	Tyrosine transaminase	AKG + TYR <==> GLU + 34HPP
AATA	2-aminoadipate transaminase	GLU + 2OXOADP <==> AKG + L2AADP
ACO	Aconitate synthetase	CIT <==> ISOCIT
ACS	Acetyl-coenzyme A synthetase	2 ATP + AC ==> ACCOACYT + 2 ADP
ACXT	Acetate secretion	AC ==> ACXT
ADH14G	Acetaldehyde dehydrogenase	ACAL + NADHCYT ==> NADCYT + ETOH
ALD4	Cytosolic aldehyde dehydrogenase (mitochondrial)	ACAL + NADMIT ==> NADHMIT + AC
ALD6	Cytosolic aldehyde dehydrogenase	ACAL + NADPCYT ==> NADPHCYT + AC
Alt2m	L-alanine transaminase, mitochondrial	AKG + ALA <==> PYR + GLU
Aro1	Shikimate kinase	ATP + SKM ==> ADP + SKM5P
Aro1b	shikimate dehydrogenase	NADPHCYT + 3DHSK ==> NADPCYT + SKM
Aro1c	3-phosphoshikimate 1-carboxyvinyltransferase	PEP + SKM5P ==> 3PSME
Aro1d	3-dehydroquinate dehydratase	3DHQ ==> 3DHSK
Aro1e	3-dehydroquinate synthase	2DDA7P ==> 3DHQ
Aro2	Chorismate synthase	3PSME ==> CHOR
Aro3	3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase	PEP + E4P ==> 2DDA7P
Aro7	Chorismate mutase	CHOR ==> PPHN
Aro9	Phenylalanine transaminase	AKG + PHE <==> GLU + PHPYR
ART2	Aspartate transaminase	AKG + ASP <==> OAC + GLU
ASN123	Asparagine synthase (glutamine-hydrolysing)	2 ATP + ASP + GLN ==> 2 ADP + GLU + ASN
ASP1	L-asparaginase	ASN ==> ASP
Bat	Valine transaminase	AKG + VAL <==> GLU + 3MOB
Bat2b	2-Oxo-4-methyl-3-carboxypentanoate decarboxylation	3C4MOP ==> CO2 + 4MOP
Bat2c	Leucine transaminase	AKG + LEU <==> GLU + 4MOP
BIOMX	Biomass formation	435 P3G + 1639 NADPHMIT + 24118 ATP + 300 RIB5P + 128 PEP + 2104 ACCOACYT + 5552 NADPHCYT + 528 AKG + 601 OAC + 64 E4P + 14 ACCOAMIT + 314 NADMIT + 100 GOH3P + 833 NADCYT + 2500 GLUC6P + 219 PYR + 297 ASP + 302 GLU + 105 GLN + 102 ASN + 459 ALA + 165 PRO + 185 SER + 286 LYS + 102 TYR + 134 PHE + 265 VAL + 296 LEU ==> 314 NADHMIT + 1639 NADPMIT + 833 NADHCYT + 24118 ADP + 5552 NADPCYT + 1000 BIOM
CAT	Carnitine O-acetyltransferase, Carnitine shuttle	ACCOACYT ==> ACCOAMIT
CIT	Citrite synthase (mitochondrial)	OAC + ACCOAMIT ==> CIT
CIT2	Cytosolic Citrite synthase	ACCOACYT + OAC ==> CIT
CO2XT	CO2 secretion	CO2 ==> CO2XT

Table S2 (continued)

ENO	Enolase	P2G <==> PEP
FADHX	Electronic chain: Reoxidation of FADH2 P/O ratio 1.2	20 FADH2 + 24 ADP + 10 O2 ==> 24 ATP + 20 FAD
FBA	Fructose-1,6 phosphate aldorase	FRUCDP <==> DHAP + GA3P
FBP	Fructose-1,6-bisphophatase	FRUCDP ==> FRUC6P
FUM1	Fumarate hydratase	FUM <==> MAL
Gad1	Glutamate Decarboxylase	GLU ==> CO2 + 4ABUT
Gdh1	Glutamate dehydrogenase (NADP)	NADPCYT + GLU <==> NADPHCYT + AKG
Gdh2	Glutamate dehydrogenase (NAD)	NADCYT + GLU ==> AKG + NADHCYT
GLK	Glucokinase	ATP + GLUC ==> GLUC6P + ADP
Gln1	Glutamine synthetase	ATP + GLU ==> ADP + GLN
Glt1	Glutamate synthase (NADH2)	AKG + NADHCYT + GLN ==> NADCYT + 2 GLU
GLUN	Glutaminase	GLN ==> GLU
GND	6-Phosphogluconate dehydrogenase	P6G + NADPCYT ==> RIBL5P + NADPHCYT + CO2
GPD	Glycerol -3-phosphase	DHAP + NADHCYT ==> GOH3P + NADCYT
GPM	Phosphoglycerate mutase	P3G <==> P2G
GPP	Glycerol phophatase	GOH3P ==> GOH
HCITSm	Homocitrate synthase, mitochondrial	AKG + ACCOAMIT ==> HCIT
ICL	Isocitrate lyase	ISOCIT ==> GLYO + SUC
IDH	Isocitrate dehydrogenase NAD	ISOCIT + NADMIT ==> NADHMIT + AKG + CO2
IDP1	Isocitrate dehydrogenase (NADPmit-dependent)	NADPMIT + ISOCIT ==> NADPHMIT + AKG + CO2
IDP2	Isocitrate dehydrogenase (NADcyt-dependent)	ISOCIT + NADPCYT ==> NADPHCYT + AKG + CO2
Ilv26m	Acetolactate synthase, mitochondrial	2 PYR ==> CO2 + ALACS
Ilv3m	Dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate), mitochondrial	23DHMB ==> 3MOB
Ilv5m	Acetohydroxy acid isomeroreductase, mitochondrial	NADPHMIT + ALACS ==> NADPMIT + 23DHMB
KGD	Alpha-ketoglutarate dehydrogenase	AKG + NADMIT ==> NADHMIT + CO2 + SUCCOA
Leu1	2-isopropylmalate hydratase	2IPPM <==> 3C3HMP
Leu1b	3-isopropylmalate dehydratase	3C2HMP <==> 2IPPM
Leu2	3-isopropylmalate dehydrogenase	NADCYT + 3C2HMP ==> NADHCYT + 3C4MOP
Leu4	2-isopropylmalate synthase, mitochondrial	ACCOACYT + 3MOB ==> 3C3HMP
LSC	Succinate-CoA ligase	ADP + SUCCOA <==> ATP + SUC
Lys1	Saccharopine dehydrogenase (NAD, L-lysine forming)	NADCYT + SACCRP <==> AKG + NADHCYT + LYS
Lys12m	Homoisocitrate dehydrogenase, mitochondrial	NADMIT + HICIT <==> NADHMIT + OXAG
Lys25	L-aminoadipate-semialdehyde dehydrogenase (NADPH)	2 ATP + NADPHCYT + L2AADP ==> 2 ADP + NADPCYT + L2AADP6SA
Lys4m	Homoacontinate hydratase, mitochondrial	B124TC <==> HICIT

Table S2 (continued)

Lys9	Saccharopine dehydrogenase (NADP, L-glutamate forming)	NADPHCYT + GLU + L2AADP6SA <==> NADPCYT + SACCRP
MAE	Malic enzyme	MAL + NADPMIT ==> NADPHMIT + CO2 + PYR
MAINT	maintenance	ATP ==> ADP
MCITDm	2-methylcitrate dehydratase, mitochondrial	HCIT <==> B124TC
MDH	Malase dehydrrogenase	MAL + NADMIT <==> NADHMIT + OAC
MDH2	Malase dehydrrogenase (NADcyt dependent)	MAL + NADCYT <==> OAC + NADHCYT
MLS	Malase synthase	GLYO + ACCOACYT ==> MAL
NADHX	Electronic chain: Reoxidation of NADH P/O ratio 1.2	20 NADHMIT + 24 ADP + 10 O2 ==> 24 ATP + 20 NADMIT
O2XT	Oxygen input	O2XT ==> O2
OSM	Fumarate reductase	FADH2 + FUM ==> FAD + SUC
OXAGm	non-enzymatic reaction, mitochondrial	OXAG <==> CO2 + 2OXOADP
P5CDm	1-pyrroline-5-carboxylate dehydrogenase	NADMIT + 1PYR5C ==> NADHMIT + GLU
PCK	Phosphoenolpyruvate carboxykinase	ATP + OAC ==> PEP + CO2 + ADP
PDA	Pyruvate dehydrogenase	NADMIT + PYR ==> NADHMIT + ACCOAMIT + CO2
PDC	Pyruvate decarboxylase	PYR ==> ACAL + CO2
PFK	Phosphofructokinase	ATP + FRUC6P ==> ADP + FRUCDP
PGI	Glucose-6-phosphate isomerase	GLUC6P <==> FRUC6P
PGK	3-Phosphoglycerate kinase	P13G + ADP <==> P3G + ATP
Pha2	Prephenate dehydratase	PPHN ==> CO2 + PHPYR
Pro1	Glutamate 5-kinase	ATP + GLU ==> ADP + GLU5P
Pro2	Glutamate-5-semialdehyde dehydrogenase	NADPHCYT + GLU5P ==> NADPCYT + GLU5SA
Pro2b	L-glutamate 5-semialdehyde dehydratase	GLU5SA <==> 1PYR5C
Pro3	Pyrroline-5-carboxylate reductase	NADPHCYT + 1PYR5C ==> NADPCYT + PRO
PYC	Pyruvate carboxylase	ATP + CO2 + PYR ==> OAC + ADP
PYK	Pyruvate kinase	PEP + ADP ==> ATP + PYR
RKI	Ribose 5-phosphase isomerase	RIBL5P <==> RIB5P
RPE	Ribulose-phosphate 3-epimerase	RIBL5P <==> XYL5P
SDH	Succinate dehydrogenase	FAD + SUC ==> FADH2 + FUM
Ser1	Phosphoserine transaminase	GLU + 3PHP ==> AKG + PSER
Ser2	Phosphoserine phosphatase (L-serine)	PSER ==> SER
Ser3	Phosphoglycerate dehydrogenase	P3G + NADCYT ==> NADHCYT + 3PHP
SHUTTLEX	Reoxidation of cytosolic NADH to mitochondrial NADH	NADHCYT + NADMIT ==> NADHMIT + NADCYT
SOL	6-phosphoglucono-Lactonase	G15L ==> P6G
TAL	Transaldolase	SED7P + GA3P <==> E4P + FRUC6P
TDH	Glyceraldehyde-3-phosphate dehydrogenase	GA3P + NADCYT <==> NADHCYT + P13G
TKI	Trabsaldolase II	E4P + XYL5P <==> GA3P + FRUC6P
TKL	Transketolase	RIB5P + XYL5P <==> SED7P + GA3P

Table S2 (continued)

TPI	Triosephosphate isomerate	DHAP <==> GA3P
TYR1	Prephenate dehydrogenase (NADP)	NADPCYT + PPHN ==> NADPHCYT + CO2 + 34HPP
Uga1	4-aminobutyrate transaminase	AKG + 4ABUT ==> GLU + SUCSAL
Uga2	Succinate-semialdehyde dehydrogenase (NADP)	NADPCYT + SUCSAL ==> NADPHCYT + SUC
ZWF	Gllucose-6-phosphate dehydrogenase	GLUC6P + NADPCYT ==> G15L + NADPHCYT

<==> reversible reaction;
==> irreversible reaction;

Metabolites:

1PYR5C	(S)-1-Pyrroline-5-carboxylate
23DHMB	(R)-2,3-Dihydroxy-3-methylbutanoate
2DDA7P	2-Dehydro-3-deoxy-D-arabino-heptonate 7-phosphate
2IPPM	2-Isopropylmaleate
2OXOADP	2-Oxoadipate
34HPP	3-(4-Hydroxyphenyl)pyruvate
3C2HMP	3-Carboxy-2-hydroxy-4-methylpentanoate
3C3HMP	3-Carboxy-3-hydroxy-4-methylpentanoate
3C4MOP	3-Carboxy-4-methyl-2-oxopentanoate
3DHQ	3-Dehydroquinate
3DHSK	3-Dehydroshikimate
3MOB	3-Methyl-2-oxobutanoate
3PHP	3-Phosphonooxypyruvate
3PSER	3-Phosphoserine
3PSME	5-O-(1-Carboxyvinyl)-3-phosphoshikimate
4ABUT	4-Aminobutanoate
4MOP	4-Methyl-2-oxopentanoate
AC	Acetate
ACAL	Acetaldehyde
ACCOACYT	Acetyl-coenzyme A (cytosolic)
ACCOAMIT	Acetyl-coenzyme A (mitochondria)
ACXT	External acetate
ADP	Adenosine-5'-diphosphate
AKG	Alpha-ketoglutarate
ALA	Alanine
ALACS	(S)-2-Acetolactate
ASN	Asparagine
ASP	Aspartate
ATP	adenosine triphosphate
B124TC	But-1-ene-1,2,4-tricarboxylate
BIOM	Biomass
CHOR	Chorismate
CIT	Citrate
CO2	Carbon dioxide (External)
CO2XT	External Carbon dioxide
DHAP	Dihydroxyacetone phosphate
E4P	Erthrose-4-phosphate
ETOH	External ethanol
FAD	Flavin adenine dinucleotide
FADH2	Flavin adenine dinucleotide, reduced
FRUC6P	Fructose-6-phosphate
FRUCDP	D-Fructose 1,6-bisphosphate

FUM	Fumarate
G15L	6-phospho-D-glucono-1,5-lactone
GA3P	Glyceraldehyde-3-phosphate
GLU	Glutamate
GLU5P	alpha-D-Glutamyl phosphate
GLU5SA	L-Glutamate 5-semialdehyde
GLUC	Glucose
GLUC6P	Glucose-6-phosphate
GLN	Glutamine
GLYO	Glyoxylate
GOH	Glycerol
GOH3P	Glycerol-3-phosphate
HCIT	2-Hydroxybutane-1,2,4-tricarboxylate
ISOCIT	Isocitrate
L2AADP	L-2-Aminoadipate
L2AADP6SA	L-2-Aminoadipate 6-semialdehyde
LEU	Leucine
MAL	Malate
NADCYT	Nicotinamide adenine dinucleotide (cytosolic)
NADHCYT	Nicotinamide adenine dinucleotide - reduced (cytosolic)
NADHMIT	Nicotinamide adenine dinucleotide - reduced (mitochondrial)
NADMIT	Nicotinamide adenine dinucleotide (mitochondrial)
NADPCYT	Nicotinamide adenine dinucleotide phosphate (cytosolic)
NADPHCYT	Nicotinamide adenine dinucleotide phosphate - reduced (cytosolic)
NADPHMIT	Nicotinamide adenine dinucleotide phosphate - reduced
NADPMIT	Nicotinamide adenine dinucleotide phosphate (mitochondrial)
O2	Oxygen
O2XT	External Oxygen
OAC	Oxaloacetate
OXAG	Oxaloglutarate
P13G	3-Phospho-D-glyceroyl phosphate
P2G	D-Glycerate 2-phosphate
P3G	D-Glycerate 3-phosphate
P6G	6-Phospho-D-gluconate
PEP	Phosphoenolpyruvate
PHE	Phenylalanine
PHPYR	Phenylpyruvate
PPHN	Prephenate
PRO	Proline
PYR	Pyruvate
RIB5P	Ribose-5-phosphate
RIBL5P	Ribulose-5-phosphate
SACCRP	N6-(L-1,3-Dicarboxypropyl)-L-lysine
SED7P	Sedoheptulose-7-phosphate
SER	Serine
SKM	Shikimate
SKM5P	Shikimate 3-phosphate
SUC	Succinate
SUCSAL	Succinate semialdehyde
SUCCOA	Succinyl-coenzyme A
TYR	Tyrosine
VAL	valine
XYL5P	Xylulose-5-phosphate

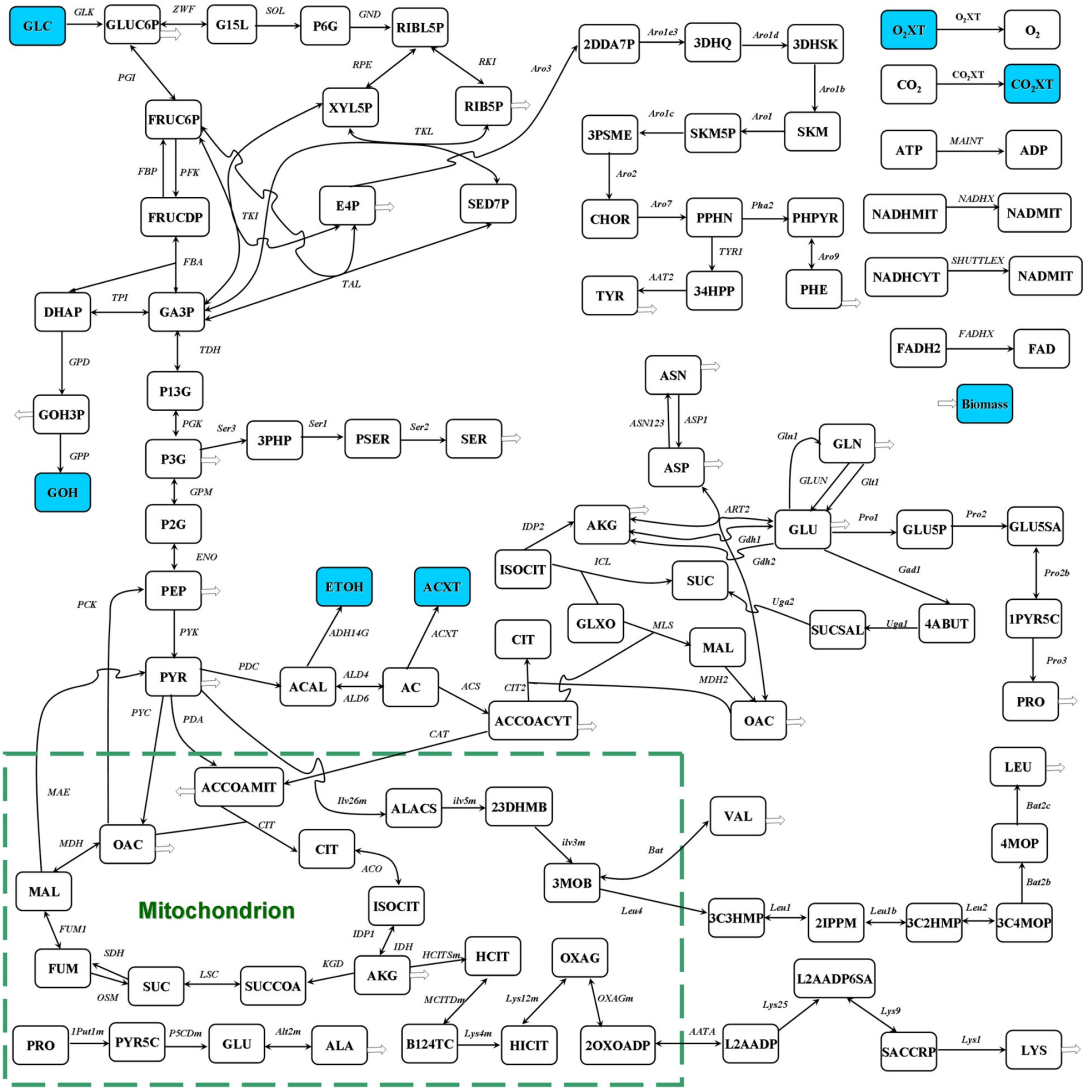

Figure S2 Metabolic network model for *S. cerevisiae* (Blue metabolites are external ones)