Supplementary Table 3 List of genes, enzymes and reactions. These reactions are those actually used in the metabolic flux analyses. The objective function of achieving the maximum growth rate is shown at the bottom.

Pathway	*Gene*	Enzyme	Reactoin
Glycolysis			
	ptsI, ptsH	Phosphotransferase system	GLC + PEP -> G6P + PYR
	pgi	Phosphoglucose isomerase	G6P <-> F6P
	pfk	Phosphofructokinase	ATP + F6P <-> ADP + F16P
	fbp	Fructose-1,6-bisphosphate a	F16P -> F6P + PI
	fba	Fructose-1,6-bisphosphatas	F16P <-> T3P1 + T3P2
	tpi	Triosphosphate isomerase	T3P1 <-> T3P2
	gap	Glyceraldehyde-3-phosphat	NAD + PI + T3P1 <-> a13P2DG + NADH
	pgk	Phosphoglycerate kinase	a13P2DG + ADP <-> a3PDGL + ATP
	gpm	Phosphoglycerate mutase	a3PDGL <-> a2PDGL
	eno	Enolase	a2PDGL <-> PEP
	pyk	Pyruvate kinase	ADP + PEP -> ATP + PYR
	pck	PEP carboxykinase	ATP + OA <-> ADP + CO2 + PEP
	ppc	PEP carboxylase	CO2 + PEP -> OA + PI
	pdh	Pyruvate dehydrogenase	COA + NAD + PYR -> ACCOA + CO2 + NADH
	pps	PEP synthase	ATP + PYR -> AMP + PEP + PI
Pentose phosphate shunt			
	zwf	Glucose-6-phosphate dehyd	G6P + NADP <-> D6PGL + NADPH
	pgl	6-Phosphogluconolactonase	D6PGL -> D6PGC
	gnd	6-Phosphogluconate dehydr	D6PGC + NADP <-> CO2 + NADPH + RL5P
	rpi	Ribose-5-phosphate isomer	RL5P <-> R5P
	rpe	Ribose-5-phosphate epimer	RL5P <-> X5P
	tktA	Transketolase 1	R5P + X5P <-> S7P + T3P1
	tal	Transaldolase	S7P + T3P1 <-> E4P + F6P
	tktB	Transketolase 2	E4P + X5P <-> F6P + T3P1
	edd	6-Phosphogluconate dehydr	D6PGC -> a2K3D6PG
	eda	2-Keto-3-deoxy-6-phospho	a2K3D6PG -> PYR + T3P1
Glycogen metabolism			
	pgm	Glycogen synthase	G6P <-> G1P
	glgA	Glycogen phosphorylase	ATP + G1P -> ADP + GLYCOGEN + PPI
	glgP	Dissimilation of pyruvate	GLYCOGEN + PI -> G1P
	ldh	Lactate dehydrogenase	NADH + PYR <-> LAC + NAD

adh	Alcohol dehydrogenase	ACAL + NADH <-> ETHANOL + NAD
adh	Acetaldehyde dehydrogena	ACCOA + NADH <-> ACAL + NAD
pfl	Pyruvate formate lyase	COA + PYR -> ACCOA + FORMATE
pta	Phosphotransacetylase	ACCOA + PI <-> ACTP + COA
ackA	Acetate kinase	ACTP + ADP <-> AC + ATP
fhl	Formate dehydrogenase	FORMATE -> CO2

TCA cycle and glyoxylate bypass

gltA	Citrate synthase	ACCOA + OA <-> CIT + COA
acn	Aconitase	CIT <-> ICIT
idh	Isocitrate dehydrogenase	ICIT + NADP <-> AKG + CO2 + NADPH
sucAB	2-Ketoglutarate dehydroger	AKG + COA + NAD <-> CO2 + NADH + SUCCOA
sucCD	Succinate thiokinase	ADP + PI + SUCCOA <-> COA + ATP + SUCC
frdABCD	Fumurate reductase	FADH2 + FUM -> FAD + SUCC
fumC	Fumarase	FUM <-> MAL
mdh	Malate dehydrogenase	MAL + NAD <-> NADH + OA
maeB	Malic enzyme	MAL + NADP -> CO2 + NADPH + PYR

Respiration

ndh	NADH dehydrogenase II	NADH + Q -> NAD + QH2
ndh	NADH dehydrogenase I	NADH + Q -> 4 HEXT + NAD + QH2
fdnGHI, fdo	Formate dehydrogenase	FORMATE + Q -> CO2 + 2 HEXT + QH2
frdABCD	Fumarate reductase comple	FADH2 + Q <-> FAD + QH2
		QH2ext -> QH2
		Q -> Qext

ATP synthesis

unc	F0F1-ATPase	ATP <-> ADP + 3 HEXT + PI

Alternative Carbon Source

Melibiose

melA	Alpha-galactosidase (melib	MELI -> GLC + GLAC

Galactose

galK	Galactokinase	GLAC + ATP -> GAL1P + ADP
galT	Galactose-1-phosphate urid	GAL1P + UDPG <-> G1P + UDPGAL
galE	UDP-glucose 4-epimerase	UDPGAL <-> UDPG
galU	UDP-glucose-1-phosphate u	G1P + UTP <-> UDPG + PPI

Lactose

	lacZ	Beta-galactosidase (LACTa	LCTS -> GLC + GLAC
Fructose			
	fruK	1-Phosphofructokinase (Fru	F1P + ATP -> FDP + ADP
	xylA	Xylose isomerase	FRU -> GLC
Mannose			
	cpsG	Phosphomannomutase	MAN6P <-> MAN1P
	manA	Mannose-6-phosphate isom	MAN1P <-> F6P
N-Acetylglucosamine			
	nagA	N-Acetylglucosamine-6-ph	NAGP -> GA6P + AC
Glucosamine			
	nagB	Glucosamine-6-phosphate d	GA6P -> F6P + NH3
Sialic Acid			
	nanA	N-Acetylneuraminate lyase	SLA -> PYR + NAMAN
Xylose			
	xylA	Xylose isomerase	XYL <-> XUL
	xylB	Xylulokinase	XUL + ATP -> X5P + ADP
Ribose			
	rbsK	Ribokinase	RIB + ATP -> R5P + ADP
Mannitol			
	mtlD	Mannitol-1-phosphate 5-del	MNT6P + NAD <-> F6P + NADH
Biosynthesis of aspartate			
	aspC	Aspartate transaminase	GLU + OA <-> AKG + ASP
Biosynthesis of asparagines			
	asnB	Glutamine-dependent aspar	ASP + ATP + GLN -> AMP + ASN + GLU + PPI
	asnA	Ammonia-dependent aspara	ASP + ATP + NH3 -> AMP + ASN + PPI
Biosynthesis of glutamate			
	gdhA	Glutamate dehydrogenase	AKG + NADPH + NH3 -> GLU + NADP
	glnA	Glutamine synthatase	ATP + GLU + NH3 -> ADP + GLN + PI
	gltBD	Glutamate synthase	AKG + GLN + NADPH -> 2 GLU + NADP
Biosynthesis of alanine			
	alaB	Glutamic-pyruvic transamir	GLU + PYR <-> AKG + ALA
Biosynthesis of arginine, putrescine, and spermidine			
	argA	N-Acetylglutamate synthas	ACCOA + GLU -> COA + NAGLU
	argB	N-Acetylglutamate kinase	ATP + NAGLU -> ADP + NAGLUYP

argC	N-Acetylglutamate phospha	NADPH + NAGLUYP <-> NADP + NAGLUSAL + PI
argD	Acetylornithine aminotrans	GLU + NAGLUSAL <-> AKG + NAARON
argE	N-Acetylornithinase	NAARON -> AC + ORN
carAB	Carbamoyl phosphate synth	2 ATP + CO2 + GLN -> 2 ADP + CAP + GLU + PI
argF1	Ornithine carbamoyl transfe	CAP + ORN <-> CITR + PI
argG	Argininosuccinate synthase	ASP + ATP + CITR <-> AMP + ARGSUCC + PPI
argH	Argininosuccinase	ARGSUCC <-> ARG + FUM
speC	Ornithine decarboxylase	ORN -> CO2 + PTRSC
spE	Spermidine synthase	DSAM + PTRSC -> a5MTA
speD	Adenosylmethionine decarb	SAM <-> CO2 + DSAM
	Unknown pathway	a5MTA -> ADN + MET
speA	Agmatine decarboxylase	ARG -> AGM + CO2
speB	Agmatine ureohydrolase	AGM -> UREA + PTRSC

Biosynthesis of proline

proB	Glutamyl kinase	ATP + GLU -> ADP + GLUP
proA	Glutamate-5-semialdehyde	GLUP + NADPH <-> GLUGSAL + NADP + PI
proC	Pyrroline-5-carboxylate red	GLUGSAL + NADPH <-> NADP + PRO
	Ornithine oxoacid transami	ORG + AKG -> GLU + GLUGSAL

Biosynthesis of branched-chain amino acids

leuA	Isopropylmalate synthase	ACCOA + OIVAL -> CBHCAP + COA
leuCD	Isopropylmalate isomerase	CBHCAP <-> IPPMAL
leuB	3-Isopropylmalate dehydrog	IPPMAL + NAD -> CO2 + NADH + OICAP
ilvE	Transaminase C	GLU + OICAP -> AKG + LEU
ilvB	Acetyohydroxy acid syntha	2 PYR -> ACLAC + CO2
ilvC	Acetohydroxy acid isomero	ACLAC + NADPH -> DHVAL + NADP
ilvD	Dihydroxy acid dehydratase	DHVAL -> OIVAL
ilvE	Transaminase C	GLU + OIVAL <-> AKG + VAL
ilvA	Threonine deaminase	THR -> NH3 + OBUT
ilvB	Acetohydroxy acid synthase	OBUT + PYR -> ABUT + CO2
ilvC	Acetohydroxy acid isomero	ABUT + NADPH -> DHMVA + NADP
ilvD	Dihydroxy acid dehydratase	DHMVA -> OMVAL
ilvE	Transaminase B	GLU + OMVAL <-> AKG + ILE
	Amino acid oxidase	ILE + O2 -> NH3 + OMVAL

Biosynthesis of aromatic amino acids

aroFGH	3-Deoxy-D-arabinoheptulos	E4P + PEP -> a3DDAH7P + PI
aroB	3-Dehydroquinate synthase	a3DDAH7P -> DQT + PI

aroD	3-Dehydroquinate dehydrat	DQT <-> DHSK
aroE	Shikimate dehydrogenase	DHSK + NADPH <-> NADP + SME
aroKL	Shikimate kinase	ATP + SME -> ADP + SME3P
aroA	5-Enolpyruvoylshikimate-3	PEP + SME3P <-> a3PSME + PI
aroC	Chorismate synthase	a3PSME -> CHOR + PI
pheA	Chorismate mutase	CHOR -> PHEN
pheA	Prephenate dehydratase	PHEN -> CO2 + PHPYR
tyrB	Phenylalanine aminotransfe	GLU + PHPYR -> AKG + PHE
tyrA	Prephanate dehydrogenase	NADP + PHEN -> CO2 + HPHPYR + NADPH
tyrB	Tyrosine aminotransferase	GLU + HPHPYR <-> AKG + TYR
trpDE	Anthranilate synthase	CHOR + GLN -> AN + GLU + PYR
trpD	Anthranilate phosphoribosy	AN + PRPP -> NPRAN + PPI
trpC	Phosphoribosyl anthranilate	NPRAN -> CPAD5P
trpC	Indoleglycerol phosphate sy	CPAD5P -> CO2 + IGP
trpAB	Tryptophan synthetase	IGP + SER -> T3P1 + TRP

Biosynthesis of histidine synthesis

prs	Phosphoribosyl pyrophosph	ATP + R5P <-> AMP + PRPP
hisG	Phosphoribosyl pyrophosph	ATP + PRPP -> PPI + PRBATP
hisI	PR-ATP pyrophosphohydrc	PRBATP -> PPI + PRBAMP
hisI	PR-AMP cyclohydrolase	PRBAMP -> PRFP
hisA	5-ProFAR isomerase	PRFP -> PRLP
hisFH	Imidazoleglycerol phosphat	GLN + PRLP -> AICAR + DIMGP + GLU
hisB	IGP dehydratase	DIMGP -> IMACP
hisC	L-Histidinol phosphate ami	GLU + IMACP -> AKG + HISOLP
hisB	Hol-P-phosphatase	HISOLP -> HISOL + PI
hisD	Hol dehydrogenase	HISOL + 2 NAD -> HIS + 2 NADH

Biosynthesis of serine, glycine, and 1-carbon units

serA	3-Phosphoglycerate dehydr	a3PDGL + NAD -> NADH + PHP
serC	Phosphoserine transaminase	GLU + PHP -> a3PSER + AKG
serB	Phosphoserine phosphatase	a3PSER -> PI + SER
glyA	Serine hydroxymethyltransf	GLY + METTHF -> SER + THF
gevHTP	Glycine cleavage system	GLY + NAD + THF -> CO2 + METTHF + NADH + NH3
tdh	Threonine dehydrogenase	NAD + THR <-> AABK + NADH
kbl	Amino-b-ketobutyrase	AABK + COA -> ACCOA + GLY
	Formate THF ligase	ATP + FORMATE + THF -> ADP + FTHF + PI
purU	Formyl THF deformylase	FTHF -> FORMATE + THF
folA	Dihydrofolate reductase	DHF + NADPH <-> NADP + THF

Biosynthesis of cysteine

cysDN	ATP sulfhydrolase	ATP + H2SO4 -> APS + PPI
cysC	ATS kinase	APS + ATP -> ADP + PAPS
cysH	PAPS sulfotransferase	NADPH + PAPS -> H2SO3 + NADP + PAP
cysGIJ	NAHPH-sulfite reductase	H2SO3 + 3 NADPH <-> H2S + 3 NADP
cysE	Serine transacetylase	ACCOA + SER -> ASER + COA
cysKM	O-Acetylserine (thiol)-lyase	ASER + H2S -> AC + CYS
	Sulfotransferase	H2SO3 + PAP <-> PAPS
	Adenylyl sulfate kinase	ADP + PAPS -> APS + ATP

Biosynthesis of threonine and lysine

thrA	Aspartate kinase	ASP + ATP <-> ADP + BASP
asd	Aspartate semialdehyde deh	BASP + NADPH <-> ASPSA + NADP + PI
thrA	Homoserine dehydrogenase	ASPSA + NADPH <-> HSER + NADP
thrB	Homoserine kinase	ATP + HSER -> ADP + PHSER
thrC	Threonine synthase	PHSER -> PI + THR
dapA	Dihydrodipicolinate synthas	ASPSA + PYR -> D23PIC
dapB	Dihydrodipicolinate reducta	D23PIC + NADPH -> NADP + PIP26DX
dapD	Tetrahydrodipicolinate succ	PIP26DX + SUCCOA -> COA + NS2A6O
dapC	Succinyl diaminopimelate a	GLU + NS2A6O -> AKG + NS26DP
dapE	Succinyl diaminopimelate d	NS26DP -> D26PIM + SUCC
dapF	Diaminopimelate epimerase	D26PIM -> MDAP
lysA	Diaminopimelate decarboxy	MDAP -> CO2 + LYS

Biosynthesis of methionine

metA	Homoserine transsuccinylas	HSER + SUCCOA -> COA + OSLHSER
metB	Cystathionine synthase	CYS + OSLHSER -> HCYS + NH3 + PYR + SUCC
metC	Cystathionase	ADN + HCYS <-> SAH
metEH	Methionine synthase	HCYS + MTHF -> MET + THF
metK	Methionyl adenosyl transfe	ATP + MET -> PI + PPI + SAM

Biosynthesis of purine nucleotides

purF	Glutamine PRPP amidotran	GLN + PRPP -> GLU + PPI + PRAM
purD	GAR synthetase	ATP + GLY + PRAM <-> ADP + GAR + PI
purNT	GAR transformylase	FTHF + GAR -> FGAR + THF
purL	FGAM synthetase	ATP + FGAR + GLN -> ADP + FGAM + GLU + PI
purM	AIR synthetase	ATP + FGAM -> ADP + AIR + PI
purK	RCAIM synthetase	AIR + CO2 + ATP -> RCAIM + PI + ADP

purE	PRSCAIM synthetase	RCAIM -> PRSCAIM
purB	Adenylosuccinate lyase	SAICAR <-> AICAR + FUM
		PRSCAIM + ATP +ASP <-> ADP + PI + PRSCAIM
purH	AICAR transformylase	AICAR + FTHF -> PRFICA + THF
purH	IMP cyclohydrolase	PRFICA -> IMP
purA	Adenylosuccinate synthetas	ASP + GTP + IMP -> ASUC + GDP + PI
purB	Adenylosuccinate lyase	ASUC <-> AMP + FUM
	AMP phosphatase	AMP -> ADN + PI
adk	Adenylate kinase	ADN + ATP -> ADP + AMP
adk	Adenylate kinase	AMP + ATP -> 2 ADP
guaB	IMP dehydrogenase	IMP + NAD -> NADH + XMP
guaA	GMP synthetase	ATP + GLN + XMP -> AMP + GLU + GMP + PPI
gmk	GMP kinase	ATP + GMP <-> ADP + GDP
gmk	GDP kinase	ATP + GDP <-> ADP + GTP
deoD	Ribonucleotide reductase (A	ADP + NADPH -> DADP + NADP
deoD	Ribonucleotide reductase (G	GDP + NADPH -> DGDP + NADP
deoD	Ribonucleotide reductase (A	ATP + NADPH -> DATP + NADP
deoD	Ribonucleotide reductase (G	GTP + NADPH -> DGTP + NADP
nck	dADP kinase	ATP + DADP -> ADP + DATP
ndk	dGDP kinase	ATP + DGDP -> ADP + DGTP
ndk	dAMP kinase	DAMP + ATP -> ADP + DADP
ndk	dGMP kinase	DGMP + ATP -> DGDP + ADP

Biosynthesis of pyrimidines

pyrBI	Aspartate carbamoyl transfe	ASP + CAP -> CAASP + PI
pyrC	Dihydroorotase	CAASP <-> DOROA
pyrD	Dihydroorotate dehydrogen	DOROA + O2 <-> H2O2 + OROA
pyrE	Orotate phosphoribosyl tran	OROA + PRPP <-> OMP + PPI
pyrF	OMP decarboxylase	OMP -> CO2 + UMP
pyrH	UMP kinase	ATP + UMP <-> ADP + UDP
ndk	UDP kinase	ATP + UDP -> ADP + UTP
pyrG	CTP synthetase	ATP + GLN + UTP -> ADP + CTP + GLU + PI
ndk	CMP kinase	ATP + CMP <-> ADP + CDP
ndk	CDP kinase	ATP + CDP -> ADP + CTP
cdd	Deoxycytidilate deaminase	DCMP -> DUMP + NH3
nrdAB	Ribonucleotide reductase (C	CDP + NADPH -> DCDP + NADP
nrdAB	Ribonucleotide reductase (U	NADPH + UDP -> DUDP + NADP
nrdAB	Ribonucleotide reductase (C	CTP + NADPH -> DCTP + NADP
nrdAB	Ribonucleotide reductase (U	NADPH + UTP -> DUTP + NADP

ndk	dCMP kinase	ATP + DCMP <-> ADP + DCDP
ndk	dCDP kinase	ATP + DCDP -> ADP + DCTP
ndk	dUDP kinase	ATP + DUDP -> ADP + DUTP
dut	dUTP pyrophosphatase	DUTP -> DUMP + PPI
ndk	dUMP kinase	ATP + DUMP <-> ADP + DUDP
thyA	Thymidilate synthetase	DUMP + METTHF -> DHF + TMP
tmk	TMP kinase	ATP + TMP <-> ADP + TDP
ndk	TDP kinase	ATP + TDP <-> ADP + TTP

Biosynthesis of THF

metF	Methylene THF reductase	METTHF + NADH -> MTHF + NAD
folD	Methylene THF dehydroge	METTHF + NADP <-> METHF + NADPH
folD	Methenyl tetrahydrofolate c	METHF <-> FTHF

Biosynthesis of membrane lipids

acc	Acetyl-CoA carboxylase	ACCOA + ATP + CO2 <-> ADP + MALCOA + PI
mta	Malonyl-CoA:ACP transac	ACP + MALCOA <-> COA + MALACP
kasI	b-Ketoacyl-ACP synthase I	MALACP -> ACACP + CO2
ata	Acetyl-CoA:ACP transacyl	ACACP + COA <-> ACCOA + ACP
fab	b-Ketoacyl-ACP synthase I	ACACP + 6 MALACP + 12 NADPH -> 6 ACP + C140ACP + 6 CO2 + 12 NADP
fab	b-Ketoacyl-ACP synthase I	ACACP + 6 MALACP + 11 NADPH -> 6 ACP + C141ACP + 6 CO2 + 11 NADP
fab	b-Ketoacyl-ACP synthase I	ACACP + 7 MALACP + 14 NADPH -> 7 ACP + C160ACP + 7 CO2 + 14 NADP
fab	b-Ketoacyl-ACP synthase I	ACACP + 7 MALACP + 13 NADPH -> 7 ACP + C161ACP + 7 CO2 + 13 NADP
fab	b-Ketoacyl-ACP synthase I	ACACP + 8 MALACP + 15 NADPH -> 8 ACP + C181ACP + 8 CO2 + 15 NADP
gpsA	Glycerol-3-phosphate dehy	NADH + T3P2 <-> GL3P + NAD
pls	1-Acyl-G3P acyltransferase	0.03 C140ACP + 0.086 C141ACP + 0.607 C160ACP + 0.12 C161ACP + 0.85 C181ACP + GL3P -> 1.69 ACP + PA
cdsA	CDP-Diacylglycerol synthe	CTP + PA <-> CDPDG + PPI
pssA	Phosphatidylserine synthas	CDPDG + SER <-> CMP + PS
psd	PS decarboxylase	PS -> CO2 + PE
pgsA	Phosphatidylglycerol phosp	CDPDG + GL3P <-> CMP + PGP
pgpA	Phosphatidylglycerol phosp	PGP -> PG + PI
cls	Cardiolipin synthase	2 PG <-> CL + GL

Biosynthesis of isoprenoids

	Aldose reductase	GL + NADP <-> GLAL + NADPH
	Glyceraldehyde kinase	ATP + GLAL -> ADP + T3P1
	Hydroxymethyl-glutaryl-C	3 ACCOA -> 2 COA + HMGCOA
	3-Methyl-glutaconyl-CoA h	HMGCOA <-> TMGCOA
	IPP synthase	3 ATP + HMGCOA + 2 NADPH -> 3 ADP + CO2 + COA + IPPP + 2 NADP + PI

	GGPP synthase	4 IPPP -> GGPP + 3 PPI
	Methylcrotonyl-CoA carbo:	ATP + CO2 + MCCOA <-> ADP + PI + TMGCOA
	Acyl-CoA dehydrogenase	ISOVCOA + Q <-> MCCOA + QH2
	2-Keto-isocaproate decarbo	COA + NADP + OICAP -> CO2 + ISOVCOA + NADPH

Biosynthesis of quinone

menF	Isochorismate synthase 1	CHOR -> ICHOR
menD	a-Ketoglutarate decarboxyl:	AKG + TPP -> SSALTPP + CO2
menD	SHCHC synthase	ICHOR + SSALTPP -> PYR + SHCHC + TPP + CO2
menC	O-Succinylbenzoate-CoA s:	SHCHC -> OSB
menE	O-Succinylbenzoic acid-Co	ATP + COA + OSB -> AMP + OSBCOA + PPI
menB	Naphthoate synthase	OSBCOA -> COA + DHNA
menA	1,4-Dihydroxy-2-naphthoat	DHNA -> CO2 + PPI + Q
menG	S-Adenosylmethionine-2-D	Q + SAM -> QH2 + SAH
ubiC	Chorismate pyruvate-lyase	a4HBZ + GGPP -> a2PPP + CO2 + PPI
ubiADX	Hydroxybenzoate octapreny	a2PPP + O2 -> a2O6H
ubiB	2O6H synthetase	a2O6H + 2 O2 + 3 SAM -> QH2 + 3 SAH
ubiEFGH	QH2 synthetase	CHOR -> a4HBZ + PYR

Biosynthesis of riboflavin

ribA	GTP cyclohydrolase	GTP -> FORMATE + D6RP5P + PPI
ribD	Pyimidine deaminase	D6RP5P -> A6RP5P + NH3
ribD	Pyrimidine reductase	A6RP5P + NADPH -> A6RP5P2 + NADP
ribB	3,4-Dihydroxy-2-butanone-	A6RP5P2 -> DB4P + FORMATE + PI
ribE	6,7-Dimethyl-8-ribitylluma:	A6RP + DB4P -> D8RL + PI
ribC	Riboflavin synthase	D8RL -> A6RP + RIBOFLAVIN
ribF	Riboflavin kinase	ATP + RIBOFLAVIN -> ADP + FMN
ribF	FAD synthetase	ATP + FMN -> FAD + PPI

Biosynthesis of folate

folE	GTP cyclohydrolase	GTP -> AHTD + FORMATE
ntpA	H2Neopterin triphosphate p	AHTD -> DHP + 3 PI
	H2Neopterin aldolase	DHP -> AHHMP + GLAL
folK	6-Hydroxymethyl H2pterin	AHHMP + ATP -> AHHMD + AMP
folP	H2pteroate synthase	AHHMD + AN -> DHD + PPI
folA	Dihydrofolate reductase	ATP + DHD + GLU -> ADP + DHF + PI

Tetrapyrrole Biosynthesis

gltX	Glutamyl-tRNA synthetase	GLU + ATP -> GTRNA + AMP + PPI
hemA	Glutamyl-tRNA reductase	GTRNA + NADPH -> GSA + NADP
hemL	Glutamate-1-semialdehyde	GSA -> ALAV
hemB	Porphobilinogen synthase	8 ALAV -> 4 PBG
hemC	Hydroxymethylbilane synth	4 PBG -> HMB + 4 NH3
hemD	Uroporphyrinogen III synth	HMB -> UPRG
cysG	Uroporphyrin-III C-methylt	SAM + UPRG -> SAH + PC2
cysG	1,3-Dimethyluroporphyrino	PC2 + NAD -> NADH + SHCL
cysG	Siroheme ferrochelatase	SHCL -> SHEME
hemE	Uroporphyrinogen decarbo	UPRG -> 4 CO2 + CPP
hemH	Ferrochelatase	PPIX -> PTH
cyoE	Heme O synthase	PTH + FPP -> HO + PPI

Vitamin B6 (Pyridoxine) Biosynthesis

pdxB	Erythronate-4-phosphate de	ER4P + NAD <-> OHB + NADH
serC	Hypothetical transaminase/p	OHB + GLU <-> PHT + AKG
pdxAJ	Pyridoxal-phosphate biosyn	PHT + DX5P -> P5P + CO2
pdxH	Pyridoxine 5'-phosphate oxi	P5P + O2 <-> PL5P + H2O2
thrC	Threonine synthase	PHT -> 4HLT + PI
pdxK	Pyridoxine kinase	PYRDX + ATP -> P5P + ADP
pdxK	Pyridoxine kinase	PL + ATP -> PL5P + ADP
pdxH	Pyridoxine 5'-phosphate oxi	PYRDX + O2 <-> PL + H2O2
pdxH	Pyridoxine 5'-phosphate oxi	PL + O2 + NH3 <-> PDLA + H2O2
pdxK	Pyridoxine kinase	PDLA + ATP -> PDLA5P + ADP
pdxH	Pyridoxine 5'-phosphate oxi	PDLA5P + O2 -> PL5P + H2O2 + NH3
glyA	Serine hydroxymethyltransf	PL5P + GLU -> PDLA5P + AKG
glyA	Serine hydroxymethyltransf	PL5P + ALA -> PDLA5P + PYR

panBCDE	CoA Synthase	ALA + 4 ATP + CTP + CYS + METTHF + NADPH + OIVAL -> 2 ADP + AMP + CO2 + COA + NADP + 2 PPI + THF
acpS	ACP Synthase	COA -> a35ADP + ACP
	3,5-ADP phosphatase	a35ADP -> AMP + PI
nadAB	Quinolate synthase	ASP + FAD + T3P2 -> FADH2 + PI + QNL
nadC	Quinolate phosphoribosyl tr	PRPP + QNL -> CO2 + NICNT + PPI
nadD	NAMN adenylyl tranferase	ATP + NICNT -> DANAD + PPI
nadE	Deamido-NAD ammonia lig	ATP + DANAD + NH3 -> AMP + NAD + PPI
	NAD kinase	ATP + NAD -> ADP + NADP
	NADP phosphatase	NADP -> NAD + PI
gltX, hemA	GSA synthetase	ATP + GLU + NADPH -> AMP + GSA + NADP + PPI
hemBCD	Porphyrinogen synthetase	2 ALAV -> NH3

Biosynthesis of lipopolysaccharide and murein		
	glmS	Glutamine fructose-6-P tran	F6P + GLN -> GA6P + GLU
	glmU	Glucosamine-P acetyl trans	ACCOA + GA6P -> AGA6P + COA
	glmU	Acetyl glucosamine mutase	AGA6P <-> AGA1P
		UDP N-acetylglucosamine	AGA1P + UTP <-> PPI + UDPGA
		UDP N-acetylglucosamine	UDPGA <-> UDPGLN
	kdsA	N-Acylglucosamine-6-P 2-(	PEP + UDPGA <-> PI + UDPGC
		UDP-N-acetylmuramate de	NADPH + UDPGC -> NADP + UDPAM
	kdsB	CMP-2-keto-3-deoxyoctanc	CTP + PEP + R5P -> CMPKDO + 2 PI + PPI
		Isomerase+mutase+pyroph	ATP + S7P <-> ADPHEP + PPI
		Ethanolamine phosphotrans	CMP + PE <-> CDPETN + DGR
		Phosphatidate phosphatase	PA <-> DGR + PI
		Lyposaccharide synthetase	3 ADPHEP + 2 ATP + 2 C140ACP + 3 CDPETN + 3 CMPKDO + 3 PE + 3 UDPGLN + 2 UDPG + 4 UDPGAL -> LPS + 2 AC + 5 ADP + 3 CMP + DGR + 6 UDP + UMP
UDP glucose synthase		
		UDP glucose synthase	G1P + UTP -> PPI + UDPG
		UDP galactose synthase	G1P + UTP <-> PPI + UDPGAL
		Murein synthetase	2 ALA + 5 ATP + D26PIM + GLU + UDPAM + UDPGA -> PEPTIDO + 5 ADP + 5 PI + 2 UDP
Polyphosphate and pyrophosphate metabolism		
	ppa	Pyrophosphatase	PPI -> 2 PI
	ppk	Polyphosphate kinase	1000 ATP <-> 1000 ADP + POLYP
	ppx	Polyphosphatase	POLYP -> 1000 PI
Glycerol metabolism		
		Glycerol kinase	ATP + GL <-> ADP + GL3P
		Glycerol-3-phosphate dehy	FAD + GL3P -> FADH2 + T3P2
Transport reactions		
		Ammonia transport	NH3ext <-> NH3
		Sulfate transport	H2SO4ext <-> H2SO4
	pit	Phosphate transport	PIext <-> PI
		Acetate transport	ACext <-> AC
		Lactate transport	LACext <-> LAC
		Formate transport	FORMATEext <-> FORMATE
		Ethanol transport	ETHANOLext <-> ETHANOL

	Succinate transport	SUCCext <-> SUCC
	D-Glyceraldehyde transport	GLALext <-> GLAL
	Glucose transport	GLCext <-> GLC
	Carbon dioxide transport	CO2ext <-> CO2
	Oxygen transport	O2ext <-> O2
	CoA transport	COAext -> COA
	NAD transport	NADext -> NAD
araE	Arabinose (low affinity)	ARABxt + HEXT -> ARAB
araFGH	Arabinose (high affinity)	ARABxt + ATP -> ARAB + ADP + PI
fruABF	Fructose	FRUxt + PEP -> F1P + PYR
gntST	Gluconate	GLCNxt + ATP -> GLCN + ADP + PI
glpF	Glycerol	GLxt <-> GL
malX, crr, n	Maltose	MLTxt + PEP -> MLT6P + PYR
mtlA, cmtAI	Mannitol	MNTxt + PEP -> MNT6P + PYR
manXYZ, pt	Mannose	MANxt + PEP -> MAN1P + PYR
melB	Melibiose	MELIxt + HEXT -> MELI
rbsABCD, x	Ribose	RIBxt + ATP -> RIB + ADP + PI
xylE	Xylose (low affinity)	XYLxt + HEXT -> XYL
xylFG, rbsB	Xylose (high affinity)	XYLxt + ATP -> XYL + ADP + PI
cycA	Alanine	ALAxt + ATP -> ALA + ADP + PI
brnQ	Branched chain amino acid	BCAAxt + HEXT -> BCAA
gltP	Glutamate	GLUxt + HEXT -> GLU
gltJKL	Glutamate	GLUxt + ATP -> GLU + ADP + PI
glnHPQ	Glutamine	GLNxt + ATP -> GLN + ADP + PI
cycA, proV	Glycine	GLYxt + ATP -> GLY + ADP + PI
lysP	Lysine	LYSxt + HEXT -> LYS
sdaC	Serine	SERxt + HEXT -> SER
potABCD	Spermidine & putrescine	SPMDxt + ATP -> SPMD + ADP + PI
potABCD	Spermidine & putrescine	PTRCxt + ATP -> PTRC + ADP + PI
livJ	Threonine	THRxt + ATP -> THR + ADP + PI
dppABCDF	Dipeptide	DIPEPxt + ATP -> DIPEP + ADP + PI
oppABCDF	Oligopeptide	OPEPxt + ATP -> OPEP + ADP + PI
uraA	Uracil	URAxt + HEXT -> URA
gpt	Xanthine	XANxt -> XAN

*** Objective function

(Please note that the objective function used in metabolic flux analyses is converted to molar basis rather than wt% shown in the Methods section.
Also, glycogen and polyamines were not considered in the biomass.)

Maximize: 0.72387 PROTEIN + 0.1216 RNA + 0.02093 DNA + 0.00055 LIPID + 0.02659 LPS + 0.02621 PEPTIDO + 0.01535 FATTYACID + 0.0065 COFACTOR

*** About this *in silico* metabolic network:

The metabolic reaction network constructed directly from the genome sequence in this study is currently limited by several factors such as possible invalid annotation, missing links, etc.
More effort based on bioinformatic and experimental verification is required to further improve and fine-tune the current reaction network.

*** About the glucose transport system:

We assumed that glucose is transported by the PTS in this study based on COG annotation results.
However, it should be noted that this is not experimentally verified.
Therefore, we also carried out metabolic flux analysis by assuming that glucose is transported by non-PTS system, and compared the results with those shown in Figure 3.
It was found that the general metabolic characteristics were not considerably altered by changing the glucose transport system.
There were some minor changes in flux values (most notable for the pyruvate kinase flux for obvious reason),
but the flux distribution patterns were generally similar (results not shown).

Abbreviation

Name	Type	Full name
4HLT	Intermediate	4-Hydroxybenzoate
a13P2DG	Intermediate	1,3_*P* -D glycerate
a2K3D6PG	Intermediate	2-Dehydro-3-deoxy-6-*P* -gluconate
a2O6H	Intermediate	2-Octaprenol 6-hydroxyphenol
a2PDGL	Intermediate	2-*P* -D glycerate
a2PPP	Intermediate	2-Polyprenylphenol
a35ADP	Intermediate	3.5-ADP
a3DDAH7P	Intermediate	3-Deoxy-D- arabinoheptulosonate-7-phosphate
a3PDGL	Intermediate	3 *P* -D glycerate
a3PSER	Intermediate	3-Phosphoserine
a3PSME	Intermediate	*O* (1-Carboxyvinyl)-3D-shikimate
a4HBZ	Intermediate	4-Hydroxybenzoate
a5MTA	Intermediate	5-Methylthioadenosine
A6RP	Intermediate	5-Amino-6-ribitylamino-2,4(1H,3H)-pyrimidinedione
A6RP5P	Intermediate	5-Amino-6-ribitylamino-2,4(1H,3H)-pyrimidinedione-5'-phsopahte
A6RP5P2	Intermediate	5-Amino-6-ribitylamino-2,4(1H,3H)-pyrimidinedione-5'-phsopahte2
AABK	Intermediate	2-Amino-3-ketobutyrate
ABUT	Intermediate	2-Aceto-2-hydroxybutyrate
AC	Intermediate	Acetate
ACACP	Intermediate	Acetyl-ACP
ACAL	Intermediate	Acetaldehyde
ACCOA	Intermediate	Acetyl-CoA
ACext	Unknown	External-Acetate
ACLAC	Intermediate	Acetyl-CoA
ACP	Intermediate	Acetolactate
ACTP	Intermediate	Acetyl-phosphate
ADN	Intermediate	Adenosine
ADP	Intermediate	Adenosine diphosphate
ADPHEP	Intermediate	ADP-mannoheptose
AGA1P	Intermediate	*N* -Acetyl-D-glucosamine-1-phosphate
AGA6P	Intermediate	*N* -Acetyl-D-glucosamine-6-phosphate
AGM	Intermediate	PHEPADP-Mannoheptose
AHHMD	Intermediate	2-Amino-4-hydroxy-6-hydroxymethyl dihydropteridine-pyrophosphate
AHHMP	Intermediate	2-Amino-4-hydroxy-6-hydroxymethyl dihydropteridine
AHTD	Intermediate	2-Amino-4-hydroxy-6-(erythro-1-2-3-trihydroxypropyl) dihydropteridine-phosphate
AICAR	Intermediate	5-Phosphoribosyl-5-amino-4-imidazole carboxamide
AIR	Intermediate	5-Phosphoribosyl-5-aminoimidazole
AKG	Intermediate	α- Ketoglutarate
ALA	Intermediate	Alanine
ALAV	Intermediate	δ- Amonolevulinate
AMP	Intermediate	Adenosine monophosphate
AN	Intermediate	Anthranilate
APS	Intermediate	Adenylyl sulfate
ARAB	Intermediate	Arabinose
ARABxt	Unknown	External-Arabinose
ARG	Intermediate	Arginine
ARGSUCC	Intermediate	l-Arginiosuccinate
ASER	Intermediate	*o* -Acetylserine
ASN	Intermediate	Asparagine
ASP	Intermediate	Aspartate
ASPSA	Intermediate	Aspartate β-semialdehyde
ASUC	Intermediate	Adenylsuccinate
ATP	Intermediate	Adenosine triphosphate
BASP	Intermediate	β- Aspartyl-phosphate
biomass	Secretion	Biomass
C140ACP	Intermediate	Myristic acid ACP
C141ACP	Intermediate	β-Hydroxymyristic acid ACP
C160ACP	Intermediate	Palmitic acid ACP
C161ACP	Intermediate	Palmitoleic acid ACP

C181ACP	Intermediate	*cis* -Vaccenic acid ACP
CAASP	Intermediate	Carbamoyl aspartate
CAP	Intermediate	Carbamoyl phosphate
CBHCAP	Intermediate	3-Carboxy-3-hydroxy-isocaproate
CDP	Intermediate	Cytidine diphosphate
CDPDG	Intermediate	CDP-1,2-Diacylglycerol
CDPETN	Intermediate	CDP-Ethanolamine
CHOR	Intermediate	Chorismate
CIT	Intermediate	Citrate
CITR	Intermediate	Citrulline
CL	Intermediate	Cardiolypin
CMP	Intermediate	Cytidine monophosphate
CMPKDO	Intermediate	CMP-2-Keto-3-deoxyoctanoate
CO2	Intermediate	Carbon dioxide
CO2ext	Unknown	Extrernal carbon dioxide
COA	Intermediate	Coenzyme A-SH
COAext	Unknown	External Coenayme A-SH
COFACTOR	Intermediate	Cofactors
CPAD5P	Intermediate	1-*o* -Carboxyphenylamino 1-deoxyribulose-5-phosphate
CPP	Intermediate	Coproporphyrinogen III
CTP	Intermediate	Cytidine triphosphate
CYS	Intermediate	Cysteine
D23PIC	Intermediate	2,3_Dihydrodipicolinate
D26PIM	Intermediate	L,L-2,6-Diaminopimelate
D6PGC	Intermediate	D-6-Phosphoglucono-δ-lactone
D6PGL	Intermediate	D-6-Phosphogluconate
D6RP5P	Intermediate	2,5-Diamino-6-ribosylamino-4(3H)-pyrimidinedione 5'-phosphate
D8RL	Intermediate	6,7-Dimethyl-8-ribityllumazine
DADP	Intermediate	Deoxyadenosine diphosphate
DANAD	Intermediate	Deamido-NAD
DATP	Intermediate	Deoxyadenosine triphosphate
DB4P	Intermediate	L-3,4-Dihydroxy-2-butanone-4-phosphate
DCDP	Intermediate	Deoxycytidine diphosphate
DCMP	Intermediate	2-Deoxy-guanosine-5-phosphate
DCTP	Intermediate	Deoxycytidine triphosphate
DGDP	Intermediate	Deoxyguanosine diphosphate
DGR	Intermediate	D-1,2-Diacylglycerol
DGTP	Intermediate	Deoxyguanosine triphosphate
DHD	Intermediate	7,8-Dihydropteroate
DHF	Intermediate	Dihydrofolate
DHMVA	Intermediate	2,3-Dihydroxy-3-methyl-valerate
DHNA	Intermediate	DTBDethiobiotin
DHP	Intermediate	Dihydroneopterin
DHSK	Intermediate	Dehydroshikimate
DHVAL	Intermediate	α,β-Dihydroxy-isovalerate
DIMGP	Intermediate	*d*- Erythroimidazoleglycerol-phosphate
DIPEP	Intermediate	Dipeptide
DIPEPxt	Unknown	External-Dipeptide
DNA	Intermediate	DNA
DOROA	Intermediate	Dihydroorotic acid
DQT	Intermediate	3-Dehydroquinate
DSAM	Intermediate	Decarboxylated SAM
DUDP	Intermediate	Deoxyuridine diphosphate
DUMP	Intermediate	Deoxyuridine monophosphate
DUTP	Intermediate	Deoxyuridine triphosphate
DX5P	Intermediate	Deoxyxylulose-5-phosphate
E4P	Intermediate	Erythrose 4-phosphate
ER4P	Intermediate	Erythronate-4-phosphate
ETHANOL	Intermediate	Ethanol
ETHANOLext	Unknown	External-Ethanol
F16P	Intermediate	Fructose 1,6-diphosphate
F1P	Intermediate	Fructose 1-phosphate

F6P	Intermediate	Fructose 6-phosphate
FAD	Intermediate	Flavin adenine dinucleotide
FADH2	Intermediate	Flavin adenine dinucleotide
FATTYACID	Intermediate	Fatty acids
FDP	Intermediate	Fructose 1,6-diphosphate
FGAM	Intermediate	5-Phosphoribosyl -*N*-formylgycineamidine
FGAR	Intermediate	5-Phosphoribosyl -*N*-formylgycineamide
FMN	Intermediate	Riboflavin 5'-phosphate
FORMATE	Intermediate	Formate
FORMATEext	Unknown	External-Formate
FPP	Intermediate	trans Farnesyl pyrophosphate
FRU	Intermediate	Fructose
FRUxt	Unknown	External-Fructose
FTHF	Intermediate	10-Formyl-tetrahydrofolate
FUM	Intermediate	Fumarate
G1P	Intermediate	Glucose 1-phosphate
G6P	Intermediate	Glucose 6-phosphate
GA6P	Intermediate	Glucosamine- 6-phosphate
GAL1P	Intermediate	Galactose 1-Phosphate
GAR	Intermediate	5-Phosphoribosyl glycineamide
GDP	Intermediate	Guanosine diphosphate
GGPP	Intermediate	Geranylgeranyl pyrophosphate
GL	Intermediate	Glycerol
GLxt	Unknown	External-Glycerol
GL3P	Intermediate	Glycoden 3-phosphate
GLAC	Intermediate	Galactose
GLAL	Intermediate	D-Glyceraldehyde
GLALext	Unknown	External-D-Glyceraldehyde
GLC	Intermediate	Glucose
GLCext	Unknown	Extrernal-Glucose
GLCN	Intermediate	Galactose
GLCNxt	Unknown	External-Galactose
GLN	Intermediate	Glutamine
GLU	Intermediate	Glutamate
GLUGSAL	Intermediate	L-Glutamate γ-semialdehyde
GLUP	Intermediate	Glutamyl phosphate
GLY	Intermediate	Glycine
GLYCOGEN	Intermediate	Glycogen
GMP	Intermediate	Guanosine monophosphate
GSA	Intermediate	Glutamate 1-semialdehyde
GTP	Intermediate	Guanosine triphosphate
GTRNA	Intermediate	L-Glutamyl-tRNA(glu)
H2O2	Intermediate	Hydrogen peroxide
H2S	Intermediate	Hydrogen sulfide
H2SO3	Intermediate	Hydrogen sulfite
H2SO4	Intermediate	Hydrogen sulfate
H2SO4ext	Unknown	External-Hydrogen sulfate
HCYS	Intermediate	Homocysteine
HEXT	Intermediate	External H+
HIS	Intermediate	Histidine
HISOL	Intermediate	Histidinol
HISOLP	Intermediate	1-Histidinol-phosphate
HMB	Intermediate	Hydroxymethylbilane
HMGCOA	Intermediate	3-Hydroxy-3-methy-glutaryl CoA
HO	Intermediate	Heme O
HPHPYR	Intermediate	para-Hydroxy phenyl pyruvate
HSER	Intermediate	Homoserine
ICHOR	Intermediate	Isochorismate
ICIT	Intermediate	Isocitrate
IGP	Intermediate	Indole glycerol phosphate
ILE	Intermediate	Isoleucine
IMACP	Intermediate	Imidazole acetyl-phosphate

IMP	Intermediate	Inosine monophosphate
IPPMAL	Intermediate	3-Isopropylmalate
IPPP	Intermediate	Isopentyl pyrophosphate
ISOVCOA	Intermediate	Isovaleryl-CoA
LAC	Intermediate	Lactate
LACext	Unknown	External-Lactate
LCTS	Intermediate	Lactose
LEU	Intermediate	Leucine
LIPID	Intermediate	Lipid
LPS	Intermediate	Lipposaccharide
LYS	Intermediate	Lysine
MAL	Intermediate	Malate
MALACP	Intermediate	Malonvl-ACP
MALCOA	Intermediate	Malonvl-COA
MAN1P	Intermediate	Mannose 1-Phosphate
MAN6P	Intermediate	Mannose 6-Phosphate
MAN	Intermediate	Mannose
MANxt	Unknown	External-Mannose
MCCOA	Intermediate	3-Methyl crotonyl-COA
MDAP	Intermediate	meso-Diaminopimelate
MELI	Intermediate	Melibiose
MELIxt	Unknown	External-Melibiose
MET	Intermediate	Methionine
METHF	Intermediate	5,10-Methenyl tetrahydrofolate
METTHF	Intermediate	5,10-Methene tetrahydrofolate
MLT6P	Intermediate	Maltose 6-phosphate
MLT	Intermediate	Maltose
MLTxt	Unknown	External-Maltose
MNT6P	Intermediate	Mannitol 6-Phosphate
MTHF	Intermediate	5,10-Methyl tetrahydrofolate
NAARON	Intermediate	N-α-Acetyl ornithine
NAD	Intermediate	Nicotinamide adenine dinucleotide
NADext	Unknown	Exteranl-Nicotinamide adenine dinucleotide
NADH	Intermediate	Nicotinamide adenine dinucleotide
NADP	Intermediate	Nicotinamide adenine dinucleotide phosphate
NADPH	Intermediate	Nicotinamide adenine dinucleotide phosphate
NAG	Intermediate	N-Acetylglucosamine
NAGLU	Intermediate	N-Acetyl glutamate
NAGLUSAL	Intermediate	N-Acetyl glutamate semialdehyde
NAGLUYP	Intermediate	N-Acetyl glutamyl-phosphate
NAGP	Intermediate	N-Acetylglucosamine
NAMAN	Intermediate	N-Acetylneuraminate
NH3	Intermediate	Ammonia
NH3ext	Unknown	External-Ammonia
NICNT	Intermediate	Nicotinate nucleotide
NPRAN	Intermediate	*N*-5- Phosphoribosyl-antranilate
NS26DP	Intermediate	*N*- Succinyl-1,1-2,6-diaminopimelate
NS2A6O	Intermediate	*N*- Succinyl-2-amino-6-ketopimelate
O2	Intermediate	Oxygen
O2ext	Unknown	External-Oxygen
OA	Intermediate	Oxaloacetate
OBUT	Intermediate	Oxobutyrate
OHB	Intermediate	3-Hydroxy-4-phospho-hydroxy-alpha-ketobutyrate
OICAP	Intermediate	2-Oxoisocaproate
OIVAL	Intermediate	Oxoisovalerate
OMP	Intermediate	Orotidylate
OMVAL	Intermediate	Oxomethylvalerate
OPEP	Intermediate	Oligopeptide
OPEPxt	Unknown	External-Oligopeptide
ORN	Intermediate	Ornithine
OROA	Intermediate	Orotic acid
OSB	Intermediate	O-Succinylbenzoic acid

OSBCOA	Intermediate	COAO-Succinylbenzoyl-CoA
OSLHSER	Intermediate	*o*-Succinyl-L-homoserine
P5P	Intermediate	Pyridoxine-5'-phosphate
PA	Intermediate	Phosphatidyl acid
PAP	Unknown	Adenosine-3,5-diphosphate
PAPS	Intermediate	3-Phosphoadenylyl sulfate
PBG	Intermediate	Probilinogen III
PC2	Intermediate	Percorrin 2
PDLA	Intermediate	Pyridoxamine
PDLA5P	Intermediate	Pyridoxamine-5-phosphate
PE	Intermediate	Phosphatidyl ethanolamine
PEP	Intermediate	Phosphoenolpyruvate
PEPTIDO	Intermediate	Peptidoglycan
PG	Intermediate	Phosphatidvl glycerol
PGP	Intermediate	1-1 Phosphatidvl-glycerol-phosphate
PHE	Intermediate	Phenylalanine
PHEN	Intermediate	Prephenate
PHP	Intermediate	3-Phosphohydroxypyruvate
PHPYR	Intermediate	Pheny pyruvate
PHSER	Intermediate	*o*-Phospho-1-homoserine
PHT	Intermediate	Phospho-hydroxy-threonine
PI	Intermediate	Phosphate(inorganic)
PIext	Unknown	External-phosphate(inorganic)
PIP26DX	Intermediate	δ- Pieperidine-2,6-dicarboxylate
PL	Intermediate	Pyridoxal
PL5P	Intermediate	Pyridoxal 5'-phosphate
POLYP	Intermediate	Polyphoshate
PPI	Intermediate	Pyrophosphate
PPIX	Intermediate	Protoporphyrin IX
PRAM	Intermediate	5-Phospho-β-D-ribosyl amine
PRBAMP	Intermediate	Phosphoribosyl-AMP
PRBATP	Intermediate	Phosphoribosyl-ATP
PRFICA	Intermediate	5-Phosphoribosyl-formamido-4-imidazole carboxamide
PRFP	Intermediate	Phosphoribosyl-formaimino-AICAR-phosphate
PRLP	Intermediate	Phosphoribulosyl-formimino-AICAR-phosphate
PRO	Intermediate	Proline
PROTEIN	Intermediate	Protein
PRPP	Intermediate	Phosphoribosyl pyrophosphate
PRSCAIM	Intermediate	5-Phosphoribosy-14-*N*-succinocarboxyamide-5-amino
PS	Intermediate	Phosphatidyl serine
PTH	Intermediate	Protoheme
PTRC	Intermediate	Putrescine
PTRCxt	Unknown	External-Putrescine
PTRSC	Intermediate	Putrescine
PYR	Intermediate	Pyruvate
PYRDX	Intermediate	Pyridoxine
Q	Intermediate	Ubiquinone
Qext	Unknown	External-Ubiquinone
QH2	Intermediate	Ubiquinol
QH2ext	Unknown	External-Ubiquinol
QNL	Intermediate	Quinolate
R5P	Intermediate	Ribose 5-phosphate
RCAIM	Intermediate	5-p-Ribosyl-4-carboxy-5-aminoimidazole
RIB	Intermediate	Ribose
RIBOFLAVIN	Intermediate	Riflavin
RL5P	Intermediate	D-Ribulose 5-phosphate
RNA	Intermediate	RNA
S7P	Intermediate	D-Sedoheptulose-7-*P*
SAH	Intermediate	*S*-Adenosyl homocystine
SAICAR	Intermediate	5-Phosphoribosyl-4-(N-succinocarboxyamide)-5-amino-imidazole
SAM	Intermediate	*S*-Adenosyl methionine
SER	Intermediate	Serine

SHCHC	Intermediate	2-Succinyl-6-hydroxy-2
SHCL	Intermediate	Sirohydrochlorin
SHEME	Intermediate	Siroheme
SLA	Intermediate	Sialic acid
SME	Intermediate	Shikimate
SME3P	Intermediate	Shikimate-3-phosphate
SPMD	Intermediate	Spermidine
SPMDext	Unknown	External-Spermidine
SSALTPP	Intermediate	Succinate semialdehyde - thiamine pyrophosphate
SUCC	Intermediate	Succinate
SUCCext	Unknown	External-Succinate
SUCCOA	Intermediate	Succiny-CoA
T3P1	Intermediate	Glyceraldehyde-3-phosphate
T3P2	Intermediate	Dihydroxyacetone phosphate
TDP	Intermediate	Thymidine-5-diphosphate
THF	Intermediate	Tetrahydrofolate
THR	Intermediate	Threonine
TMGCOA	Intermediate	*trans* -3-Methyl-glutaconyl-CoA
TMP	Intermediate	Thymidine-5-monophosphate
TPP	Intermediate	Thiamine-pyrophosphate
TRP	Intermediate	Tryptophan
TTP	Intermediate	Thymidine-5-triphosphate
TYR	Intermediate	Tyrosine
UDP	Intermediate	Uridine diphosphate
UDPAM	Intermediate	UDP-Acetylmuramate
UDPG	Intermediate	UDP-*N* -Acetylglucose
UDPGA	Intermediate	UDP-*N* -Acetylglucosamine
UDPGAL	Intermediate	UDP-*N* -Acetylgalactosamine
UDPGC	Intermediate	UDP-*N* -Acetylglucosamine-enolpyruvate
UDPGLN	Intermediate	UDP-Actylglucosamine
UMP	Intermediate	Uridine monophosphate
UPRG	Intermediate	Uroporphyrinogen III
URA	Intermediate	Urea
URAxt	Unknown	External-Urea
UTP	Intermediate	Uridine triphosphate
VAL	Intermediate	Valine
X5P	Intermediate	Xylulose-5-phosphate
XAN	Intermediate	Xanthine
XANxt	Intermediate	Xanthine
XMP	Intermediate	Xantosine monophosphate
XUL	Intermediate	Xylulose
XULxt	Unknown	External-Xylulose
XYL	Intermediate	Xylose
XYLxt	Unknown	External-Xylose