

Supporting information 1A List of the functional categories and their subgroups

Carbohydrate Metabolism

Glycolysis / Gluconeogenesis
Citrate cycle (TCA cycle)
Pentose phosphate pathway
Pentose and glucuronate interconversions
Fructose and mannose metabolism
Galactose metabolism
Ascorbate and aldarate metabolism
Starch and sucrose metabolism
Amino sugar and nucleotide sugar metabolism
Pyruvate metabolism
Glyoxylate and dicarboxylate metabolism
Propanoate metabolism
Butanoate metabolism
C5-Branched dibasic acid metabolism
Inositol phosphate metabolism

Energy Metabolism

Oxidative phosphorylation
Methane metabolism
Nitrogen metabolism
Sulfur metabolism

Lipid Metabolism

Fatty acid biosynthesis
Fatty acid metabolism
Synthesis and degradation of ketone bodies
Glycerolipid metabolism
Glycerophospholipid metabolism
Biosynthesis of steroids

Glycan Biosynthesis and Metabolism

Lipopolysaccharide biosynthesis
Peptidoglycan biosynthesis

Metabolism of Cofactors and Vitamins

Thiamine metabolism
Riboflavin metabolism
Vitamin B6 metabolism
Nicotinate and nicotinamide metabolism
Pantothenate and CoA biosynthesis
Biotin metabolism
Folate biosynthesis
One carbon pool by folate
Porphyrin and chlorophyll metabolism
Ubiquinone and other terpenoid-quinone biosynthesis

Transport Reactions

Miscellaneous Reactions

Amino Acid Metabolism

Alanine, aspartate and glutamate metabolism
Glycine, serine and threonine metabolism
Cysteine and methionine metabolism
Valine, leucine and isoleucine degradation
Valine, leucine and isoleucine biosynthesis
Lysine biosynthesis
Lysine degradation
Arginine and proline metabolism
Histidine metabolism
Tyrosine metabolism
Phenylalanine metabolism
Tryptophan metabolism
Phenylalanine, tyrosine and tryptophan biosynthesis

Metabolism of Other Amino Acids

beta-Alanine metabolism
Taurine and hypotaurine metabolism
Aminophosphonate metabolism
Selenoamino acid metabolism
Cyanoamino acid metabolism
D-Glutamine and D-glutamate metabolism
D-Alanine metabolism
Glutathione metabolism
O-antigen

Biosynthesis of Secondary Metabolites

Terpenoid backbone biosynthesis
Streptomycin biosynthesis
Novobiocin biosynthesis

Xenobiotics Biodegradation and Metabolism

Caprolactam degradation
Stilbene, Coumarine and Lignin Biosynthesis
Limonene and pinene degradation
gamma-Hexachlorocyclohexane degradation
2,4-Dichlorobenzoate degradation
1,2-Dichloroethane degradation
1,4-Dichlorobenzene degradation
Naphthalene and anthracene degradation
Benzoate degradation via CoA ligation
Benzoate degradation via hydroxylation
1- and 2-Methylnaphthalene degradation
Metabolism of xenobiotics by cytochrome P450

Nucleotide Metabolism

Purine metabolism
Pyrimidine metabolism

Supporting information 1B List of biochemical reactions used in PruMBEL1071

Glycolysis/ Gluconeogenesis	glucokinase	GLC + ATP -> G6P + ADP	glk	PP_1011
Glycolysis/ Gluconeogenesis	glucokinase	bDGLC + ATP -> bDG6P + ADP	glk	PP_1011
Glycolysis/ Gluconeogenesis	glucose-6-phosphate isomerase	G6P <-> bDG6P	pgi-1 pgi-2	PP_1808
Glycolysis/ Gluconeogenesis	glucose-6-phosphate isomerase	G6P <-> F6P	pgi-1 pgi-2	PP_1808
Glycolysis/ Gluconeogenesis	glucose-6-phosphate isomerase	bDG6P <-> F6P	pgi-1 pgi-2	PP_1808
Glycolysis/ Gluconeogenesis	phosphoglucumutase	G6P <-> G1P	xanA	PP_1777
Glycolysis/ Gluconeogenesis	ADP-glucose:1,4-alpha-D-glucan 4-alpha-D-glucosyltransferase	ADPG -> ADP + 14aDglucan	glgA	PP_3578
Glycolysis/ Gluconeogenesis	ADP-glucose:1,4-alpha-D-glucan 4-alpha-D-glucosyltransferase	14aDglucan -> GLYCOGEN	glgB	PP_5288
Glycolysis/ Gluconeogenesis	1,4-alpha-D-glucan:phosphate alpha-D-glucosyltransferase	GLYCOGEN + PI -> G1P + AMY	glgP	PP_4050
Glycolysis/ Gluconeogenesis	fructose-bisphosphatase	FDP -> F6P + PI	fbp	PP_5040
Glycolysis/ Gluconeogenesis	fructose-bisphosphate aldolase	FDP <-> G3P + DHAP	lda	PP_4960
Glycolysis/ Gluconeogenesis	triose-phosphate isomerase	DHAP <-> G3P	tpiA	PP_4715
Glycolysis/ Gluconeogenesis	glyceraldehyde-3-phosphate dehydrogenase	G3P + PI + NAD <-> NADH + 13PDG	gap-1 gap-2	PP_1009
Glycolysis/ Gluconeogenesis	phosphoglycerate kinase	13PDG + ADP <-> 3PG + ATP	pgk	PP_2149
Glycolysis/ Gluconeogenesis	phosphoglycerate mutase	3PG <-> 2PG	pgm	PP_4963
Glycolysis/ Gluconeogenesis	phosphopyruvate hydratase	2PG <-> PEP	eno	PP_5056
Glycolysis/ Gluconeogenesis	pyruvate kinase	PEP + ADP -> PYR + ATP	pykAF	PP_1612
Glycolysis/ Gluconeogenesis	pyruvate dehydrogenase (acetyl-transferring)	THMPP + PYR -> HTHPP + CO2	aceE aceB	PP_1362
Glycolysis/ Gluconeogenesis	pyruvate dehydrogenase (acetyl-transferring)	HTHPP + LIPO -> ADLIPO + THMPP	acoA	PP_0339
Glycolysis/ Gluconeogenesis	dihydrolipoyllysine-residue acetyltransferase	COA + ADLIPO -> ACCOA + DLIPO	aceF aceC	PP_0554
Glycolysis/ Gluconeogenesis	dihydrolipoyl dehydrogenase	DLIPO + NAD -> LIPO + NADH	bkdB	PP_0555
Glycolysis/ Gluconeogenesis	Acetyl-CoA synthetase	ATP + AC + COA <-> AMP + PPI + ACCOA	lpdG lpdV	PP_0338
Glycolysis/ Gluconeogenesis	alcohol dehydrogenase	ACAL + NADH <-> ETH + NAD	lpd3	PP_0553
Glycolysis/ Gluconeogenesis	Ethanol:NADP+ oxidoreductase	ETH + NADP <-> ACAL + NADPH	fadDx acsA	PP_2213
Glycolysis/ Gluconeogenesis	quinoprotein ethanol dehydrogenase	ETH + PQQ -> PQQH2 + ACAL	acsB	PP_4487
TCA cycle	citrate synthase	ACCOA + OA -> COA + CIT	gltA	PP_4702
TCA cycle	aconitate hydratase	CIT <-> ICIT	acnA acnB	PP_1616
TCA cycle	isocitrate dehydrogenase (NADP)	ICIT + NADP -> NADPH + AKG + CO2	icd	PP_3839
TCA cycle	oxoglutarate dehydrogenase	AKG + LIPO -> SDLIPO + CO2	kgdA	PP_2426
TCA cycle	dihydrolipoyllysine-residue succinyltransferase	SDLIPO + COA <-> DLIPO + SUCCOA	kgdB	PP_2674
TCA cycle	succinate-CoA ligase	ADP + PI + SUCCOA <-> ATP + SUCC + COA	sucD sucC	PP_4185
TCA cycle	Fumarate reductase	SUCC + Q + 2 H <-> FUM + QH2	sdhB sdhA	PP_4186
TCA cycle	fumarate hydratase	FUM <-> MAL	sdhD sdhC	PP_4190
TCA cycle	malate dehydrogenase	MAL + NAD <-> NADH + OA	mdh	PP_4191
TCA cycle	Pyruvate:carbon-dioxide ligase (ADP-ATP + PYR + HCO3 <-> ADP + PI + OA forming)	accC-2	accC-2	PP_4192
Pentose phosphate pathway	glucose-6-phosphate 1-dehydrogenase	G6P + NADP -> D6PGL + NADPH	zwf-123	PP_0944
Pentose phosphate pathway	6-phosphogluconolactonase	D6PGL -> D6PGC	pgl	PP_1755
Pentose phosphate pathway	phosphogluconate dehydrogenase	D6PGC + NADP -> NADPH + CO2 + RL5P	gnd	PP_0897
Pentose phosphate pathway	ribulose-phosphate 3-epimerase	RL5P <-> X5P	rpe rpiA	PP_0654
Pentose phosphate pathway	phosphoglucumutase	R1P <-> R5P	xanA	PP_3581
Pentose phosphate pathway	transketolase	R5P + X5P <-> G3P + S7P	tktA	PP_5347
Pentose phosphate pathway	transketolase	X5P + E4P <-> F6P + G3P	tktA	PP_1022
Pentose phosphate pathway	transaldolase	G3P + S7P <-> E4P + F6P	tal	PP_4042
Pentose phosphate pathway	ribokinase	DRIB + ATP -> DR5P + ADP	rbsK	PP_5351
Pentose phosphate pathway	ribokinase	RIB + ATP -> R5P + ADP	rbsK	PP_1023
Pentose phosphate pathway	gluconate dehydratase	GLCxt + H2O -> GLUCxt	Gcd	PP_0415
Pentose phosphate pathway	gluconate dehydratase	GLUCxt -> KDGxt + H2O	Gad	PP_5150
Pentose phosphate pathway	2-dehydro-3-deoxy-phosphogluconate aldolase	KDGxt -> KDG	Gac	PP_1777
Pentose phosphate pathway	2-dehydro-3-deoxygluconokinase	KDPG -> PYR + G3P	eda	PP_3578
Pentose phosphate pathway	gluconokinase	KDG + ATP -> K6PG + ADP	kguK	PP_5288
Pentose phosphate pathway	glucose dehydrogenase	K6PG + NADPH -> D6PGC + NADP	kguD	PP_4965
Pentose phosphate pathway	gluconate dehydrogenase	GLUC + ATP -> D6PGC + ADP	gnuK	PP_2168
Pentose phosphate pathway	gluconate dehydrogenase	GLUC + FAD <-> DHGL + FADH2	gcd	PP_2458
Pentose phosphate pathway	Phosphogluconate dehydratase	D6PGC -> KDPG	edd	PP_2458
Pentose and glucuronate interconversions	D-Altronate hydro-lyase	DALT -> KDG	edd	PP_1444
Pentose and glucuronate interconversions	UDP-glucose dehydrogenase	UDPG + 2 NAD <-> UDPDGLUC + 2 NADH	edd	PP_3569
Fructose and mannose metabolism	1-phosphofructokinase	F1P + ATP -> FDP + ADP	fruK	PP_3383
Fructose and mannose metabolism	fructose-bisphosphate aldolase	F1P -> DHAP + T3	lda	PP_3377
Fructose and mannose metabolism	mannose-6-phosphate isomerase	MAN6P <-> F6P	fbp	PP_1024
Fructose and mannose metabolism	phosphomannomutase	MAN6P <-> MAN1P	xanA	PP_3378
Fructose and mannose metabolism	2,3-butanediol dehydrogenase	SOT + NAD <-> FRU + NADH	adh	PP_3376
Fructose and mannose metabolism	GDP-mannose 6-dehydrogenase	GDPMAN + 2 NAD -> GMANU + 2 NADH	algD	PP_3416
Fructose and mannose metabolism	D-Fructose 2-phosphate phosphatase	F2P -> FRU + PI	sixA aceK	PP_1444
Fructose and mannose metabolism	Poly(beta-D-1,4-mannuronide) lyase	ALGNT -> OLGRRNS	algL	PP_3578
Fructose and mannose metabolism	mannose-1-phosphate guanylyltransferase/mannose-6-phosphate isomerase	GDP + MAN1P -> PI + GDPMAN	algA	PP_5288
Fructose and mannose metabolism	GDP-mannose 4,6 dehydratase	GDPMAN -> G4D6DMAN	gmd	PP_0552
Fructose and mannose metabolism	acyl-transferase	GDPMAN + MANN -> GDP + MANN1	phaG	PP_1288
Fructose and mannose metabolism	GDPmannose:mannan 1,4-beta-D-mannosyltransferase	GDPMAN + 14BMANN -> GDP + 14BMANN	phaG	PP_4167
Fructose and mannose metabolism	Oxidoreductases	S6P + NADP <-> SB1P + NADPH	gbd	PP_4565
Galactose metabolism	UDP-glucose 4-epimerase	UDPG <-> UDPGAL	galE	PP_1281

Galactose metabolism	UTP-glucose-1-phosphate uridylyltransferase	G1P + UTP <=> UDPG + PPI	galU	PP_3821
Galactose metabolism	Oxidoreductases	bGLAC + NADPH <=> 3KbGALC + NADP	gbd	PP_2650 PP_2368
Ascorbate and aldarate metabolism	D-galactarate hydro-lyase	DGAL <=> D4DG		PP_3601
Ascorbate and aldarate metabolism	D-Glucuronolactone:NAD+ oxidoreductase	GCL + NAD <=> GLUCR + NADH		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278 PP_3599
Ascorbate and aldarate metabolism	5-dehydro-4-deoxyglucarate dehydratase	D4DG <=> 25DOP + CO2		
Ascorbate and aldarate metabolism	D-Glucarate hydro-lyase	GLUCR <=> D4DG		PP_4757
Ascorbate and aldarate metabolism	Oxidoreductases	2D3DX + NAD <=> 5H24DP + NADH	gbd	PP_2650 PP_2368 PP_1955 PP_4052
Ascorbate and aldarate metabolism	cytochrome P450 family protein 1,4-alpha-D-Glucan:1,4-alpha-D- glucan 4-alpha-D-glycosyltransferase	ASB -> MDAC MLT -> 2 GLC	malQ	
Starch and sucrose metabolism	1,4-alpha-D-Glucan:1,4-alpha-D- glucan 6-alpha-D-(1,4-alpha-D- glucano)-transferase	AMY -> STA	glgB	PP_4058
Starch and sucrose metabolism	ADP-glucose:1,4-alpha-D-glucan 4- alpha-D-glucosyltransferase	ADPG -> ADP + AMY	glgA	PP_4050
Starch and sucrose metabolism	1,4-alpha-D-Glucan:orthophosphate alpha-D-glucosyltransferase	STA + PI -> AMY + G1P	glgP	PP_5041
Starch and sucrose metabolism	D-Glucoside glucohydrolase	DGLS -> ROH + GLC	bglX	PP_1403
Starch and sucrose metabolism	beta-D-Glucoside glucohydrolase	CBIO -> 2 bDGLC	bglX	PP_1403
Starch and sucrose metabolism	1,4-beta-D-Glucan glucohydrolase	CLO -> CLO + bDGLC	bglX	PP_1403
Starch and sucrose metabolism	endo-1,4-beta-D-glucanase	CLO -> CLO + CBIO		PP_2637
Starch and sucrose metabolism	UDP-glucose-beta-glucan glucosyltransferase	UDPG + CLO -> UDP + CLO		PP_2635
Aminosugars metabolism	D-Glucosamine 1-phosphate 1,6- phosphomutase	GA6P <=> GA1P	glmM	PP_4716
Aminosugars metabolism	glutamine-fructose-6-phosphate transaminase	F6P + GLN -> GLU + GA6P	glmS	PP_5409
Aminosugars metabolism	glucosamine-1-phosphate N- acetyltransferase	ACCOA + GA1P -> NAGA1P + COA	glmU	PP_5411
Aminosugars metabolism	UDP-N-acetylglucosamine diphosphorylase	UTP + NAGA1P <=> UDPNAG + PPI	glmU	PP_5411
Aminosugars metabolism	UDP-N-acetylglucosamine 1- carboxyvinyltransferase	UDPNAG + PEP <=> UDPNAGEP + PI	murA	PP_0964
Aminosugars metabolism	UDP-N-acetylmuramate dehydrogenase	UDPNAGEP + NADPH -> UDPNAM + NADP	murB	PP_1904
Aminosugars metabolism	beta-hexosaminidase	CHBIO -> 2 NAGA	nagZ	PP_2145
Aminosugars metabolism	phosphohistidine phosphatase SixA, isocitrate dehydrogenase kinase/phosphatase	ACMAM + PI <=> NAMAM6P	sixA aceK	PP_4167 PP_4565
Aminosugars metabolism	UDP-N-acetyl-D-glucosamine 2- epimerase	UDPNAG <=> UDPNAMAM	wecB	PP_1811
Aminosugars metabolism	UDP-N-acetyl-D-glucosamine 2- epimerase	UDPNAG <=> ACMAM + UDP	wecB	PP_1811
Nucleotide sugars metabolism	dTDPglucose 4-epimerase	DTDPGLU <=> DTDPGAL		PP_0501
Nucleotide sugars metabolism	dTDPglucose 4-epimerase	UDPG <=> UDPGAL	galE	PP_3129
Nucleotide sugars metabolism	4-hydroxybutyrate dehydrogenase	UDPGAL + 2 NAD <=> UDPGALUR + 2 NADH	gbd	PP_2650 PP_2368
Nucleotide sugars metabolism	4-hydroxybutyrate dehydrogenase	DTDPGLU + 2 NADP -> DTDPGLUC + 2 NADPH	gbd	PP_2650 PP_2368
Nucleotide sugars metabolism	dTDP-4-dehydrohamnose 3,5- epimerase	DTDP4D6DG <=> GDP4D6DM	rmlC	PP_1782 PP_0265
Nucleotide sugars metabolism	dTDP-4-dehydrohamnose 3,5- epimerase	DTDP4D6DG <=> DTDP4D6DM	rmlC	PP_1782 PP_0265
Nucleotide sugars metabolism	dTDP-4-dehydrohamnose reductase	GDP4D6DM + NADPH -> GDP4D6DM + NADP	rmlD	PP_1784
Nucleotide sugars metabolism	dTDP-4-dehydrohamnose reductase	DTDP4D6DM + NADPH -> DTDP6DM + NADP	rmlD	PP_1784
Pyruvate metabolism	phosphate acetyltransferase	ACETYLP + COA <=> ACCOA + PI	pta	PP_0774
Pyruvate metabolism	phosphoenolpyruvate carboxylase	PEP + CO2 -> OA + PI	ppc	PP_1505
Pyruvate metabolism	(R)-S-lactoylglutathione methylglyoxal-lyase (isomerizing)	RGT + MTG <=> LTG	gloA	PP_3766
Pyruvate metabolism	S-(2-hydroxyacyl)glutathione hydrolase	LTG -> RGT + LAC	gloB	PP_4144
Pyruvate metabolism	oxaloacetate decarboxylase	MAL + NADP <=> PYR + CO2 + NADPH	oadA	PP_5346
Pyruvate metabolism	oxaloacetate decarboxylase	MAL + NAD <=> PYR + CO2 + NADH	oadA	PP_5346
Pyruvate metabolism	oxaloacetate decarboxylase	OA -> PYR + CO2	oadA	PP_5346
Pyruvate metabolism	aldehyde dehydrogenase (NAD)	ACAL + NAD -> NADH + AC		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_1649 PP_0339
Pyruvate metabolism	aldehyde dehydrogenase (NAD)	ACAL + NADP <=> AC + NADPH		
Pyruvate metabolism	D-lactate dehydrogenase	LAC + NAD <=> PYR + NADH	ldhA	PP_1649
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH	aceE acoB acoA	PP_0339
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH		PP_0554 PP_0555
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH	aceF	PP_0338
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH	acoC	PP_0553
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH	bkdB	PP_4403
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH	lpdG	PP_4187
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH	lpdV	PP_4404
Pyruvate metabolism	Pyruvate:NAD+ 2-oxidoreductase (CoA-acetylating)	PYR + COA + NAD -> ACCOA + CO2 + NADH	lpd3	PP_5366

Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	aceE	PP_0339
Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	acoB acoA	PP_0554 PP_0555
Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	aceF	PP_0338
Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	acoC	PP_0553
Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	bkdB	PP_4403
Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	lpdG	PP_4187
Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	lpdV	PP_4404
Pyruvate metabolism	Pyruvate:NAD+ 2-oxido-reductase (CoA-acetylating)	PYR + COA + NADP -> ACCOA + CO2 + NADPH	lpd3	PP_5366
Pyruvate metabolism	(S)-Lactate:ferricytochrome-c 2-oxido-reductase	LLAC + 2 FCYTC -> PYR + 2 FOCYTC	lldD	PP_4736
Pyruvate metabolism	ATP:pyruvate,water phosphotransferase	ATP + PYR -> AMP + PEP + PI	ppsA	PP_2082
Pyruvate metabolism	(S)-Malate:NADP+ oxidoreductase(oxaloacetate-decarboxylating)	MAL + NAD <=> PYR + CO2 + NADH	maeB	PP_5085
Pyruvate metabolism	(S)-Malate:NADP+ oxidoreductase(oxaloacetate-decarboxylating)	MAL + NADP <=> PYR + CO2 + NADPH	maeB	PP_5085
Pyruvate metabolism	(S)-Malate:(acceptor) oxidoreductase	MAL + FAD <=> FADH2 + OA	mqo-1	PP_0751
Pyruvate metabolism	(S)-Malate:(acceptor) oxidoreductase	MAL + FAD <=> FADH2 + OA	mqo-2	PP_1251
Pyruvate metabolism	(S)-Malate:(acceptor) oxidoreductase	MAL + FAD <=> FADH2 + OA	mqo-3	PP_2925
Pyruvate metabolism	L-Malate glyoxylate-lyase (CoA-acetylating)	ACCOA + GLX -> MAL + COA	glcB	PP_0356
Pyruvate metabolism	Acetyl-CoA:acetyl-CoA C-acetyltransferase	2 ACCOA -> COA + AACCOA	atoB fadAx	PP_2051 PP_2215 PP_3754 PP_4636 PP_0490 PP_0491 PP_2183 PP_2184 PP_2185 PP_2186 PP_4596 PP_0256 PP_4299
Glyoxylate and dicarboxylate metabolism	Formate dehydrogenase	FORM + NAD <=> CO2 + NADH		
Glyoxylate and dicarboxylate metabolism	2-hydroxy-3-oxopropionate reductase	DGLYCERATE + NAD <=> H3OP + NADH	glxR	PP_4299
Glyoxylate and dicarboxylate metabolism	4-hydroxy-2-oxoglutarate aldolase	HYDROXYAKG -> PYR + GLX	eda	PP_1024
Glyoxylate and dicarboxylate metabolism	2-phosphoglycolate phosphohydrolase	2PPG -> GLYCOLATE + PI		PP_0094
Glyoxylate and dicarboxylate metabolism	3-phosphoglycolate phosphohydrolase	2PPG -> GLYCOLATE + PI	gph	PP_0416
Glyoxylate and dicarboxylate metabolism	4-phosphoglycolate phosphohydrolase	2PPG -> GLYCOLATE + PI		PP_1764
Glyoxylate and dicarboxylate metabolism	5-phosphoglycolate phosphohydrolase	2PPG -> GLYCOLATE + PI		PP_1907
Glyoxylate and dicarboxylate metabolism	L-Malate glyoxylate-lyase	ACCOA + GLX <=> MAL + COA	glcB	PP_0356
Glyoxylate and dicarboxylate metabolism	Glyoxylate carboxy-lyase	2 GLX -> H3OP + CO2	gcl	PP_4297
Glyoxylate and dicarboxylate metabolism	Isocitrate glyoxylate-lyase	ICIT -> SUCC + GLX	aceA	PP_4116
Glyoxylate and dicarboxylate metabolism	Hydroxypyruvate ketol-isomerase	HPYR -> H3OP	hyi	PP_4298
Glyoxylate and dicarboxylate metabolism	glycerate dehydrogenase	DGLYCERATE + NAD <=> HPYR + NADH	hprA	PP_0762
Glyoxylate and dicarboxylate metabolism	hydroxypyruvate reductase	DGLYCERATE + NAD <=> HPYR + NADH		PP_4300
Glyoxylate and dicarboxylate metabolism	hydroxypyruvate reductase	DGLYCERATE + NADP <=> HPYR + NADPH	hprA	PP_0762
Glyoxylate and dicarboxylate metabolism	Glycolate:NAD+ oxidoreductase	GLYCOLATE + NAD <=> GLX + NADH	glcD glcE	PP_3745
Glyoxylate and dicarboxylate metabolism	glycolate oxidase	GLYCOLATE + O2 -> GLX + H2O2	glcF	PP_3746 PP_3747
Propanoate metabolism	non-enzyme	HPCOA + NADP <=> OPCOA + NADPH		
Propanoate metabolism	non-enzyme	OPCOA + O2 + NADPH <=> MALCOA + NADP		
Propanoate metabolism	phosphate acetyltransferase	PROPIONYLP + COA <=> PROPIONYLCOA + PI	pta	PP_0774
Propanoate metabolism	2-Propyn-1-yl:NAD+ oxidoreductase	P1AL + NAD -> PRPYN + NADH		
Propanoate metabolism	acetyl-CoA acetyltransferase	2 ACCOA <=> COA + AACCOA	atoB fadAx	PP_2051 PP_2215 PP_3754 PP_4636 PP_0582 PP_0214
Propanoate metabolism	4-aminobutyrate aminotransferase	bALA + AKG <=> 3OPPA + GLU	gabT	PP_0596
Propanoate metabolism	beta alanine-pyruvate transaminase	ALA + 3OPPA <=> PYR + bALA		PP_0763
Propanoate metabolism		HPCOA + PI + ADP <=> HPPA + COA + ATP		PP_2437
Propanoate metabolism		HPCOA <=> PNCOA		PP_2793
Propanoate metabolism	acyl-CoA dehydrogenase, putative	ETFLA + PPCOA <=> RTFLA + PNCOA		PP_2213
Propanoate metabolism	acetyl-CoA synthetase	ATP + PROPANOATE <=> PPI + PPADY	fadDx acsA	PP_4487
Propanoate metabolism	acetyl-CoA synthetase	PPADY + COA <=> AMP + PPCOA	acsB	PP_4702 PP_2213 PP_4487 PP_4702
Propanoate metabolism	propionyl-CoA synthetase	ATP + PROPANOATE <=> PPI + PPADY		PP_2351
Propanoate metabolism	propionyl-CoA synthetase	PPADY + COA <=> AMP + PPCOA		PP_2351
Propanoate metabolism	propionyl-CoA carboxylase	ATP + PPCOA + HCO3 -> ADP + PI + MOPCOA		PP_4065
Propanoate metabolism	methylmalonate-semialdehyde dehydrogenase	METHMASAL + COA + NAD -> PPCOA + CO2 + NADH	mmsA-1	PP_4067
Propanoate metabolism	methylcitrate synthase	MCIT + COA <=> PPCOA + OA	mmsA-2	PP_0597 PP_4667
Propanoate metabolism	2-methylcitrate dehydratase	MCIT -> MACO	prpD	PP_2338
Propanoate metabolism	2-methylisocitrate dehydratase	MICIT <=> H2O + MACO	acnM	PP_2336
Propanoate metabolism	2-methylisocitrate lyase	MICIT <=> PYR + SUCC	prpB	PP_2334
Propanoate metabolism	primary alcohol dehydrogenase	P1OL + PQQ -> P1AL + PQQH2	qedH	PP_2674
Butanoate metabolism	succinate dehydrogenase	SUCC + FAD <=> FADH2 + FUM	sdhB sdhA	PP_4190
Butanoate metabolism	succinate-semialdehyde dehydrogenase	SUCCSAL + NAD -> SUCC + NADH	sdhD sdhC	PP_4191 PP_4192 PP_4193
Butanoate metabolism	4-aminobutyrate aminotransferase	GABA + AKG <=> SUCCSAL + GLU	gabD	PP_0213 PP_0214 PP_2488 PP_4422 PP_0214
Butanoate metabolism	quinoprotein ethanol dehydrogenase	B1OL + PQQ -> B1AL + PQQH2	gabT	PP_2674
Butanoate metabolism	aldehyde dehydrogenase family protein	B1AL + NAD -> BYNO + NADH	qedH	PP_2679 PP_0545 PP_2680 PP_2694 PP_3463 PP_5258 PP_3073
Butanoate metabolism	3-hydroxybutyrate dehydrogenase	HBTU + NAD <=> AAC + NADH	bdhA	PP_3073
Butanoate metabolism	acetyltransferase, GNAT family	RHBCOA <=> PBBUT	phaA phaC	PP_5003 PP_5005
Butanoate metabolism	3-hydroxyacyl-CoA epimerase	SHBCOA <=> RHBCOA	fadB	PP_2136
Butanoate metabolism	butyryl-CoA dehydrogenase	C040COA + NAD <=> CTCOA + NADH		PP_4948

Butanoate metabolism	enoyl-CoA hydratase/isomerase family protein	SHBCOA <-> CTCOA
Butanoate metabolism	(S)-3-Hydroxybutanoyl-CoA:NAD+ oxidoreductase	SHBCOA + NAD <-> AACCOA + NADH
Butanoate metabolism	3-hydroxyacyl-CoA dehydrogenase	SHBCOA + NADP <-> AACCOA + NADPH
Butanoate metabolism	PaaC CoA-transferase, subunit A, putative	SUCCOA + AAC <-> SUCC + AACCOA
Butanoate metabolism	dihydrodipicolinate synthase, putative	G1COA <-> HGCOA
Butanoate metabolism	hydroxymethylglutaryl-CoA lyase	H3MCOA <-> ACCOA + AAC
Butanoate metabolism	Oxidoreductases	BUTANAL + NADH <-> BUTANOL + NAD
Butanoate metabolism	Oxidoreductases	BUTANAL + NADPH <-> BUTANOL + NADP
C5-Branched dibasic acid metabolism	Itaconate:CoA ligase (ADP-forming)	ATP + ITC + COA <-> ADP + PI + ITCCOA
Inositol Phosphate Metabolism	3-Oxopropanoate:NAD+ oxidoreductase	3OPPA + COA + NAD -> ACCOA + CO2 + NADH
Inositol Phosphate Metabolism	3-Oxopropanoate:NAD+ oxidoreductase	3OPPA + COA + NAD -> ACCOA + CO2 + NADH
Inositol Phosphate Metabolism	myo-Inositol 1-phosphate phosphatase	INO1P -> MI + PI
Inositol Phosphate Metabolism	1D-myo-Inositol 3-phosphate phosphatase	INO3P -> MI + PI
Inositol Phosphate Metabolism	myo-Inositol 4-phosphate phosphatase	INO4P -> MI + PI
Oxidative phosphorylation	NADH dehydrogenase	NADH + Q -> NAD + QH2
Oxidative phosphorylation		QH2 + 0.5 O2 -> Q + 2 Hxt
Oxidative phosphorylation	NADH dehydrogenase	QH2 + 0.5 O2 -> Q + 4 Hxt
Oxidative phosphorylation	Ubiquinol:ferricytochrome-c oxidoreductase	Q + NADH -> QH2 + NAD
Oxidative phosphorylation		Q + 2 FOCYTC -> QH2 + 2 FCYTC
Oxidative phosphorylation	Ferrocycytochrome-c:oxygen oxidoreductase	O2 + 4 FOCYTC -> 4 FCYTC
Oxidative phosphorylation	inorganic diphosphatase	PPI -> 2 PI
Oxidative phosphorylation	proton-pumping inorganic diphosphatase	PPI -> 2 PI + H
Oxidative phosphorylation	ATP:polyphosphate phosphotransferase	ATP + PPI <-> ADP + H5P3O10
ATP synthesis	ATP synthase	ADP + PI + 3 H <-> ATP
Pentose Phosphate metabolism	Sedoheptulose 1,7-bisphosphate D-glyceraldehyde-3-phosphate-lyase	DHAP + E4P -> S17BP
Methane metabolism	quinoprotein ethanol dehydrogenase	MeOH + PQQ <-> PQQH2 + FALD
Methane metabolism	quinoprotein ethanol dehydrogenase	RCYTC + FALD -> CYTC + FORM
Methane metabolism		FALD -> METTHF
Methane metabolism	Hydrogen-peroxide:hydrogen-peroxide oxidoreductase	MeOH + H2O2 -> FALD
Methane metabolism	S-(hydroxymethyl)glutathione dehydrogenase	HMG + NAD -> FMGT + NADH
Nitrogen metabolism	L-Aspartate ammonia-lyase	ASP <-> FUM + NH3
Nitrogen metabolism	Carbonic acid hydro-lyase	CO2 -> H2CO3
Nitrogen metabolism	nitrite reductase	NO2 + 3 NADH -> 3 NAD + NH3
Nitrogen metabolism	ATP:carbamate phosphotransferase	ATP + CABM -> ADP + CAP
Nitrogen metabolism	ATP:carbamate phosphotransferase	ADP + CAP <-> ATP + NH3 + CO2
Nitrogen metabolism	glycine cleavage	GLY + THF + NAD -> METTHF + NADH + CO2 + NH3
Nitrogen metabolism	glycine cleavage	GLY + THF + NAD -> METTHF + NADH + CO2 + NH3
Nitrogen metabolism	L-Histidine ammonia-lyase	HIS <-> UCNA + NH3
Nitrogen metabolism	D-Amino-acid:(acceptor) oxidoreductase (deaminating)	DALA + FAD -> PYR + NH3 + FADH2
Nitrogen metabolism	L-ornithine N5-oxygenase	NH3 + O2 -> HAMN
Nitrogen metabolism	L-Asparagine amidohydrolase	ASP + NH3 -> ASN
Nitrogen metabolism	L-Glutamine amidohydrolase	GLU+ NH3 -> GLN
Nitrogen metabolism	L-Glutamate:NADP+ oxidoreductase (transaminating)	AKG + GLN + NADPH -> NADP + 2 GLU
Sulfur metabolism	sulfate adenylyltransferase	SLF + ATP -> PPI + APS
Sulfur metabolism	adenylyl-sulfate kinase	APS + ATP -> ADP + PAPS

fadB fadB1x phaB ech	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066
fadB fadB2x	PP_2136 PP_2214 PP_0302 PP_2047
paaC paaH	PP_3282 PP_3755 PP_3122 PP_3123 PP_2639
mvaB gbd	PP_3540 PP_2650 PP_2368 PP_2650 PP_2368
gbd	PP_2650 PP_2368
sucD sucC	PP_4185 PP_4186 PP_0597
mmsA-1	PP_0597
mmsA-2	PP_4667
suHb	PP_0838
suHb	PP_0838
suHb	PP_0838
nuoA nuoB nuoCD nuoE nuoF nuoG nuoH nuoI nuoJ nuoK nuoL nuoM nuoN	PP_4119 PP_4120 PP_4121 PP_4122 PP_4123 PP_4124 PP_4125 PP_4126 PP_4127 PP_4128 PP_4129 PP_4130 PP_4131
cyd cyo ndh	PP_0626
petA petB petC	PP_1317 PP_1318 PP_1319
ccoN-1 ccoO-1 ccoQ-1 ccoP-1 ccoN-2 ccoO-2 ccoQ-2 ccoP-2	PP_4250 PP_4251 PP_4252 PP_4253 PP_4255 PP_4256 PP_4257 PP_4258 PP_0103 PP_0104 PP_0106
ppa	PP_0538
ppa	PP_0538
ppk	PP_5217
atpC atpD atpG atpA atpH atpF atpE atpB	PP_5412 PP_5413 PP_5414 PP_5415 PP_5416 PP_5417 PP_5418 PP_5419 PP_4960
qedH	PP_2674
qedH	PP_2674
katE katA	PP_0115 PP_0481 PP_3668 PP_1616
aspA cynT nirB nirD	PP_5338 PP_0100 PP_1705 PP_1706 PP_0999
arcC	PP_0999
arcC	PP_0999
gcvT-1 gcvH-1 gcvP-1 lpd	PP_0986 PP_0989 PP_0988 PP_4187
gcvT-2 gcvH-2 gcvP-2 lpd	PP_5194 PP_5193 PP_5192 PP_4187 PP_5032 PP_4434 PP_5270 PP_1255 PP_4311 PP_3796
ansA ansA gltD gltB	PP_2453 PP_2453 PP_5075 PP_5076 PP_4037
cysD cysNC	PP_1303 PP_1304
cysNC	PP_1304

Sulfur metabolism	phosphoadenylyl-sulfate reductase (thioredoxin)	PAPS + RTHIO -> OTHIO + SLF + AMP	cysH	PP_2328
Sulfur metabolism	hydrogen-sulfide:NADP+ oxidoreductase	SLF + 3 NADPH -> H2S + 3 NADP	cysI	PP_2371 PP_0860
Sulfur metabolism	FMN dependent alkanesulfonate monooxygenase	HETHSLF + FMNH2 + O2 -> GLAL + FMN + Hxt + H2O + SLF	ssuD	PP_0238
Sulfur metabolism	FMN dependent alkanesulfonate monooxygenase	MSLF + FMNH2 + O2 -> FALD + FMN + Hxt + H2O + SLF	ssuD	PP_0238
Sulfur metabolism	FMN dependent alkanesulfonate monooxygenase	ETHSLF + FMNH2 + O2 -> ACAL + FMN + Hxt + H2O + SLF	ssuD	PP_0238
Sulfur metabolism	FMN dependent alkanesulfonate monooxygenase	PENTSLF + FMNH2 + O2 -> AMACAL + FMN + Hxt + H2O + SLF	ssuD	PP_0238
Sulfur metabolism	FMN reductase	FMN + NADPH -> FMNH2 + NADP	ssuE	PP_0236
Fatty acid biosynthesis	acetyl-CoA carboxylase	ACCOA + ATP + CO2 <=> MALCOA + ADP + PI	accC-1 accB accA accD	PP_0558 PP_0559 PP_1607 PP_1996 PP_1913
Fatty acid biosynthesis	[acyl-carrier-protein] S-malonyltransferase	MALCOA + ACP -> MALACP + COA	fabD	PP_1916
Fatty acid biosynthesis	3-oxoacyl-[acyl-carrier-protein] synthase	ACCOA + ACP -> ACACP + COA	fabF fabB	PP_4175 PP_3303 PP_4379 PP_4545
Fatty acid biosynthesis	Decanoyl-[acyl-carrier protein] synthesis (lumped reaction)	ACACP + 4 MALACP + 8 NADPH -> 8 NADP + C100ACP + 4 CO2 + 4 ACP		
Fatty acid biosynthesis	Dodecanoyl-[acyl-carrier protein] synthesis (lumped reaction)	ACACP + 5 MALACP + 10 NADPH -> 10 NADP + C120ACP + 5 CO2 + 5 ACP		
Fatty acid biosynthesis		ACACP + 6 MALACP + 12 NADPH -> 12 NADP + C140ACP + 6 CO2 + 6 ACP		
Fatty acid biosynthesis	Hexadecanoyl-[acyl-carrier protein] synthesis (lumped reaction)	ACACP + 7 MALACP + 14 NADPH -> 14 NADP + C160ACP + 7 CO2 + 7 ACP		
Fatty acid biosynthesis	Stearoyl-[acyl-carrier protein] synthesis (lumped reaction)	ACACP + 8 MALACP + 16 NADPH -> 16 NADP + C180ACP + 8 CO2 + 8 ACP		
Fatty acid metabolism	Fatty acid oxidation (n-C16:0)	ATP + 8 COA + 7 FAD + C160 + 7 NAD -> 8 ACCOA + AMP + 7 FADH2 + 7 NADH + PPI	fadD fadD2 fadB fadB1x phaB ech fadB fadB2x fadA phaD	PP_4549 PP_4550 PP_3458 PP_2437 PP_2793 PP_1893 PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066 PP_2136 PP_2214 PP_0302 PP_2047 PP_2137 PP_3280 PP_0582
Fatty acid metabolism	Fatty acid oxidation (decanoate)	ATP + 5 COA + 4 FAD + C100 + 4 NAD -> 5 ACCOA + AMP + 4 FADH2 + 4 NADH + PPI	fadD fadD2 fadB fadB1x phaB ech fadB fadB2x fadA phaD	PP_4549 PP_4550 PP_3458 PP_2437 PP_2793 PP_1893 PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066 PP_2136 PP_2214 PP_0302 PP_2047 PP_2137 PP_3280 PP_0582
Fatty acid metabolism	Fatty acid oxidation (hexanoate)	ATP + 3 COA + 2 FAD + C060 + 2 NAD -> 3 ACCOA + AMP + 2 FADH2 + 2 NADH + PPI		PP_4549 PP_4550 PP_3458 PP_2437 PP_2793 PP_1893 PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066 PP_2136 PP_2214 PP_0302 PP_2047 PP_2137 PP_3280 PP_0582
Fatty acid metabolism	rubredoxin-NAD+ reductase	2 RUBDR + NAD + Hxt <=> 2 RUBDO + NADH	rubB	PP_5314
Biosynthesis of steroids	1-deoxy-D-xylulose-5-phosphate synthase	PYR + G3P -> DX5P + CO2	dxs	PP_0527
Biosynthesis of steroids	1-deoxy-D-xylulose-5-phosphate reductoisomerase	DX5P + NADPH -> MDE4P + NADP	dxr	PP_1597
Biosynthesis of steroids	2-C-methyl-D-erythritol 4-phosphate cytidyltransferase	MDE4P + CTP -> CDPMPDE + PPI	ispD	PP_1614
Biosynthesis of steroids	4-(cytidine 5'-diphospho)-2-C-methyl-D-erythritol kinase	CDPMPDE + ATP -> 2PCDPMPDE + ADP	ispE	PP_0723
Biosynthesis of steroids	2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase	2PCDPMPDE -> MDECPP + CMP		PP_1618
Biosynthesis of steroids	4-hydroxy-3-methylbut-2-en-1-yl diphosphate synthase	MDECPP + NADH -> NAD + HMB4PP	ispG	PP_0853
Biosynthesis of steroids	4-hydroxy-3-methylbut-2-enyl diphosphate reductase	HMB4PP + NADH -> NAD + IPP	ispH	PP_0606
Biosynthesis of steroids	geranyltranstransferase	DMPP + IPP -> GPP + PPI	ispA	PP_0528

Biosynthesis of steroids	dimethylallyltransferase	GPP + IPP -> FPP + PPI	ispA	PP_0528
Biosynthesis of steroids	NAD(P)H dehydrogenase	RVK + NADH -> VK + NAD		PP_3720
Glycerolipid metabolism	glycerol kinase	GL + ATP -> GL3P + ADP	glpK	PP_1075
Glycerolipid metabolism	alcohol dehydrogenase	GL + NAD <-> T3 + NADH		PP_1616
				PP_2426
				PP_3839
				PP_0545
				PP_2589
				PP_2680
				PP_2694
				PP_3463
				PP_5258
				PP_5278
				PP_3178
Glycerolipid metabolism	glycerate kinase	DGLYCERATE + ATP -> 3PG + ADP	lip	PP_4854
Glycerolipid metabolism	triacylglycerol lipase	DGR -> AGCR + C160	lip	PP_4854
Glycerolipid metabolism	triacylglycerol lipase	TAGCR -> DGR + C160	lip	PP_4854
Glycerolipid metabolism	diacylglycerol kinase	ATP + DGR -> ADP + PA	dgkA-1	PP_1636
			dgkA-2	PP_2973
			plsB	PP_1520
Glycerophospholipid metabolism	glycerol-3-phosphate O-acyltransferase	GL3P + 0.067 C100ACP + 0.182 C120ACP + 0.018 C140ACP + 0.587 C160ACP + 0.046 C180ACP + 0.1 C181ACP -> AGL3P + ACP		
Glycerophospholipid metabolism	1-acylglycerol-3-phosphate O-acyltransferase	AGL3P + 0.067 C100ACP + 0.182 C120ACP + 0.018 C140ACP + 0.587 C160ACP + 0.046 C180ACP + 0.1 C181ACP -> PA + ACP	plsC	PP_1844
				PP_0058
Glycerophospholipid metabolism	glycerophosphodiester phosphodiesterase	GL3PETHAM -> ETHAM + GL3P		PP_2152
Glycerophospholipid metabolism	glycerophosphodiester phosphodiesterase	GL3PCHOL -> CHOL + GL3P		PP_2152
Glycerophospholipid metabolism	Ethanolamine ammonia-lyase	ETHAM <-> ACAL + NH3		PP_0542
Glycerophospholipid metabolism	glycerol-3-phosphate dehydrogenase	GL3P + Q -> DHAP + QH2	glpD	PP_1073
Glycerophospholipid metabolism	phosphatidate cytidyltransferase	PA + CTP <-> CDPDG + PPI	cdsA	PP_1596
Glycerophospholipid metabolism	CDP-diacylglycerol-serine O-phosphatidyltransferase	CDPDG + SER <-> CMP + PS	pssA-1	PP_3664
Glycerophospholipid metabolism	phosphatidylserine decarboxylase	PS -> PE + CO2	pssA-2	PP_4677
			psd	PP_4908
Glycerophospholipid metabolism	glycerol-3-phosphate dehydrogenase	DHAP + NADPH <-> GL3P + NADP	gpsA	PP_4169
Glycerophospholipid metabolism	CDP-diacylglycerol-glycerol-3-phosphate 3-phosphatidyltransferase	CDPDG + GL3P <-> CMP + PGP	pgsA	PP_4097
Glycerophospholipid metabolism	phosphatidylglycerophosphatase	PGP -> PI + PG	pgpA	PP_0520
Glycerophospholipid metabolism	cardiolipin synthase	CDPDG + PG -> CMP + CL	cls	PP_5364
				PP_3264
Glycerophospholipid metabolism	acetyltransferase	GL3P + ACOA -> AGL3P + COA		PP_5163
Purine metabolism	ribose-phosphate diphosphokinase	R5P + ATP <-> PRPP + AMP	prsA	PP_0722
Purine metabolism	amidophosphoribosyltransferase	PRPP + GLN -> PRAM + PPI + GLU	purF	PP_2000
Purine metabolism	phosphoribosylamine-glycine ligase	PRAM + ATP -> GLY <-> GAR + ADP + PI	purD	PP_4823
Purine metabolism	phosphoribosylglycinamide formyltransferase	GAR + FTHF -> FGAR + THF	purN	PP_1664
Purine metabolism	phosphoribosylformylglycinamide synthase	FGAR + ATP + GLN -> FGAM + GLU + ADP + PI	purL	PP_1037
Purine metabolism	phosphoribosylformylglycinamide cyclo-ligase	FGAM + ATP -> AIR + ADP + PI	purM	PP_1665
Purine metabolism	phosphoribosylaminoimidazole carboxylase	AIR + CO2 + ATP -> CAIR + ADP + PI	purK purE	PP_5335
Purine metabolism	phosphoribosylaminoimidazolesuccinocarboxamide synthase	CAIR + ATP + ASP <-> SAICAR + ADP + PI	purC	PP_5336
Purine metabolism	adenylosuccinate lyase	SAICAR <-> AICAR + FUM	purB	PP_1240
Purine metabolism	phosphoribosylaminoimidazolecarboxamide formyltransferase	AICAR + FTHF <-> PRFICA + THF	purH	PP_4016
Purine metabolism	phosphoribosylaminoimidazolecarboxamide formyltransferase	PRFICA <-> IMP	purH	PP_4822
Purine metabolism	adenylosuccinate synthase	IMP + GTP + ASP -> ASUC + GDP + PI	purA	PP_4889
Purine metabolism	adenylosuccinate lyase	ASUC <-> FUM + AMP	purB	PP_4016
Purine metabolism	IMP dehydrogenase	IMP + NAD -> XMP + NADH	guaB	PP_1031
Purine metabolism	GMP synthase	XMP + ATP + GLN -> GMP + GLU + AMP + PPI	guaA	PP_1032
Purine metabolism	GMP synthase	ATP + XMP + NH3 -> AMP + PPI + GMP	guaA	PP_1032
Purine metabolism	adenylate cyclase	ATP -> cAMP + PPI	cyaA	PP_5222
Purine metabolism	adenylate cyclase	GTP -> cGMP + PPI	cyaA	PP_5222
Purine metabolism	guanylate kinase	DGMP + ATP <-> DGDP + ADP	gmK-2	PP_5296
Purine metabolism	nucleoside-diphosphate kinase	IDP + ATP <-> ITP + ADP	ndk	PP_0849
Purine metabolism	adenine phosphoribosyltransferase	AD + PRPP -> PPI + AMP	apt	PP_4266
Purine metabolism	adenine phosphoribosyltransferase	GN + PRPP -> PPI + GMP	apt	PP_4266
Purine metabolism	hypoxanthine phosphoribosyltransferase	HYXN + PRPP -> PPI + IMP		PP_0747
Purine metabolism	hypoxanthine phosphoribosyltransferase	XAN + PRPP -> PPI + XMP		PP_0747
Purine metabolism	dGTPase	DGTP -> DG + H5P3O10		PP_2102
Purine metabolism	GTP diphosphokinase	ATP + GTP -> pppGpp + AMP	relA	PP_1656
Purine metabolism	guanosine-3',5'-bis(diphosphate) 3'-diphosphatase	pppGpp -> GDP + PPI	spoT	PP_5302
Purine metabolism	adenylate kinase	ATP + AMP <-> 2 ADP	adk	PP_1506
Purine metabolism	ribonucleoside-diphosphate reductase	ADP + RTHIO -> DADP + OTHIO	nrdB nrdA	PP_1177
Purine metabolism	nucleoside-diphosphate kinase	DADP + ATP <-> DATP + ADP	ndk	PP_1179
Purine metabolism	guanylate kinase	GMP + ATP <-> GDP + ADP	gmK-2	PP_0849
Purine metabolism	nucleoside-diphosphate kinase	GDP + ATP <-> GTP + ADP	ndk	PP_0849
Purine metabolism	ribonucleoside-diphosphate reductase	GDP + RTHIO -> DGDP + OTHIO	nrdB nrdA	PP_1177
Purine metabolism	nucleoside-diphosphate kinase	DGDP + ATP <-> DGTP + ADP	ndk	PP_1179
Purine metabolism	ADP-ribose ribophosphohydrolase	ARIB -> AMP + R5P	ndk	PP_0849
Purine metabolism	ATP-AMP phosphotransferase	ATP + DAMP <-> ADP + DADP	adk	PP_1506
Purine metabolism	polyphosphate phosphohydrolase	pppGpp <-> ppGpp + PI	ppx	PP_5216
Purine metabolism	P1,P4-bis(5'-nucleosyl)-tetraphosphate	AppppA -> 2 ADP	apaH	PP_0399
Purine metabolism	nucleosidebisphosphohydrolase			
	1-(5'-Phosphoribosyl)-5-amino-4-imidazolecarboxamide:pyrophosphate phosphoribosyltransferase	AICAR + PPI <-> A4IZM + PRPP	apt	PP_4266
Purine metabolism	ATP:nucleoside-diphosphate phosphatransferase	ATP + dIDP <-> ADP + dITP	ndk	PP_0849
Purine metabolism	Polyribonucleotide:orthophosphate nucleotidyltransferase	RNA + PI <-> RNA + ADP	pnp	PP_4708
Purine metabolism	ATP:polynucleotide adenyltransferase	ATP + RNA <-> PPI + RNA	rpoB rpoC rpoA rpoZ	PP_0447
				PP_0448
				PP_0479
				PP_5301
				PP_0849
Purine metabolism	ATP:nucleoside-diphosphate phosphatransferase	ATP + ADP <-> ADP + ATP	ndk	
Purine metabolism	pyruvate kinase	PEP + ADP <-> PYR + ATP	pykA pykF	PP_1362
				PP_4301
Purine metabolism	pyruvate kinase	GTP + PYR <-> GDP + PEP	pykA pykF	PP_1362
				PP_4301
Purine metabolism	Polyribonucleotide:orthophosphate nucleotidyltransferase	RNA + PI <-> RNA + GDP	pnp	PP_4708
Purine metabolism	ATP:polynucleotide adenyltransferase	GTP + RNA <-> PPI + RNA	rpoB rpoC rpoA rpoZ	PP_0447
				PP_0448
				PP_0479
				PP_5301

Purine metabolism	Deoxyguanosine 5'-triphosphate:DNA deoxynucleotidyltransferase(DNA-directed)	DGTP + DNA <=> PPI + DNA	dnaN polA holC dnaE holB dnaQ dnaX holA	PP_0011 PP_0123 PP_0979 PP_1606 PP_1966 PP_4141 PP_3119 PP_4796 PP_4269 PP_4768
Purine metabolism	pyruvate kinase	DGDP + PEP -> DGTP + PYR	pykA pykF	PP_1362 PP_4301
Purine metabolism	2'-Deoxyguanosine 5'-monophosphate phosphohydrolase	DGMP <=> DG + PI	ushA	PP_1414 PP_2531
Purine metabolism	GMP:pyrophosphate phosphoribosyltransferase	GMP + PPI <=> GN + PRPP		PP_0747
Purine metabolism	Guanosine 5'-monophosphate phosphohydrolase	GMP -> GN + PI	ushA	PP_1414 PP_2531
Purine metabolism	Xanthosine 5'-phosphate phosphohydrolase	XMP -> XTSINE + PI	ushA	PP_1414 PP_2531
Purine metabolism	Inosine 5'-monophosphate phosphohydrolase	IMP -> INS + PI	ushA	PP_1414 PP_2531
Purine metabolism	Adenosine 5'-monophosphate phosphohydrolase	AMP -> ADN + PI	ushA	PP_1414 PP_2531
Purine metabolism	AMP:pyrophosphate phosphoribosyltransferase	AMP + PPI <=> ADN + PRPP		PP_0747
Purine metabolism	pyruvate kinase	DATP + PYR <=> DADP + PEP	pykA pykF	PP_1362 PP_4301
Purine metabolism	Deoxyadenosine 5'-triphosphate:DNA deoxynucleotidyltransferase(DNA-directed)	DATP + DNA <=> PPI + DNA	dnaN polA holC dnaE holB dnaQ dnaX holA	PP_0011 PP_0123 PP_0979 PP_1606 PP_1966 PP_4141 PP_3119 PP_4796 PP_4269 PP_4768 PP_1414
Purine metabolism	2'-Deoxyadenosine 5'-monophosphate phosphohydrolase	dAMP <=> DA + PI	ushA	PP_1414
Purine metabolism	2'-Deoxyadenosine 5'-monophosphate phosphohydrolase	dAMP <=> DA + PI		PP_2531
Purine metabolism	AMP phosphoribohydrolase	AMP -> AD + R5P		PP_4779
Purine metabolism	Deoxyadenosine aminohydrolase	DA <=> DIN + NH3	add	PP_0591
Purine metabolism	Adenosine ribohydrolase	ADN -> AD + RIB		PP_2460
Purine metabolism	Adenosine aminohydrolase	ADN -> INS + NH3	add	PP_0591
Purine metabolism	Inosine ribohydrolase	INS -> HYXN + RIB		PP_2460
Purine metabolism	Xanthine:NAD+ oxidoreductase	HYXN + NAD -> XAN + NADH	xdhA xdhB	PP_4278 PP_4279
Purine metabolism	Xanthine:NAD+ oxidoreductase	XAN + NAD -> URATE + NADH	xdhA xdhB	PP_4278 PP_4279
Purine metabolism	Xanthosine ribohydrolase	XTSINE -> XAN + RIB		PP_2460
Purine metabolism	Guanine aminohydrolase	GN -> XAN + NH3	gad	PP_4281
Purine metabolism	Guanosine ribohydrolase	GSN -> GN + RIB		PP_2460
Purine metabolism	Urea amidohydrolase	UREA -> CO2 + 2 NH3	ureA ureB ureC	PP_2843 PP_2844 PP_2845 PP_4288
Purine metabolism	Ureidoglycolate amidohydrolase (decarboxylating)	URGLY <=> GLX + 2 NH3 + CO2		
Purine metabolism	ATP:adenylylsulfate 3'-phosphotransferase	ATP + APS -> ADP + PAPS	cysNC	PP_1304
Pyrimidine metabolism	aspartate carbamoyltransferase	CAP + ASP -> CAASP + PI	pyrB	PP_4998
Pyrimidine metabolism	dihydroorotate	CAASP <=> DOROA	pyrC	PP_1086
Pyrimidine metabolism	dihydroorotate oxidase	DOROA + O2 <=> H2O2 + OROA	pyrD	PP_4999
Pyrimidine metabolism	dihydroorotate oxidase	DOROA + FAD <=> FADH2 + OROA	pyrD	PP_2095
Pyrimidine metabolism	orotate phosphoribosyltransferase	OROA + PRPP <=> PPI + OMP	pyrE	PP_5291
Pyrimidine metabolism	orotidine-5'-phosphate decarboxylase	OMP -> CO2 + UMP	pyrF	PP_1815
Pyrimidine metabolism	cytidylate kinase	ATP + UMP <=> ADP + UDP	cmk	PP_1771
Pyrimidine metabolism	nucleoside-diphosphate kinase	UDP + ATP <=> UTP + ADP	ndk	PP_0849
Pyrimidine metabolism	CTP synthase	UTP + GLN + ATP -> GLU + CTP + ADP + PI	pyrG	PP_1610
Pyrimidine metabolism	CTP synthase	ATP + UTP + NH3 -> ADP + PI + CTP	pyrG	PP_1610
Pyrimidine metabolism	nucleoside-diphosphate kinase	CDP + ATP <=> CTP + ADP	ndk	PP_0849
Pyrimidine metabolism	ribonucleoside-diphosphate reductase	CDP + RTHIO -> DCDP + OTHIO	nrdB nrdA	PP_1177 PP_1179
Pyrimidine metabolism	nucleoside-diphosphate kinase	DCDP + ATP <=> DCTP + ADP	ndk	PP_0849
Pyrimidine metabolism	dCTP deaminase	DCTP -> DUTP + NH3	dcd	PP_1100
Pyrimidine metabolism	dUTP diphosphatase	DUTP -> PPI + DUMP	dut	PP_5286
Pyrimidine metabolism	nucleoside-diphosphate kinase	DTDP + ATP <=> DTTT + ADP	ndk	PP_0849
Pyrimidine metabolism	cytidylate kinase	CMP + ATP <=> ADP + CDP	cmk	PP_1771
Pyrimidine metabolism	thioredoxin-disulfide reductase	OTHIO + NADPH -> RTHIO + NAD	trxB	PP_0786
Pyrimidine metabolism	cytidylate kinase	DCMP + ATP <=> ADP + DCDP	cmk	PP_1771
Pyrimidine metabolism	uracil phosphoribosyltransferase	URA + PRPP -> UMP + PPI	upp pyrR	PP_0746 PP_4997 PP_1619 PP_5141
Pyrimidine metabolism	pseudouridylate synthase	URA + R5P <=> PURISP		
Pyrimidine metabolism	5,10-methylenetetrahydrofolate:dUMP C-methyltransferase	DUMP + METTHF -> DHF + DTMP	thyA	PP_5141
Pyrimidine metabolism	nucleoside-diphosphate kinase	DUDP + ATP <=> DUTP + ADP	ndk	PP_0849
Pyrimidine metabolism	ribonucleoside-diphosphate reductase	UDP + RTHIO -> OTHIO + DUDP	nrdB nrdA	PP_1177 PP_1179
Pyrimidine metabolism	Polyribonucleotide:orthophosphate nucleotidyltransferase	RNA + PI <=> RNA + UDP	pnp	PP_4708
Pyrimidine metabolism	UTP:RNA uridylyltransferase	UTP + RNA <=> PPI + RNA	rpoB rpoC rpoA rpoZ	PP_0447 PP_0448 PP_0479 PP_5301
Pyrimidine metabolism	dCTP deaminase	CTP -> UTP + NH3	dcd	PP_1100
Pyrimidine metabolism	Uridine triphosphate:RNA nucleotidyltransferase (DNA-directed)	CTP + RNA <=> PPI + RNA	rpoB rpoC rpoA rpoZ	PP_0447 PP_0448 PP_0479 PP_5301
Pyrimidine metabolism	Polyribonucleotide:orthophosphate nucleotidyltransferase	RNA + PI <=> RNA + CDP	pnp	PP_4708
Pyrimidine metabolism	Cytidine-5'-monophosphate phosphohydrolase	CMP -> CYTD + PI	ushA	PP_1414 PP_2531
Pyrimidine metabolism	Cytosine aminohydrolase	CYTS -> URA + NH3	codA	PP_3189
Pyrimidine metabolism	N-Carbamoyl-beta-alanine amidohydrolase	3URDPP -> bALA + CO2 + NH3		PP_0614 PP_4034
Pyrimidine metabolism	2'-Deoxycytidine 5'-monophosphate phosphohydrolase	dCMP -> DC + PI	ushA	PP_1414 PP_2531

Pyrimidine metabolism	Deoxycytidine triphosphate:DNA deoxynucleotidyltransferase(DNA-directed)	dCTP + DNA <-> PPI + DNA	dnaN polA holC dnaE holB dnaQ dnaX holA	PP_0011 PP_0123 PP_0979 PP_1606 PP_1966 PP_4141 PP_3119 PP_4796 PP_4269 PP_4768
Pyrimidine metabolism	Thymidine triphosphate:DNA deoxynucleotidyltransferase(DNA-directed)	dTTP + DNA <-> PPI + DNA	dnaN polA holC dnaE holB dnaQ dnaX holA	PP_0011 PP_0123 PP_0979 PP_1606 PP_1966 PP_4141 PP_3119 PP_4796 PP_4269 PP_4768
Pyrimidine metabolism	Thymidylate 5'-phosphohydrolase	DTMP -> DT + PI	ushA	PP_1414 PP_2531
Pyrimidine metabolism	5-Methylcytosine aminohydrolase	5MCYT <-> DT + NH3	codA	PP_3189
Pyrimidine metabolism	N-Carbamoyl-beta-alanine amidohydrolase	URBUT -> GABA + CO2 + NH3		PP_0614 PP_4034
Pyrimidine metabolism	Uridine 5'-monophosphate phosphohydrolase	UMP -> URI + PI	ushA	PP_1414 PP_2531
Glutamate metabolism	glutamine synthetase	GLU + NH3 + ATP -> GLN + ADP + PI	glnA	PP_5046 PP_3148 PP_4547 PP_5183 PP_5184 PP_5299 PP_0675
Glutamate metabolism	glutamate dehydrogenase (NADP)	AKG + NH3 + NADH <-> GLU + NAD	gdhA	PP_0675
Glutamate metabolism	glutamate dehydrogenase (NADP)	AKG + NH3 + NADPH <-> GLU + NADP	gdhA	PP_0675
Glutamate metabolism	carbamoyl-phosphate synthase	GLN + 2 ATP + CO2 -> GLU + CAP + 2 ADP + PI	carB carA	PP_4723 PP_4724 PP_0243
Glutamate metabolism	L-glutamate:L-cysteine gamma-ligase (ADP-forming)	ATP + GLU + CYS -> ADP + PI + GCYS	gshA	PP_4993
Glutamate metabolism	gamma-L-Glutamyl-L-cysteine:glycine ligase (ADP-forming)	ATP + GCYS + GLY -> ADP + PI + RGT	gshB	PP_4993
Glutamate metabolism	glutathione:NADP+ oxidoreductase	NAD + 2 RGT <-> OGT + NADH	gor	PP_3819
Glutamate metabolism	glutathione:NADP+ oxidoreductase	NADP + 2 RGT <-> OGT + NADPH + Hxt	gor	PP_3819
Glutamate metabolism	L-Glutamine amidohydrolase	GLU+ NH3 <-> GLN	ansA	PP_2453
Glutamate metabolism	L-Glutamate 1-carboxy-lyase	GLU -> GABA + CO2	speA	PP_0567
Glutamate metabolism	L-Glutamate:tRNA(Gln) ligase (AMP-forming)	GLU + ATP + TGLU -> GTRNA + AMP + PPI	gltX	PP_1977 PP_4694 PP_2904
Glutamate metabolism	L-Glutamine:tRNA(Gln) ligase (AMP-forming)	ATP + GLN + TGLN -> AMP + PPI + GNTRNA	glnS	PP_2904
Alanine and aspartate metabolism	asparaginase	ASN -> ASP + NH3	ansB	PP_0495
Alanine and aspartate metabolism	asparaginase	ASN -> ASP + NH3		PP_1160
Alanine and aspartate metabolism	aspartate transaminase	OA + GLU <-> ASP + AKG	aspC	PP_3721 PP_0858 PP_1872 PP_4692
Alanine and aspartate metabolism	asparagine synthase	ASP + ATP + GLN <-> GLU + ASN + AMP + PPI	asnB	PP_1750
Alanine and aspartate metabolism	L-Aspartic acid:oxygen oxidoreductase (deaminating)	ASP + O2 <-> OA + NH3 + H2O2	nadB	PP_1426
Alanine and aspartate metabolism	L-Alanine:tRNA(Ala) ligase (AMP-forming)	ATP + ALA + TALA <-> AMP + PPI + ATRNA	alaS	PP_4474
Alanine and aspartate metabolism	L-Aspartate:tRNA(Asp) ligase (AMP-forming)	TASP + ASP + ATP -> ASTRNA + PPI + AMP	aspS	PP_1213
Alanine and aspartate metabolism	L-Aspartate:tRNAAsp ligase (AMP-forming)	ATP + ASP + TASN -> AMP + PPI + ASNTRNA	aspS	PP_1213
Glycine, serine and threonine metabolism	aspartate kinase	ASP + ATP -> ADP + BASP		PP_4473
Glycine, serine and threonine metabolism	aspartate-semialdehyde dehydrogenase	BASP + NADPH -> NADP + PI + ASPSA	asd	PP_1989 PP_1992
Glycine, serine and threonine metabolism	homoserine dehydrogenase	ASPSA + NADPH -> NADP + HSER	hom	PP_1470 PP_0664
Glycine, serine and threonine metabolism	homoserine kinase	HSER + ATP -> ADP + PHSER	thrB	PP_0121
Glycine, serine and threonine metabolism	threonine synthase	PHSER -> THR + PI	thrC	PP_1471 PP_0662
Glycine, serine and threonine metabolism	phosphoglycerate dehydrogenase	3PG + NAD -> NADH + PHP	serA	PP_5155 PP_2533
Glycine, serine and threonine metabolism	phosphoserine transaminase	PHP + GLU -> AKG + 3PSER	serC	PP_1768
Glycine, serine and threonine metabolism	phosphoserine phosphatase	3PSER -> PI + SER	serB	PP_4909
Glycine, serine and threonine metabolism	glycine hydroxymethyltransferase	THF + SER <-> GLY + METTHF	glyA-1 glyA-2	PP_0322 PP_0671 PP_0321
Glycine, serine and threonine metabolism	threonine aldolase	THR <-> GLY + ACAL		
Glycine, serine and threonine metabolism	aminomethyltransferase	THF + SAP -> METTHF + NH3 + DHLIPOYLPROTEIN	gcvT-1 gcvT-2	PP_0986 PP_5194
Glycine, serine and threonine metabolism	glycine dehydrogenase	GLY + LIPOYLPROTEIN -> SAP + CO2	gcvP-1 gcvP-2	PP_0988 PP_5192
Glycine, serine and threonine metabolism	dihydropyridyl dehydrogenase	DHLIPOYLPROTEIN + NAD -> NADH + LIPOYLPROTEIN	lpdG lpdV lpd3	PP_4187 PP_4404 PP_5366
Glycine, serine and threonine metabolism	L-serine ammonia-lyase	SER -> PYR + NH3	sda-1 sda-2 sda-3	PP_0297 PP_0987 PP_3144
Glycine, serine and threonine metabolism	L-serine ammonia-lyase	SER -> PYR + NH3	ilvA-1 ilvA-2	PP_3446 PP_5149 PP_3191 PP_4430
Glycine, serine and threonine metabolism	threonine ammonia-lyase	THR -> OBUT + NH3	ilvA-1 ilvA-2	PP_3446 PP_5149 PP_3191 PP_4430 PP_4594
Glycine, serine and threonine metabolism	cystathionine gamma-lyase	LLCT <-> CYS + NH3 + OBUT		
Glycine, serine and threonine metabolism	choline-sulfatase	CHOLS + H2O -> CHOL + SLF	betC	PP_0077
Glycine, serine and threonine metabolism	choline dehydrogenase	CHOL + NAD -> BETAH + NADH	betA	PP_5064
Glycine, serine and threonine metabolism	betaine-aldehyde dehydrogenase	BETAH + NAD <-> BET + NADH	betB	PP_5063 PP_1481
Glycine, serine and threonine metabolism	betaine-aldehyde dehydrogenase	BETAH + NADP <-> BET + NADPH	betB	PP_5063 PP_1481
Glycine, serine and threonine metabolism	betaine-homocysteine transmethylease	BET + HCYS -> DMGLY + MET		
Glycine, serine and threonine metabolism	betaine-homocysteine transmethylease	DMGLY + FAD + H2O <-> SARC + FALD + FADH2		
Glycine, serine and threonine metabolism	sarcosine oxidase	SARC + O2 <-> GLY + FALD + H2O2	soxB soxD soxA soxG	PP_0323 PP_0324 PP_0325 PP_0326 PP_3775 PP_0321
Glycine, serine and threonine metabolism	threonine aldolase	ATHR <-> GLY + ACAL		
Glycine, serine and threonine metabolism	diaminobutyrate-2-oxoglutarate transaminase	GLU + ASPSA -> AKG + DAMBUT		PP_2800 PP_4223

Glycine, serine and threonine metabolism	oxidoreductase	MTG + NADPH -> HAC + NADP		PP_2368
Glycine, serine and threonine metabolism	oxidoreductase	MTG + NADPH -> HAC + NADP	gbd	PP_2650
Glycine, serine and threonine metabolism	threonyl-tRNA synthetase	ATP + THR + TTHR -> AMP + PPI + TTRNA	thrS	PP_2465
Glycine, serine and threonine metabolism	seryl-tRNA synthetase	ATP + SER + TSER -> AMP + PPI + STRNA	serS	PP_4000
Glycine, serine and threonine metabolism	glycyl-tRNA synthetase	ATP + GLY + TGLY -> AMP + PPI + GLTRNA	glyS glyQ	PP_0060 PP_0061
Methionine metabolism	cystathionine gamma-synthase	CYS + OSLHSER -> LLCT + SUCC	metB	PP_0659
Methionine metabolism	methionine synthase	HCYS + MTHF <=> THF + MET	metH	PP_2375
Methionine metabolism	5-methyltetrahydropteroyltriglutamate homocysteine methyltransferase	MTHPG + HCYS -> THPG + MET	metE	PP_2698
Methionine metabolism	homoserine O-acetyltransferase	ACCOA + HSER <=> COA + OAHSER	metX	PP_5097
Methionine metabolism	cystathionine gamma-synthase	OSLHSER + H2S -> HCYS + SUCC	metB	PP_0659
Methionine metabolism	cystathionine gamma-lyase	OSLHSER -> SUCC + OBUT + NH3	metB	PP_0659
Methionine metabolism	LLCT -> CYS + NH3 + OBUT			PP_4594
Methionine metabolism	methionine adenosyltransferase	MET + ATP -> PPI + PI + SAM	metK	PP_4967
Methionine metabolism	S-adenosylhomocysteine nucleosidase	SAH <=> SRLH + AD		PP_3254
Methionine metabolism	S-adenosylhomocysteine nucleosidase	5MTA -> AD + 5MDR		PP_3254
Methionine metabolism	acetyl-CoA:L-homoserine O-acetyltransferase	ACCOA + HSER -> COA + OAHSER	metX	PP_5097
Methionine metabolism	cystathionine gamma-synthase	OAHSER + CYS <=> LLCT + AC	metB	PP_0659
Methionine metabolism	cystathionine gamma-synthase/O-acetylhomoserine (thiol)-lyase	OAHSER + H2S -> HCYS + AC	metB metY	PP_0659 PP_2528
Methionine metabolism	cystathionine gamma-synthase/O-acetylhomoserine (thiol)-lyase	OAHSER + THSUL + RTHIO -> HCYS + SLF + OTHIO + AC	metB metY	PP_0659 PP_2528
Methionine metabolism	5-Methylthio-5-deoxy-D-ribose-1-phosphate ketol-isomerase	SMTDR1P -> SMTDRB1P		PP_1766
Methionine metabolism	DNA (cytosine-5-)-methyltransferase	SAM + CYS (in DNA) <=> SAH + 5MCYT (in DNA)		PP_3989
Methionine metabolism	methionyl-tRNA synthetase	ATP + MET + TMET -> AMP + PPI + MTRNA	metG	PP_1097
Methionine metabolism	methionyl-tRNA formyltransferase	MTRNA + FTHF -> THF + FMTRNA	fmt	PP_0067
Cysteine metabolism	cystathionine gamma-lyase	CYS -> H2S + PYR + NH3		PP_4594
Cysteine metabolism	serine O-acetyltransferase	SER + ACCOA -> COA + ASER		PP_0228
Cysteine metabolism	serine O-acetyltransferase	SER + ACCOA -> COA + ASER	cysE	PP_0840
Cysteine metabolism	cysteine synthase	ASER + H2S -> CYS + AC	cysM	PP_1654
Cysteine metabolism	cysteine synthase	ASER + H2S -> CYS + AC	cysK	PP_4571
Cysteine metabolism	L-serine dehydratase	SER -> AACL	sda-1 sda-2 sda-3	PP_0297 PP_0987 PP_3144 PP_4594
Cysteine metabolism	cystathionine gamma-lyase	CYS -> PYR + NH3 + TCYS		PP_3721
Cysteine metabolism	aspartate aminotransferase	MCPYR + GLU -> CYS + AKG	aspC	PP_0858 PP_1872 PP_4692
Cysteine metabolism	aspartate aminotransferase	CYST + AKG <=> SFPYR + GLU	aspC	PP_3721 PP_0858 PP_1872 PP_4692
Cysteine metabolism	aspartate aminotransferase	SFALA + AKG -> SFIPYR + GLU	aspC	PP_3721 PP_0858 PP_1872 PP_4692
Cysteine metabolism	cystathionine gamma-synthase	ASER + THSUL -> SSCYS + AC	cysM cysK metB	PP_1654 PP_4571 PP_0659
Cysteine metabolism	cysteine synthase	ASER + THSUL + RTHIO -> CYS + SLF + OTHIO + AC	cysM	PP_1654
Cysteine metabolism	cysteine synthase	ASER + THSUL + RTHIO -> CYS + SLF + OTHIO + AC	cysK	PP_4571
Cysteine metabolism	cysteine synthase	ATP + CYS + TRCYS -> AMP + PPI + CTRNA	cysS	PP_2905
Cysteine metabolism	O-acetylhomoserine (thiol)-lyase	ASER + THSUL + RTHIO -> CYS + SLF + OTHIO + AC	metY	PP_2528
Valine, leucine and isoleucine biosynthesis	acetolactate synthase	2 PYR -> ACLAC + CO2	ilvN ilvB	PP_4679 PP_4680 PP_1157 PP_1394 PP_3365
Valine, leucine and isoleucine	ketol-acid reductoisomerase	ACLAC + NADPH -> NADP + DHMVA	ilvC	PP_4678
Valine, leucine and isoleucine	dihydroxy-acid dehydratase	DHMVA -> OIVAL	ilvD	PP_5128
Valine, leucine and isoleucine biosynthesis	branched-chain-amino-acid transaminase	OIVAL + GLU <=> AKG + VAL	ilvE	PP_3511
Valine, leucine and isoleucine	leucine dehydrogenase	OIVAL + NH3 + NADH -> VAL + NAD		PP_4617
Valine, leucine and isoleucine	valyl-tRNA synthetase	ATP + VAL + TVAL -> AMP + PPI + VTRNA	valS	PP_0977
Valine, leucine and isoleucine biosynthesis	acetolactate synthase	PYR + OBUT -> ABUT + CO2	ilvN ilvB	PP_4679 PP_4680 PP_1157 PP_1394 PP_3365
Valine, leucine and isoleucine	ketol-acid reductoisomerase	ABUT + NADPH -> NADP + DHMP	ilvC	PP_4678
Valine, leucine and isoleucine	dihydroxy-acid dehydratase	DHMP -> 3MOP	ilvD	PP_5128
Valine, leucine and isoleucine biosynthesis	branched-chain-amino-acid transaminase	3MOP + GLU <=> AKG + ILE	ilvE	PP_3511
Valine, leucine and isoleucine	leucine dehydrogenase	3MOP + NH3 + NADH -> ILE + NAD		PP_4617
Valine, leucine and isoleucine	isoleucyl-tRNA synthetase	ATP + ILE + TILE -> AMP + PPI + ITRNA	ileS	PP_0603
Valine, leucine and isoleucine	2-isopropylmalate synthase	ACCOA + OIVAL -> COA + IPPMAL	leuA	PP_1025
Valine, leucine and isoleucine biosynthesis	3-isopropylmalate dehydratase	IPPMAL <=> CBHCAP	leuC leuD	PP_1985 PP_1986 PP_1988
Valine, leucine and isoleucine	3-isopropylmalate dehydrogenase	CBHCAP + NAD -> NADH + OICAP	leuB	PP_1988
Valine, leucine and isoleucine	spontaneous	OICAP -> 4MOP + CO2		
Valine, leucine and isoleucine biosynthesis	branched-chain-amino-acid transaminase	4MOP + GLU -> AKG + LEU	ilvE	PP_3511
Valine, leucine and isoleucine	leucine dehydrogenase	4MOP + NH3 + NADH <=> LEU + NAD		PP_4617
Valine, leucine and isoleucine	leucyl-tRNA synthetase	ATP + LEU + TLEU -> AMP + PPI + LTRNA	leuS	PP_4794
Valine, leucine and isoleucine degradation	3-hydroxyisobutyrate dehydrogenase	HIBUT + NAD -> METHMASAL + NADH	mmsB	PP_4666 PP_1143 PP_4617
Valine, leucine and isoleucine degradation	leucine dehydrogenase	LEU + NAD <=> 4MOP + NH3 + NADH		
Valine, leucine and isoleucine degradation	leucine dehydrogenase	bLEU + NAD -> O4MP + NH3 + NADH		PP_4617
Valine, leucine and isoleucine degradation	branched-chain amino acid aminotransferase	LEU + AKG -> 4MOP + GLU	ilvE	PP_3511
Valine, leucine and isoleucine degradation	2-oxoisocaproate dehydrogenase	4MOP + LIPO -> SMBDH + CO2	bkdA1 bkdA2	PP_4401 PP_4402 PP_5163
Valine, leucine and isoleucine degradation	acetyltransferase	SMBDH + COA -> MBTCOA+ DLIPO		
Valine, leucine and isoleucine degradation	isovaleryl-CoA dehydrogenase	MBTCOA + FAD -> MCTCOA + FADH2	ivd	PP_4064
Valine, leucine and isoleucine degradation	acyl-CoA dehydrogenase	MBTCOA + FAD <=> MCTCOA + FADH2		PP_2437 PP_2793

Valine, leucine and isoleucine degradation	3-Hydroxyisopentyl-CoA hydro-lyase	HIVCOA <-> MCTCOA	fadB fadB1x phaB ech	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066 PP_3511
Valine, leucine and isoleucine degradation	branched-chain amino acid aminotransferase	VAL + AKG -> OIVAL + GLU	ivE	PP_4401 PP_4402 PP_5163
Valine, leucine and isoleucine degradation	2-oxoisocaproate dehydrogenase	OIVAL + LIPO -> S2MDH + CO2	bkdA1 bkdA2	PP_4401 PP_4402 PP_5163
Valine, leucine and isoleucine degradation	acetyltransferase	OIVAL + LIPO -> S2MDH + CO2		PP_5163
Valine, leucine and isoleucine degradation	acetyltransferase	S2MDH + COA -> MPPCOA + DLIPO		PP_4948
Valine, leucine and isoleucine degradation	isovaleryl-CoA dehydrogenase	MPPCOA + O2 -> 2MPECOA		PP_2437 PP_2793
Valine, leucine and isoleucine degradation	acyl-CoA dehydrogenase	MPPCOA + FAD <-> 2MPECOA + FADH2	fadB fadB1x phaB ech	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066
Valine, leucine and isoleucine degradation	3-Hydroxyisopentyl-CoA hydro-lyase	2MPECOA -> HDXBUTCOA		PP_2136 PP_2214 PP_0302 PP_2047 PP_0596
Valine, leucine and isoleucine degradation	3-hydroxyacyl-CoA dehydrogenase	HIBUT + NAD <-> METHMASAL + NADH	fadB fadB2x	PP_2136 PP_2214 PP_0302 PP_2047 PP_0596
Valine, leucine and isoleucine degradation	beta-alanine-pyruvate transaminase	ALA + METHMASAL <-> PYR + GABA		PP_0214
Valine, leucine and isoleucine degradation	(S)-3-amino-2-methylpropionate transaminase	GABA + AKG <-> METHMASAL + GLU	gabT	PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278 PP_3511
Valine, leucine and isoleucine degradation	aldehyde dehydrogenase	METHMASAL + NAD -> METHMA + NADH		PP_4401 PP_4402 PP_5163
Valine, leucine and isoleucine degradation	branched-chain amino acid aminotransferase	ILE + AKG -> 3MOP + GLU	ivE	PP_4401 PP_4402 PP_5163
Valine, leucine and isoleucine degradation	2-oxoisocaproate dehydrogenase	3MOP + LIPO -> S2MBDH + CO2	bkdA1 bkdA2	PP_4401 PP_4402 PP_5163
Valine, leucine and isoleucine degradation	acetyltransferase	S2MBDH + COA -> 2MBTCOA + DLIPO		PP_4948
Valine, leucine and isoleucine degradation	isovaleryl-CoA dehydrogenase	2MBTCOA + O2 -> 2MBECCOA		PP_2437 PP_2793
Valine, leucine and isoleucine degradation	acyl-CoA dehydrogenase	2MBTCOA + FAD <-> 2MBECCOA + FADH2	fadB fadB1x phaB ech	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066
Valine, leucine and isoleucine degradation	3-Hydroxyisopentyl-CoA hydro-lyase	2MBECCOA <-> 3H2MBCOA		PP_2136 PP_2214 PP_0302 PP_2047 PP_0596
Valine, leucine and isoleucine degradation	3-hydroxyacyl-CoA dehydrogenase	3H2MBCOA + NAD <-> 2MATACOA + NADH	fadB fadB2x	PP_2136 PP_2214 PP_0302 PP_2047 PP_2137 PP_3280 PP_0582
Valine, leucine and isoleucine degradation	acetyl-CoA acyltransferase	COA + 2MATACOA -> PPCOA + ACCOA	fadA phaD	PP_0597
Valine, leucine and isoleucine degradation	methylmalonate-semialdehyde dehydrogenase	METHMASAL + COA + NAD -> PPCOA + CO2 + NADH	mmsA-1	PP_0597
Valine, leucine and isoleucine degradation	methylmalonate-semialdehyde dehydrogenase	METHMASAL + COA + NAD -> PPCOA + CO2 + NADH	mmsA-2	PP_4667
Lysine biosynthesis	dihydrodipicolinate synthase	ASPSA + PYR -> DHDP	dapA	PP_1237 PP_1257 PP_2036 PP_4725 PP_1530
Lysine biosynthesis	dihydrodipicolinate reductase	DHDP + NADPH -> NADP + TDHDP	dapB	PP_1530
Lysine biosynthesis	2,3,4,5-tetrahydropyridine-2,6-dicarboxylate N-succinyltransferase	TDHDP + SUCCOA -> SAOPIM + COA		PP_1588
Lysine biosynthesis	succinyl-diaminopimelate transaminase	SAOPIM + GLU -> SDAPIM + AKG	dapE	PP_1525
Lysine biosynthesis	succinyl-diaminopimelate desuccinylase	SDAPIM -> DAPIM + SUCC		PP_3790 PP_5228 PP_2077 PP_5227
Lysine biosynthesis	diaminopimelate epimerase	DAPIM <-> MDAPIIM	dapF-1 dapF-2	PP_3790 PP_5228 PP_2077 PP_5227
Lysine biosynthesis	diaminopimelate decarboxylase	MDAPIIM -> LYS + CO2	lysA-1 lysA-2	PP_1496 PP_4189 PP_4188 PP_0158
Lysine biosynthesis	lysyl-tRNA synthetase	ATP + LYS + TLYS -> AMP + PPI + LYTRNA	lysS	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066
Lysine degradation	2-oxoglutarate dehydrogenase	OAP + LIPO -> GDHLA + CO2	atoB fadAx	PP_2051 PP_2215 PP_3754 PP_4636 PP_1192 PP_1924 PP_2073 PP_4846 PP_5163 PP_2650 PP_2368
Lysine degradation	2-oxoglutarate dehydrogenase	GCOA + DLIPO <-> COA + GDHLA		
Lysine degradation	glutaryl-CoA dehydrogenase	GCOA + FAD -> CTCOA + FADH2 + CO2		
Lysine degradation	enoyl-CoA hydratase/isomerase family protein	CTCOA -> SHBCOA		
Lysine degradation	Acetyl-CoA:acetyl-CoA C-acetyltransferase	COA + AACCOA -> 2 ACCOA		
Lysine degradation	putative acetyltransferase	LYS + ACCOA <-> N6AL + COA		
Lysine degradation	oxidoreductase	5AAPT + NADH + CO2 <-> AM2OXH + NAD	gbd	

Lysine degradation	5,10-Methylenetetrahydrofolate:glycine hydroxymethyltransferase	HN6TL -> TMANB + GLY	glyA-1 glyA-2	PP_0322 PP_0671
Lysine degradation	aldehyde dehydrogenase	TMAMBL + NAD -> TMAMBT + NADH		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278 PP_3514 PP_3515 PP_4947
Arginine and proline metabolism	N-methylhydantoinase	ATP + MHDTN -> ADP + PI + CBSARC	hyuB hyuA	PP_1001
Arginine and proline metabolism	1-pyrroline-5-carboxylate dehydrogenase	P5C + NAD -> NADH + GLU	putA	PP_4947
Arginine and proline metabolism	1-pyrroline-5-carboxylate dehydrogenase	GLUGSAL + NAD -> NADH + GLU	putA	PP_4947
Arginine and proline metabolism	S-methyl-5'-thiadenosine adeninehyrase	GLUGSAL <-> P5C SMTA -> AD + 5MDR		PP_3254
Arginine and proline metabolism	oxaloacetate decarboxylase	HYDROXYAKG -> PYR + GLX	oadA	PP_5346
Arginine and proline metabolism	2-dehydro-3-deoxyphosphogluconate aldolase	HYDROXYAKG -> PYR + GLX	eda	PP_1024
Arginine and proline metabolism	succinylglutamic semialdehyde dehydrogenase	SUCGLU5S + NAD -> SUCGLU + NADH	aruD	PP_4478
Arginine and proline metabolism	succinylarginine dihydrolase	N2SARG -> N2SORN + CO2 + 2 NH3	astB	PP_4477
Arginine and proline metabolism	arginine N-succinyltransferase	SUCCOA + ARG -> COA + N2SARG	aruG aruF	PP_4479 PP_4480
Arginine and proline metabolism	arginine deiminase	ARG -> CITR + NH3	arcA	PP_1001
Arginine and proline metabolism	carbamate kinase	ATP + NH3 + CO2 -> ADP + CAP	arcC	PP_0999
Arginine and proline metabolism	proline dehydrogenase	PRO + FAD -> P5C + FADH2	putA	PP_4947 PP_3190 PP_3533 PP_4431 PP_4947
Arginine and proline metabolism	ornithine cyclodeaminase	ORN -> PRO + NH3		
Arginine and proline metabolism	1-pyrroline-5-carboxylate dehydrogenase	T4HP + FAD -> P3H5C + FADH2	putA	PP_4947
Arginine and proline metabolism	1-pyrroline-5-carboxylate dehydrogenase	P3H5C + NAD -> E4HGLU + NADH	putA	PP_4947
Arginine and proline metabolism	1-pyrroline-5-carboxylate dehydrogenase	E4HGLU + NAD -> HGLUSA + NADH	putA	PP_4947
Arginine and proline metabolism	Proline dehydrogenase	E4HGLU + NAD -> HGLUSA + NADH	putA	PP_4947
Arginine and proline metabolism	aspartate aminotransferase	P3H5C -> HGLUSA E4HGLU + AKG -> HYDROXYAKG + GLU	aspC	PP_3721 PP_0858 PP_1872 PP_4692
Arginine and proline metabolism	Pyrroline-5-carboxylate reductase	P3H5C + NADH -> T4HP + NAD	proC-2	PP_5095
Arginine and proline metabolism	succinylglutamate desuccinylase	SUCGLU -> GLU + SUCC	astE	PP_4475 PP_0864
Arginine and proline metabolism	Ornithine decarboxylase, biosynthetic	ORN -> PTRC + CO2		
Arginine and proline metabolism	Agmatinase	AGM -> UREA + PTRC	speB	PP_2196 PP_4523 PP_0567
Arginine and proline metabolism	Arginine decarboxylase, degradative	ARG -> CO2 + AGM	speA	
Arginine and proline metabolism	aspartate aminotransferase	ARG + PYR -> ALA + GOP	aruH	PP_3721
Arginine and proline metabolism	Oxoprolinase	GOP + Hxt -> CO2 + GBAL	arul	PP_3723
Arginine and proline metabolism	4-guandinoethylaldehyde dehydrogenase	GBAL + NAD + H2O -> GBUT + NADH + 2 Hxt		PP_5278
Arginine and proline metabolism	guanidinobutyrase	GBUT + H2O -> GABA + UREA	gbuA	PP_4523 PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278
Arginine and proline metabolism	Aldehyde dehydrogenase	AMBL + NADP -> GABA + NADPH		
Arginine and proline metabolism	arginyl-tRNA synthetase	ATP + ARG + TARG -> AMP + PPI + ARTRNA	argS	PP_5089
Arginine and proline metabolism	prolyl-tRNA synthetase	ATP + PRO + TPRO -> AMP + PPI + PTRNA	proS	PP_1205
Arginine and proline metabolism	proline iminopeptidase	PEPTIDE -> PRO + PEPTIDE	pip	PP_5028
Histidine metabolism	ATP phosphoribosyltransferase	PRPP + ATP -> PPI + PRBATP	hisG	PP_0966
Histidine metabolism	phosphoribosyl-ATP diphosphatase	PRBATP -> PPI + PRBAMP	hisE	PP_5015
Histidine metabolism	phosphoribosyl-AMP cyclohydrolase	PRBAMP -> PRFP	hisI	PP_5014
Histidine metabolism	1-(5-phosphoribosyl)-5-[(5-phosphoribosylamino)methylideneamino]imidazole-4-carboxamide isomerase	PRFP -> PRLP	hisA	PP_0292
Histidine metabolism	amidotransferase	PRLP + GLN -> GLU + AICAR + DIMGP	hisH hisF	PP_0290 PP_0293 PP_0289
Histidine metabolism	imidazoleglycerol-phosphate dehydratase	DIMGP -> IMACP	hisB	PP_0967
Histidine metabolism	histidinol-phosphate transaminase	IMACP + GLU -> AKG + HISOLP	hisC	
Histidine metabolism	histidinol dehydrogenase	HISOL + 2 NAD -> HIS + 2 NADH	hisD	PP_0966
Histidine metabolism	L-Histidine ammonia-lyase	HIS -> UCNA + NH3	hutH	PP_5032
Histidine metabolism	urocanate hydratase	UCNA -> IDZPP	hutU	PP_5033
Histidine metabolism	imidazolonepropionase	IDZPP -> FMMGLU	hutI	PP_5030
Histidine metabolism	N-Formimino-L-glutamate formiminohydrolase	FMMGLU -> GLU + FMM	hutG	PP_5029
Histidine metabolism	Methyltransferases	FMM -> FORM + NH3		
Histidine metabolism	L-Histidine carboxy-lyase	HIS + SAM -> NPMHIS + SAH		PP_5114 PP_2552
Histidine metabolism	aldehyde dehydrogenase	HIS -> HISTAMINE + CO2 IMZACAL + NAD -> IMZAC + NADH		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278
Histidine metabolism	histidyl-tRNA synthetase	ATP + HIS + THIS -> AMP + PPI + HTRNA	hisS	PP_0854
Tyrosine metabolism	aspartate transaminase	AKG + TYR -> 4HPP + GLU	aspC	PP_3721 PP_0858 PP_1872 PP_4692
Tyrosine metabolism	aromatic-amino-acid transaminase	AKG + TYR -> 4HPP + GLU	tyrB-1 tyrB-2	PP_1972 PP_3590 PP_3433 PP_2554
Tyrosine metabolism	4-hydroxyphenylpyruvate dioxygenase	4HPP + O2 -> HOMOGEN + CO2	hpd	
Tyrosine metabolism	homogentisate 1,2-dioxygenase	HOMOGEN + O2 -> MACTAC	hmgA	PP_4621
Tyrosine metabolism	L-ornithine N5-oxygenase	HOMOGEN + O2 -> GTAH + CO2		PP_3796
Tyrosine metabolism	maleylacetacetate isomerase	MACTAC -> FUMACTAC		PP_4619
Tyrosine metabolism	fumarylacetacetate	FUMACTAC -> AAC + FUM		PP_4620
Tyrosine metabolism	Lyase	2HHPDD -> 4H2OHEP		PP_2639
Tyrosine metabolism	Lyase	2OHEPED -> 4H2OHEP		PP_2639
Tyrosine metabolism	phenylacetyl-CoA ligase	ATP + 4HPHEAC + COA -> AMP + PPI + 4HPHEACCOA	phaE	PP_3279 PP_1192 PP_1924 PP_2073 PP_4846 PP_5163 PP_2552
Tyrosine metabolism	Acyltransferases	4HPHEACCOA + GLY -> 4HPHEACG + COA		
Tyrosine metabolism	aromatic-L-amino-acid decarboxylase	TYR -> TYRM + CO2		
Tyrosine metabolism	aromatic-L-amino-acid decarboxylase	DHPHE -> AE12BZ + CO2		PP_2552
Tyrosine metabolism	Methyltransferases	MTYRM + SAM -> HORD + SAH		PP_5114
Tyrosine metabolism	alcohol dehydrogenase	DHPHEG + NAD -> DHMAH + NADH		PP_1616 PP_3839

Phenylalanine metabolism	4-hydroxyphenylpyruvate dioxygenase	PHPYR + O2 -> 2HPHEAC + CO2	hpd	PP_3433 PP_2554
Phenylalanine metabolism	aspartate transaminase	PHE + AKG <-> PHPYR + GLU	aspC	PP_3721 PP_0858 PP_1872 PP_4692 PP_0967
Phenylalanine metabolism	histidinol-phosphate aminotransferase	PHE + AKG <-> PHPYR + GLU	hisC	
Phenylalanine metabolism	aromatic-amino-acid transaminase	PHE + AKG <-> PHPYR + GLU	tyrB-1 tyrB-2	PP_1972 PP_3590
Phenylalanine metabolism	L-Phenylalanine carboxy-lyase	PHE -> PHELAM + CO2		PP_2552
Phenylalanine metabolism	D-amino-acid dehydrogenase	DPHE + FAD + H2O -> PHPYR + NH3 + FADH2	dadA-1 dadA-2	PP_4434 PP_5270 PP_1255 PP_4311 PP_3279
Phenylalanine metabolism	phenylacetyl-CoA ligase	ATP + PHEACT + COA -> AMP + PPI + 4PHEACCOA	phaE	
Phenylalanine metabolism	lumped reaction	4PHEACCOA + COA -> SUCCOA + 2 ACCOA		
Phenylalanine metabolism	Phenylacetaldehyde:NAD+ oxidoreductase	PHEACAL + NAD -> PHEACT + NADH		
Phenylalanine metabolism	Phenethylamine:oxygen oxidoreductase	PHEAM + O2 -> PHEACAL + NH3 + H2O2		
Phenylalanine metabolism		PHEACT -> 4HPHEAC		
Tyrosine metabolism		4HPHEAC -> HOMOGEN		
Phenylalanine metabolism		CMAR -> 4HBZ	fos ech vdh	PP_3356 PP_3358 PP_3357 PP_1192 PP_1924 PP_2073 PP_4846 PP_5163 PP_2552
Phenylalanine metabolism	Acyitransferases	4PHEACCOA + GLY -> 4PHEACG + COA		
Tryptophan metabolism	5-Hydroxykynurenamine decarboxy-lyase	5HKN -> 5HKNN + CO2		
Tryptophan metabolism	5-Hydroxy-L-tryptophan decarboxy-lyase	5HTRY -> SEROTONIN + CO2		PP_2552
Tryptophan metabolism	L-Tryptophan decarboxy-lyase	TRP -> TRYP + CO2		PP_2552
Tryptophan metabolism	aldehyde dehydrogenase	5HIDACAL + NAD -> 5HIDAC + NADH		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278 PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278 PP_5114 PP_5114 PP_5114 PP_0115 PP_0481 PP_3668 PP_2887 PP_4189 PP_2051 PP_2215 PP_3754 PP_4636 PP_1311 PP_2324 PP_3080 PP_1866 PP_5078 PP_3569
Tryptophan metabolism	aldehyde dehydrogenase	I3ACAL + NAD -> I3AC + NADH		
Tryptophan metabolism	Methyltransferases	SEROTONIN -> MTXTP		
Tryptophan metabolism	Methyltransferases	HANTH -> MTANT		
Tryptophan metabolism	Methyltransferases	XTHE -> 8MTXN		
Tryptophan metabolism	Hydrogen-peroxide:hydrogen-peroxide oxidoreductase	2 HANTH + 2 O2 -> CINVLIN + 2 H2O2	katE katA	PP_0115 PP_0481 PP_3668 PP_2887 PP_4189 PP_2051 PP_2215 PP_3754 PP_4636 PP_1311 PP_2324 PP_3080 PP_1866 PP_5078 PP_3569
Tryptophan metabolism	2-oxoglutarate dehydrogenase	OAP + COA + NAD -> GCOA + CO2 + NADH	kgdA	PP_4189
Tryptophan metabolism	acetyl-CoA C-acetyltransferase	COA + AACCOA -> 2 ACCOA	atoB fadAx	PP_2051 PP_2215 PP_3754 PP_4636 PP_1311 PP_2324 PP_3080 PP_1866 PP_5078 PP_3569
Tryptophan metabolism	tryptophanyl-tRNA synthetase	ATP + TRP + TTRP -> AMP + PPI + TRTRNA	aroF-1 aroF-2	PP_1311 PP_2324 PP_3080 PP_1866 PP_5078 PP_3569
Phenylalanine, tyrosine and tryptophan biosynthesis	3-deoxy-7-phosphoheptulonate synthase	E4P + PEP -> PI + 3DDAH7P	aroF-1 aroF-2	PP_1311 PP_2324 PP_3080 PP_1866 PP_5078 PP_3569
Phenylalanine, tyrosine and tryptophan biosynthesis	3-dehydroquinate synthase	3DDAH7P -> DQT + PI	aroB	PP_5078 PP_3569
Phenylalanine, tyrosine and tryptophan biosynthesis	quinat dehydrogenase	DQT + Q <-> DQT + QH2		PP_3569
Phenylalanine, tyrosine and tryptophan biosynthesis	3-dehydroquinate dehydratase	DQT -> DHSK	aroQ-1 aroQ-2 aroQ-3	PP_0560 PP_2407 PP_3003 PP_0074 PP_3002 PP_2406 PP_2608 PP_3768 PP_5079
Phenylalanine, tyrosine and tryptophan biosynthesis	shikimate dehydrogenase	DHSK + NADPH -> SME + NADP	aroE-1 aroE-2	PP_0074 PP_3002 PP_2406 PP_2608 PP_3768 PP_5079
Phenylalanine, tyrosine and tryptophan biosynthesis	shikimate kinase	SME + ATP -> ADP + SME3P	aroK	PP_1770
Phenylalanine, tyrosine and tryptophan biosynthesis	3-phosphoshikimate 1-carboxyvinyltransferase	SME3P + PEP -> 3PSME + PI		
Phenylalanine, tyrosine and tryptophan biosynthesis	chorismate synthase	3PSME -> PI + CHOR	PP1830	PP_1830
Phenylalanine, tyrosine and tryptophan biosynthesis	anthranilate synthase	CHOR + GLN -> GLU + PYR + AN	trpE trpG	PP_0417 PP_0420 PP_0421
Phenylalanine, tyrosine and tryptophan biosynthesis	anthranilate phosphoribosyltransferase	AN + PRPP -> PPI + NPRAN	trpD	PP_0421
Phenylalanine, tyrosine and tryptophan biosynthesis	phosphoribosylanthranilate isomerase	NPRAN -> CPAD5P	trpF	PP_1995
Phenylalanine, tyrosine and tryptophan biosynthesis	indole-3-glycerol-phosphate synthase	CPAD5P -> CO2 + IGP	trpC	PP_0422
Phenylalanine, tyrosine and tryptophan biosynthesis	tryptophan synthase	IGP + SER -> G3P + TRP	trpA trpB	PP_0082 PP_0083 PP_0082 PP_0083 PP_0082 PP_0083 PP_1769
Phenylalanine, tyrosine and tryptophan biosynthesis	tryptophan synthase	INDOLE + G3P <-> IGP	trpA trpB	PP_0082 PP_0083 PP_0082 PP_0083 PP_1769
Phenylalanine, tyrosine and tryptophan biosynthesis	tryptophan synthase	SER + INDOLE -> TRP	trpA trpB	PP_0082 PP_0083 PP_0082 PP_0083 PP_1769
Phenylalanine, tyrosine and tryptophan biosynthesis	chorismate mutase	CHOR <-> PHEN	pheA	PP_1769
Phenylalanine, tyrosine and tryptophan biosynthesis	prephenate dehydratase	PHEN -> CO2 + PHPYR	pheA	PP_1769
Phenylalanine, tyrosine and tryptophan biosynthesis	prephenate dehydrogenase	PHEN + NAD -> 4HPP + CO2 + NADH		PP_1770
Phenylalanine, tyrosine and tryptophan biosynthesis	aromatic-amino-acid transaminase	ASP + PHEN -> OA + PTYR	tyrB-1 tyrB-2	PP_1972 PP_3590
Phenylalanine, tyrosine and tryptophan biosynthesis	prephenate dehydratase	PTYR -> PHE + CO2	pheA	PP_1769
Phenylalanine, tyrosine and tryptophan biosynthesis	phenylalanyl-tRNA synthetase	ATP + PHE + TPHE -> AMP + PPI + PHTRNA	pheS pheT	PP_2469 PP_2470 PP_4490
Phenylalanine, tyrosine and tryptophan biosynthesis	phenylalanine-4-hydroxylase	PHE + TTRHBP + O2 -> TYR + DHBP	phhA	PP_4490
Phenylalanine, tyrosine and tryptophan biosynthesis	tyrosyl-tRNA synthetase	ATP + TYR + TTYR -> AMP + PPI + TYTRNA	tyrS	PP_0436
Urea cycle and metabolism of amino groups	glutamate 5-kinase	GLU + ATP -> ADP + GLUP	proB	PP_0691
Urea cycle and metabolism of amino groups	glutamate-5-semialdehyde dehydrogenase	GLUP + NADPH <-> NADP + PI + GLUGSAL	proA	PP_4811
Urea cycle and metabolism of amino groups	nonenzyme	GLUGSAL <-> P5C		
Urea cycle and metabolism of amino groups	pyrroline-5-carboxylate reductase	P5C + NADPH <-> PRO + NADP	proC-2	PP_5095
Urea cycle and metabolism of amino groups	acetylglutamate kinase	NAGLU + ATP -> ADP + NAGLUP	argB	PP_5289
Urea cycle and metabolism of amino groups	N-acetyl-gamma-glutamyl-phosphate reductase	NAGLUP + NADPH <-> NADP + PI + NAGLUS	argC	PP_3633 PP_0432
Urea cycle and metabolism of amino groups	acetonitrile aminotransferase	NAGLUS + GLU <-> AKG + NAORN	argD	PP_4481 PP_0372
Urea cycle and metabolism of amino groups	N2-acetyl-L-ornithine amidohydrolase	NAORN -> AC + ORN	argE	PP_5186 PP_3571

Urea cycle and metabolism of amino groups	argininosuccinate synthase	CITR + ASP + ATP -> AMP + PPI + ARGSUCC	argG	PP_1088
Urea cycle and metabolism of amino groups	argininosuccinate lyase	ARGSUCC <=> FUM + ARG	argH	PP_0184
Urea cycle and metabolism of amino groups	N-acetylglutamate synthase	GLU + ACCOA -> COA + NAGLU	argJ argA	PP_1346
Urea cycle and metabolism of amino groups	glutamate N-acetyltransferase	NAORN + GLU <=> ORN + NAGLU	argJ	PP_5185
Urea cycle and metabolism of amino groups	ornithine carbamoyltransferase	ORN + CAP <=> CITR + PI	argI argF	PP_1346 PP_1000
Urea cycle and metabolism of amino groups	4-aminobutanal:NAD+ 1-oxidoreductase	AMBL + NAD -> GABA + NADH		PP_1079 PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278 PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5279
Urea cycle and metabolism of amino groups	N4-Acetylaminobutanal:NAD+ oxidoreductase	N4ACAMBL + NAD -> 4ACAMBA + NADH		PP_2680 PP_2694 PP_3463 PP_5258 PP_5279
b-Alanine metabolism		ASP -> CO2 + bALA		PP_0614
b-Alanine metabolism	N-Carbamoyl-beta-alanine amidohydrolase	3URDPP <=> bALA + CO2 + NH3		PP_4034
b-Alanine metabolism	aldehyde dehydrogenase	bAMPAL + NAD -> bALA + NADH		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278 PP_2437 PP_2793
b-Alanine metabolism	acyl-CoA dehydrogenase	FAD + PPCOA <=> FADH2 + PNCOA		PP_3535
Taurine and Hypotaurine metabolism	gamma-glutamyltranspeptidase	GLUPEP + TAU -> PEPTIDE + GLUTAU	ggt-1 ggt-2	PP_4659
Taurine and Hypotaurine metabolism	taurine dioxygenase	TAU + AKG + O2 -> SLF + AMACAL + SUCC + CO2	tauD	PP_0230 PP_0169
Aminophosphonate metabolism	Oxidoreductases	CLLT -> H2AEP		PP_0056 PP_2679 PP_2209
Aminophosphonate metabolism	2-aminoethylphosphonate-pyruvate transaminase	CLLT + PYR <=> PPACAL + ALA	phnW	PP_5114
Aminophosphonate metabolism	Transferases	MCobl + PPACAL -> HPPP + VB12		PP_3535
Selenoamino acid metabolism	gamma-glutamyltranspeptidase	GLUPEP + SEMSC -> PEPTIDE + GGSEMSC	ggt-1 ggt-2	PP_4659
Selenoamino acid metabolism	cystathionine gamma-synthase	PPHSER + SENCYS -> SLCYSTH + PI	metB	PP_0659
Selenoamino acid metabolism	cystathionine gamma-synthase	ATHSER + SENCYS -> SLCYSTH + AC	metB	PP_0659
Selenoamino acid metabolism	cystathionine gamma-synthase	SUCHSER + SENCYS -> SLCYSTH + SUCC	metB	PP_0659
Selenoamino acid metabolism	cystathionine gamma-lyase	SLCYSTH -> SENCYS + NH3 + OBUT		PP_4594
Selenoamino acid metabolism	methionyl-tRNA synthetase	ATP + SLNMET + TMET -> AMP + PPI + SMTRNA	metG	PP_1097
Selenoamino acid metabolism	methionine-gamma-lyase	SLNMET -> MTHSNL + NH3 + OBUT	mdeA	PP_1308
Selenoamino acid metabolism	S-adenosylmethionine synthetase	ATP + SLNMET -> PI + PPI + SEANSMET	metK	PP_4967
Selenoamino acid metabolism	Transferases	R + SEANSMET -> CH3-R + SESEHCYS		PP_5114
Selenoamino acid metabolism	selenocysteine lyase	SENCYS + P5P <=> SELD + ALA + PL5P	csdA	PP_1529
Selenoamino acid metabolism	cysteine synthase	ASER + SELD -> SENCYS + AC	cysM cysK	PP_1654 PP_4571
Selenoamino acid metabolism	selenide, water dikinase	ATP + SELD <=> AMP + SLNPP + PI	selD	PP_0823
Selenoamino acid metabolism	L-selenocysteinyl-tRNA(Sel)synthase	STRNA + SLNPP -> SSSTRNA + PI	selA	PP_0493
Selenoamino acid metabolism	hydrogen-sulfide:NADP+ oxidoreductase	SELT + 3 NADP -> SELD + 3 NADPH	cysI	PP_2371 PP_0860
Selenoamino acid metabolism	sulfate adenylyltransferase	ATP + SELN <=> PPI + ADNSEL	cysD cysNC	PP_1303 PP_1304
Selenoamino acid metabolism	adenylylsulfate kinase	ATP + ADNSEL -> ADP + PPADSEL	cysNC	PP_1304
Cyanoamino acid metabolism	beta-glucosidase	CNGLCS -> CYNHR + GLC	bgIX	PP_1403
Cyanoamino acid metabolism	Lyases	HCYSI + 2 CN -> AAGCB + HCYS + THCYN		PP_2639
Cyanoamino acid metabolism	gamma-glutamyltranspeptidase	CYALA + GLU -> rGLUCYA	ggt-1 ggt-2	PP_3535 PP_4659
Cyanoamino acid metabolism	gamma-glutamyltranspeptidase	CYALA + GLU -> rGLUAPP + CO2	ggt-1 ggt-2	PP_3535 PP_4659
D-Glutamine and D-glutamate metabolism	glutamate racemase	DGLU <=> GLU	murl	PP_0736
D-Glutamine and D-glutamate metabolism	L-Asparagine amidohydrolase	DGLN -> DGLU+ NH3	ansA	PP_2453
D-Alanine metabolism	alanine racemase	ALA <=> DALA		PP_3722
D-Alanine metabolism	alanine racemase	ALA <=> DALA	dadX	PP_5269
D-Alanine metabolism	D-alanine-D-alanine ligase	2 DALA + ATP -> ALAALA + ADP + PI	ddlB ddlA	PP_1339
Glutathione metabolism	glutathione reductase	OGT + NADPH -> NADP + 2 RGT		PP_4346
Glutathione metabolism	glucose-6-phosphate 1-dehydrogenase	bDGBP + NADP -> D6PGL + NADPH	gor zwf-1 zwf-2 zwf-3	PP_3819 PP_1022 PP_4042 PP_5351 PP_0777 PP_1686 PP_1874
Glutathione metabolism	glutathione peroxidase	H2O2 + 2 RGT <=> OGT		PP_3535 PP_4659
Glutathione metabolism	gamma-glutamyltranspeptidase	RGT -> CYSGLY + GLU	ggt-1 ggt-2	PP_3535 PP_4659
Glutathione metabolism	gamma-glutamyltranspeptidase	RGT + LAMACID -> CYSGLY + GLUAM	ggt-1 ggt-2	PP_3535 PP_4659
Glutathione metabolism	membrane alanyl aminopeptidase	CYSGLY -> CYS + GLY	pepN	PP_2017
Glutathione metabolism	glutathione S-transferase	RX + RGT -> HX + RSLGTH		PP_1347 PP_1821 PP_2536 PP_4104 PP_3535 PP_4659
Glutathione metabolism	gamma-glutamyltranspeptidase	RSGLTH -> RSALGLY + GLU	ggt-1 ggt-2	PP_2017 PP_1811
Glutathione metabolism	membrane alanyl aminopeptidase	RSALAGLY -> RSALA + GLY	pepN	PP_2017
O-antigen	UDP-N-acetylglucosamine 2-epimerase	UDPNAG -> UDPNAMAM	wecB	PP_1811
O-antigen	glucose-1-phosphate thymidyllyltransferase	DTTP + G1P <=> DTDPLGU + PPI	rmlA	PP_1783
O-antigen	dTDPglucose 4,6-dehydratase	DTDPLGU -> DTDPA4D6DG		PP_1785
O-antigen	dTDP-4-dehydrohamnose 3,5-epimerase	DTDPA4D6DG -> DTDPA4D6DM	rmlB	PP_0265
O-antigen	dTDP-4-dehydrohamnose 3,5-epimerase	DTDPA4D6DG -> DTDPA4D6DM	rmlC	PP_1782
O-antigen	dTDP-4-dehydrohamnose reductase	DTDPA4D6DM + NADPH -> DTDPRMN + NADP	rmlD	PP_1784
Lipopolysaccharide biosynthesis	UDP-N-acetylglucosamine acyltransferase	C140ACP + UDPNAG -> ACP + UDPG2AA	lpxA	PP_1603
Lipopolysaccharide biosynthesis	UDP-3-O-[3-hydroxymyristoyl] N-acetylglucosamine deacetylase	UDPG2AA -> UDPG2A + AC	lpxC	PP_1343
Lipopolysaccharide biosynthesis	UDP-3-O-[3-hydroxymyristoyl] glucosamine N-acyltransferase	UDPG2A + C140ACP -> ACP + UDPG23A	lpxD	PP_1601
Lipopolysaccharide biosynthesis	UDP-2,3-diacylglycerolase	UDPG23A -> UMP + LIPX		PP_2902
Lipopolysaccharide biosynthesis	lipid A-disaccharide synthase	LIPX + UDPG23A -> UDP + DISAC1P	lpxB	PP_1604
Lipopolysaccharide biosynthesis	tetraacyl-disaccharide 4'-kinase	DISAC1P + ATP -> ADP + LIPIV	lpxK	PP_1900
Lipopolysaccharide biosynthesis	3-deoxy-D-manno-octulosonic-acid transferase	LIPIV + CMPKDO -> KDOLIPIV + CMP	kdtA	PP_4928
Lipopolysaccharide biosynthesis	3-deoxy-D-manno-octulosonic-acid transferase	KDOLIPIV + CMPKDO -> K2LIPIV + CMP	kdtA	PP_4928
Lipopolysaccharide biosynthesis	lipid A biosynthesis lauroyl acyltransferase	K2LIPIV + C140ACP + C120ACP -> LIPA + 2 ACP	htrB	PP_1735 PP_0063
Lipopolysaccharide biosynthesis	2-dehydro-3-deoxyphosphooctonate aldolase	PEP + A5P -> KDOP + PI	kdsA-1 kdsA-2	PP_1611 PP_1807

Lipopolysaccharide biosynthesis	3-deoxy-D-manno-octulosonate 8-phosphate phosphatase	KDOP -> KDO + PI		PP_0956
Lipopolysaccharide biosynthesis	3-deoxy-manno-octulosonate cytidyltransferase	KDO + CTP -> PPI + CMPKDO	kdsB	PP_1902
Lipopolysaccharide biosynthesis		G1P + UTP -> PPI + UDPG	galU	PP_3821
Lipopolysaccharide biosynthesis	diacylglycerol kinase	DGR + ATP -> ADP + PA	dgkA-1 dgkA-2	PP_1636 PP_2973
Lipopolysaccharide biosynthesis		LIPA + 3 ADPHEP + 2 UDPG + 2 CDPETN + 3 CMPKDO -> LPS + 3 ADP + 2 UDP + 3 CMP + 2 CDP		
Peptidoglycan biosynthesis		UDCP + ADP <=> ATP + UDCPOL		
Peptidoglycan biosynthesis		UDPNAMAG + LYS + ATP -> UPPMNLADGLL + ADP + PI		
Peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanyl-D-glutamyl-2,6-diaminopimelate--D-alanyl-D-alanine ligase	UDPMNLADGLL + ALAALA + ATP -> UPPMNLADGLLDADA + ADP + PI	murF	PP_1333
Peptidoglycan biosynthesis	phospho-N-acetylmuramoyl-pentapeptide-transferase	UDPMNLADGLLDADA + UDCP -> UPPMNLADGLLDADA + UMP	mraY	PP_1334
Peptidoglycan biosynthesis	UDP-N-acetylglucosamine--N-acetylmuramyl-(pentapeptide) pyrophosphoryl-undecaprenol N-acetylglucosamine transferase	UPPMNLADGLLDADA + UDPNAG -> UPPMN(GN)LADGLLDADA + UDP	murG	PP_1337
Peptidoglycan biosynthesis	glutamine synthetase	UPPMN(GN)LADGLLDADA + ATP + NH3 -> UPPMN(GN)LADGNLLDADA + ADP + PI	glnA	PP_5046 PP_3148 PP_4547 PP_5183 PP_5184 PP_5299
Peptidoglycan biosynthesis		5 GLY + UPPMN(GN)LADGNLLDADA -> UPPMN(GN)LADGNLL(G)SDADA		
Peptidoglycan biosynthesis		UPPMN(GN)LADGNLL(G)SDADA -> UDCPP + PPEPTIDO		
Peptidoglycan biosynthesis		UDPNAMAG + LYS + ATP -> UPPMNLADGLL + ADP + PI		
Peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanyl-D-glutamyl-2,6-diaminopimelate--D-alanyl-D-alanine ligase	UDPMNLADGLL + ALAALA + ATP -> UPPMNLADGLLDADA + ADP + PI	murF	PP_1333
Peptidoglycan biosynthesis	phospho-N-acetylmuramoyl-pentapeptide-transferase	UDPMNLADGLLDADA + UDCP -> UPPMNLADGLLDADA + UMP	mraY	PP_1334
Peptidoglycan biosynthesis	UDP-N-acetylglucosamine--N-acetylmuramyl-(pentapeptide) pyrophosphoryl-undecaprenol N-acetylglucosamine transferase	UPPMNLADGLLDADA + UDPNAG -> UPPMN(GN)LADGLLDADA + UDP	murG	PP_1337
Peptidoglycan biosynthesis	glutamine synthetase	UPPMN(GN)LADGLLDADA + ATP + NH3 -> UPPMN(GN)LADIGLLDADA + ADP + PI	glnA	PP_5046 PP_3148 PP_4547 PP_5183 PP_5184 PP_5299
Peptidoglycan biosynthesis		5 GLY + UPPMN(GN)LADIGLLDADA -> UPPMN(GN)LADIGLL(G)SDADA		
Peptidoglycan biosynthesis		UPPMN(GN)LADIGLL(G)SDADA -> UDCPP + PPEPTIDO		
Peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanyl-D-glutamate--2,6-diaminopimelate ligase	UDPNAMAG + MDAPIM + ATP -> UPPMNLADGMD + ADP + PI	murE	PP_1332
Peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanyl-D-glutamyl-2,6-diaminopimelate--D-alanyl-D-alanine ligase	UDPMNLADGMD + ALAALA + ATP -> UPPMNLADGMDDADA + ADP + PI	murF	PP_1333
Peptidoglycan biosynthesis	phospho-N-acetylmuramoyl-pentapeptide-transferase	UDPMNLADGMDDADA + UDCP -> UPPMNLADGMDDADA + UMP	mraY	PP_1334
Peptidoglycan biosynthesis	UDP-N-acetylglucosamine--N-acetylmuramyl-(pentapeptide) pyrophosphoryl-undecaprenol N-acetylglucosamine transferase	UPPMNLADGMDDADA + UDPNAG -> UPPMN(GN)LADGMDDADA + UDP	murG	PP_1337
Peptidoglycan biosynthesis	glutamine synthetase	UPPMN(GN)LADGMDDADA + ATP + NH3 -> UPPMN(GN)LADGNMDDADA + ADP + PI	glnA	PP_5046 PP_3148 PP_4547 PP_5183 PP_5184 PP_5299
Peptidoglycan biosynthesis	peptidoglycan amidohydrolase	ACALA -> ACMUR + ALA		
Peptidoglycan biosynthesis	cell division protein FtsI	UPPMN(GN)LADGMDDADA + GLCMURAGAADPP -> UDCPP + GLCMURAGAADPP	ftsI mrcB	PP_1331 PP_4683
Peptidoglycan biosynthesis	UDP-N-acetylmuramate-alanine ligase	UDPNAM + ALA + ATP -> ADP + PI + UDPNAMA	murC	PP_1338
Peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanine-D-glutamate ligase	UDPNAMA + DGLU + ATP -> UDPNAMAG + ADP + PI	murD	PP_1335
Peptidoglycan biosynthesis	undecaprenyl-diphosphatase	UDCPP -> UDCP + PI		PP_2862
Peptidoglycan biosynthesis	thiamine biosynthesis protein ThiC	UPPMN(GN)LADGNMD(G)SDADA -> UDCPP + PPEPTIDO AIR -> AHM	thiC	PP_4922
Thiamine metabolism	hydroxymethylpyrimidine kinase	AHM + ATP -> AHMP + ADP	thiD	PP_4782
Thiamine metabolism	phosphomethylpyrimidine kinase	AHMP + ATP -> AHMPP + ADP	thiD	PP_4782
Thiamine metabolism	thiamine-phosphate	THZP + AHMPP -> THMP + PPI	thiE	PP_4783
Thiamine metabolism	pyrophosphorylase			PP_1348
Thiamine metabolism	phosphohistidine phosphatase	THMP -> THIAMIN + PI	aceK	PP_4565
Thiamine metabolism	thiamine monophosphate kinase	THMP + ATP <=> THMPP + ADP	thiL	PP_0519
Thiamine metabolism		ATP + CYS + DX5P + TYR -> 4HBA + THZP + ALA + AMP + CO2 + PPI	thiF	
Riboflavin metabolism	6,7-dimethyl-8-ribitylumazine synthase	DB4P + A6RP -> D8RL + PI	RIBH	PP_0517
Riboflavin metabolism	3,4-dihydroxy-2-butanone 4-phosphate synthase	RL5P -> DB4P + FORM	RIBB	PP_0516 PP_0530
Riboflavin metabolism	GTP cyclohydrolase II	GTP -> D6RP5P + FORM + PPI	ribA-1 ribA-2	PP_3813 PP_0516 PP_0522 PP_3813
Riboflavin metabolism	diaminohydroxyphosphoribosylaminopyrimidine deaminase	D6RP5P -> A6RP5P + NH3	ribD	PP_0514
Riboflavin metabolism	5-amino-6-(5-phosphoribosylamino)uracil reductase	A6RP5P + NADPH -> A6RP5P2 + NADP	ribD	PP_0514
Riboflavin metabolism	riboflavin synthase	2 D8RL -> RIBFLAV + A6RP	ribE-1 ribE-2	PP_0515 PP_2916 PP_0602
Riboflavin metabolism	riboflavin kinase/FMN adenylyltransferase	RIBFLAV + ATP -> FMN + ADP	ribF	PP_0602
Riboflavin metabolism	FMN adenylyltransferase	FMN + ATP -> FAD + PPI	ribF	PP_0602
Riboflavin metabolism		RIBFLAV -> DMBZM		
Riboflavin metabolism	nicotinate-nucleotide--dimethylbenzimidazole phosphoribosyltransferase	NACN + DMBZM -> NAC + PPARDBZ	cobT	PP_1679
Riboflavin metabolism	isocitrate dehydrogenase kinase/phosphatase	PPARDBZ -> aRIBAZOLE + PI	aceK	PP_4565
Riboflavin metabolism	Hydrolases	A6RP5P2 -> A6RP + PI	aceK	PP_4565
Vitamin B6 metabolism		4HLT -> PYRDX		
Vitamin B6 metabolism	D-erythrose 4-phosphate dehydrogenase	E4P + NAD <=> ER4P + NADH	epd	PP_4964
Vitamin B6 metabolism	erythronate-4-phosphate dehydrogenase	ER4P + NAD <=> OHB + NADH	pdxB	PP_2117
Vitamin B6 metabolism	phosphoserine aminotransferase	OHB + GLU <=> PHT + AKG	serC	PP_1768
Vitamin B6 metabolism	threonine synthase	PHT -> 4HLT + PI	thrC	PP_1471 PP_0662
Vitamin B6 metabolism	4-hydroxythreonine-4-phosphate dehydrogenase	PHT + NAD -> 3A2OPP + NADH	pdxA	PP_0402
Vitamin B6 metabolism	pyridoxine 5-phosphate synthase	3A2OPP + DX5P -> P5P + PI	pdxJ	PP_1436
Vitamin B6 metabolism	pyridoxine kinase	PYRDX + ATP -> P5P + ADP	pkxY	PP_5357
Vitamin B6 metabolism	isocitrate dehydrogenase kinase/phosphatase	P5P -> PYRDX + PI	aceK	PP_4565

Vitamin B6 metabolismism	pyridoxamine 5'-phosphate oxidase	P5P + O2 -> PL5P + H2O2	pdxH	PP_1129
Vitamin B6 metabolismism	isocitrate dehydrogenase kinase/phosphatase	PL5P-> PL + PI	aceK	PP_4565
Vitamin B6 metabolismism	pyridoxine kinase	PL + ATP-> PL5P + ADP	pkxY	PP_5357
Vitamin B6 metabolismism	pyridoxamine 5'-phosphate oxidase	PDLA5P + O2-> PL5P + H2O2 + NH3	pdxH	PP_1129
Vitamin B6 metabolismism	pyridoxine kinase	PDLA + ATP-> PDLA5P + ADP	pkxY	PP_5357
Vitamin B6 metabolismism	isocitrate dehydrogenase kinase/phosphatase	PDLA5P-> PDLA + PI	aceK	PP_4565
Vitamin B6 metabolismism	pyridoxamine 5'-phosphate oxidase	PYRDx + O2 <-> PL + H2O2	pdxH	PP_1129
Vitamin B6 metabolismism	pyridoxamine 5'-phosphate oxidase	PL + O2 + NH3 <-> PDLA + H2O2	pdxH	PP_1129
Nicotinate and nicotinamide	L-aspartate oxidase	ASP + FUM -> IMNASP + SUCC	nadB	PP_1426
Nicotinate and nicotinamide	L-aspartate oxidase	ASP + O2 -> IMNASP + H2O2	nadA	PP_1231
Nicotinate and nicotinamide	quinolinate synthase	IMNASP + DHAP -> QA + PI	nadC	PP_0787
Nicotinate and nicotinamide metabolismism	nicotinate-nucleotide diphosphorylase	PYDC + PRPP -> NACN + CO2 + PPI		
Nicotinate and nicotinamide metabolismism	nicotinate phosphoribosyltransferase	NAC + PRPP <-> NACN + PPI	pncB	PP_4868
Nicotinate and nicotinamide metabolismism	nicotinate-nucleotide adenylyltransferase	NACN + ATP <-> PPI + NAAD		PP_4810
Nicotinate and nicotinamide metabolismism	5'-nucleotidase	NACN -> NACD + PI	ushA surE	PP_1414 PP_2531 PP_1620
Nicotinate and nicotinamide metabolismism	5'-nucleotidase	NAMN -> NAMD + PI	ushA surE	PP_1414 PP_2531 PP_1621 PP_4810
Nicotinate and nicotinamide metabolismism	nicotinate-nucleotide adenylyltransferase	NAMN + ATP <-> NAD + PPI		
Nicotinate and nicotinamide metabolismism	purine nucleosidase	NAMD -> NAM + RIB		PP_2460
Nicotinate and nicotinamide metabolismism	NAD synthase (glutamine-hydrolysing)	NAAD + ATP + GLN -> NAD + AMP + PPI + GLU	nadE	PP_4869
Nicotinate and nicotinamide metabolismism	NAD(P) transhydrogenase	NADP + NADH <-> NADPH + NAD	pntB	PP_0155
Nicotinate and nicotinamide metabolismism	NAD kinase	NAD + ATP -> NADP + ADP		PP_2012
Nicotinate and nicotinamide metabolismism	phosphatase	NADP -> NAD + PI	aceK	PP_4565
Nicotinate and nicotinamide metabolismism	NAD(P) transhydrogenase	NADPH + NAD <-> NADP + NADH	sthA	PP_2151
Nicotinate and nicotinamide metabolismism	Hydrolases	MALEM -> MALE + NH3	nicF	PP_5402
Nicotinate and nicotinamide metabolismism	nicotinate:NADP+ 6-oxidoreductase (hydroxylating)	NAC + NADP -> HNAC + NADPH	nicAB	PP_3947 PP_3948 PP_3944
Nicotinate and nicotinamide metabolismism	6-Hydroxynicotinate, hydrogen-donor: oxygen oxidoreductase	O2 + 2 HNAC -> 2 DHPY + 2 CO2	nicC	
Nicotinate and nicotinamide metabolismism	2,5-Dihydroxypyridine:oxygen 5,6-oxidoreductase	DHPY + O2 -> NFM	nicX	PP_3945
Nicotinate and nicotinamide metabolismism		NFM -> MALEM + FORM	nicD	PP_3943
Nicotinate and nicotinamide metabolismism	Maleate cis-trans-isomerase	MALE -> FUM	nicE	
Pantothenate and CoA biosynthesis	3-methyl-2-oxobutanoate hydroxymethyltransferase	OIVAL + METTHF -> AKP + THF	panB	PP_4699
Pantothenate and CoA biosynthesis	2-dehydropantoate 2-reductase	AKP + NADPH -> NADP + PANT		PP_1351 PP_2325 PP_2998 PP_4700 PP_0438
Pantothenate and CoA biosynthesis	pantoate-beta-alanine ligase	PANT + bALA + ATP -> AMP + PPI + PNTO	panC	
Pantothenate and CoA biosynthesis	ATP:pantothenate 4'-phosphotransferase	ATP + PNTO -> ADP + 4PPNTO		
Pantothenate and CoA biosynthesis	acyl carrier protein phosphodiesterase	ACP -> 4PPNTE + APACP		PP_2866 PP_4538
Pantothenate and CoA biosynthesis	phosphopantothenate—cysteine ligase	4PPNTO + CTP + CYS -> CDP + PI + 4PPNCYS	coaBC	PP_5285
Pantothenate and CoA biosynthesis	phosphopantothenate—cysteine ligase	4PPNTO + ATP + CYS -> ADP + PI + 4PPNCYS	coaBC	PP_5285
Pantothenate and CoA biosynthesis	phosphopantothenoylecysteine decarboxylase	4PPNCYS -> CO2 + 4PPNTE	coaBC	PP_5285
Pantothenate and CoA biosynthesis	panetheine-phosphate adenylyltransferase	4PPNTE + ATP -> PPI + DPCOA	coaD	PP_5123
Pantothenate and CoA biosynthesis	dephospho-CoA kinase	DPCOA + ATP -> ADP + COA		PP_0631
Biotin metabolismism	8-amino-7-oxononanoate synthase	ALA + CHCOA <-> CO2 + COA + AONA	bioF	PP_0363
Biotin metabolismism	adenosylmethionine-8-amino-7-oxononanoate aminotransferase	SAM + AONA <-> SAMOB + DANNA	bioA	PP_4984
Biotin metabolismism	dethiobiotin synthetase	CO2 + DANNA + ATP <-> DTB + PI + ADP	bioD	PP_0366
Biotin metabolismism	biotin synthetase	DTB + CYS -> ALA + BT	bioB	PP_0362
Biotin metabolismism	biotin-[acetyl-CoA carboxylase] ligase	ATP + BT <-> PPI + BT5AMP	birA	PP_0437
Biotin metabolismism	biotin-[acetyl-CoA carboxylase] ligase	BT5AMP + APCARX -> AMP + HLCARX	birA	PP_0437
Folate biosynthesis	GTP cyclohydrolase I	GTP -> FORM + AHTD	folE-1 folE-2	PP_1823 PP_2512
Folate biosynthesis	dihydroneopterin aldolase	DHP -> AHHMP + GLAL	folB	PP_0392
Folate biosynthesis	2-amino-4-hydroxy-6-hydroxymethylidihydropteridine diphosphokinase	AHHMP + ATP -> AMP + AHHMD	folK-2	PP_4698
Folate biosynthesis	aminodeoxychorismate synthase	CHOR + GLN -> ADCHOR + GLU	pabB	PP_2329
Folate biosynthesis	aminodeoxychorismate lyase	ADCHOR -> PYR + PABA	pabC	PP_1917
Folate biosynthesis	dihydropterolate synthase	PABA + AHHMD -> PPI + DHPT	folP	PP_4717
Folate biosynthesis	dihydropterolate synthase	PABA + AHHMP -> DHPT	folP	PP_4717
Folate biosynthesis	dihydrofolate synthase	DHPT + ATP + GLU -> ADP + PI + DHF	folC	PP_1997
Folate biosynthesis	dihydrofolate synthase	DHPT + ATP + GLU -> ADP + PI + DHF	folC	PP_1997
Folate biosynthesis	tetrahydrofolylpolyglutamate synthase	THF + ATP + GLU <-> ADP + PI + THFG	folC	PP_1997
Folate biosynthesis	tetrahydrofolylpolyglutamate synthase	THFG + ATP + GLU <-> ADP + PI + THFG	folC	PP_1997
Folate biosynthesis	dihydrofolate reductase	DHF + NADPH -> NADP + THF	folA	PP_5132
Folate biosynthesis	dihydrofolate reductase	DHF + NAD <-> FOL + NADH	folA	PP_5132
Folate biosynthesis	dihydrofolate reductase	DHF + NADP <-> FOL + NADPH	folA	PP_5132
Folate biosynthesis	dihydrofolate reductase	FOL + NADH -> THF + NAD	folA	PP_5132
Folate biosynthesis	dihydrofolate reductase	FOL + NADPH -> THF + NADP	folA	PP_5132
Folate biosynthesis	2-amino-4-oxo-6-[(1S,2R)-1,2-dihydroxy-3-triphosphoxypropyl]-7,8-dihydroxypteridine triphosphate lyase	AHTD -> PYTHP + H5P3O10		PP_2341
Folate biosynthesis	ATP-dependent DNA helicase	AHTD -> DHP + PPI	cadA-2	PP_5139 PP_4261 PP_2432 PP_2432 PP_1945
Folate biosynthesis	dihydropteridine reductase	DHBP + NADH <-> TTRHBP + NAD		
Folate biosynthesis	dihydropteridine reductase	DHBP + NADPH <-> TTRHBP + NADP		
One carbon pool by folate	methylenetetrahydrofolate dehydrogenase (NADP)	METTHF + NADP <-> METHF + NADPH	folD-1	PP_2265
One carbon pool by folate	methylenetetrahydrofolate dehydrogenase (NADP)	METTHF + NADP <-> METHF + NADPH	folD-2	PP_2265
One carbon pool by folate	methenyltetrahydrofolate cyclohydrolase	METHF <-> FTHF	folD-1	PP_1945
One carbon pool by folate	methenyltetrahydrofolate cyclohydrolase	METHF <-> FTHF	folD-2	PP_2265
One carbon pool by folate	5,10-methylenetetrahydrofolate reductase (FADH2)	METTHF + NADH <-> MTHF + NAD	metF	PP_4977
One carbon pool by folate	5,10-methylenetetrahydrofolate:dUMP C-methyltransferase	DUMP + METTHF <-> DHF + DTMP	thyA	PP_5141
One carbon pool by folate	formyltetrahydrofolate hydrolase	FTHF <-> FORM + THF	purU-1	PP_0327
One carbon pool by folate	formyltetrahydrofolate hydrolase	FTHF <-> FORM + THF	purU-2	PP_1367
One carbon pool by folate	formyltetrahydrofolate hydrolase	FTHF <-> FORM + THF	purU-3	PP_1943
One carbon pool by folate	dihydrofolate reductase	DHF + NADPH -> NADP + THF	folA	PP_5132
One carbon pool by folate	OC searchOC viewer			
One carbon pool by folate	dihydrofolate reductase	DHF + NADH -> NAD + THF	folA	PP_5132
One carbon pool by folate	OC searchOC viewer			

One carbon pool by folate	phosphoribosylglycinamide formyltransferase	GAR + FTHF -> FGAR + THF	purN	PP_1664
One carbon pool by folate	aminomethyltransferase	METHF -> 5FTHF	gcvT-1 gcvT-2	PP_0986 PP_5194
Porphyrin and chlorophyll metabolism	glutamyl-tRNA synthetase	GLU + ATP -> GTRNA + AMP + PPI	gltX	PP_1977
Porphyrin and chlorophyll metabolism	glutamyl-tRNA reductase	GTRNA + NADPH -> GSA + NADP + TGLU	hemA	PP_0732
Porphyrin and chlorophyll metabolism	glutamate-1-semialdehyde 2,1-aminomutase	GSA -> ALAV	hemL	PP_4784
Porphyrin and chlorophyll metabolism	porphobilinogen synthase	2 ALAV -> PBG	hemB-1	PP_2913
Porphyrin and chlorophyll metabolism	hydroxymethylbilane synthase	4 PBG -> HMB + 4 NH3	hemB-2	PP_3322
Porphyrin and chlorophyll metabolism	uroporphyrinogen-III synthase	HMB -> UPRG	hemC	PP_0186
Porphyrin and chlorophyll metabolism	uroporphyrin-III C-methyltransferase	SAM + UPRG -> SAH + PC2	hemD	PP_0187
Porphyrin and chlorophyll metabolism	precorrin-2 dehydrogenase	PC2 + NAD -> NADH + SHCL	cobA-1	PP_2090
Porphyrin and chlorophyll metabolism	sirohydrochlorin ferrochelatase	SHCL -> SHEME	cobA-2	PP_3999
Porphyrin and chlorophyll metabolism	uroporphyrinogen decarboxylase	UPRG -> 4 CO2 + CPP	cobA-2	PP_3999
Porphyrin and chlorophyll metabolism	ferrochelatase	PPIX -> PTH	hemE	PP_5074
Porphyrin and chlorophyll metabolism	oxygen-independent coproporphyrinogen III oxidase	CPP + 2 SAM -> PPHG + 2 CO2 + 2 MET + 2 DA	hemH	PP_0744
Porphyrin and chlorophyll metabolism	coproporphyrinogen III oxidase	CPP + O2 -> PPHG + 2 CO2	hemN	PP_4264
Porphyrin and chlorophyll metabolism	magnesium chelatase	ATP + PPIX + MG -> ADP + PI + MGPPIX	hemF	PP_0073
Porphyrin and chlorophyll metabolism	precorrin-2 C20-methyltransferase	SAM + PC2 -> SAH + PC3A	PP_3505	PP_3506
Porphyrin and chlorophyll metabolism	precorrin-3B synthase	PC3A + O2 -> PC3B	cobl	PP_4827
Porphyrin and chlorophyll metabolism	precorrin-3B C17-methyltransferase	SAM + PC3B -> SAH + PC4		PP_4829
Porphyrin and chlorophyll metabolism	precorrin-4 C11-methyltransferase	SAM + PC4 -> SAH + PC5	cobJ	PP_4826
Porphyrin and chlorophyll metabolism	precorrin-6A synthase	PC5 + SAM -> PC6A + AC + SAH	cobM	PP_3410
Porphyrin and chlorophyll metabolism	precorrin-6X reductase	PC6A + NADPH -> PC6B + NADP	cobF(?)	PP_3763
Porphyrin and chlorophyll metabolism	precorrin-6Y C5,15-methyltransferase	2 SAM + PC6B -> 2 SAH + PC8X + CO2	cobK	PP_4832
Porphyrin and chlorophyll metabolism	precorrin-8X methylmutase	PC8X -> HYGBYR	cobL	PP_4830
Porphyrin and chlorophyll metabolism	hydrogenbyirinic acid a,c-diamide synthase	HYGBYR + 2 GLN + 2 ATP -> HYGACDM + 2 PI + 2 GLU + 2 ADP	cobH	PP_4828
Porphyrin and chlorophyll metabolism	cobaltochelatase	HYGACDM + COBAL + ATP -> COB2ACDM + PI + ADP	cobB	PP_1673
Porphyrin and chlorophyll metabolism	cob(II)yrinic acid a,c-diamide reductase	COB2ACDM + NADH -> COB1ACDM + NAD	cobN(?)	PP_3507
Porphyrin and chlorophyll metabolism	cob(II)yrinic acid a,c-diamide reductase	2 COB2ACDM + FMN -> 2 COB1ACDM + FMNH2		PP_1674
Porphyrin and chlorophyll metabolism	cob(I)alamin adenosyltransferase	COB1ACDM + ATP -> ADCOBACD + H5P3O10	cobO	PP_1672
Porphyrin and chlorophyll metabolism	adenosylcobyrinic acid synthase	ADCOBACD + 4 GLN + 4 ATP -> ADCOHEX + 4 GLU + 4 PI + 4 ADP	cobQ	PP_1677
Porphyrin and chlorophyll metabolism	adenosylcobinamide-phosphate synthase	ATP + ADCOHEX + 1APP2OL -> ADCOMN + ADP + PI	cobD cobC	PP_1675
Porphyrin and chlorophyll metabolism	adenosylcobinamide-phosphate synthase	ADCOHEX + D1AP2OP + ATP -> ADCOMNP + ADP + PI	cobD cobC	PP_1676
Porphyrin and chlorophyll metabolism	adenosylcobinamide kinase	ADCOMN + ATP -> ADCOMNP + ADP	cobP	PP_1678
Porphyrin and chlorophyll metabolism	adenosylcobinamide kinase	ADCOMN + GTP -> ADCOMNP + GDP	cobP	PP_1678
Porphyrin and chlorophyll metabolism	guanylyltransferase	ADCOMNP + GTP -> ADGCOMN + PPI	cobP	PP_1678
Porphyrin and chlorophyll metabolism	adenosylcobinamide-GDP ribazoletransferase	ADGCOMN + aRIBAZOLE -> VB12COZ + GMP	cobS	PP_1681
Ubiquinone biosynthesis	4-hydroxybenzoate octaprenyltransferase	4HBZ + OPP -> O4HBZ + PPI	ubiA	PP_5318
Ubiquinone biosynthesis	chorismate-pyruvate lyase	CHOR -> 4HBZ + PYR	ubiC(?)	PP_5317
Ubiquinone biosynthesis	3-octaprenyl-4-hydroxybenzoate carboxy-lyase	O4HBZ -> CO2 + 2OPPP	ubiD	PP_0548
Ubiquinone biosynthesis	demethylmenaquinone methyltransferase	2OPPP + O2 + NADPH -> 2O6H + NADP		PP_5213
Ubiquinone biosynthesis (Menaquinone)	ubiquinone/menaquinone biosynthesis methyltransferase	DMK + SAM -> MKH2 + SAH	ubiE	PP_0427
Ubiquinone biosynthesis	ubiquinone/menaquinone biosynthesis methyltransferase	PTNPHQ + SAM -> PHQ + SAH	ubiE	PP_5011
Ubiquinone biosynthesis	ubiquinone/menaquinone biosynthesis methyltransferase	2OPMB + SAM -> 2OPMMB + SAH		PP_5011
Ubiquinone biosynthesis	ubiquinone/menaquinone biosynthesis methyltransferase	2OPMMB + O2 + NADPH -> 2OMHMB + NADP		
Ubiquinone biosynthesis	3-demethylubiquinone-9 3-methyltransferase	2O6H + SAM -> 2OPMP + SAH	ubiG	PP_1765
Ubiquinone biosynthesis	3-demethylubiquinone-9 3-methyltransferase	2OMHMB + SAM -> Q + SAH	ubiG	PP_1765
Ubiquinone biosynthesis	2-octaprenyl-6-methoxyphenol hydroxylase	2OPMP + O2 + NADPH -> 2OPMB + NADP	ubiH	PP_5199
Ubiquinone biosynthesis	NADH dehydrogenase	QH2 + NAD <-> Q + NADH	nuoA nuoB nuoCD nuoE nuoF nuoG nuoH nuoI nuoJ nuoK nuoL nuoM nuoN	PP_4119 PP_4120 PP_4121 PP_4122 PP_4123 PP_4124 PP_4125 PP_4126 PP_4127 PP_4128 PP_4129 PP_4130 PP_4131
Ubiquinone biosynthesis	ubiquinone biosynthesis monoxygenase	HPMMBZQ + O2 + NADPH -> HPMHMBZQ + NADP	Coq7(?)	PP_0427
Terpenoid Biosynthesis	di-trans.poly-cis-decaprenylcistransferase	FPP -> GGPP	uppS	PP_1595
Terpenoid Biosynthesis	coniferyl alcohol:NADP+ oxidoreductase	GGPP + 7 IPP -> UDCPP + 7 PPI	uppS	PP_1595
Stilbene, Coumarine and Lignin Biosynthesis	coniferyl alcohol:NADP+ oxidoreductase	CONOL + NADP -> CONAL + NADPH		
Stilbene, Coumarine and Lignin Biosynthesis	coniferyl aldehyde:NADP+ oxidoreductase (CoA-cinnamoylating)	CONAL + NAD -> FER + NADH		
Stilbene, Coumarine and Lignin Biosynthesis	Ferulate:CoA ligase (AMP-forming)	CONAL + CoA + NADP -> FERCOA + NADPH		
Stilbene, Coumarine and Lignin Biosynthesis	beta-D-Glucosyl-2-coumarinate glucosylhydrolase	ATP + FER + COA -> AMP + PPI + FERCOA		
Stilbene, Coumarine and Lignin Biosynthesis	Oxidoreductases	FERCOA -> VN + COA	bglX	PP_1403
Stilbene, Coumarine and Lignin Biosynthesis	Hydrolases	bG2HCouM + H2O -> CouM + GLC		
Caprolactam Degradation	6-Hydroxyhexanoate:NADP+ oxidoreductase	COUMT -> COUM		
Caprolactam Degradation	Ligases	THSTB -> TTHSTB		PP_1955
Caprolactam Degradation	(3S)-3-hydroxyacyl-CoA hydro-lyase	CHFAM + H2O -> CHAM + FORM		PP_5402
Caprolactam Degradation		HH + NADP -> OHO + NADPH		PP_2426
Caprolactam Degradation		ADIP + COA + ATP -> ADIPCOA + AMP + PPI		PP_0763
Caprolactam Degradation		5C2PCOA + H2O -> 3HADIPCOA	fadB fadB1x phaB ech	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066

Caprolactam Degradation	(S)-3-hydroxyacyl-CoA:NAD+ oxidoreductase	3HADIPCOA + NAD -> 3OADIPCOA + NADH	fadB fadB2x	PP_2136 PP_2214 PP_0302 PP_2047 PP_3713
gamma-Hexachlorocyclohexane Degradation	catechol dioxygenase	TCHCATOL + O2 -> TCHMUC	catA	PP_3713
gamma-Hexachlorocyclohexane Degradation	catechol dioxygenase	CHCATOL + O2 -> CHMUC	catA	PP_2492
gamma-Hexachlorocyclohexane Degradation	Oxidoreductases	HBNQ -> BZQ + H2O		PP_2492
gamma-Hexachlorocyclohexane Degradation	Oxidoreductases	THBN <-> HBNQ		
gamma-Hexachlorocyclohexane Degradation	Oxidoreductases	NICATOL + O2 -> THBN + NO2		
2,4-Dichlorobenzoate Degradation	p-hydroxybenzoic hydroxylase	4HBZ + O2 + NADPH -> DHBZ + NADP + H2O	pobA	PP_3537
2,4-Dichlorobenzoate Degradation	4-Hydroxy-3-methoxybenzoate:oxygen oxidoreductase	VN + O2 + NADH -> VNL + NAD + H2O		
2,4-Dichlorobenzoate Degradation	vanillate monooxygenase	VNL + O2 + NADH -> DHBZ + NAD + FALD + H2O	vanAB	PP_3736 PP_3737
2,5-Dichlorobenzoate Degradation	CoA Synthetase	CAFF + ATP + COA -> CAFFCOA + AMP + PPI	fcs ech vdh	PP_3356 PP_3358 PP_3357
2,6-Dichlorobenzoate Degradation	hydratase/aldolase	CAFFCOA + H2O -> DHBAL + ACCOA		
2,8-Dichlorobenzoate Degradation	Oxidoreductases	DHBAL + NAD + H2O -> DHBZ + NADH		
2,4-Dichlorobenzoate Degradation	protocatechuic 3,4-oxygenase	DHBZ + O2 -> 3CMUC	pcaGH	PP_4655 PP_4656
2,4-Dichlorobenzoate Degradation		SFLN + OH -> HSLF + MLAC	qedH	PP_3812
1,2-Dichloroethane degradation		CHETOH + PQQ -> CHETAL + PQQH2		PP_2674
1,2-Dichloroethane degradation		CHETAL + NAD + H2O -> CHAC + NADH		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278
Tetrachloroethane Degradation	Acetaldehyde hydro-lyase	ACLE + H2O -> ACAL		PP_2639
Tetrachloroethane Degradation	Oxidoreductases	ETYO + COA + NAD -> ACCOA + NADH	gbd	PP_2368 PP_2650 PP_3894
Naphthalene and anthracene degradation	salicylate monooxygenase	HNAPTHO + NADH + O2 + H -> NAPTHDOL + CO2 + NAD + H2O	nahG	
Naphthalene and anthracene degradation	salicylate monooxygenase	SALC + O2 + NADH + H -> CATOL + CO2 + NAD + H2O	nahG	PP_3894
Naphthalene and anthracene degradation		NTBZ + O2 + 2 Hxt <-> CATOL + NO3		PP_1955
Limonene and pinene degradation	Acid--thiol ligases	3IP6OH + COA + ATP -> 3IP6OHCOA + ADP + PI		PP_0763
Limonene and pinene degradation	Acid--thiol ligases	3IP6OH + COA + ATP -> 3IP6OHCOA + AMP + PPI		PP_0763
Limonene and pinene degradation	Acid--thiol ligases	PRLC + COA + ATP -> PRLCOA + ADP + PI		PP_0763
Limonene and pinene degradation	Acid--thiol ligases	PRLC + COA + ATP -> PRLCOA + AMP + PPI		PP_0763
Limonene and pinene degradation	Acid--thiol ligases	3IP6OHS -> 3IP6OHCOAS		PP_0763
Limonene and pinene degradation	Acid--thiol ligases	2M5IPH25Cc + ATP + COA -> 2M5IPH25COAc + AMP + PI		PP_0763
Limonene and pinene degradation	Acid--thiol ligases	2M5IPH25Ct + ATP + COA -> 2M5IPH25COAt + AMP + PI		PP_0056
Limonene and pinene degradation	limonene-1,2-diol:(acceptor) 2-oxidoreductase	LMDO -> H2OLM		PP_2679
Limonene and pinene degradation	alpha-Pinene dehydrogenase	PIN + NADPH -> MYTOL + H2O + NADP		PP_1955
Limonene and pinene degradation	alpha-Pinene dehydrogenase	PIN + O2 + 2 Hxt -> PICVOL + H2O		PP_1955
Limonene and pinene degradation	aldehyde dehydrogenase	PRLAH + NAD + H2O -> PRLC + NADH + H		PP_0545 PP_2589 PP_2680 PP_2694 PP_3463 PP_5258 PP_5278
Limonene and pinene degradation	Oxidoreductases	2H4IPCHCCOA + NAD -> 4IP2OCHCCOA + NADH		PP_2492
Limonene and pinene degradation	Myrtenol dehydrogenase	MYTOL + O2 + NAD -> MYTAL + 2 H2O + NADH		PP_2492
Limonene and pinene degradation	Pinocarveol dehydrogenase	PICVOL -> PICVN + H		PP_2492
Limonene and pinene degradation	3-Hydroxy-2,6-dimethyl-5-methylene-heptanoyl-CoA dehydrogenase	3H26DM5MHCOA + NAD -> 26DM5M3OHCOA + NADH		PP_2492
Limonene and pinene degradation	cis-2-Methyl-5-isopropylhexa-2,5-dienyl-CoA hydro-lyase	2M5IPH25COAc -> 3H26DM5MHCOA	fadB fadB1x	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066
Limonene and pinene degradation	trans-2-Methyl-5-isopropylhexa-2,5-dienyl-CoA hydro-lyase	2M5IPH25COAt -> 3H26DM5MHCOA	fadB fadB1x phaB	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066
Limonene and pinene degradation	2,6-Dimethyl-5-methylene-3-oxo-heptanoyl-CoA C-acetyltransferase	26DM5M3OHCOA + COA -> 3IPB3ECOAc + PPCOA		PP_2318 PP_4762 PP_5331
Benzoate Degradation via CoA Ligation	benzoate hydroxylase	BZ + NADH + O2 -> 16DH24CHECC + NAD	benABC	PP_3161 PP_3162
Benzoate Degradation via CoA Ligation	benzoate hydroxylase	BZ + NADPH + O2 -> 16DH24CHECC + NADP	benABC	PP_3161 PP_3162 PP_3163
Benzoate Degradation via CoA Ligation	dihydrodihydroxybenzoate dehydrogenase	16DH24CHECC + NAD -> CATOL + NADH + CO2	benD	PP_3164
Benzoate Degradation via CoA Ligation	Hydro-lyases	6HCHCBCOA -> 26DHCHCBCOA		
Benzoate Degradation via CoA Ligation	Oxidoreductases	26DHCHCBCOA + NAD -> 602HCHCBCOA + NADH		PP_2492
Benzoate Degradation via CoA Ligation	Hydrolases	602HCHCBCOA -> HPIMCOA		PP_2318
Benzoate Degradation via CoA Ligation	Hydro-lyases	23DHPIMCOA + H2O -> HPIMCOA		
Benzoate Degradation via CoA Ligation	3-hydroxypimeloyl-CoA:NAD+ oxidoreductase	HPIMCOA + NAD -> OPIMCOA + NADH + H		
Benzoate Degradation via CoA Ligation		OPIMCOA + COA -> GCOA + ACCOA		PP_2318 PP_4762 PP_5331
Benzoate Degradation via CoA Ligation	glutaryl-CoA dehydrogenase	GCOA + FAD -> G1COA + FADH2	gcdH	PP_0158
Benzoate Degradation via CoA Ligation	Glutaconyl-1-CoA carboxy-lyase	G1COA -> CTCOA + CO2		

Benzoate Degradation via CoA Ligation		CTCOA -> RHBCOA	fadB fadB1x phaB	PP_2136 PP_2217 PP_3283 PP_3358 PP_1412 PP_1845 PP_3284 PP_3491 PP_3726 PP_3732 PP_4030 PP_4066
Benzoate Degradation via CoA Ligation	3-hydroxybutyryl-CoA dehydrogenase	RHBCOA + NADP -> AACCOA + NADPH	paaC paaH	PP_3282 PP_3755 PP_0302 PP_3713
Benzoate Degradation via Hydroxylation	catechol 1,2-dioxygenase	CATOL + O2 -> MUCA	catA	PP_3714
Benzoate Degradation via Hydroxylation	2,5-Dihydro-5-oxofuran-2-acetate lyase	MUCA <-> 5O25DHFAC		
Benzoate Degradation via Hydroxylation	2-Oxo-2,5-dihydrofuran-5-acetate delta3-delta2-isomerase	5O25DHFAC <-> 2O23DHFAC	catC	PP_3714
Benzoate Degradation via Hydroxylation	4-Carboxymethylbut-3-en-4-olide enol-lactonohydrolase	2O23DHFAC + H2O -> OADIP	pcaD	PP_1380
Benzoate Degradation via Hydroxylation	3-oxoadipate CoA-transferase	SUCCOA + OADIP -> SUCC + OADIPCOA	pcaIJ	PP_3951 PP_3952
Benzoate Degradation via Hydroxylation	acetyl-CoA C-acyltransferase	COA + OADIPCOA -> SUCCOA + ACCOA	fadA phaD	PP_0582 PP_2137 PP_3280
Benzoate Degradation via Hydroxylation	AcyItransferases	COA + OADIPCOA -> SUCCOA + ACCOA	pcaF	PP_1377
Benzoate Degradation via Hydroxylation	protocatechuic 3,4-oxygenase	GALL + O2 -> 2PY46DC	pcaGH	PP_4655 PP_4656
Benzoate Degradation via Hydroxylation	2-Carboxy-2,5-dihydro-5-oxofuran-2-acetate lyase	3CMUC <-> 4CMUCNLAC	pcaB	PP_1379
Benzoate Degradation via Hydroxylation	4-Carboxymuconolactone carboxy-lyase	4CMUCNLAC <-> 2O23DHFAC + CO2	pcaC	PP_1381 PP_3648
Benzoate Degradation via Hydroxylation	Gallic acid dioxygenase	GALL + O2 -> 2 Hxt + 4C2O3HD	GalA-kt	PP_2518
Benzoate Degradation via Hydroxylation	4-oxalmesaconate isomerase	4C2O3HD <-> 4OMC		
Benzoate Degradation via Hydroxylation	4-oxalmesaconate hydratase	H2O + 4OMC -> 4C4H2OADIP		
Benzoate Degradation via Hydroxylation	4-oxalictromalate aldolase	4C4H2OADIP -> OAA + PYR		
Benzoate Degradation via Hydroxylation	Hydro-lyases	2H3MBNPYR + H2O -> MSLACAH + PYR	nahG	PP_2639 PP_3944 PP_1616 PP_3839
Benzoate Degradation via Hydroxylation	salicylate monooxygenase	MSALC + O2 + NADH -> MCATOL + NAD + CO2 + H2O		
Benzoate Degradation via Hydroxylation	alcohol dehydrogenase	HMNAPTH + NAD -> NAPTHAH + NADH		
Benzoate Degradation via Hydroxylation	Oxidoreductases	12DH12DH8CNAPTH -> 12DH8CNAPTH	acdA	PP_2492 PP_2639 PP_0368 PP_0370 PP_2216 PP_3492 PP_3725
Benzoate Degradation via Hydroxylation	Hydro-lyases	2H3CBNPYR + H2O -> FSALAC + PYR		
Benzoate Degradation via Hydroxylation	Oxidoreductases	NAPTHMSUCCOA -> NAPTHMESUCCOA + 2 H		
1- and 2-Methylnaphthalene Degradation	Hydro-lyases	NAPTHMESUCCOA + H2O -> NAPTHHMSUCCOA		
1- and 2-Methylnaphthalene Degradation	Oxidoreductases	NAPTHHMSUCCOA -> NAPTHOMSUCCOA + 2 H		
1- and 2-Methylnaphthalene Degradation	AcyItransferases	NAPTHOMSUCCOA + COA -> NAPTHOCCA + SUCCOA		
1- and 2-Methylnaphthalene Degradation	salicylate monooxygenase	MSALC4 + O2 + NADH -> MCATOL4 + NAD + CO2 + H2O	nahG	PP_5331 PP_3944 PP_2639
1- and 2-Methylnaphthalene Degradation	Hydro-lyases	2H4HMBNPYR + H2O -> HMSALCAH + PYR	nahG	PP_3944 PP_1616 PP_3839
1- and 2-Methylnaphthalene Degradation	salicylate monooxygenase	HMSALC + O2 + NADH -> HMCATOL + NAD + CO2 + H2O		
1- and 2-Methylnaphthalene Degradation	alcohol dehydrogenase	HMNAPTH2 + NAD -> NAPTHAH2 + NADH		
Miscellaneous reaction		5 GLY + UPPMN(GN)LADGNMDDADA -> UPPMN(GN)LADGNMD(G)5DADA		
Miscellaneous reaction		PPEPTIDO + DALA -> PEPTIDO + DALAxt		
Miscellaneous reaction		DB4P + A6RP -> DBRL + PI		
Miscellaneous reaction		A6RP5P2 -> A6RP + PI		
Miscellaneous reaction		RL5P -> DB4P + FORM		
Miscellaneous reaction		GLAL + NAD -> NADH + GLYCOLATE		
Miscellaneous reaction		SAH -> HCYS + ADN		
Miscellaneous reaction		HEPPP + IPP -> OPP + PPI		
Miscellaneous reaction		DTMP + ATP <-> DTDp + ADP		
Miscellaneous reaction		HISOLP -> PI + HISOL		
Miscellaneous reaction		PNT0 + ATP -> ADP + 4PPNT0		
Miscellaneous reaction		ASP -> CO2 + bALA		
Miscellaneous reaction		IPP <-> DMPP		
Miscellaneous reaction		FPP + IPP -> GGPP + PPI		
Miscellaneous reaction		GGPP + IPP -> PPPP + PPI		
Miscellaneous reaction		PPPP + IPP -> HPPP + PPI		
Miscellaneous reaction		HPPP + IPP -> HEPPP + PPI		
DNA	DNA synthesis (lumped reaction)	0.621 DATP + 0.997 DCTP + 0.621 DTTp + 0.997 DGTP + 4.4 ATP -> 4.4 ADP + 4.4 PI + DNA		
RNA	RNA synthesis (lumped reaction)	0.38 ATP + 0.339 GTP + 0.25 CTP + 0.27 UTP -> 1.25 ADP + 1.25 PI + RNA		
Protein	protein synthesis (lumped reaction)	0.025426 ALA + 0.011664 ARG + 0.02236 ASN + 0.02236 ASP + 0.000802 CYS + 0.028394 GLN + 0.028394 GLU + 0.024885 GLY + 0.004913 HIS + 0.011794 ILE + 0.011794 LEU + 0.013665 LYS + 0.004614 MET + 0.007764 PHE + 0.011833 PRO + 0.011742 SER + 0.0126 THR + 2.46E-05 TRP + 0.002674 TYR + 0.018514 VAL + 40 ATP -> 40 ADP + 40 PI + PROTEIN		
Phospholipid		0.944 PE + 0.306 PG + 0.074 CL -> PHOSPHOLIPID		
Cofactors and vitamins (CAV)		0.145 COA + 0.141 FAD + 0.243 FMN + 0.36 Q + 0.167 NAD + 0.149 NADP + 0.249 THF + 0.657 PYRDX + 0.419 THIAMIN -> CAV		
Biomass		0.5 PROTEIN + 0.028 DNA + 0.2 RNA + 0.049 PHOSPHOLIPID + 0.03 CAV + 0.025 LPS + 0.2266 PEPTIDO + 15 ATP -> BIOMASS + 15 ADP + 15 PI		
Maintenance		ATP -> ADP + PI		
LPS		1.908 LIPA + 3.229 ADPHEP + 16.96 UDPG + 29.03 UDPNAG + 5.64 NAGA1P -> LPS + 3.229 ADP + 46 UDP		
Carbohydrate (CARBO)		1.897 UDPNAG + 3.794 UDPGAL -> 5.691 UDP + CARBO		
Carbon sources				
Transport 4HBZ		4HBZxt -> 4HBZ	pcaK	PP_1376
Transport CONOL		CONOLxt -> CONOL	pcaK	PP_1376
Transport DHBZ		DHBZxt -> DHBZ	fruA fruB	PP_0795 PP_0793
Transport FRU		FRUxt + PEP -> PYR + F1P	glpF	PP_1076 PP_2548
Transport GL		GLxt <-> GL	glk	PP_1011
Transport GL3P		GL3Pxt + Hxt <-> GL3P	gntP	PP_3417 PP_0652
Transport GLAC		GLACxt + ATP -> GLAC + ADP + PI		
Transport GLC1		GLCxt + ATP -> G6P + ADP + PI		
Transport GLUC		GLUCxt + Hxt -> GLUC		
Transport MAN		MANxt + ATP -> ADP + MAN6P	phaK	PP_3271
Transport PHEACT		PHEACTxt -> PHEACT	ftsB ftsC	PP_2454 PP_2456
Transport RIB		RIBxt + ATP -> RIB + ADP + PI	ftsD ftsA	PP_2459 PP_2455
Transport RMN		RMNxt + Hxt <-> RMN		
Transport XYL		XYLxt + Hxt <-> XYL		
Transport KDG		KDGxt -> KDG	benK	PP_3165
Transport BZ		BZxt -> BZ	vanK	
Transport VN		VNxt -> VN	Gcd	PP_1444
Transport GLC	Extracellular interconversions	GLCxt -> GLUCxt	Gad	PP_3382 PP_3383
Transport GLUC	Extracellular interconversions	GLUCxt -> KDGxt		
Metabolites				
Transport AC		AC <-> ACxt + Hxt		

Transport AKG	AKGxt + Hxt -> AKG	KgtP	PP_1400
Transport CIT1	CITxt + Hxt <-> CIT		PP_2703
			PP_0147
			PP_2057
			PP_3074
Transport FORMATE1	FORM -> FORMxt		PP_1156
Transport FORMATE2	FORMxt + NO3xt -> FORM + NO3 + Hxt		
Transport FUM1	FUMxt + Hxt -> FUM	lctP	PP_4735
Transport LAC1	LACxt + Hxt <-> LAC	lctP	PP_4735
Transport LAC2	LACxt + Hxt -> LAC		
Transport MAL1	MALxt + Hxt -> MAL		
Transport MAL2	MALxt + Hxt <-> MAL	dotA	
Transport PYR	PYRxt + Hxt <-> PYR		
Transport SUCC1	SUCCxt + Hxt <-> SUCC	dotA	
Transport SUCC2	SUCCxt + Hxt -> SUCC		
Other considerable compounds			
Transport CO2	CO2xt <-> CO2		
Transport Cd1	Cdxt + ATP -> Cd + ADP + Pi	cadA-1	PP_0041
Transport Cd2	Cd + ATP -> Cdxt + ADP + Pi	cadA-2	PP_5139
Transport Cu	Cu + ATP -> Cuxt + ADP + Pi		PP_0586
			PP_4261
Transport H	Hxt + ATP <-> ADP + Pi		
Transport K1	Kxt + ATP -> K + ADP + Pi	kdpA kdpC	PP_4161
			PP_4159
Transport K2	Kxt -> K	trkH	PP_3953
			PP_4507
			PP_4304
Transport K3	K + Hxt -> Kxt	kefB	PP_5246
			PP_0713
Transport Mg	Mgxt + ATP -> Mg + ADP + Pi	mgtB mgtE	PP_3311
			PP_2645
			PP_4471
Transport Na1	Na + Hxt <-> Naxt		
Transport Na2	2 Na + 3 Hxt <-> 2 Naxt		
Transport Na3	Na + 2 Hxt <-> Naxt		
Transport NAC	NACxt <-> NAC		
Transport NH3	NH3xt <-> NH3	amtB	PP_5233
Transport NO3	NO3xt <-> NO3	nasA	PP_2092
Transport O2	O2xt <-> O2		
Transport P11	Plxt + ATP -> ADP + 2 Pi	pstS pstC	PP_5329
		pstA pstB	PP_5328
			PP_5327
			PP_5326
			PP_2656
			PP_2657
			PP_2658
			PP_2659
Transport P12	Plxt + Hxt <-> Pi		PP_1373
			PP_4103
Transport P13	Plxt + Naxt -> Pi + Na		PP_0145
Transport PNT0	PNT0xt + Naxt -> PNT0 + Na		PP_4524
Transport PTRC	PTRCxt + ATP -> PTRC + ADP + Pi	PotF PotI	PP_0873
		PotH PotG	PP_5177
			PP_5178
			PP_5179
Transport PYRDX	PYRDXxt <-> PYRDX		
Transport SLF1	SLFxt + ATP -> SLF + ADP + Pi	cysP cysA	PP_4305
		cysW cysT	PP_5168
			PP_5169
			PP_5170
Transport SLF2	SLFxt + Hxt -> SLF		PP_0075
			PP_0101
			PP_0718
			PP_1407
Transport SLF3	SLFxt + Naxt -> SLF + Na		PP_3931
Transport TAU	TAUxt + ATP -> TAU + ADP + Pi	SsuA SsuB	PP_0170
		SsuC	PP_0171
			PP_0172
			PP_0209
			PP_0208
			PP_0207
			PP_3211
			PP_3210
			PP_3217
			PP_3637
			PP_3635
			PP_3636
Amino acids			
Transport ALA1	ALAXt + ATP -> ALA + ADP + Pi	aapJ aapQ	PP_1297
		aapM aapP	PP_1298
			PP_1299
			PP_1300
Transport ALA2	ALAXt + Hxt -> ALA		PP_0496
Transport ALA3	ALAXt + Naxt <-> ALA + Na	aotJ aotM	PP_4486
Transport ARG1	ARGxt + ATP -> ARG + ADP + Pi	aotQ aotP	PP_4484
			PP_4485
			PP_4483
Transport ARG2	ORNxt + ARG <-> ORN + ARGxt	arcD	PP_1002
			PP_1003
Transport ASN	ASNxt + ATP -> ASN + ADP + Pi	aapJ aapQ	PP_1297
		aapM aapP	PP_1298
			PP_1299
			PP_1300
Transport ASP1	ASPxt + ATP -> ASP + ADP + Pi	glti gltK gltJ	PP_1071
		gltL	PP_1069
			PP_1070
			PP_1068
Transport ASP2	ASPxt + Hxt -> ASP		
Transport CYS	CYSxt + ATP -> CYS + ADP + Pi	flhY yecS	PP_0227
		yecC	PP_0226
			PP_0225
Transport DALA	DALAXt + ATP -> DALA + ADP + Pi	cycA	PP_4840
Transport DGLU	DGLUxt + ATP -> DGLU + ADP + Pi		
Transport GLN	GLNxt + ATP -> GLN + ADP + Pi		
Transport GLU1	GLUxt + ATP -> GLU + ADP + Pi		
		glti gltK gltJ	PP_5022
		gltL	PP_5023
			PP_5024
			PP_1071
			PP_1069
			PP_1070
			PP_1068
Transport GLU2	GLUxt + Hxt <-> GLU		
Transport GLY1	GLYxt + ATP -> GLY + ADP + Pi	cycA	PP_4840
Transport GLY2	GLYxt + Naxt <-> GLY + Na		PP_0496
Transport HIS2	HISxt + ATP -> HIS + ADP + Pi	aapJ aapQ	PP_1297
		aapM aapP	PP_1298
			PP_1299
			PP_1300
Transport ILE1	ILExt + Hxt -> ILE		
Transport ILE2	ILExt + ATP -> ILE + ADP + Pi	livG braG	PP_1138
		braD livM	PP_1137
		braC	PP_1139
			PP_1140
			PP_1141
Transport ILE3	ILE + Hxt <-> ILExt		
Transport LEU1	LEUxt + Hxt -> LEU		

Transport LEU2	LEUxt + ATP -> LEU + ADP + PI	livG braG braD livM braC	PP_1138 PP_1137 PP_1139 PP_1140 PP_1141
Transport LEU3	LEU + Hxt <-> LEUxt		
Transport LYS1	LYSxt + ATP -> LYS + ADP + PI	aapJ aapQ aapM aapP	PP_1297 PP_1298 PP_1299 PP_1300
Transport LYS2	LYS + Hxt -> LYSxt	lysE yggA	PP_2429 PP_3405 PP_3438
Transport MET	METxt + ATP -> MET + ADP + PI	aapJ aapQ aapM aapP	PP_1297 PP_1298 PP_1299 PP_1300
Transport PHE1	PHExt + ATP -> PHE + ADP + PI	aapJ aapQ aapM aapP	PP_1297 PP_1298 PP_1299 PP_1300
Transport PHE2	PHExt -> PHE	aroP	PP_0927 PP_4495 PP_5031
Transport PRO1	PROxt + ATP -> PRO + ADP + PI	ProX ProW ProV	PP_0076 PP_0295 PP_0294 PP_1059
Transport PRO2	PROxt + Hxt -> PRO		
Transport SER	SERxt + ATP -> SER + ADP + PI	aapJ aapQ aapM aapP	PP_1297 PP_1298 PP_1299 PP_1300
Transport THR1	THRxt + ATP -> THR + ADP + PI	aapJ aapQ aapM aapP	PP_1297 PP_1298 PP_1299 PP_1300
Transport THR2	THR + Hxt <-> THRxt		
Transport TRP1	TRPxt + ATP -> TRP + ADP + PI	aapJ aapQ aapM aapP	PP_1297 PP_1298 PP_1299 PP_1300
Transport TRP2	TRPxt -> TRP		
Transport TYR1	TYRxt + ATP -> TYR + ADP + PI	aapJ aapQ aapM aapP	PP_1297 PP_1298 PP_1299 PP_1300
Transport TYR2	TYRxt -> TYR	aroP	PP_0927 PP_4495 PP_5031
Transport VAL1	VALxt + Hxt <-> VAL		
Transport VAL2	VALxt + ATP -> VAL + ADP + PI	livG braG braD livM braC	PP_1138 PP_1137 PP_1139 PP_1140 PP_1141

Supporting information 1C List of metabolite abbreviations used in PpuMBEL1071

12DH12DH8CNAPTH	cis-1,2-Dihydroxy-1,2-dihydro-8-carboxynaphthalene
12DH8CNAPTH	1,2-Dihydroxy-8-carboxynaphthalene
13PDG	3-Phospho-D-glyceroyl phosphate, 1,3-Bisphospho-D-glycerate
14aDglucan	1,4 alpha D-glucan, Amylose
14BMANN	1,4-beta-D-Mannan
16DH24CHECC	Benzoate diol;
1APP2OL	D-1-Aminopropan-2-ol O-phosphate,
23DHPIMCOA	2,3-Didehydro-pimeloyl-CoA
25DOP	2,5-Dioxopentanoate, 2-Oxoglutarate semialdehyde
26DHCHCBCOA	2,6-Dihydroxycyclohexane-1-carboxyl-COA
26DM5M3OHCOA	2,6-Dimethyl-5-methylene-3-oxo-heptanoyl-COA
2D3DX	2-Dehydro-3-deoxy-D-pentionate
2H3CBNPYR	2-Hydroxy-3-carboxybenzalpyruvate
2H3MBNPYR	2-Hydroxy-3-methylbenzalpyruvate
2H4HMBNPYR	2-Hydroxy-4-hydroxymethylbenzalpyruvate
2H4IPCHCCOA	2-Hydroxy-4-isopropenylcyclohexane-1-carboxyl-CoA
2HHPDD	2-Hydroxyhepta-2,4-dienedioate
2HPHEAC	2-Hydroxyphenylacetate
2M5IPH25Cc	cis-2-Methyl-5-isopropylhexa-2,5-dienoic acid
2M5IPH25COAc	cis-2-Methyl-5-isopropylhexa-2,5-dienoyl-CoA
2M5IPH25Ct	trans-2-Methyl-5-isopropylhexa-2,5-dienoic acid
2M5IPH25COAt	trans-2-Methyl-5-isopropylhexa-2,5-dienoyl-CoA
2MATACOA	2-Methylacetoacetyl-CoA; 2-Methyl-3-acetoacetyl-CoA
2MPECOA	2-Methylprop-2-enoyl-CoA, Methylacrylyl-CoA
2O23DHFAC	2-Oxo-2,3-dihydrofuran-5-acetate
2O6H	2-Octaprenyl-6-hydroxyphenol
2OHEPED	2-Oxohept-3-enedioate; 2-Oxohept-3-ene-1,7-dioate
2OMHMB	2-Octaprenyl-3-methyl-5-hydroxy-6-methoxy-1,4-benzoquinone
2OPMB	2-Octaprenyl-6-methoxy-1,4-benzoquinone
2OPMMB	2-Octaprenyl-3-methyl-6-methoxy-1,4-benzoquinone
2OPMP	2-Octaprenyl-6-methoxyphenol
2OPPP	2-Octaprenylphenol
2PCDPMDE	2-Phospho-4-(cytidine 5'-diphospho)-2-C-methyl-D-erythritol
2PG	2-Phospho-D-glycerate
2PPG	2-Phosphoglycolate
2PY46DC	2-Pyrone-4,6-dicarboxylate
3A2OPP	3-Amino-2-oxopropyl phosphate
3CMUC	3-Carboxy-cis,cis-muconate
3DDAH7P	2-Dehydro-3-deoxy-D-arabino-heptonate 7-phosphate
3H26DM5MHCOA	3-Hydroxy-2,6-dimethyl-5-methylene-heptanoyl-COA
3HADIPCOA	(3S)-3-Hydroxyadipyl-CoA
3IP6OH	(3R)-3-Isopropenyl-6-oxoheptanoate
3IP6OHS	(3S)-3-Isopropenyl-6-oxoheptanoate
3IP6OHCOA	(3R)-3-Isopropenyl-6-oxoheptanoyl-CoA
3IP6OHCOAS	(3S)-3-Isopropenyl-6-oxoheptanoyl-CoA
3IPB3EC	3-Isopropylbut-3-enoic acid
3IPB3ECOAS	3-Isopropylbut-3-enoyl-CoA
3IPPIMCOA	3-Isopropenylpimelyl-CoA
3KbGALC	3-Keto-beta-D-galactose
3MOP	3-Methyl-2-oxopentanoate, (S)-3-Methyl-2-oxopentanoic acid
3OADIPCOA	3-Oxoadipyl-CoA
3OPPA	3-Oxopropanoate
3PG	3-Phospho-D-glycerate, D-Glycerate 3-phosphate
3PSER	3-Phosphoserine
3PSME	5-O-(1-Carboxyvinyl)-3-phosphoshikimate
3URDPP	3-Ureidopropionate

4ACAMBA	4-Acetamidobutanoate
4C2HMUC	4-Carboxy-2-hydroxy-cis,cis-muconate
4C2HMUCSAH	4-Carboxy-2-hydroxymuconate Semialdehyde
4C2O3HD	4-Carboxy-2-oxo-3-hexenedioate
4C2O4PENT	4-Carboxy-2-oxo-4-pentanoate
4C4H2OADIP	4-Carboxy-4-hydroxy-2-oxoadipate
4CMUCNLAC	4-Carboxymuconolactone,
4H2OHEP	4-Hydroxy-2-oxo-heptanedioate
4H4M2OGLUT	4-Hydroxy-4-methyl-2-oxoglutarate
4HAC	4-Hydroxyphenylacetaldehyde
4HBA	4-Hydroxy-benzyl alcohol
4HBZ	4-Hydroxybenzoate
4HLT	4-Hydroxy-L-threonine
4HPHEAC	4-Hydroxyphenylacetate; 4-Hydroxyphenylacetic acid
4HPHEACCOA	4-Hydroxyphenylacetyl-CoA
4HPHEACG	4-Hydroxyphenylacetyl glycine
4HPP	3-(4-Hydroxyphenyl)pyruvate, 4-Hydroxyphenylpyruvate
4IP2OCHCCOA	4-Isopropenyl-2-oxy-cyclohexanecarboxyl-CoA
4MOP	4-Methyl-2-oxopentanoate
4OMC	4-oxalomesaconate
4PHEACCOA	Phenylacetyl-CoA
4PHEACG	Phenylacetyl glycine
4PPNCYS	(R)-4'-Phosphopantothenoyl-L-cysteine
4PPNTE	Pantetheine 4-phosphate
4PPNTO	D-4'-Phosphopantothenate
5AAPT	5-Acetamidopentanoate
5C2PCOA	5-Carboxy-2-pentenoyl-CoA
5FTHF	5-Formyltetrahydrofolate
5H24DP	5-Formyltetrahydrofolate
5HIDAC	5-Hydroxyindoleacetate
5HIDACAL	5-Hydroxyindoleacetaldehyde
5HKN	5-Hydroxykynurenine
5HKNN	5-Hydroxykynurenamine
5HTRY	5-Hydroxy-L-tryptophan
5MCYT	5-Methylcytosine
5MDR	5-Methylthio-D-ribose
5MTA	5'-Methylthioadenosine
5O25DHFAC	(S)-5-Oxo-2,5-dihydrofuran-2-acetate
6HCHCBCOA	6-Hydroxycyclohex-1-enecarbonyl-CoA
6O2HCHCBCOA	6-Oxo-2-hydroxycyclohexane-1-carboxyl-CoA
8MTXN	8-Methoxykynurenate
A4IZM	5-Amino-4-imidazolecarboxamide
A5P	D-Arabinose 5-phosphate
A6RP	4-(1-D-Ribitylamino)-5-amino-2,6-dihoxypyrimidine, 4-(1-D-Ribitylamino)-5-aminouracil
A6RP5P	5-Amino-6-(5'-phosphoribosylamino)uracil
A6RP5P2	5-Amino-6-(5'-phosphoribitylamino)uracil
AAC	Acetoacetic acid
AACCOA	Acetoacetyl-CoA; Acetoacetyl coenzyme A; 3-Acetoacetyl-CoA
AACL	2-Aminoacrylate; Dehydroalanine
AAGCB	alpha-Amino-gamma-cyanobutanoate
ABUT	2-Aceto-2-hydroxybutanoate
AC	Acetate
ACACP	Acetyl-[acyl-carrier protein]
ACAL	Acetaldehyde
ACALA	N-Acetylmuramoyl-Ala
ACCOA	Acetyl-CoA
ACETYLP	Acetyl-P, Acetyl phosphate
ACLAC	2-Acetolactate

ACLE	Acetylene
ACMAM	N-Acetyl-D-mannosamine
ACMUR	N-Acetyl-D-muramoate
ACOA	Acyl-CoA
ACP	Acyl-carrier protein
ACPTPI	Acetylpsudotropine
ACTPI	Acetyl tropine
AD	Adenine
ADCHOR	4-amino-4-deoxychorismate
ADCOBACD	Adenosyl cobyrate a,c diamide
ADCOHEX	Adenosyl cobyrate hexaamide
ADCOMN	adenosylcobinamide
ADCOMNP	adenosylcobinamide phosphate
ADGCOMN	Adenosine-GDP-cobinamide
ADIP	Adipate, Hexan-1,6-dicarboxylate
ADIPCOA	Adipyl-CoA, 5-Carboxypentanoyl-CoA
ADLIPO	6-S-Acetyldihydrolipoamide
ADN	Adenosine
ADNSEL	Adenylylselenate
ADP	ADP
ADPG	ADPglucose
ADPHEP	ADP-L-glycero-D-manno-heptose
AE12BZ	Dopamine
AGCR	Glyceride
AGL3P	Acyl-sn-glycerol 3-phosphate
AGM	Agmatine
AHHMD	2-Amino-7,8-dihydro-4-hydroxy-6-(diphosphooxymethyl)pteridine
AHHMD	2-Amino-7,8-dihydro-4-hydroxy-7-(diphosphooxymethyl)pteridine
AHHMP	2-Amino-4-hydroxy-6-hydroxymethyl-7,8-dihydropteridine
AHM	4-Amino-5-hydroxymethyl-2-methylpyrimidine
AHMP	4-Amino-5-hydroxymethyl-2-methylpyrimidine-phosphate
AHMPP	2-Methyl-4-amino-5-hydroxymethylpyrimidine diphosphate
AHTD	2-Amino-4-hydroxy-6-(erythro-1,2,3-trihydroxypropyl)-dihydropteridine triphosphate
AICAR	1-(5'-Phosphoribosyl)-5-amino-4-imidazolecarboxamide
AIR	Aminoimidazole ribotide
AKG	2-Oxoglutarate, a-Ketoglutarate
AKP	2-Dehydropantoate
ALA	L-Alanine
ALAALA	D-alanyl-D-alanine
ALAV	D-Aminolevulinate
ALGNT	(Alginate)n - Polymer
AM2OXH	6-Acetamido-2-oxohexanoate; 2-Oxo-6-acetamidocaproate
AMACAL	Aminoacetaldehyde
AMBL	4-Aminobutanal, 4-Aminobutyraldehyde
AMP	AMP
AMY	Amylose, Maltodextrin
AN	Anthranilate
AONA	8-amino-7-oxononanoate
APACP	Apoprotein
APCARX	Apo-[carboxylase]
AppppA	P1,P4-Bis(5'-adenosyl) tetraphosphate
APS	Adenylylsulfate
ARG	L-Arginine
ARGSUCC	N-(L-Arginino)succinate
ARIB	ADPribose
aRIBAZOLE	N1-(alpha-D-ribose)-5,6-dimethylbenzimidazole
ASB	Ascorbate
ASER	O-Acetyl-L-serine
ASN	L-Asparagine

ASP	L-Aspartate
ASPSA	L-Aspartate 4-semialdehyde
ASUC	N6-(1,2-Dicarboxyethyl)-AMP, Adenylosuccinate
ATHR	L-Allothreonine; L-allo-Threonine
ATHSER	O-Acetylhomoserine
ATP	ATP
B1AL	3-Butyn-1-al
B1OL	3-Butyn-1-ol
bALA	beta-Alanine
bAMPAL	beta-Aminopropion aldehyde
BASP	4-Phospho-L-aspartate, L-4-Aspartyl phosphate
bDG6P	beta-D-Glucose-6-phosphate
bDGLC	beta-D-Glucose
BET	Betanine
BETAH	Betanine aldehyde
bG2HCOUM	beta-D-Glucosyl-2-coumarinate
bGLAC	beta-D-Galactose
BIOMASS	Biomass
bLEU	L-beta-Leucine
BT	Biotin
BT5AMP	Biotinyl-5'-AMP
BUTANAL	Butanal
BUTANOL	Butanol
BYNO	3-Butynoate
BZ	Benzoate
BZQ	p-Benzoquinone
C040COA	Butanoyl-CoA
C100ACP	Decanoyl-[acyl-carrier protein]
C120ACP	Dodecanoyl-[acyl-carrier protein]
C140ACP	Myristoyl-[acyl-carrier protein]
C160	Hexadecanoic acid, Hexadecanoate
C160ACP	Hexadecanoyl-[acyl-carrier protein]
C180ACP	Stearoyl-[acyl-carrier protein]
C181ACP	Oleoyl-[acyl-carrier protein]
CAASP	N-Carbamoyl-L-aspartate
CABM	Carbamate; Carbamic acid; Aminoformic acid
CAFF	Caffeate
CAFFCOA	Caffeoyl-CoA
CAIR	1-(5-Phospho-D-ribose)-5-amino-4-imidazolecarboxylate
cAMP	3',5'-Cyclic AMP
CAP	Carbamoyl phosphate
CARBO	Carbohydrate
CATOL	Catechol
CAV	Cofactors and vitamins
CBHCAP	3-Isopropylmalate
CBIO	Cellobiose
CBSARC	N-Carbamoylsarcosine
Cd	Cadmium
CDP	CDP
CDPDG	CDP-diacylglycerol
CDPETN	CDP-Ethanolamine
CDPMDE	4-(Cytidine 5'-diphospho)-2-C-methyl-D-erythritol
cGMP	3',5'-Cyclic GMP
CHAC	Chloroacetic acid
CHAM	Cyclohexanamine
CHBIO	Chitobiose
CHCATOL	3-Chlorocatechol
CHCOA	6-carboxyhexanoyl-CoA
CHETOH	Ethylene chlorohydrin, 2-Chloroethanol

CHETAL	2-Chloroethanal, Chloroacetaldehyde
CHFAM	N-Cyclohexylformamide
CHMUC	2-Chloro-cis,cis-muconate
CHOL	Choline
CHOR	Chorismate
CINVLIN	Cinnavalinate
CIT	Citrate
CITR	L-Citrulline
CL	Cardiolipin (biomass component)
CLLT	Ciliatine, 2-Aminoethylphosphonate
CLO	Cellulose, 1,4-beta-D-Glucosyl
CMAR	4-Coumarate; p-Coumaric acid; trans-4-Hydroxycinnamate; 4-Hydroxycinnamate
CMP	CMP
CMPKDO	CMP-2-keto-3-deoxyoctanoate
CN	Cyanide
CNGLCS	Cyanoglycoside
CO2	CO2
COA	CoA
COB1ACDM	Cob(I)yrinate a,c diamide
COB2ACDM	Cob(II)yrinate a,c diamide
COBALT	Cobalt
CONOL	Coniferyl alcohol
CONAL	Coniferyl aldehyde
COUM	Coumarine
COUMT	2-Coumarinate, cis-2-Hydroxy cinnamate
CPAD5P	1-(2-Carboxyphenylamino)-1-deoxy-D-ribulose 5-phosphate
CPP	Coproporphyrinogen III
CPPI	Coproporphyrinogen I
CTCOA	Crotonoyl-CoA
CTP	CTP
Cu	Copper
CYALA	3-Cyano-L-alanine
CYNHR	Cyanohydrin
CYS	L-Cysteine
CYSGLY	L-Cysteinyglycine
CYST	L-Cysteate
CYTC	Cytochrome c
CYTD	Cytidine
CYTS	Cytosine
D1AP2OP	D-1-Aminopropan-2-ol O-phosphate
D4DG	5-Dehydro-4-deoxy-D-glucarate
D6PGC	6-Phospho-D-gluconate
D6PGL	D-Glucono-1,5-lactone 6-phosphate
D6RP5P	2,5-Diamino-6-hydroxy-4-(5'-phosphoribosylamino)-pyrimidine
D8RL	6,7-Dimethyl-8-(1-D-ribityl)lumazine
DA	Deoxyadenosine
DADP	dADP
DALA	D-alanine
DALT	D-Altronate
DAMBUT	alpha,gamma-Diaminobutyrate; L-2,4-Diaminobutyrate
DAMP	DAMP
DANNA	7,8-Diaminononanoate
DAPIM	L,L-2,6-Diaminopimelate
DATP	dATP
DB4P	L-3,4-Dihydroxy-2-butanone 4-phosphate
DC	Deoxycytidine
DCDP	dCDP
DCMP	dCMP

DCTP	dCTP
DEP	Diethyl phosphate
DG	Deoxyguanosine
DGAL	D-Galactarate
DGDP	dGDP
DGLN	D-Glutamine
DGLS	D-Glucoside
DGLU	D-Glutamate
DGLYCERATE	D-glycerate
DGMP	dGMP
DGR	D-1,2-Diacylglycerol, 1,2-Diacyl-sn-glycerol
DGTP	dGTP
DHAP	Glycerone phosphate, Dihydroxyacetone phosphate
DHBP	Dihydrobiopterin
DHBAL	3,4-Dihydroxybenzaldehyde
DHBZ	3,4-Dihydroxybenzoate, Protocatechuate
DHDP	2,3-Dihydrodipicolinate
DHF	Dihydrofolate
DHGL	2-Dehydro-D-gluconate
DHLIPOYLPROTEIN	Dihydrolipoylprotein
DHMAH	3,4-Dihydroxymandelaldehyde
DHMP	(R)-2,3-dihydroxy-3-methylpentanoate
DHMVA	(R)-2,3-dihydroxy-3-methylbutanoate
DHP	2-Amino-4-hydroxy-6-(D-erythro-1,2,3-trihydroxypropyl)-7,8-dihydropteridine, Dihydroneopterin
DHPHE	L-Dopa
DHPHEG	3,4-Dihydroxyphenylethyleneglycol
DHPT	Dihydropteroate
DHPY	2,5-Dihydroxypyridine
DHSK	3-Dehydroshikimate
DIMGP	D-erythro-1-(Imidazol-4-yl)glycerol 3-phosphate
DIN	Deoxyinosine
DISAC1P	2,3-bis(3-hydroxytetradecanoyl)-D-glucosaminy-1,6-beta-D-2,3-bis(3-hydroxytetradecanoyl)-beta-D-glucosaminy-1-phosphate or dissacharide 1-P
DLG	2,3-Dioxo-L-gulonate
DLIPO	Dihydrolipoamide
DMBZMZ	Dimethylbenzimidazole
DMGLY	Dimethylglycine
DMK	2-Demethylmenaquinone
DMPP	Dimethylallyl diphosphate
DNA	DNA (biomass component)
DOROA	(S)-Dihydroorotate
DPCOA	Dephospho-CoA
DPHE	D-Phenylalanine
DQT	3-Dehydroquinone
DR5P	2-Deoxy-D-ribose 5-phosphate
DRIB	Deoxyribose
DST	3,4-Dihydroxystyrene
DT	Thymidine
DTB	Dethiobiotin
DTC	3,4-Dihydroxy-trans-cinnamate
DTDP	dTDP
DTDP4D6DG	dTDP-4-dehydro-6-deoxy-D-glucose
DTDP4D6DM	dTDP-4-dehydro-6-deoxy-L-mannose
DTDP6DM	dTDP-6-deoxy-L-mannose
DTDPGAL	dTDP-galactose
DTDPGLU	dTDP-glucose
DTDPGLUC	dTDP-D-glucuronate
DTMP	dTMP
DTTP	dTTP
DU	Deoxyuridine

DUDP	dUDP
DUMP	dUMP
DUTP	dUTP
DX5P	1-Deoxy-D-xylulose 5-phosphate
E4HGLU	L-erythro-4-Hydroxyglutamate
E4P	D-Erythrose 4-phosphate
ECGME	Ecgonine methyl ester
EP	Ethyl phosphate
ER4P	4-Phosphoerythronate
ETFLA	Electron-transferring flavoprotein
ETH	Ethanol
ETHAM	Ethanolamine
ETHSLF	Ethanesulfonate
ETYO	Ethylene oxide
F1P	D-Fructose 1-phosphate
F2P	beta-D-Fructose 2-phosphate;
F6P	beta-D-Fructose 6-phosphate
FAD	FAD
FADH2	FADH2
FALD	Formaldehyde
FCYTC	Ferricytochrome c
FDP	beta-D-Fructose 1,6-bisphosphate
FER	Ferulate
FERCOA	Feruloyl-CoA
FGAM	2-(Formamido)-N1-(5'-phosphoribosyl)acetamidine
FGAR	5'-Phosphoribosyl-N-formylglycinamide
FLEOL	Fluoren-9-ol
FMGT	S-Formylglutathione
FMM	Formamide; Methanamide
FMMGLU	N-Formimino-L-glutamate; N-Formimidoyl-L-glutamate
FMN	FMN
FMNH2	Reduced FMN
FOCYTC	Ferrocyclochrome c
FOL	Folate;
FORM	Formate
FPP	trans,trans-Farnesyl diphosphate
FRU	D-Fructose
FSALAC	3-Formylsalicylic acid
FTHF	10-Formyltetrahydrofolate
FUM	Fumarate
FUMACTAC	Fumarylacetoacetate
G15L	D-Glucono-1,5-lactone
G1COA	Glutaconyl-1-CoA
G1P	D-Glucose 1-phosphate
G3P	D-Glyceraldehyde 3-phosphate, (2R)-2-Hydroxy-3-(phosphonoxy)-propanal
G4D6DMAN	GDP-4-dehydro-6-deoxy-D-mannose
G6P	alpha-D-Glucose 6-phosphate
GA1P	D-Glucosamine 1-phosphate
GA6P	D-Glucosamine 6-phosphate
GABA	4-Aminobutanoate
GALL	Gallate
GAR	5'-Phosphoribosylglycinamide
GBAL	4-Guanidinobutanal
GBUT	4-Guanidinobutanoate
GCL	D-Glucuronolactone
GCOA	Glutaryl-CoA
GCYS	gamma-L-Glutamyl-L-cysteine
GDHLA	S-Glutaryl dihydroipoamide
GDP	GDP
GDP4D6DM	GDP-4-dehydro-6-deoxy-L-mannose

GDPRMN	GDP-6-deoxy-L-mannose, GDP-L-rhamnose	
GGPP	Geranylgeranyl diphosphate	
GGSEMSC	gamma-Glutamyl-Se-methylselenocysteine	
GHMSAL	gamma-hydroxymuconic semialdehyde	
GL	Glycerol	
GL3P	sn-Glycerol-3-phosphate, sn-Glycerol 3-phosphate	
GL3PCHOL	sn-glycero-3-Phosphocholine	
GL3PETHAM	sn-glycero-3-Phosphoethanolamine	
GLAC	D-Galactose	
GLAL	Glycolaldehyde	
GLC	alpha-D-Glucose	
GLN	L-Glutamine	
GLU	L-Glutamate	
GLUAM	5-L-Glutamyl)-L-amino acid	
GLUC	D-Gluconate	
GLUCR	D-Glucarate	
GLUGSAL	L-Glutamate 5-semialdehyde	
GLUP	alpha-D-Glutamyl phosphate	
GLUPEP	(5-L-Glutamyl)-peptide	
GLUTAU	5-L-Glutamyl-taurine	
GLX	Glyoxylate	
GLY	Glycine	
GLYCOGEN	Glycogen	
GLYCOLATE	Glycolate	
GLYN	Glycerone	
GMP	GMP	
GN	Guanine	
GNTRNA	L-GlutaminyI-tRNA(Gln)	
GOP	5-guanidino-2-oxopentanoate	
GPP	Geranyl diphosphate	
GSA	Glutamate-1-semialdehyde, L-Glutamate 1-semialdehyde, 4-Amino-5-oxopentanoate	(S)-
GSN	Guanosine	
GTAH	Gentisate aldehyde	
GTP	GTP	
GTRNA	L-Glutamyl-tRNA(glu)	
H2AEP	1-Hydroxy-2-aminoethylphosphonate	
H2O	Water	
H2O2	H2O2	
H2OLM	Hydroxy-2-oxolimonene	
H2S	Hydrogen sulfide	
SO3	Sulfite	
H3MCOA	(S)-3-Hydroxy-3-methylglutaryl-CoA	
H3OP	2-Hydroxy-3-oxopropanoate, Tartronate semialdehyde	
H5P3O10	Triphosphate	
HANTH	3-Hydroxyanthranilate	
HBNQ	Hydroxybenzoquinone, 2-Hydroxy-1,4-benzoquinone	
HBUTn2	((R)-3-Hydroxybutanoyl)(n-2)	
HCNS	Homocarnosine	
HCYS	Homocysteine, L-Homocysteine	
HCYSI	Homocystine	
HEDC	2-Hydroxyethylenedicarboxylate	
HEPPP	all-trans-Heptaprenyl diphosphate	
HETHSLF	2-Hydroxyethanesulfonate	
HGCOA	2-Hydroxyglutaryl-CoA	
HH	6-Hydroxyhexanoic acid	
HIBUT	(S)-3-Hydroxyisobutyrate	
HIS	L-Histidine	
HISOL	L-Histidinol	
HISOLP	L-Histidinol phosphate	

HKN	3-Hydroxykynurenamine
HLCARX	Holo-[carboxylase]
HLK	3-Hydroxy-L-kynurenine
HMB	Hydroxymethylbilane
HMB4PP	1-Hydroxy-2-methyl-2-butenyl 4-diphosphate
HMCATOL	4-Hydroxymethylcatechol
HMNAPTH	1-Hydroxymethylnaphthalene
HMNAPTH2	2-Hydroxymethylnaphthalene
HMSALC	4-Hydroxymethylsalicylate
HMSALCAH	4-Hydroxymethylsalicylaldehyde
HN6TL	3-Hydroxy-N6,N6,N6-trimethyl-L-lysine
HNAC	6-Hydroxynicotinate
HNAPTHO	1-Hydroxy-2-naphthoate
HOMOGEN	Homogentisate
HOPT	4-Hydroxy-2-oxopentanoate
HORD	Hordenine
HOS	2-Hydroxy-3-oxosuccinate
HPCOA	3-Hydroxypropionyl-CoA
HPIMCOA	3-Hydroxypimeloyl-CoA
HPPP	2-Hydroxypropylphosphonate
HPRPP	all-trans-Hexaprenyl diphosphate
HPYR	hydroxypyruvate
HQ	Hydroquinone
HSER	L-Homoserine
HST	4-Hydroxystyrene
HTRNA	L-Histidyl-tRNA(His)
HXSP	2-Hydroxyisophthalic acid
Hxt	External proton
HYDROXYAKG	4-Hydroxy-2-oxoglutarate, D-4-Hydroxy-2-oxoglutarate
HYGACDM	Hydrogenobyrinate a,c diamide
HYXN	Hypoxanthine
I3AC	Indole-3-acetate
I3ACAL	Indole-3-acetaldehyde
ICHOR	Isochorismate
ICIT	Isocitrate
IDP	IDP
IGP	Indoleglycerol phosphate, (3-Indolyl)-glycerol phosphate
ILE	L-Isoleucine
IMACP	3-(Imidazol-4-yl)-2-oxopropyl phosphate
IMNASP	Iminoaspartate
IMP	IMP
IMZAC	Imidazole-4-acetate
IMZACAL	Imidazole-4-acetaldehyde
INO1P	Inositol 1-phosphate
INO3P	Inositol 3-phosphate
INO4P	Inositol 4-phosphate
INS	Inosine
IPP	Isopentenyl diphosphate
IPPMAL	2-Isopropylmalate
ITC	Itaconate
ITCCOA	Itaconyl-CoA
ITP	ITP
K	Potassium
K2LIPV	KDO2-lipid IV(A)
KDG	2-Dehydro-3-deoxy-D-gluconate, 2-ketogluconate
KDO	2-Dehydro-3-deoxy-D-octonate
KDOLIPV	KDO-lipid IV(A)
KDOP	2-Dehydro-3-deoxy-D-octonate 8-phosphate, Deoxy-D-manno-octulosonate 8-phosphate

KDPG	2-Dehydro-3-deoxy-D-gluconate-6-phosphate
LAC	(R)-Lactate, D-Lactate
LACTAL	(S)-Lactaldehyde, L-Lactaldehyde
LACTOSE	Lactose
LAMACID	L-Amino acid (just the amino group, no side chain)
LARABINOSE	L-Arabinose
LEU	L-Leucine
LIG	Lignin
RLIM	R-Limonene
SLIM	S-Limonene
LIPA	KDO(2)-lipid A
LIPIV	Lipid IV(A)
LIPO	Lipoamide
LIPOYLPROTEIN	Lipoylprotein
LIPX	Lipid X
LLAC	(S)-Lactate, L-Lactate
LLCT	L-Cystathionine
LMDOL	Limonene-1,2-diol
LPS	Lippolysaccharide
LRIBULOSE	L-Ribulose
LRIBULOSE5P	L-Ribulose-5-phosphate
LTG	(R)-S-Lactoylglutathione
LXN	L-Lyxonate
LXYLULOSE	L-Xylulose
LXYLULOSE1P	L-Xylulose-1-phosphate
LXYLULOSE5P	L-Xylulose-5-phosphate
LYS	L-Lysine
MACO	cis-2-Methylnaconitate
MACTAC	4-Maleylacetoacetate; 4-Maleylacetoacetic acid
MAL	Malate, (S)-Malate
MALACP	Malonyl-[acyl-carrier protein]
MALCOA	Malonyl-CoA
MALE	Maleate
MALEM	Maleamate
MAN	alpha-D-Mannose
MAN1P	alpha-D-Mannose 1-phosphate
MAN6P	D-Mannose 6-phosphate
MANN	Mannan(n) - Polymer
MANN1	Mannan(n+1) - Polymer
MCATOL	3-Methylcatechol
MCATOL4	4-Methylcatechol
MCOBL	Methylcobalamin
MCPYR	Mercaptopyruvate
MDAC	Monodehydroascorbate
MDAPIM	meso-2,6-Diaminopimelate
MDE4P	2-C-Methyl-D-erythritol 4-phosphate
MDECPP	2-C-Methyl-D-erythritol 2,4-cyclodiphosphate
MEOH	Methanol
MELI	Melibiose
MELT	Melibiotol
MET	L-Methionine
METHF	5,10-Methenyltetrahydrofolate
METHMASAL	Methylmalonate semialdehyde, (S)-Methylmalonate semialdehyde
METHMA	Methylmalonate
METTHF	5,10-Methylenetetrahydrofolate
Mg	Magnesium
MHDTN	N-Methylhydantoin; N-Methylimidazolidine-2,4-dione
MI	myo-Inositol
MK	menaquinone
MKH2	menaquinol
MLAC	2-Maleylacetate

MLT	Maltose
MNT1P	D-Mannitol 1-phosphate
MPHATE	1-Methoxyphenanthrene
MPPCOA	2-Methylpropanoyl-CoA, Isobutyryl-CoA
MSALC	3-Methylsalicylate
MSALC4	4-Methylsalicylate
MSALCAH	3-Methylsalicylaldehyde
MSLF	Methanesulfonate
MTG	Methylglyoxal
MTHF	5-Methyltetrahydrofolate
MTHMNP	5,10-Methylenetetrahydromethanopterin
MTRA	meso-Tartaric acid, meso-Tartrate
MUCA	cis,cis-Muconate
MYTAL	Myrtenal
MYTOL	Myrtenol
N4ACAMBL	N4-Acetylaminobutanal
Na	Sodium
NAAD	Deamido-NAD+
NAC	Nicotinate
NACD	Nicotinate D-ribonucleoside
NACN	Nicotinate D-ribonucleotide
NAD	NAD+
NADH	NADH
NADP	phenylacetyl-CoA ligase
NADPH	NADPH
NAGA	N-Acetyl-D-glucosamine
NAGA1P	N-Acetyl-D-glucosamine 1-phosphate
NAGLU	N-Acetyl-L-glutamate
NAGLUP	N-Acetyl-L-glutamate 5-phosphate
NAGLUS	N-Acetyl-L-glutamate 5-semialdehyde
NAM	Nicotinamide
NAMAM6P	N-Acetyl-D-mannosamine 6-phosphate
NAMD	N-Ribosylnicotinamide
NAMN	Nicotinamide D-ribonucleotide
NAORN	N2-Acetyl-L-ornithine
NAPTH	Naphthalene
NAPTHAC	1-Naphthoic acid
NAPTHAH	1-Naphthaldehyde
NAPTHAC2	2-Naphthoic acid
NAPTHAH2	2-Naphthaldehyde
NAPTHDOL	Naphthalene-1,2-diol
NAPTHHMSUCCOA	Naphthyl-2-hydroxymethyl-succinyl COA
NAPTHMESUCCOA	Naphthyl-2-methylene-succinyl-COA
NAPTHMSUCCOA	Naphthyl-2-methyl-succinyl-COA
NAPTHOCHOA	2-Naphthoyl-COA
NAPTHOMSUCCOA	Naphthyl-2-oxomethyl-succinyl-COA
NH3	NH3
NICATOL	4-Nitrocatechol
NO2	Nitrite
NO3	Nitrate
NPRAN	N-(5-Phospho-D-ribose)anthranilate
NTBZ	Nitrobenzene
OA	Oxaloacetate
OADIP	3-Oxoadipate
OADIPCOA	3-Oxoadipyl-COA
OAG	2-Oxoarginine
OAHSER	O-Acetyl-L-homoserine
OANTIGEN	O-Antigen
OBUT	2-Oxobutanoate
OGT	Oxidized glutathione
OH	OH
OHB	alpha-Keto-3-hydroxy-4-phosphobutyrate

OHO	6-Oxohexanoate, Hexan-1-one-6-carboxylate	
OICAP	3-Carboxy-4-methyl-2-oxopentanoate, (2S)-2-Isopropyl-3-oxosuccinate	
OIVAL	(R)-2-Oxoisovalerate, 3-Methyl-2-oxobutanoic acid	
OLGRNS	Oligouronides	
OMP	Orotidine 5'-phosphate	
OPIMCOA	3-Oxopimeloyl-CoA	
OPP	all-trans-Octaprenyl diphosphate	
OROA	Orotate	
OSB	O-succinylbenzoate	
OSBCOA	O-succinylbenzoate-CoA	
OSLHSER	O-Succinyl-L-homoserine	
OTHIO	Oxidized thioredoxin	
P1AL	2-Propyn-1-al	
P3H5C	L-1-Pyrroline-3-hydroxy-5-carboxylate	
P5C	(S)-1-Pyrroline-5-carboxylate	
P5P	Pyridoxine-5'-phosphate, Pyridoxine 5-phosphate, Pyridoxine phosphate	
PA	Phosphatidate, 1,2-Diacyl-sn-glycerol 3-phosphate	
PABA	4-Aminobenzoate	
PANT	Pantoate	
PAP	Adenosine 3',5'-bisphosphate	
PAPS	3'-Phosphoadenylyl sulfate, 3'-Phosphoadenosine 5'-phosphosulfate, Phospho-5'-adenylyl sulfate	3'-
PBBUT	Poly-beta-hydroxybutyrate	
PBG	Prophobilinogen	
PC2	Precorin 2	
PCOA	Palmitoyl-CoA	
PDLA	Pyridoxamine	
PDLA5P	Pyridoxamine-5-phosphate	
PE	Phosphatidylethanolamine	
PECG	Pseudoecgonine	
PECGCOA	Pseudoecgonyl-CoA	
PEP	Phosphoenolpyruvate	
PEPTIDE	Peptide	
PEPTIDO	Peptidoglycan (biomass component)	
PG	Phosphatidylglycerol	
PGP	Phosphatidylglycerophosphate	
PHATOL	1-Phenanthrol	
PHBUT	Poly-beta-hydroxybutyrate	
PHE	L-Phenylalanine	
PHEACT	Phenylacetate	
PHEAM	Phenylethylamine	
PHEN	Prephenate	
PENTSLF	Pentanesulfonate	
PHOSPHOLIPID	Phospholipids (biomass component)	
PHP	3-Phosphonooxypyruvate	
PHPYR	Phenylpyruvate	
PHSER	O-Phospho-L-homoserine	
PHT	Phospho-hydroxy-threonine, O-Phospho-4-hydroxy-L-threonine	
PI	Orthophosphate	
PICVN	Pinocarvone	
PICVOL	Pinocarveol	
PIN	alpha-Pinene	
PL	Pyridoxal	
PL5P	Pyridoxal 5'-phosphate	
PNCOA	Propenoyl-CoA	
PNP	p-Nitrophenol	
PNTD	(R)-Pantothenate	
PO	Paraoxon	
PPAC	Phosphonoacetaldehyde	
PPACAL	Phosphonoacetaldehyde	
PPADSEL	3'-Phosphoadenylylselenate	

PPARDBZ	N1-(5-Phospho-alpha-D-ribose)-5,6-dimethylbenzimidazole
PPCOA	Propanoyl-CoA
PPD	Propane-1,2-diol
PPEPTIDO	Peptidoglycan precursor
ppGpp	guanosine 5'-diphosphate 3'-diphosphate
PPHG	Protoporphyrinogen, Protoporphyrinogen IX
PPHSER	O-Phosphorylhomoserine
PPI	Pyrophosphate
PPIX	Protoporphyrin IX
pppGpp	Guanosine 3'-diphosphate 5'-triphosphate
PPPP	all-trans-Pentaprenyl diphosphate
PPYR	3-Phosphonopyruvate
PQQ	Pyrroloquinoline quinone
PQQH2	Reduced pyrroloquinoline-quinone
PRAM	5-Phosphoribosylamine
PRBAMP	N1-(5-Phospho-D-ribose)-AMP
PRBATP	N1-(5-Phospho-D-ribose)-ATP
PRFICA	1-(5'-Phosphoribosyl)-5-formamido-4-imidazolecarboxamide
PRFP	5-(5-Phospho-D-ribose)aminoformimino-1-(5-phosphoribosyl)-imidazole-4-carboxamide
PRLAH	Perillyl aldehyde
PRLOH	Perillyl Alcohol
PRLC	Perillic acid
PRLCOA	Perillyl-CoA
PRLP	N-(5'-Phospho-D-1'-ribulose)formimino-5-amino-1-(5"-phospho-D-ribose)-4-imidazolecarboxamide
PRO	L-Proline
PROPANOATE	Propanoate
PROPIONYLCOA	Propionyl-CoA
PROPIONYLP	Propionyl-phosphate
PROTEIN	Proteins
PRPYN	Propynoate
PRPP	5-Phospho-alpha-D-ribose 1-diphosphate
PS	Phosphatidylserine
PTH	Protoheme
PTPI	Pseudotropine
PURI5P	Pseudouridine 5'-phosphate
PYDC	Pyridine-2,3-dicarboxylate
PYR	Pyruvate
PYRDX	Pyridoxine
PYTHP	6-Pyruvoyltetrahydropterin, 6-Pyruvoyl-5,6,7,8-tetrahydropterin
Q	ubiquinone
QH2	ubiquinol
QT	Quinate
R1P	D-Ribose 1-phosphate
R3R3HBUT	(R)-3-((R)-3-Hydroxybutanoyloxy)butanoate
R5P	D-Ribose 5-phosphate
RAF	Raffinose
rGLUAPP	gamma-Glutamyl-beta-aminopropionitrile
rGLUCYA	gamma-Glutamyl-beta-cyanoalanine
RGT	Reduced glutathione, Glutathione
RHAMN	Rhamnulose
RHAMN1P	Rhamnulose-1-phosphate
RHBCOA	(R)-3-Hydroxybutanoyl-CoA
RIB	D-Ribose
RIBFLAV	Riboflavin
RL5P	D-Ribulose 5-phosphate
RMN	D-Rhamnose
RNA	RNA
ROH	Alcohol with R side chain
RSALA	R-S-Alanine

RSALGLY	R-S-Alanylglycine
RSGLTH	R-S-Glutathione
RTHIO	Reduced thioredoxin
RUBDR	Rubredoxin - Reduced
RUBDO	Rubredoxin - Oxidized
S6P	Sorbitol 6-phosphate
S7P	Sedoheptulose 7-phosphate
SAH	S-Adenosyl-L-homocysteine
SAICAR	1-(5'-Phosphoribosyl)-5-amino-4-(N-succinocarboxamide)-imidazole
SALC	Salicylate
SAM	S-Adenosyl-L-methionine
SAMOB	S-adenosyl-4-methylthio-2-oxobutanoate
SAOPIM	N-Succinyl-2-amino-6-oxopimelate
SAP	S-Aminomethyldihydrolipoylprotein
SB1P	Sorbose 1-phosphate
SBZ	4-Sulfobenzoate
SBZAH	4-Sulfobenzaldehyde
SBZOH	4-Sulfobenzyl alcohol
SDAPIM	N-Succinyl-L-2,6-diaminopimelate
SDLIPO	S-Succinyldihydrolipoamide
SEANSMET	Se-Adenosylselenomethionine
SELD	Selenide
SELT	Selenite
SEMSC	Se-Methylselenocysteine
SENCYS	Selenocysteine
SER	L-Serine
SEROTONIN	3-(2-Aminoethyl)-1H-indol-5-ol
SFLN	4-Sulfolactone
SFALA	3-Sulfinio-L-alanine
SFIPYR	3-Sulfinylpyruvate
SFPYR	3-Sulfopyruvate
SHBCOA	(S)-3-Hydroxybutyryl-CoA
SHCHC	2-succinyl-6-hydroxy-2,4-cyclohexadiene-1-carboxylate
SHCL	Sirohydrochlorin
SEME	Siroheme
SLCYSTH	Selenocystathionine
SLF	Sulfate
SLNMET	Selenomethionine
SLNPP	selenophosphate
SME	Shikimate
SME3P	Shikimate 3-phosphate
SMTDR1P	S-Methyl-5-thio-D-ribose 1-phosphate
SMTDRB1P	S-Methyl-5-thio-D-ribulose 1-phosphate
SMTRNA	Selenomethionyl-tRNA(Met)
SOT	D-Sorbitol
SRLH	S-Ribosyl-L-homocysteine
SSCYS	S-Sulfo-L-cysteine
SSTRNA	L-selenocysteinyl-tRNA(Sec)
STA	Starch
STACHYOSE	Stachyose
STRNA	L-seryl-tRNA(Sec)
SUC	Sucrose
SUC6P	Sucrose 6-phosphate
SUCC	Succinate
SUCCOA	Succinyl-CoA
SUCHSER	O-Succinylhomoserine
T3	D-Glyceraldehyde
T4HP	trans-4-Hydroxy-L-proline
T4S	Toluene-4-sulfonate

TAGCR	Triacylglycerol
TARTRATE	(R,R)-Tartaric acid
TAU	Taurine
TCHCATOL	3,4,6-Trichlorocatechol
TCHMUC	2,3,5-Trichloro-cis,cis-muconate
TCYS	Thiocysteine
TDHDP	2,3,4,5-Tetrahydrodipicolinate
THBN	Benzene-1,2,4-triol, 1,2,4-Trihydroxybenzene
THCYN	Thiocyanate
THF	Tetrahydrofolate
THFG	Tetrahydrofolyl-[Glu](n)
THFG	Tetrahydrofolyl-Poly[Glu] - Polymer
THIAMIN	Thiamin
THIS	tRNA(His)
THMNP	5,6,7,8-Tetrahydromethanopterin
THMP	Thiamin monophosphate
THMPP	Thiamin diphosphate
THR	L-Threonine
THRD	Thioredoxin
THSTB	3,4',5-Trihydroxystilbene
THSUL	Thiosulfate , HS2O3
THZP	4-Methyl-5-(2-phosphoethyl)-thiazole, 4-Methyl-5-(2-phosphono-oxyethyl)-thiazole
TMAMBL	4-Trimethylammoniobutanal
TMAMBT	4-Trimethylammoniobutanoate
TMET	tRNA(Met)
TPI	Tropine
TRE6P	alpha,alpha'-Trehalose 6-phosphate
TRP	L-Tryptophan
TRYP	Tryptamine
TTHSTB	3,3',4'5-Tetrahydroxystilbene
TTRHBP	Tetrahydrobiopterin
TYR	L-Tyrosine
UDCP	Undecaprenyl phosphate
UDCPP	Undecaprenyl diphosphate
UDP	UDP
UDPDGLUC	UDP-glucuronate
UDPG	UDPglucose
UDPG23A	UDP-2,3-bis(3-hydroxytetradecanoyl)glucosamine
UDPG2A	UDP-3-O-(3-hydroxytetradecanoyl)glucosamine
UDPG2AA	UDP-3-O-(3-hydroxytetradecanoyl)-N-acetylglucosamine
UDPGAL	UDP-D-galactose
UDPGALUR	UDP-D-galacturonate
UDPMNLADGMD	UDP-N-acetylmuramoyl-L-alanyl-D-gamma-glutamyl-meso-2,6-diaminopimelate
UDPMNLADGMDDADA	UDP-N-acetylmuramoyl-L-alanyl-D-glutamyl-6-carboxy-L-lysyl-D-alanyl-D-alanine
UDPNAG	UDP-N-acetyl-D-glucosamine
UDPNAGEP	UDP-N-acetyl-3-(1-carboxyvinyl)-D-glucosamine
UDPNAM	UDP-N-acetylmuramate
UDPNAMA	UDP-N-acetylmuramoyl-L-alanine
UDPNAMAG	UDP-N-acetylmuramoyl-L-alanyl-D-glutamate
UMP	UMP
UPPMN(GN)LADGMDDADA	Undecaprenyl-diphospho-N-acetylmuramoyl-(N-acetylglucosamine)-L-alanyl-D-glutamyl-meso-2,6-diaminopimeloyl-D-alanyl-D-alanine
UPPMN(GN)LADGNMD(G)5DADA	Undecaprenyl-diphospho-N-acetylmuramoyl-(N-acetylglucosamine)-L-alanyl-D-glutamyl-meso-2,6-diaminopimeloyl-(glycyl)5-D-alanyl-D-alanine
UPPMN(GN)LADGNMDDADA	Undecaprenyl-diphospho-N-acetylmuramoyl-(N-acetylglucosamine)-L-alanyl-D-glutamyl-meso-2,6-diaminopimeloyl-D-alanyl-D-alanine
UPPMNLADGMDDADA	Undecaprenyl-diphospho-N-acetylmuramoyl-L-alanyl-D-glutamyl-meso-2,6-diaminopimeloyl-D-alanyl-D-alanine

UPRG	Uroporphyrinogen III
URA	Uracil
URI	Uridine
UTP	UTP
VAL	L-Valine
VB12COZ	Vitamin B12 coenzyme
VN	Vanillin
VNL	Vanillate
X5P	D-Xylulose-5-phosphate
XAN	Xanthine
XMP	Xanthosine 5'-phosphate
XTHE	Xanthurenic acid
XTSINE	Xanthosine
XYL	D-Xylose