## Supporting Information 1A: List of metabolic reactions used in SpoMBEL1693

REACTION NAME	COMPARTMEN	METABOLIC REACTION	SUBSYSTEM	Gene(s) S. pombe	EC
alanine racemase	T Cytosol	ALA <-> dALA	Alanine and Aspartate Metabolism	SPBC359.02	5.1.1.1
alanine aminotransferase (predicted)	Cytosol	AKG + ALA <-> GLU + PYR	Alanine and Aspartate Metabolism	SPBC582.08	2.6.1.2
L-alanine transaminase	Mitochondria	AKG + ALA <-> GLU + PYR	Alanine and Aspartate Metabolism	SPBC582.08	2.6.1.2
aspartate-semialdehyde dehydrogenase	Cytosol	4pasp + H + NADPH -> aspSA + NADP + Pi	Alanine and Aspartate Metabolism	SPCC1827.06c	1.2.1.11
asparagine synthase (glutamine-hydrolysing)	Cytosol	ASP + ATP + GLN + H2O -> AMP + ASN + GLU + H + PPi	Alanine and Aspartate Metabolism	SPBC119.10	6.3.5.4
aspartate kinase (predicted)	Cytosol	ASP + ATP -> 4pasp + ADP	Alanine and Aspartate Metabolism	SPBC19F5.04	2.7.2.4
aspartate transaminase (predicted)	Cytosol	AKG + ASP <-> GLU + OAA	Alanine and Aspartate Metabolism	SPAC10F6.13c	2.6.1.1
aspartate transaminase (predicted)	Mitochondria	AKG + ASP <-> GLU + OAA	Alanine and Aspartate Metabolism	SPBC725.01	2.6.1.1
aspartate transaminase (predicted)	Nucleus	AKG + ASP <-> GLU + OAA	Alanine and Aspartate Metabolism	SPAC10F6.13c	2.6.1.1
homocysteine S-methyltransferase	Cytosol	SAM + HCYS -> SAH + H + MET	Alanine and Aspartate Metabolism	SPAC57A7.07c	2.1.1.10
1,4-alpha-D-Glucan glucanohydrolase	Cytosol	GLYCogen + H2O -> dext	Alternate Carbon Metabolism	SPAC23D3.14c	3.2.1.1
Dextrin 6-alpha-D-glucanohydrolase	Cytosol	dext + H2O -> GLC	Alternate Carbon Metabolism	SPBC14C8.05c	3.2.1.3
L-lactate dehydrogenase	Cytosol	LAC + NAD <-> PYR + NADH + H	Alternate Carbon Metabolism	SPAC186.08c	1.1.1.27
L-lactate dehydrogenase (mitochondria??)	Mitochondria	LAC + NAD <-> PYR + NADH + H	Alternate Carbon Metabolism	SPAC186.08c	1.1.1.27
beta-fructofuranosidase-like protein	Cytosol	H2O + sucr -> fru + GLC	Alternate Carbon Metabolism	SPAPB24D3.10c	3.2.1.20
beta-fructofuranosidase-like protein	Extracellular	H2O + sucr -> fru + GLC	Alternate Carbon Metabolism	SPAPB24D3.10c	3.2.1.20
glucan 1,4-alpha-glucosidase	Golgi apparatus	GLYCogen + H2O -> GLC	Alternate Carbon Metabolism	SPBC14C8.05c	3.2.1.3
glucan 1,4-alpha-glucosidase, vacuole	Endoplasmic Reticulum	GLYCogen + H2O -> GLC	Alternate Carbon Metabolism	SPBC14C8.05c	3.2.1.3
lactoylglutathione lyase	Nucleus	GTHrd + mtHgxl -> lgt-S	Alternate Carbon Metabolism	SPBC12C2.12c	
hydroxyacylglutathione hydrolase (predicted)	Nucleus	H2O + lgt-S -> GTHrd + H + dLAC	Alternate Carbon Metabolism	SPCC13B11.03c	3.1.2.6
1,3-beta-glucan synthase	Cytosol	$UDPg \sim 13BDGLCn + H + UDP \\$	Alternate Carbon Metabolism	SPAC24C9.07c SPBC19G7.05c SPCC1840.02c SPAC19B12.03	2.4.1.34
1,6-beta-glucan synthase	Cytosol	UDPg -> 16BDGLCn + H + UDP	Alternate Carbon Metabolism	SPAC23H3.11c SPAC17G6.11c	
13-alpha-glucan synthase	Cytosol	UDPg -> 13ADGLCn + H + UDP	Alternate Carbon Metabolism		
Aminoacetone:oxygen	Cytosol	aact + H2O + O2 -> H2O2 + mtHgxl + NH4	Alternate Carbon Metabolism		
oxidoreductase(deaminating)(flavin-containing) (R,R)-butanediol dehydrogenase	Cytosol	btd-RR + NAD <-> actn-R + H + NADH	Alternate Carbon Metabolism		1.1.1.4
hydroxyacylglutathione hydrolase (predicted)	Cytosol	H2O + lgt-S -> GTHrd + H + dLAC	Alternate Carbon Metabolism	SPAC824.07	3.1.2.6
lactaldehyde dehydrogenase	Cytosol	H2O + lald-L + NAD -> 2 H + LAC + NADH	Alternate Carbon Metabolism	SI AC024.07	3.1.2.0
lactoylglutathione lyase	Cytosol	GTHrd + mtHgxl -> lgt-S	Alternate Carbon Metabolism	SPBC12C2.12c	
methylglyoxal synthase	Cytosol	DHAP -> mtHgxl + Pi	Alternate Carbon Metabolism	51 501202.120	
D-sorbitol dehydrogenase (D-fructose producing)		NAD + sbt-D -> fru + H + NADH	Alternate Carbon Metabolism	SPBC1773.05c	1.1.1.14
L-sorbitol dehydrogenase (L-sorbose-producing)	Cytosol	NAD + sbt-L -> H + NADH + srb-L	Alternate Carbon Metabolism	SPBC1773.05c	1.1.1.14
trehalose-phosphatase	Cytosol	H2O + TRE6p -> Pi + TRE	Alternate Carbon Metabolism	SPAC328.03+SPAC19G1 2.15c+SPAC22F8.05 SPAC328.03+SPAC19G1	2.4.1.15
alpha,alpha-trehalose-phosphate synthase (UDP-forming)	Cytosol	G6P + UDPg >> H + TRE6p + UDP	Alternate Carbon Metabolism	2.15c+SPACUNK4.16c SPAC328.03+SPAC19G1 2.15c+SPAC22F8.05 SPAC328.03+SPAC19G1	2.4.1.15
	G 1	Mac The A GLO		2.15c+SPACUNK4.16c	22120
alpha,alpha-trehalase	Cytosol	H2O + TRE -> 2 GLC	Alternate Carbon Metabolism	SPBC660.07	3.2.1.28
alpha,alpha-trehalase (vacuolar)	Vacuole	H2O + TRE -> 2 GLC	Alternate Carbon Metabolism	an Later on	3.2.1.28
2-Hydroxybutyrate:NAD+ oxidoreductase 1-aminocyclopropane-1-carboxylate	Cytosol	$2Hb + NAD \rightarrow 2obut + NADH + H$	Anaplerotic reactions	SPAC186.08c	1.1.1.27
aminohydrolase (isomerizing)	Cytosol	ACP1C + H2O <-> 20but + NH4	Anaplerotic reactions	SPAC922.03	3.5.99.7
malic enzyme (NAD),	Cytosol	$MAL + NAD \rightarrow CO2 + NADH + PYR$	Anaplerotic reactions	SPCC794.12c	1.1.1.38
malic enzyme (NADP),	Cytosol	$MAL + NADP \rightarrow CO2 + NADPH + PYR$	Anaplerotic reactions	SPCC794.12c	1.1.1.38
fructose-bisphosphatase	Cytosol	$FDP + H2O \rightarrow F6P + Pi$	Anaplerotic reactions	SPBC1198.14c	3.1.3.11
Isocitrate lyase	Cytosol	ICIT -> GLX + SUCC	Anaplerotic reactions	SPBC1683.11c	4.1.3.1
methylisocitrate lyase	Mitochondria	MICIT -> PYR + SUCC	Anaplerotic reactions	SPBC1683.11c	4.1.3.1
2-methylcitrate synthase	Mitochondria	H2O + OAA + ppCoA -> 2MCIT + CoA + H	Anaplerotic reactions	SPAC6C3.04	2.3.3.1
malic enzyme (NAD)	Mitochondria	$MAL + NAD \rightarrow CO2 + NADH + PYR$	Anaplerotic reactions	SPCC794.12c	1.1.1.38
malic enzyme (NADP)	Mitochondria	$MAL + NADP \rightarrow CO2 + NADPH + PYR$	Anaplerotic reactions	SPCC794.12c	1.1.1.38
pyruvate carboxylase	Cytosol	$ATP + HCO3 + PYR \rightarrow ADP + H + OAA + Pi$	Anaplerotic reactions	SPBC17G9.11c	6.4.1.1
Estrone 3-sulfate sulfohydrolase	Cytosol	$e3s + H2O \Rightarrow est + SO4$	Androgen and Estrogen Metabolism	SPBPB10D8.02c	3.1.6.1
Estrone 3-sulfate sulfohydrolase	Nucleus	$e3s + H2O \Rightarrow est + SO4$	Androgen and Estrogen Metabolism	SPBPB10D8.02c	3.1.6.1
D-arabinono-1,4-lactone oxidase	Mitochondria	Dara14lac + O2 <-> ertascb-D + H2O2	Arabinose Metabolism	SPAPB1A10.12c	
D-arabinose 1-dehydrogenase (NADP)	Cytosol	$arab\text{-}D + NADP \rightarrow Dara14lac + H + NADPH$	Arabinose Metabolism		
ornithine cyclodeaminase	Cytosol	ORN <-> PRO + NH4	Arginine and Proline Metabolism	SPAP11E10.01	4.3.1.12
ornithine carbamoyltransferase	Mitochondria	$cbp + ORN \Rightarrow CITR + H + Pi$	Arginine and Proline Metabolism	SPAC4G9.10	2.1.3.3
deoxyhypusine synthaseic/nucleus		H2O[n] + Q6[m] + spmd[n] -> 13dAMPp[n] + 4abutn[n] + Q6H2[m]	Arginine and Proline Metabolism	SPBC1271.04c	2.5.1.46
acteylornithine transaminase	Nucleus	acg5SA + GLU -> acorn + AKG	Arginine and Proline Metabolism	SPCC777.09c	2.6.1.11
ornithine transaminase	Nucleus	AKG +ORN -> GLU + GLU5SA	Arginine and Proline Metabolism	SPBC21C3.08c	2.6.1.13
spermidine synthase	Nucleus	$ametam + ptrc \rightarrow 5mta + H + spmd$	Arginine and Proline Metabolism	SPBC12C2.07c	2.5.1.16
arginase	Nucleus	ARG + H2O ->ORN + urea	Arginine and Proline Metabolism	SPBP26C9.02c	3.5.3.1
glutamate-5-semialdehyde dehydrogenase	Nucleus	GLU5p + H + NADPH -> GLU5SA + NADP + Pi	Arginine and Proline Metabolism	SPAC3H1.07 SPAC821.11	1.2.1.41
Ornithine Decarboxylase	Nucleus	H +ORN -> CO2 + ptrc	Arginine and Proline Metabolism  Arginine and Proline Metabolism	SPAC821.11 SPAC144.04c	4.1.1.17
L-4-hydroxyglutamate semialdehyde	Mitochondria	4HGLUSA + H2O + NAD <-> e4HGLU + 2 H + NADH	Arginine and Proline Metabolism  Arginine and Proline Metabolism	SPBC24C6.04	v.1.1.1/
dehydrogenase					1.2.1.38,
acetylglutamate kinase	Mitochondria	$acGLU + ATP \rightarrow acg5p + ADP$	Arginine and Proline Metabolism	SPAC4G9.09c	2.7.2.8
N-acteylglutamate synthase (predicted)	Mitochondria	$ACCoA + GLU \Rightarrow acGLU + CoA + H$	Arginine and Proline Metabolism	SPBC1271.14	2.3.1.35, 2.3.1.1
acteylornithine transaminase	Mitochondria	acg5SA + GLU -> acorn + AKG	Arginine and Proline Metabolism	SPCC777.09c	2.6.1.11
N-acetyl-g-glutamyl-phosphate reductase	Mitochondria	acg5p + H + NADPH -> acg5SA + NADP + Pi	Arginine and Proline Metabolism	SPAC4G9.09c	1.2.1.38,
amidase	Cytosol	4gudbd + H2O -> 4gudbutn + NH4		SPBPB8B6.03	2.7.2.8 3.5.1.4
	-		Arginine and Proline Metabolism	SPBP88B6.03 SPBP26C9.02c	
arginase	Cytosol	ARG + H2O -> ORN + urea	Arginine and Proline Metabolism	SPAC3H1.07	3.5.3.1
argininosuccinate lyase	Cytosol	argsuc <-> ARG + FUM	Arginine and Proline Metabolism	SPBC1539.03c SPBC1773.14	4.3.2.1
argininosuccinate synthase	Cytosol	ASP + ATP + CITR <-> AMP + argsuc + H + PPi	Arginine and Proline Metabolism	SPBC428.05c	6.3.4.5
		-			

carbamoyl-phosphate synthase (glutamine-	Cytosol	2 ATP + GLN + H2O + HCO3 -> 2 ADP + cbp + GLU + 2 H + Pi	Arginine and Proline Metabolism	SPAC22G7.06c SPAC16.03c	6.3.5.5,
hydrolysing)	-		_	SPBC56F2.09c	2.1.3.2
deoxyhypusine synthase L-erythro-4-Hydroxyglutamate:2-oxoglutarate		H2O[c] + Q6[m] + spmd[c] -> 13dAMPp[c] + 4abutn[c] + Q6H2[m]	Arginine and Proline Metabolism	SPBC1271.04c	2.5.1.46
aminotransferase (predicted)	Cytosol	AKG + e4HGLU -> 4H2Oglt + GLU	Arginine and Proline Metabolism	SPAC10F6.13c	2.6.1.1
L-erythro-4-Hydroxyglutamate:2-oxoglutarate aminotransferase (predicted)	Mitochondria	AKG + e4HGLU -> 4H2Oglt + GLU	Arginine and Proline Metabolism	SPBC725.01	2.6.1.1
L-glutamate 5-semialdehyde dehydratase	Cytosol	GLU5SA <-> 1PYR5c + H + H2O	Arginine and Proline Metabolism		
L-glutamate 5-semialdehyde dehydratase	Mitochondria	GLU5SA <-> IPYR5c + H + H2O	Arginine and Proline Metabolism	an L coo L L	
glutamate-5-semialdehyde dehydrogenase glutamate 5-kinase	Cytosol Cytosol	GLU5p + H + NADPH -> GLU5SA + NADP + Pi ATP + GLU -> ADP + GLU5p	Arginine and Proline Metabolism  Arginine and Proline Metabolism	SPAC821.11 SPAC17H9.13c	1.2.1.41 2.7.2.11
L-hydroxyproline reductase (NAD)	Cytosol	1p3H5c + 2 H + NADH -> 4HPROT + NAD	Arginine and Proline Metabolism	SPAPYUG7.05	1.5.1.2
L-hydroxyproline reductase (NADP)	Cytosol	1p3H5c + 2 H + NADPH -> 4HPROT + NADP	Arginine and Proline Metabolism	SPAPYUG7.05	1.5.1.2
L-hydroxyproline dehydrogenase (NAD)	Mitochondria	$4HPROT + NAD \Rightarrow 1p3H5c + 2 H + NADH$	Arginine and Proline Metabolism	SPBC24C6.04	
L-hydroxyproline dehydrogenase (NADP)	Mitochondria	4HPROT + NADP -> 1p3H5c + 2 H + NADPH	Arginine and Proline Metabolism	SPBC24C6.04	
ornithine Carbamoyltransferase	Cytosol Cytosol	cbp +ORN -> CITR + H + Pi	Arginine and Proline Metabolism	SPAC4G9.10 SPAC144.04c	2.1.3.3 4.1.1.17
Ornithine Decarboxylase ornithine transaminase	Cytosol	H +ORN -> CO2 + ptrc AKG +ORN -> GLU + GLU5SA	Arginine and Proline Metabolism  Arginine and Proline Metabolism	SPBC21C3.08c	2.6.1.13
glutamate N-acetyltransferase (predicted)	Mitochondria	acom + GLU -> acGLU +ORN	Arginine and Proline Metabolism	SPBC1271.14	2.3.1.35,
pyrroline-5-carboxylate reductase	Cytosol	1PYR5c + 2 H + NADPH -> NADP + PRO	Arginine and Proline Metabolism	SPAPYUG7.05	2.3.1.1
L-1-pyrroline-3-hydroxy-5-carboxylate	-	1p3H5c + 2 H2O + NAD -> e4HGLU + H + NADH	-		1.5.1.2
dehydrogenase L-1-ryffonne-3-nydroxy-3-carboxyfate	Mitochondria	1p3n3c + 2 n2O + NAD -> e4nOLU + n + NADn	Arginine and Proline Metabolism	SPBC24C6.04	
spontaneous conversion to L-4-Hydroxyglutamate	Mitochondria	1p3H5c + H + H2O <-> 4HGLUSA	Arginine and Proline Metabolism		
spermidine synthase	Cytosol	$ametam + ptrc \rightarrow 5mta + H + spmd$	Arginine and Proline Metabolism	SPBC12C2.07c	2.5.1.16
L-asparaginase	Golgi apparatus	ASN + H2O -> ASP + NH4	Asparagine metabolism	SPAC186.03 SPAC977.12 SPBPB8B6.05c SPBPB21E7.09	3.5.1.1
L-asparaginase	Cytoplasm	ASN + H2O -> ASP + NH4	Asparagine metabolism	SPAC186.03 SPAC977.12 SPBPB8B6.05c SPBPB21E7.09	3.5.1.1
L-asparaginase	Extracellular	ASN + H2O -> ASP + NH4	Asparagine metabolism	SPAC186.03 SPAC977.12 SPBPB8B6.05c	3.5.1.1
Isocitrate dehydrogenase (NAD+)	Mitochondria	ICIT + NAD <-> AKG + CO2 + NADH	Citric Acid Cycle	SPBPB21E7.09 SPAC11G7.03 SPBC902.05c	1.1.1.41
isocitrate dehydrogenase (NADP)	Cytosol	ICIT + NADP <-> AKG + CO2 + NADPH	Citric Acid Cycle	SPAC11G7.03 SPBC902.05c	1.1.1.41
Isocitrate dehydrogenase (NADP+)	Mitochondria	ICIT + NADP <-> AKG + CO2 + NADPH	Citric Acid Cycle	SPAC11G7.03 SPBC902.05c	1.1.1.41
Isocitrate dehydrogenase (NADP+)	Peroxisome	ICIT + NADP <-> AKG + CO2 + NADPH	Citric Acid Cycle	SPAC11G7.03	1.1.1.41
ATP citrate synthase	Mitochondria	ADP + Pi + ACCoA + OAA -> CIT + ATP + CoA	Citric Acid Cycle	SPBC902.05c SPAC22A12.16	2.3.3.8
aconitase	Cytosol	CIT <-> ICIT	Citric Acid Cycle	SPAC24C9.06c	4.2.1.3
	-		•	SPBP4H10.15 SPAC24C9.06c	
Aconitate hydratase	Mitochondria	CIT <-> ICIT	Citric Acid Cycle	SPBP4H10.15	4.2.1.3
oxoglutarate dehydrogenase (lipoamide) oxoglutarate dehydrogenase (dihydrolipoamide S-	Mitochondria	AKG + H + lpam <-> CO2 + sdHlam	Citric Acid Cycle	SPBC3H7.03c	1.2.4.2
succinyltransferase)	Mitochondria	CoA + sdHlam -> dHlam + SUCCoA	Citric Acid Cycle	SPBC3H7.03c	1.2.4.2
citrate synthase	Mitochondria	ACCoA + H2O + OAA -> CIT + CoA + H	Citric Acid Cycle	SPAC6C3.04	2.3.3.1
citrate synthase	Peroxisome Mitochondria	$ACCoA + H2O + OAA \rightarrow CIT + CoA + H$	Citric Acid Cycle	SPAC6C3.04 SPCC1620.08	2.3.3.1 6.2.1.4,
ItaconateCoA ligase (ADP-forming) succinate dehydrogenase (ubiquinone-6)	Mitochondria	ATP + CoA + itaccon < > ADP + itACCoA + Pi $Q6 + SUCC < > FUM + Q6H2$	Citric Acid Cycle  Citric Acid Cycle	SPAC16E8.17c SPBP23A10.16-SPAC14 .001+SPCC330.12c+ SPAC1556.02c SPBP23A10.16-SPAC14 .001+SPCC330.12c+ SPAC140.01+SPAC1556. .02c+SPCC330.12c+ SPBP23A10.16 SPAC140.01+SPAC1556. .02c+ SPBP23A10.16+SPAC1556. .02c+ SPBP23A10.16+SPCC33 .12c	6.2.1.5 1.3.5.1
SuccinateCoA ligase (ADP-forming)	Mitochondria	ATP + CoA + SUCC <-> ADP + Pi + SUCCoA	Citric Acid Cycle	SPCC1620.08	6.2.1.4,
- '			•	SPAC16E8.17c SPAC25B8.09	6.2.1.5
3-Isopropylmalate 3-methyltransferase	Cytosol	3c2Hmp + SAM -> 3ipmmest + SAH	Complex Alcohol Metabolism	SPAC25B8.10 SPAC13A11.06	
4-Methyl-2-oxopentanoate decarboxylase	Cytosol	4MOP + H -> 3mbald + CO2	Complex Alcohol Metabolism	SPAC3G9.11c SPAC186.09 SPAC1F8.07c	4.1.1.1
Isoamyl acetate-hydrolyzing esterase	Cytosol	H2O + iamac -> AC + H + IAMOH	Complex Alcohol Metabolism	SPCC126.10	
Isobutyl acetate-hydrolyzing esterase Ethyl acetate-hydrolyzing esterase	Cytosol Cytosol	H2O + ibutac -> AC + H + IBUTOH aces + H2O -> AC + ETOH + H	Complex Alcohol Metabolism Complex Alcohol Metabolism	SPCC126.10 SPCC126.10	
aldehyde dehydrogenase (2-methylbutanol, NAD)	-	2mbald + H + NADH -> 2mbtoH + NAD	Complex Alcohol Metabolism	SPBC1773.06c	1.1.1.1
aldehyde dehydrogenase (2-methylbutanol, NAD)	•	2mbald + H + NADH -> 2mbtoH + NAD	Complex Alcohol Metabolism	SPAC5H10.06c SPCC13B11.01	1.1.1.1
aldenyde dehydrogenase (2-methylbutanol,	Cytosol	2mbald + H + NADPH -> 2mbtoH + NADP	Complex Alcohol Metabolism	31 CC13B11.01	1.1.1.1
NADP) aldehyde dehydrogenase (isobutyl alcohol, NAD)	Cytosol	2mppal + H + NADH -> IBUTOH + NAD	Complex Alcohol Metabolism	SPBC1773.06c	1.1.1.1
aldehyde dehydrogenase (isobutyl alcohol, NAD)	Mitochondria	2mppal + H + NADH -> IBUTOH + NAD	Complex Alcohol Metabolism	SPAC5H10.06c SPCC13B11.01	1.1.1.1
		3mbald + H + NADH -> IAMOH + NAD		SPBC1773.06c	1.1.1.1
aldehyde dehydrogenase (isoamyl alcohol, NAD)		SIIIDAIU + H + NADH => IAMOH + NAD	Complex Alcohol Metabolism	SPAC5H10.06c	
aldehyde dehydrogenase (isoamyl alcohol, NAD)		2mbold : II : NADII > IAMOII : NAD		SPCC13B11.01	1.1.1.1
(2.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	Mitochondria	3mbald + H + NADH -> IAMOH + NAD	Complex Alcohol Metabolism		
aldehyde dehydrogenase (2-phenylethanol, NAD)	Mitochondria Cytosol	H + NADH + PACALD -> 2PHETOH + NAD	Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c	1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD)	Mitochondria Cytosol Mitochondria	eq:hadhadhadhadhadhadhadhadhadhadhadhadhadh	Complex Alcohol Metabolism  Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c SPCC13B11.01	1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD) aldehyde dehydrogenase (tryptophol, NAD)	Mitochondria Cytosol Mitochondria Cytosol	$\begin{split} H + NADH + PACALD &\rightarrow 2PHETOH + NAD \\ H + NADH + PACALD &\rightarrow 2PHETOH + NAD \\ H + id3acald + NADH &\rightarrow ind3etH + NAD \end{split}$	Complex Alcohol Metabolism  Complex Alcohol Metabolism  Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c SPCC13B11.01 SPBC1773.06c SPAC5H10.06c	1.1.1.1 1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD) aldehyde dehydrogenase (tryptophol, NAD) aldehyde dehydrogenase (tryptophol, NAD)	Mitochondria Cytosol Mitochondria Cytosol Mitochondria	$\begin{split} H + NADH + PACALD & > 2PHETOH + NAD \\ H + NADH + PACALD & > 2PHETOH + NAD \\ H + id3acald + NADH & > ind3etH + NAD \\ H + id3acald + NADH & > ind3etH + NAD \end{split}$	Complex Alcohol Metabolism Complex Alcohol Metabolism Complex Alcohol Metabolism Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c SPCC13B11.01 SPBC1773.06c	1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD) aldehyde dehydrogenase (tryptophol, NAD) aldehyde dehydrogenase (tryptophol, NAD) Alcohol Acetyltransferase (ethanol)	Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol	H + NADH + PACALD -> 2PHETOH + NAD H + NADH + PACALD -> 2PHETOH + NAD H + id3acald + NADH -> ind3etH + NAD H + id3acald + NADH -> ind3etH + NAD ACCOA + ETOH -> aces + CoA	Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c SPCC13B11.01 SPBC1773.06c SPAC5H10.06c	1.1.1.1 1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD) aldehyde dehydrogenase (tryptophol, NAD) aldehyde dehydrogenase (tryptophol, NAD)	Mitochondria Cytosol Mitochondria Cytosol Mitochondria	$\begin{split} H + NADH + PACALD & > 2PHETOH + NAD \\ H + NADH + PACALD & > 2PHETOH + NAD \\ H + id3acald + NADH & > ind3etH + NAD \\ H + id3acald + NADH & > ind3etH + NAD \end{split}$	Complex Alcohol Metabolism Complex Alcohol Metabolism Complex Alcohol Metabolism Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c SPCC13B11.01 SPBC1773.06c SPAC5H10.06c	1.1.1.1 1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD) aldehyde dehydrogenase (tryptophol, NAD) aldehyde dehydrogenase (tryptophol, NAD) Alcohol Acetyltransferase (ethanol) Alcohol Acetyltransferase (isoamyl alcohol)	Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Cytosol	H + NADH + PACALD -> 2PHETOH + NAD H + NADH + PACALD -> 2PHETOH + NAD H + id3acald + NADH -> ind3etH + NAD H + id3acald + NADH -> ind3etH + NAD ACCoA + ETOH -> aces + CoA ACCOA + IAMOH -> COA + iamac	Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c SPCC13B11.01 SPBC1773.06c SPAC5H10.06c	1.1.1.1 1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD) aldehyde dehydrogenase (tryptophol, NAD) aldehyde dehydrogenase (tryptophol, NAD) Alcohol Acetyltransferase (ethanol) Alcohol Acetyltransferase (isoamyl alcohol) Alcohol Acetyltransferase (2-methylbutanol)	Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol	H + NADH + PACALD -> 2PHETOH + NAD H + NADH + PACALD -> 2PHETOH + NAD H + id3acald + NADH -> ind3etH + NAD H + id3acald + NADH -> ind3etH + NAD ACCoA + ETOH -> aces + CoA ACCOA + IAMOH -> CoA + iamac 2mbtoH + ACCoA -> 2mbac + CoA	Complex Alcohol Metabolism	SPBC1773.06c SPACSH10.06c SPCC13B11.01 SPBC1773.06c SPACSH10.06c SPCC13B11.01	1.1.1.1 1.1.1.1
aldehyde dehydrogenase (2-phenylethanol, NAD) aldehyde dehydrogenase (tryptophol, NAD) aldehyde dehydrogenase (tryptophol, NAD) Alcohol Acetyltransferase (ethanol) Alcohol Acetyltransferase (isoamyl alcohol) Alcohol Acetyltransferase (2-methylbutanol) Alcohol Acetyltransferase (isobutyl alcohol)	Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol	H + NADH + PACALD -> 2PHETOH + NAD H + NADH + PACALD -> 2PHETOH + NAD H + id3acald + NADH -> ind3etH + NAD H + id3acald + NADH -> ind3etH + NAD ACCoA + ETOH -> aces + CoA ACCOA + IAMOH -> CoA + iamac 2mbtoH + ACCoA -> 2mbac + CoA ACCOA + IBUTOH -> CoA + ibutac	Complex Alcohol Metabolism	SPBC1773.06c SPAC5H10.06c SPCC13B11.01 SPBC1773.06c SPAC5H10.06c	1.1.1.1 1.1.1.1

phosphoadenylyl-sulfate reductase (thioredoxin)	Nucleus	PAPS + TRDrd -> 2 H + PAP + SO3 + TRDox	Cysteine Metabolism	SPAC13G7.06	1.8.4.8
2-hydroxybutyrate cotransport with proton		2Hb[e] + H[e] <-> 2Hb[c] + H[c]	Cysteine Metabolism		
adenylyl-sulfate kinase	Cytosol	$APS + ATP \Rightarrow ADP + H + PAPS$	Cysteine Metabolism	SPAC1782.11	2.7.1.25
adenylyl-sulfate kinase	Nucleus	$APS + ATP \Rightarrow ADP + H + PAPS$	Cysteine Metabolism	SPAC1782.11	2.7.1.25
3',5'-bisphosphate nucleotidase	Cytosol	H2O + PAP -> AMP + Pi	Cysteine Metabolism	SPCC1753.04	3.1.3.7
phosphoadenylyl-sulfate reductase (thioredoxin)	Cytosol	PAPS + TRDrd -> 2 H + PAP + SO3 + TRDox	Cysteine Metabolism	SPAC13G7.06 SPBC27.08c	1.8.4.8
sulfate adenylyltransferase sulfate adenylyltransferase	Cytosol Mitochondria	$ATP + H + SO4 \rightarrow APS + PPi$ $ATP + H + SO4 \rightarrow APS + PPi$	Cysteine Metabolism Cysteine Metabolism	SPBC27.08c SPBC27.08c	2.7.7.4
serine O-acetyltransferase	Cytosol	ACCoA + SER -> ACSER + CoA	Cysteine Metabolism	SPAC1039.08	2.3.1.30
sulfite reductase (NADPH2)		3 H2O + H2S + 3 NADP <-> 5 H + 3 NADPH + SO3		SPCC584.01c	1.8.1.2
	Cytosol		Cysteine Metabolism	SPAC10F6.01c	1.0.1.2
fatty-acidCoA ligase (tetradecanoate)	Golgi apparatus	ATP + CoA + C140 <-> AMP + PPi + C140CoA	Fatty Acid Biosynthesis	SPBP4H10.11c	
fatty acid synthase (n-C14:1)	Endoplasmic Reticulum Endoplasmic	C120 + 4 H + MALCoA + 3 NADPH + O2 -> CO2 + CoA + 3 H2O + 3 NADP + C141 C140 + 4 H + MALCoA + 3 NADPH + O2 -> CO2 + CoA + 3 H2O + 3	Fatty Acid Biosynthesis	SPAC1B2.03c	
fatty acid synthase (n-C16:1)	Reticulum Endoplasmic	NADP + C161 C160 + 4 H + MALCoA + 3 NADPH + O2 -> CO2 + CoA + 3 H2O + 3	Fatty Acid Biosynthesis	SPACIB2.03c	
fatty acid synthase (n-C18:1) fatty-acidCoA ligase (tetradecanoate)	Reticulum Endoplasmic	NADP + C181 ATP + CoA + C140 <-> AMP + PPi + C140CoA	Fatty Acid Biosynthesis Fatty Acid Biosynthesis	SPAC1B2.03c SPBC18H10.02	
Palmitoyl-CoA desaturase (n-C16:0CoA -> n-	Reticulum Endoplasmic				1.14.10.1
C16:1CoA) stearoyl-CoA desaturase (n-C18:0CoA -> n-	Reticulum Endoplasmic	H + NADPH + O2 + C160CoA -> 2 H2O + C161CoA + NADP	Fatty Acid Biosynthesis	SPCC1281.06c	1.14.19.1
C18:1CoA)	Reticulum	H + NADPH + O2 + C180CoA -> 2 H2O + NADP + C181CoA 2 ACCoA -> AACoA + CoA	Fatty Acid Biosynthesis	SPCC1281.06c	1.14.19.1 2.3.1.9
acetyl-CoA C-acetyltransferase acetyl-CoA C-acetyltransferase	Cytosol Mitochondria	2 ACCoA -> AACoA + CoA 2 ACCoA -> AACoA + CoA	Fatty Acid Biosynthesis Fatty Acid Biosynthesis	SPBC215.09c SPBC215.09c	2.3.1.9
acetyl-CoA carboxylase reaction	Cytosol	ACCoA + ATP + HCO3 <-> ADP + H + MALCoA + Pi	Fatty Acid Biosynthesis	SPAC56E4.04c	6.4.1.2
Acetyl-Coa carboxylase	Mitochondria	ACCoA + ATP + HCO3 <-> ADP + H + MALCoA + Pi	Fatty Acid Biosynthesis	SPAC56E4.04c	6.4.1.2
Acetyl-CoA ACP transacylase	Cytosol	ACP + ACCoA <-> ACACP + CoA	Fatty Acid Biosynthesis	SPAC926.09c +	3.1.2.14
Activi-coa Act transacytase	Cytosoi	ACI + ACCON <> ACACI + COA	Patty Acid Biosynthesis	SPAC4A8.11c SPBC1105.15c	3.1.2.14
Acetyl-CoA ACP transacylase	Mitochondria	ACP + ACCoA <-> ACACP + CoA	Fatty Acid Biosynthesis	SPAC4H3.09 SPAC3G9.02	
Myristicoyl-CoA desaturase (n-C14:0CoA -> n-	Correct	H. NADBU. 00 - CHOC. A 2 H2O - NADB - CHAIC. A	Franch and Disconduction	SPAC11G7.05c	
C14:1CoA) Oleoyl-CoA desaturase (n-C18:1CoA -> n-	Cytosol	H + NADPH + O2 + C140CoA -> 2 H2O + NADP + C141CoA	Fatty Acid Biosynthesis		
C18:2CoA)	Cytosol	H + NADPH + O2 + C181CoA -> 2 H2O + NADP + C182CoA	Fatty Acid Biosynthesis	SDA C026 00a :	
fatty-acyl-ACP hydrolase	Cytosol	H2O + C120ACP <-> ACP + H + C120	Fatty Acid Biosynthesis	SPAC926.09c+ SPAC4A8.11c	3.1.2.14
fatty-acyl-ACP hydrolase	Cytosol	H2O + C140ACP <-> ACP + H + C140	Fatty Acid Biosynthesis	SPAC926.09c+ SPAC4A8.11c	3.1.2.14
fatty-acyl-ACP hydrolase	Cytosol	H2O + C141ACP <-> ACP + H + C141	Fatty Acid Biosynthesis	SPAC926.09c+ SPAC4A8.11c	3.1.2.14
fatty-acyl-ACP hydrolase	Cytosol	H2O + C160ACP <-> ACP + H + C160	Fatty Acid Biosynthesis	SPAC926.09c+ SPAC4A8.11c	3.1.2.14
fatty-acyl-ACP hydrolase	Cytosol	H2O + C161ACP <-> ACP + H + C161	Fatty Acid Biosynthesis	SPAC926.09c+ SPAC4A8.11c	3.1.2.14
fatty-acyl-ACP hydrolase	Cytosol	H2O + C180ACP <-> ACP + H + C180	Fatty Acid Biosynthesis	SPAC926.09c+ SPAC4A8.11c	3.1.2.14
fatty-acyl-ACP hydrolase	Cytosol	H2O + C181ACP <-> ACP + H + C181	Fatty Acid Biosynthesis	SPAC926.09c+	3.1.2.14
fatty-acyl-ACP hydrolase	Cytosol	H2O + C182ACP <-> ACP + H + C182	Fatty Acid Biosynthesis	SPAC4A8.11c SPAC926.09c+	3.1.2.14
fatty-acidCoA ligase (tetradecanoate)	Cytosol	ATP + CoA + C140 <-> AMP + PPi + C140CoA	Fatty Acid Biosynthesis	SPAC4A8.11c SPBP4H10.11c	6.2.1.3
fatty-acidCoA ligase (tetradecenoate)	Cytosol	ATP + CoA + C141 <-> AMP + PPi + C141CoA	Fatty Acid Biosynthesis	SPBC18H10.02 SPBP4H10.11c	0.2.1.5
	-			SPBC18H10.02 SPBP4H10.11c	
fatty-acidCoA ligase (hexadecanoate)	Cytosol	ATP + CoA + C160 <-> AMP + PPi + C160CoA	Fatty Acid Biosynthesis	SPBC18H10.02 SPBP4H10.11c	
fatty-acidCoA ligase (hexadecenoate)	Cytosol	ATP + CoA + C161 <-> AMP + PPi + C161CoA	Fatty Acid Biosynthesis	SPBC18H10.02 SPBP4H10.11c	
fatty-acidCoA ligase (Octodecanoate)	Cytosol	ATP + CoA + C180 <-> AMP + PPi + C180CoA	Fatty Acid Biosynthesis	SPBC18H10.02 SPBP4H10.11c	
fatty-acidCoA ligase (Octodecanoate)	Cytosol	ATP + CoA + C181 <-> AMP + PPi + C181CoA	Fatty Acid Biosynthesis	SPBC18H10.02 SPBP4H10.11c	
fatty-acidCoA ligase (Octodecanoate)	Cytosol	ATP + CoA + C182 <-> AMP + PPi + C182CoA	Fatty Acid Biosynthesis	SPBC18H10.02 SPAC56E4.04c	
fatty acid synthase (n-C10:0)	Cytosol	$3~{\rm H} + {\rm MALCoA} + 2~{\rm NADPH} + {\rm C080} \rightarrow {\rm CO2} + {\rm CoA} + {\rm C100} + {\rm H2O} + 2~{\rm NADP}$	Fatty Acid Biosynthesis	SPAC926.09c+SPAC4A8.	6.3.4.14, 3.1.2.14
		3 H + MALACP + 2 NADPH + C080ACP -> ACP + C02 + C100ACP +		SPBC1105.15c SPAC4H3.09	
fatty-acyl-ACP synthase (n-C10:0ACP)	Mitochondria	H2O + 2 NADP	Fatty Acid Biosynthesis	SPAC3G9.02 SPAC11G7.05c	
				SPAC26F1.04c SPAC56E4.04c	
fatty acyl-CoA synthase (n-C10:0CoA)	Cytosol	$3~\mathrm{H} + \mathrm{MALCoA} + 2~\mathrm{NADPH} + \mathrm{C080CoA} -> \mathrm{CO2} + \mathrm{CoA} + \mathrm{C100CoA} + \mathrm{H2O} + 2~\mathrm{NADP}$	Fatty Acid Biosynthesis	SPAC926.09c+SPAC4A8.	6.3.4.14, 3.1.2.14
	G	C100 + 3 H + MALCoA + 2 NADPH -> CO2 + CoA + C120 + H2O + 2	F A F	SPAC56E4.04c	6.3.4.14,
fatty acid synthase (n-C12:0)	Cytosol	NADP	Fatty Acid Biosynthesis	SPAC926.09c+SPAC4A8.	3.1.2.14
		C100ACP + 3 H + MALACP + 2 NADPH -> ACP + CO2 + C120ACP +		SPBC1105.15c SPAC4H3.09	
fatty-acyl-ACP synthase (n-C12:0ACP)	Mitochondria	H2O + 2 NADP	Fatty Acid Biosynthesis	SPAC3G9.02 SPAC11G7.05c	
		GLOOG A CALL MALC A CANADRIL COA CAA GLOOG A		SPAC26F1.04c SPAC56E4.04c	62414
fatty-acyl-CoA synthase (n-C12:0CoA)	Cytosol	C100CoA + 3 H + MALCoA + 2 NADPH -> CO2 + CoA + C120CoA + H2O + 2 NADP	Fatty Acid Biosynthesis	SPAC926.09c+SPAC4A8.	6.3.4.14,
form with mothers (c. CIAO)	C1	C120 + 3 H + MALCoA + 2 NADPH -> CO2 + CoA + H2O + 2 NADP	From Arid Birmedicals	SPAC56E4.04c	6.3.4.14,
fatty acid synthase (n-C14:0)	Cytosol	+ C140	Fatty Acid Biosynthesis	SPAC926.09c+SPAC4A8. 11c	3.1.2.14
		GLOSLED AV MALED AVADRA LED GOS MAG		SPBC1105.15c SPAC4H3.09	
fatty-acyl-ACP synthase (n-C14:0ACP)	Mitochondria	C120ACP + 3 H + MALACP + 2 NADPH -> ACP + CO2 + H2O + C140ACP + 2 NADP	Fatty Acid Biosynthesis	SPAC3G9.02 SPAC11G7.05c	
				SPAC26F1.04c	
fatty-acyl-CoA synthase (n-C14:0CoA)	Cytosol	C120CoA + 3 H + MALCoA + 2 NADPH -> CO2 + CoA + H2O + 2	Fatty Acid Biosynthesis	SPAC56E4.04c SPAC926.09c+SPAC4A8.	6.3.4.14,
	-	NADP + C140CoA		11c	3.1.2.14
		GIANTER THE WAY TO A VIDENT OF THE GOLD AND		SPBC1105.15c SPAC4H3.09	
fatty-acyl-ACP synthase (n-C14:1ACP)	Mitochondria	C120ACP + 4 H + MALACP + 3 NADPH + O2 -> ACP + CO2 + 3 H2O + 3 NADP + C141ACP	Fatty Acid Biosynthesis	SPAC3G9.02	
				SPAC11G7.05c SPAC26F1.04c	
fatty and author: (COLCO)	Cutas:1	3 H + MALCoA + 2 NADPH + C140 -> CO2 + CoA + H2O + C160 + 2	Fatter A and Discount of	SPAC56E4.04c	6.3.4.14,
fatty acid synthase (n-C16:0)	Cytosol	NADP	Fatty Acid Biosynthesis	SPAC926.09c+SPAC4A8. 11c	3.1.2.14

fatty-acyl-ACP synthase (n-C16:0ACP)	Mitochondria	3 H + MALACP + C140ACP + 2 NADPH -> ACP + C02 + H2O + 2 NADP + C160ACP	Fatty Acid Biosynthesis	SPBC1105.15c SPAC4H3.09 SPAC3G9.02 SPAC11G7.05c	
fatty-acyl-CoA synthase (n-C16:0CoA)	Cytosol	3 H + MALCoA + 2 NADPH + C140CoA >> CO2 + CoA + H2O + 2 NADP + C160CoA	Fatty Acid Biosynthesis	SPAC926.09c+SPAC4A8. 11c	6.3.4.14, 3.1.2.14
fatty-acyl-ACP synthase (n-C16:1ACP)	Mitochondria	4 H + MALACP + C140ACP + 3 NADPH + O2 -> ACP + CO2 + 3 H2O + C161ACP + 3 NADP	Fatty Acid Biosynthesis	SPBC1105.15c SPAC4H3.09 SPAC3G9.02 SPAC11G7.05c	
fatty acid synthase (n-C18:0)	Cytosol	$3~H + C160 + MALCoA + 2~NADPH >> CO2 + CoA + H2O + 2~NADP \\ + C180$	Fatty Acid Biosynthesis	Hc	6.3.4.14, 3.1.2.14
fatty-acyl-ACP synthase (n-C18:0ACP)	Mitochondria	$3~\mathrm{H}+\mathrm{MALACP}+2~\mathrm{NADPH}+\mathrm{C}160\mathrm{ACP} > \mathrm{ACP}+\mathrm{C}02+\mathrm{H}2\mathrm{O}+2~$ NADP + C180ACP	Fatty Acid Biosynthesis	SPBC1105.15c SPAC4H3.09 SPAC3G9.02 SPAC11G7.05c SPAC26F1.04c	
fatty-acyl-CoA synthase (n-C18:0CoA)	Cytosol	$3~H + MALCoA + 2~NADPH + C160CoA >> CO2 + CoA + H2O + 2\\NADP + C180CoA$	Fatty Acid Biosynthesis	SPAC56E4.04c SPAC926.09c+SPAC4A8. 11c SPBC1105.15c	6.3.4.14, 3.1.2.14
fatty-acyl-ACP synthase (n-C18:1ACP)	Mitochondria	4 H + MALACP + 3 NADPH + O2 + C160ACP -> ACP + CO2 + 3 H2O + 3 NADP + C181ACP	Fatty Acid Biosynthesis	SPAC4H3.09 SPAC3G9.02 SPAC11G7.05c SPAC26F1.04c	
fatty-acyl-ACP synthase (n-C18:2ACP)	Mitochondria	$5~H + MALACP + 4~NADPH + 2~O2 + C160ACP >> ACP + CO2 + 5\\H2O + 4~NADP + C182ACP$	Fatty Acid Biosynthesis	SPBC1105.15c SPAC4H3.09 SPAC3G9.02 SPAC11G7.05c SPAC26F1.04c	
fatty acid synthase (n-C8:0), lumped reaction	Cytosol	$ \label{eq:accomp}  \mbox{ACCoA} + 8 \mbox{ H} + 3 \mbox{ MALCoA} + 6 \mbox{ NADPH} -> 3 \mbox{ CO2} + 4 \mbox{ CoA} + 2 \mbox{ H2O} + 6 \mbox{ NADP} + \mbox{ C080} $	Fatty Acid Biosynthesis	SPAC56E4.04c SPAC926.09c+SPAC4A8. 11c SPBC1105.15c	6.3.4.14, 3.1.2.14
fatty acyl-ACP synthase (n-C8:0ACP), lumped reaction	Mitochondria	$\label{eq:acacp} \begin{split} &ACACP+9~H+3~MALACP+6~NADPH >> 3~ACP+3~CO2+3~H2O+6~NADP+C080ACP \end{split}$	Fatty Acid Biosynthesis	SPAC4H3.09 SPAC3G9.02 SPAC11G7.05c SPAC26F1.04c	
fatty acyl-CoA synthase (n-C8:0CoA), lumped reaction	Cytosol		Fatty Acid Biosynthesis	SPAC56E4.04c SPAC926.09c+SPAC4A8. 11c	6.3.4.14, 3.1.2.14
Malonyl-CoA-ACP transacylase	Cytosol	ACP + MALCoA <-> CoA + MALACP	Fatty Acid Biosynthesis	SPAC926.09c+ SPAC4A8.11c SPBC1105.15c	3.1.2.14
Malonyl-CoA-ACP transacylase	Mitochondria	ACP + MALCoA <-> CoA + MALACP	Fatty Acid Biosynthesis	SPAC4H3.09 SPAC3G9.02 SPAC11G7.05c SPAC26F1.04c	
dihydropteroate synthase	Cytosol	$2AHHMD + PABA \rightarrow DHPT + PPi$	Folate Metabolism	SPBC1734.03	4.1.2.25
dihydropteroate synthase	Cytosol	2AHHMP + PABA -> DHPT + H2O	Folate Metabolism	SPBC1734.03	4.1.2.25
2-amino-4-hydroxy-6- hydroxymethyldihydropteridine diphosphokinase	Cytosol	$2AHHMP + ATP \Rightarrow 2AHHMD + AMP + H$	Folate Metabolism	SPBC1734.03	4.1.2.25
dihydroneopterin aldolase	Cytosol	DHNPT -> 2AHHMP + gcald + H	Folate Metabolism	SPBC1734.03	4.1.2.25
5,10-methylenetetrahydrofolatereductase (NADPH)	Mitochondria	2 H + MLTHF + NADPH -> 5mTHF + NADP	Folate Metabolism	SPAC56F8.10	1.5.1.20
Tetrahydrofolate:L-glutamate gamma-ligase	Mitochondria	ATP + GLU + THF <-> ADP + H + Pi + THFGLU	Folate Metabolism	SPAC227.09	6.3.2.17
(ADP-forming) Tetrahydrofolate:L-glutamate gamma-ligase				SPBC1709.17	
(ADP-forming)	Nucleus	ATP + GLU + THF <-> ADP + H + Pi + THFGLU	Folate Metabolism	SPBC1709.17	6.3.2.17
alkaline phosphatase (Dihydroneopterin), vacuole 5,10-methylenetetrahydrofolatereductase		AHDT + 3 H2O -> DHNPT + 2 H + 3 Pi	Folate Metabolism	SPBC14F5.13c	3.1.3.1
(NADPH)	Nucleus	2 H + MLTHF + NADPH -> 5mTHF + NADP	Folate Metabolism	SPAC56F8.10	1.5.1.20
GTP cyclohydrolase I	Nucleus	$GTP + H2O \Rightarrow AHDT + FORM + H$	Folate Metabolism	SPAC17A5.13	3.5.4.16
methylenetetrahydrofolate dehydrogenase (NAD)	Nucleus	MLTHF + NAD -> METHF + NADH	Folate Metabolism	SPBC1711.04	1.5.1.15
4-aminobenzoate synthase	Cytosol	ADCHO -> PABA + H + PYR	Folate Metabolism	SPBC19G7.02	
4-aminobenzoate synthase	Nucleus	ADCHO -> PABA + H + PYR	Folate Metabolism	SPBC19G7.02 SPBP8B7.29	
para-aminobenzoate synthase aspartate oxidase	Cytosol	CHOR + GLN -> ADCHO + GLU $ ASP[c] + fad[m] -> FADH2[m] + H[c] + IMASP[c]$	Folate Metabolism Folate Metabolism	SPBP8B1.29	
dihydrofolate reductase	Cytosol	DHF + H + NADPH -> NADP + THF	Folate Metabolism	SPCC1223.08c	1.5.1.3
dihydrofolate reductase	Mitochondria	DHF + H + NADPH -> NADP + THF	Folate Metabolism	SPCC1223.08c	1.5.1.3
dihydrofolate synthase	Cytosol	$ATP + DHPT + GLU \rightarrow ADP + DHF + H + Pi$	Folate Metabolism		
dihydroneopterin aldolase	Mitochondria	DHNPT -> 2AHHMP + gcald + H	Folate Metabolism	SPBC1734.03	4.1.2.25
		gcald -> pydxn			
dihydropteroate synthase Dihydroneopterin monophosphate	Mitochondria	2AHHMP + PABA -> DHPT + H2O	Folate Metabolism	SPBC1734.03	4.1.2.25
denhosnhorvlase	Nucleus Endoplasmic	dHpmp + H2O -> DHNPT + Pi	Folate Metabolism	SPBC14F5.13c	3.6.3.16
Dihydroneopterin monophosphate dephosphorylase Dihydroneopterin monophosphate	Reticulum	dHpmp + H2O -> DHNPT + Pi	Folate Metabolism	SPBC14F5.13c	3.6.3.16
Dihydroneopterin monophosphate denhosphorylase	Cytosol	dHpmp + H2O -> DHNPT + Pi	Folate Metabolism	SPBC14F5.13c	3.6.3.16
Dihydroneopterin triphosphate pyrophosphatase	Cytosol	$AHDT + H2O \Rightarrow dHpmp + H + PPi$	Folate Metabolism		
dihydropteroate synthase	Mitochondria	2AHHMD + PABA -> DHPT + PPi	Folate Metabolism	SPBC1734.03	4.1.2.25
5-formethyltetrahydrofolate cyclo-ligase	Cytosol	5FTHF + ATP -> ADP + METHF + Pi	Folate Metabolism	SPBC1703.08c	
5-formethyltetrahydrofolate cyclo-ligase 5-Formyltetrahydrofolate:10-	Mitochondria	5FTHF + ATP -> ADP + METHF + Pi	Folate Metabolism	SPBC1703.08c	6.3.3.2
Formyltetrahydrofolate isomerase	Cytosol	$5FTHF + ATP + H2O \Rightarrow 10FTHF + ADP + H + Pi$	Folate Metabolism		
formate-tetrahydrofolate ligase	Cytosol	ATP + FORM + THF -> 10FTHF + ADP + Pi	Folate Metabolism	SPBC839.16	6.3.4.3
formate-tetrahydrofolate ligase	Mitochondria	ATP + FORM + THF -> 10FTHF + ADP + Pi	Folate Metabolism	SPBC839.16	6.3.4.3
GTP cyclohydrolase I	Cytosol	GTP + H2O -> AHDT + FORM + H	Folate Metabolism	SPAC17A5.13	3.5.4.16
2-amino-4-hydroxy-6- hydroxymethyldihydropteridine diphosphokinase	Mitochondria	$2AHHMP + ATP \rightarrow 2AHHMD + AMP + H$	Folate Metabolism	SPBC1734.03	4.1.2.25
methenyltetrahydrofolate cyclohydrolase	Cytosol	H2O + METHF <-> 10FTHF + H	Folate Metabolism	SPBC839.16	6.3.4.3
methenyltetrahydrifikate cyclohydrolase	Mitochondria	H2O + METHF <-> 10FTHF + H	Folate Metabolism	SPBC839.16	6.3.4.3
methylenetetrahydrofolate dehydrogenase (NADP	) Cytosol	MLTHF + NADP <-> METHF + NADPH	Folate Metabolism	SPBC839.16	6.3.4.3
methylenetetrahydrofolate dehydrogenase (NADP	) Mitochondria	MLTHF + NADP <-> METHF + NADPH	Folate Metabolism	SPBC839.16	6.3.4.3
methylenetetrahydrofolate dehydrogenase (NAD)	Cytosol	MLTHF + NAD -> METHF + NADH	Folate Metabolism	SPBC1711.04	1.5.1.15
5,10-methylenetetrahydrofolatereductase (NADPH)	Cytosol	$2~H + MLTHF + NADPH \rightarrow 5mTHF + NADP$	Folate Metabolism	SPAC56F8.10 SPAC343.10	1.5.1.20
quinolinate synthase	Cytosol	DHAP + IMASP -> 2 H2O + Pi + Quln	Folate Metabolism	SPAC13G6.06c	
tetrahydrofolate aminomethyltransferase	Mitochondria	H2O + METHF -> 5FTHF + H	Folate Metabolism	SPAC13G5.06 SPAC3IG5.14 SPBP19A11.01 SPAC26F1.03+SPBC30D 10.13c	1.4.4.2, 2.1.2.10

SPBC1105.15c

Tetrahydrofolate:L-glutamate gamma-ligase	G		F1. W. I. P.	SPAC227.09	
(ADP-forming)	Cytosol	ATP + GLU + THF <-> ADP + H + Pi + THFGLU	Folate Metabolism	SPBC1709.17	6.3.2.17
phosphomannomutase mannose-6-phosphate isomerase	Nucleus Nucleus	man1p <-> man6p man6p <-> F6P	Fructose and Mannose Metabolism Fructose and Mannose Metabolism	SPAC1556.07 SPBC2G2.16	5.4.2.8 5.3.1.8
		•		SPAC732.02c (main)	
Fructose-2,6-bisphosphate 2-phosphatase	Cytosol	f26bp + H2O -> F6P + Pi	Fructose and Mannose Metabolism	SPAPB17E12.14c SPAC144.17c	3.1.3.46
fructose-1-phosphate kinase	Cytosol	ATP + flp -> ADP + FDP + H	Fructose and Mannose Metabolism	SDCC100C 01	27712
mannose-1-phosphate guanylyltransferase mannose-6-phosphate isomerase	Cytosol Cytosol	GTP + H + man1p -> GDPmann + PPi man6p <-> F6P	Fructose and Mannose Metabolism Fructose and Mannose Metabolism	SPCC1906.01 SPBC2G2.16	2.7.7.13 5.3.1.8
	-	·		SPAPB17E12.14c	
6-phosphofructo-2-kinase	Cytosol	$ATP + F6P \rightarrow ADP + f26bp + H$	Fructose and Mannose Metabolism	SPAC222.13c	2.7.1.105
phosphomannomutase	Cytosol Extracellular	manlp <-> man6p	Fructose and Mannose Metabolism	SPAC1556.07	5.4.2.8
	Cytosol	raffin + H2O -> melib + fru raffin + H2O -> melib + fru	Galactose metabolism Galactose metabolism	SPCC191.11 SPAC8E11.01c	3.2.1.26 3.2.1.26
	Cytosol	sta + H2O -> mant + fru	Galactose metabolism	SPAC8E11.01c	3.2.1.26
	Endoplasmic	sta + H2O -> raffin + gal	Galactose metabolism	SPAC869.07c	3.2.1.22
	Reticulum		Galactose metabolism		3.2.1.22
	Extracellular Endoplasmic	sta + H2O -> raffin + gal		SPAC869.07c	
	Reticulum	mant + H2O -> gal + melib	Galactose metabolism	SPAC869.07c	3.2.1.22
Lalaha D Calastani avva inscital	Extracellular	mant + H2O -> gal + melib	Galactose metabolism	SPAC869.07c	3.2.1.22
1-alpha-D-Galactosyl-myo-inositol galactohydrolase	Endoplasmic Reticulum	GALI + H2O <-> inost + gal	Galactose metabolism	SPAC869.07c	3.2.1.22
T-alpha-Ď-Galactosyl-myo-mositol galactohydrolase	Extracellular	GALI + H2O <-> inost + gal	Galactose metabolism	SPAC869.07c	3.2.1.22
Melibiitol galactohydrolase	Endoplasmic Reticulum	melt + H2O <-> sbt-D + gal	Galactose metabolism	SPAC869.07c	3.2.1.22
Melibiitol galactohydrolase	Extracellular	melt + H2O <-> sbt-D + gal	Galactose metabolism	SPAC869.07c	3.2.1.22
EPimelibiose galactohydrolase	Endoplasmic	emp + H2O <-> man + gal	Galactose metabolism	SPAC869.07c	3.2.1.22
EPimelibiose galactohydrolase	Reticulum Extracellular	emp + H2O <-> man + gal	Galactose metabolism	SPAC869.07c	3.2.1.22
	Endoplasmic				
Galactosylglycerol galactohydrolase	Reticulum	ggl + H2O <-> gal + GLYC	Galactose metabolism	SPAC869.07c	3.2.1.22
Galactosylglycerol galactohydrolase	Extracellular	ggl + H2O <-> gal + GLYC	Galactose metabolism	SPAC869.07c	3.2.1.22
alpha-D-glucoside glucohydrase	Nucleus	6dg + H2O -> gal + GLC	Galactose metabolism	SPBC1683.07 SPAC1039.11c	3.2.1.20
				SPAPB24D3.10c SPCC794.10	
UTP-glucose-1-phosphate URIdylyltransferase	Nucleus	g1p + H + UTP <-> PPi + UDPg	Galactose metabolism	SPCC1322.04	2.7.7.9
galactose-1-phosphate URIdylyltransferase	Nucleus	gallp + H + UTP <-> PPi + UDPgal	Galactose metabolism	SPBPB2B2.10c	2.7.7.12
UDPglucosehexose-1-phosphate URIdylyltransferase	Nucleus	gallp + UDPg <-> glp + UDPgal	Galactose metabolism	SPBPB2B2.10c	2.7.7.12
alpha-glucosidase	Nucleus	H2O + MALT -> 2 GLC	Galactose metabolism	SPBC1683.07 SPAC1039.11c	3.2.1.20
UDPglucose 4-ePimerase	Nucleus	UDPg <-> UDPgal	Galactose metabolism	SPAPB24D3.10c SPBPB2B2.12c	5.1.3.3
alpha-D-glucoside glucohydrase	Cytosol	6dg + H2O -> gal + GLC	Galactose metabolism	SPBC365.14c SPBC1683.07 SPAC1039.11c	3.2.1.20
aipiia-D-giucoside giuconydrase	Cytosoi	oug + H2O -> gai + OLC	Galactose metabolism	SPAPB24D3.10c	3.2.1.20
EPimelibiose galactohydrolase 1-alpha-D-Galactosyl-myo-mositol	Cytosol	epm + H2O <-> gal + man	Galactose metabolism	SPAC869.07c	
galactohydrolase	Cytosol	GALI + H2O <-> gal + inost	Galactose metabolism	SPAC869.07c	
galactokinase	Cytosol	$ATP + gal \rightarrow ADP + gal + H$	Galactose metabolism	SPBPB2B2.13	2.7.1.6
a-galactosidase (melibiose)	Cytosol	H2O + melib -> gal + GLC	Galactose metabolism	SPAC869.07c	2.7.7.12
galactose-1-phosphate URIdylyltransferase	Cytosol	gallp + H + UTP <-> PPi + UDPgal	Galactose metabolism	SPBPB2B2.10c SPCC794.10	2.7.7.12
UTP-glucose-1-phosphate URIdylyltransferase	Cytosol	g l p + H + UTP <-> PPi + UDPg	Galactose metabolism	SPCC1322.04	2.7.7.9
Galactosylglycerol galactohydrolase	Cytosol	ggl + H2O <-> gal + GLYC	Galactose metabolism	SPAC869.07c	
alpha-glucosidase	Cytosol	H2O + MALT -> 2 GLC	Galactose metabolism	SPBC1683.07 SPAC1039.11c SPAPB24D3.10c	3.2.1.20
Melibiitol galactohydrolase	Cytosol	melt + H2O <-> sbt-D + gal	Galactose metabolism	SPAC869.07c	
Raffinose galactohydrolase	Extracellular	raffin + H2O -> gal + sucr	Galactose metabolism	SPAC869.07c	3.2.1.22
Raffinose galactohydrolase	Endoplasmic	raffin + H2O -> gal + sucr	Galactose metabolism	SPAC869.07c	3.2.1.22
	Reticulum	-		SPBPB2B2.12c	
UDPglucose 4-ePimerase UDPglucosehexose-1-phosphate	Cytosol	UDPg <-> UDPgal	Galactose metabolism	SPBC365.14c	5.1.3.3
URIdylyltransferase	Cytosol	gallp + UDPg <-> glp + UDPgal	Galactose metabolism	SPBPB2B2.10c	2.7.7.12
4-aminobutyrate transaminase	Mitochondria	4abut + AKG -> GLU + SUCSAL	Glutamate metabolism	SPAC19D5.07	2.6.1.19
glutamate synthase (NADH2)	Mitochondria	$AKG + GLN + H + NADH \rightarrow 2 GLU + NAD$	Glutamate metabolism	SPAPB1E7.07	1.4.1.13, 1.4.1.14
glutamate dehydrogenase (NADP)	Mitochondria	AKG + H + NADPH + NH4 -> GLU + H2O + NADP	Glutamate metabolism	SPCC622.12c	1.4.1.4
chitin synthase	Cytoplasm	$UDPacgal \rightarrow cHitin + H + UDP$	Glutamate metabolism	SPAC19G12.03	2.4.1.16
chitin synthase	Endoplasmic Reticulum	UDPacgal -> cHitin + H + UDP	Glutamate metabolism	SPAC13G6.12c SPBC1709.01	2.4.1.16
UDP-N-acetylglucosamine diphosphorylase	Nucleus	acgamlp + H + UTP <-> PPi + UDPacgal	Glutamate metabolism	SPBC1289.08	2.7.7.23
phosphoacetylglucosamine mutase	Nucleus	acgam6p <> acgam1p	Glutamate metabolism	SPAC1296.01c	5.4.2.3
				SPAC13C5.05c	
glutamate dehydrogenase (NADP)	Nucleus	$AKG + H + NADPH + NH4 \rightarrow GLU + H2O + NADP$	Glutamate metabolism	SPCC622.12c SPAC1296.01c	1.4.1.4
phosphoglucosamine mutase	Nucleus	gamlp <-> gam6p	Glutamate metabolism	SPAC13C5.05c SPBC17A3.07	5.4.2.3
glutathione oxidoreductase	Nucleus	$GTHox + H + NADPH \rightarrow 2 GTHrd + NADP$	Glutamate metabolism	SPAC4F10.20 SPBC26H8.06	1.8.1.7
4-aminobutyrate transaminase	Cytosol	4abut + AKG -> GLU + SUCSAL	Glutamate metabolism	SPAC19D5.07	2.6.1.19
phosphoacetylglucosamine mutase	Cytosol	acgam6p <-> acgam1p	Glutamate metabolism	SPAC1296.01c SPAC13C5.05c	5.4.2.3
glucosamine-6-phosphate deaminase	Cytosol	gam6p + H2O -> F6P + NH4	Glutamate metabolism		
glutamate dehydrogenase (NAD)	Cytosol	GLU + H2O + NAD -> AKG + H + NADH + NH4	Glutamate metabolism	SPCC132.04c	1.4.1.2
glutamate dehydrogenase (NADP)	Cytosol	$AKG + H + NADPH + NH4 \rightarrow GLU + H2O + NADP$	Glutamate metabolism	SPCC622.12c	1.4.1.4
glutamate synthase (NADH2)	Cytosol	$AKG + GLN + H + NADH \rightarrow 2 GLU + NAD$	Glutamate metabolism	SPAPB1E7.07	1.4.1.13,
glutathione oxidoreductase	Mitochondria	GTHox + H + NADPH -> 2 GTHrd + NADP	Glutamate metabolism	SPBC17A3.07	1.4.1.14 1.8.1.7
glutathione peroxidase	Mitochondria	2 GTHrd + H2O2 <-> GTHox + 2 H2O	Glutamate metabolism	SPAPB2B4.02	
1-pyrroline-5-carboxylate dehydrogenase	Mitochondria	1PYR5c + 2 H2O + NAD -> GLU + H + NADH	Glutamate metabolism		
phosphoglucosamine mutase	Cytosol	gam1p <-> gam6p	Glutamate metabolism	SPAC1296.01c	5.4.2.3
D1-pyrroline-5-carboxylate dehydrogenase	Mitochondria	GLU5SA + H2O + NADP -> GLU + 2 H + NADPH	Glutamate metabolism	SPAC13C5.05c SPBC24C6.04	-
succinate-semialdehyde dehydrogenase (NADP)				SPAC1002.12c	
(predicted)	Cytosol	H2O + NADP + SUCSAL -> 2 H + NADPH + SUCC	Glutamate metabolism	SPAC139.05	
UDP-N-acetylglucosamine diphosphorylase	Cytosol	acgamlp + H + UTP <-> PPi + UDPacgal	Glutamate metabolism Glutamate metabolism	SPBC1289.08 SPAC16E8.03	2.7.7.23
N-acetylglucosamine-6-phosphate synthase	Cytosol	acCoA + gam6p <-> acgam6p + CoA + H	Giutamate metabonsiii	31 AC10E0.03	

glutamine synthetase	Nucleus	ATP + GLU + NH4 -> ADP + GLN + H + Pi	Glutamine Metabolism	SPAC23H4.06	6.3.1.2
anthranilate synthase	Cytosol	CHOR + GLN -> antH + GLU + H + PYR	Glutamine Metabolism	SPBC1539.09c	
	-			SPCC1442.09	26116
glutamine-fructose-6-phosphate transaminase	Cytosol	F6P + GLN -> gam6p + GLU	Glutamine Metabolism	SPBC12C2.11	2.6.1.16
glutamine synthetase	Cytosol	ATP + GLU + NH4 -> ADP + GLN + H + Pi	Glutamine Metabolism	SPAC23H4.06	6.3.1.2
glutaminase Glycerol dehydrogenase (NADP-dependent)	Cytosol Mitochondria	GLN + H2O -> GLU + NH4 GLYC + NADP -> DHA + H + NADPH	Glutamine Metabolism Glycerolipid Metabolism	SPAC13F5.03c	3.5.1.2 1.1.1.6
Glycerol denydrogenase (1745) - dependent)		0.01 12dgr + 0.02 C100CoA + 0.06 C120CoA + 0.17 C161CoA + 0.09	Giyecionpia iviciaoonsiii		1.1.1.0
triglycerol synthesis	Endoplasmic Reticulum	C182CoA + 0.24 C181CoA + 0.27 C160CoA + 0.05 C180CoA + 0.1 C140CoA -> CoA + 0.01 TAG	Glycerolipid Metabolism	SPAC13G7.05 SPCP1E11.05	2.3.1.26
phosphatidylcholine-diacylglycerol acyltransferas	Endoplasmic Reticulum	12dgr + pc -> 1agpc + TAG	Glycerolipid Metabolism	SPBC776.14 SPCC1235.15 SPCC1840.04	2.3.1.158
glycerol-3-phosphate dehydrogenase (NAD)	Nucleus	$DHAP + H + NADH \rightarrow GLYC3p + NAD$	Glycerolipid Metabolism	SPBC215.05	1.1.1.8
dihydroxyacetone kinase	Cytosol	$ATP + DHA \rightarrow ADP + DHAP + H$	Glycerolipid Metabolism	SPAC22A12.11	2.7.1.29
1 10 1 1 1 1 1 0 0 0 0 0		DULB II NABIL GLUGA NAB		SPAC977.16c SPAC23D3.04c	1110
glycerol-3-phosphate dehydrogenase (NAD)	Cytosol	DHAP + H + NADH -> GLYC3p + NAD	Glycerolipid Metabolism	SPBC215.05	1.1.1.8
glycerol-3-phosphate dehydrogenase (FAD)	Mitochondria	fad + GLYC3p -> DHAP + FADH2	Glycerolipid Metabolism	SPCC1223.03c	1.1.5.3
glycerol-3-phosphatase	Cytosol	GLYC3p + H2O -> GLYC + Pi	Glycerolipid Metabolism		
glycerol kinase Glycerophosphodiester phosphodiesterase	Cytosol Endoplasmic	$ATP + GLYC \rightarrow ADP + GLYC3p + H$	Glycerolipid Metabolism		
(Glycerophosphocholine)	Reticulum	$G3Pc + H2O \Rightarrow CHOL + GLYC3p + H$	Glycerophospholipid Metabolism	SPAC4D7.02c	3.1.4.46
Glycerophosphodiester phosphodiesterase	Mitochondria	G3Pc + H2O -> CHOL + GLYC3p + H	Glycerophospholipid Metabolism	SPAC4D7.02c	3.1.4.46
(Glycerophosphocholine)		H2O + 0.01 TAG -> 0.01 12dgr + 0.02 C100 + 0.06 C120 + H + 0.27			
Triacylglycerol lipase	Cytosol	C160 + 0.17 C161 + 0.05 C180 + 0.24 C181 + 0.09 C182 + 0.1 C140	Glycerolipid Metabolism	SPCC1450.16c	3.1.1.3
Alanine glyoxylate aminotransferase	Cytosol	$ALA + GLX \rightarrow GLY + PYR$	Glycine and Serine Metabolism		
				SPAC13G6.06c	1.4.4.2,
glycine-cleavage complex (lipoamide)	Mitochondria	GLY + H + lpam <-> alpam + CO2	Glycine and Serine Metabolism	SPAC1002.09c SPAC31G5.14 SPBP19A11.01	1.8.1.4, 2.1.2.10
	36. 1 11			SPAC13G6.06c SPAC1002.09c	1.4.4.2,
glycine-cleavage system (lipoamide)	Mitochondria	alpam + THF -> dHlam + MLTHF + NH4	Glycine and Serine Metabolism	SPAC31G5.14	1.8.1.4, 2.1.2.10
				SPBP19A11.01 SPAC13G6.06c	2.1.2.10
	36. 1 1.	WI VID W I VIDW		SPAC13G0.00c SPAC1002.09c	1.4.4.2,
glycine-cleavage complex (lipoamide)	Mitochondria	dHlam + NAD <-> H + lpam + NADH	Glycine and Serine Metabolism	SPAC31G5.14	1.8.1.4, 2.1.2.10
				SPBP19A11.01 SPAC13G6.06c	
desire deserve and a discontinuity	Mr. d det.	CLV - H - land or along CO2	Charles and Carles March Trans	SPAC13G0.00c SPAC1002.09c	1.4.4.2,
glycine-cleavage complex (lipoylprotein)	Mitochondria	GLY + H + lpro <-> alpro + CO2	Glycine and Serine Metabolism	SPAC31G5.14	1.8.1.4, 2.1.2.10
				SPBP19A11.01 SPAC13G6.06c	
alucias alecueses complex (linealemetria)	Mitochondria	olono : THE > JUliano : MI THE : NHA	Chains and Sarina Matabaliana	SPAC1002.09c	1.4.4.2,
glycine-cleavage complex (lipoylprotein)	Mitocholidia	alpro + THF -> dHlpro + MLTHF + NH4	Glycine and Serine Metabolism	SPAC31G5.14	1.8.1.4, 2.1.2.10
				SPBP19A11.01 SPAC13G6.06c	
alucias alecueses complex (linealemetria)	Mitochondria	dillere i NAD co II i lere i NADII	Chains and Sarina Matabaliana	SPAC1002.09c	1.4.4.2,
glycine-cleavage complex (lipoylprotein)	Mitochondria	dHlpro + NAD <-> H + lpro + NADH	Glycine and Serine Metabolism	SPAC31G5.14	1.8.1.4, 2.1.2.10
glycine hydroxymethyltransferase	Cytosol	SER + THF <-> GLY + H2O + MLTHF	Glycine and Serine Metabolism	SPBP19A11.01 SPAC24C9.12c	2.1.2.1
glycine hydroxymethyltransferase	Mitochondria	SER + THF <-> GLY + H2O + MLTHF	Glycine and Serine Metabolism	SPAC18G6.04c	2.1.2.1
grychie nydroxymethyltransierase	Mitochondria	SEK + IIII	Grycine and Serine Wetabonsin	SPAC13G6.06c	
glycine cleavage system	Mitochondria	GLY + NAD + THF -> CO2 + MLTHF + NADH + NH4	Glycine and Serine Metabolism	SPAC1002.09c	1.4.4.2, 1.8.1.4,
gryenic cicavage system	Mitochondina	GET + MAD + MIT > CO2 + METHI + MADIT + MIT	Gryenic and Serine Wetaoonsin	SPAC31G5.14	2.1.2.10
homoserine dehydrogenase (NADH)	Cytosol	aspSA + H + NADH -> Hom-L + NAD	Glycine and Serine Metabolism	SPBP19A11.01 SPBC776.03	1.1.1.3
homoserine dehydrogenase (NADP)	Cytosol	aspSA + H + NADPH -> Hom-L + NADP	Glycine and Serine Metabolism	SPBC776.03	1.1.1.3
homoserine kinase	Cytosol	ATP + Hom-L -> ADP + H + PHOM	Glycine and Serine Metabolism	SPBC4C3.03	2.7.1.39
L-serine dehydrogenase	Cytosol	NADP + SER <-> 2amSA + H + NADPH	Glycine and Serine Metabolism	SPAC521.03	
phosphoglycerate dehydrogenase	Cytosol	$3pg + NAD \rightarrow 3pHp + H + NADH$	Glycine and Serine Metabolism	SPCC364.07	1.1.1.95
phosphoserine transaminase	Cytosol	$3pHp + GLU \rightarrow AKG + PSER$	Glycine and Serine Metabolism	SPAC1F12.07	2.6.1.52
phosphoserine phosphatase (L-serine)	Cytosol	H2O + PSER -> Pi + SER	Glycine and Serine Metabolism	SPBC3H7.07c	3.1.3.3
L-serine deaminase	Cytosol	SER -> NH4 + PYR	Glycine and Serine Metabolism	SPBC1677.03c	4.3.1.19
Diphosphoglyceromutase	Nucleus	13dpg <-> 23dpg + H	Glycolysis/Gluconeogenesis	SPAC26F1.06	5.4.2.1
phosphoglycerate mutase	Nucleus		Glycolysis/Gluconeogenesis	SPAC1687.21 SPAC26F1.06	5.4.2.1
		2pg <-> 3pg		SPBC1815.01	
enolase	Nucleus	$2pg \Leftrightarrow H2O + PEP$	Glycolysis/Gluconeogenesis	SPBPB21E7.01c	4.2.1.11
phosphoglycerate kinase	Nucleus	3pg + ATP <-> 13dpg + ADP	Glycolysis/Gluconeogenesis	SPBC14F5.04c	2.7.2.3
hexokinase (D-fructose:ATP)	Nucleus	$ATP + fru \Rightarrow ADP + F6P + H$	Glycolysis/Gluconeogenesis	SPAC24H6.04	2.7.1.1
hexokinase (D-glucose:ATP)	Nucleus	$ATP + GLC \rightarrow ADP + G6P + H$	Glycolysis/Gluconeogenesis	SPAC4F8.07c SPAC24H6.04	2.7.1.1
Glucokinase	Nucleus	ATP + GLC -> ADP + G6P-B + H	Glycolysis/Gluconeogenesis	SPAC4F8.07c	2.7.1.1
hexokinase (D-mannose:ATP)	Nucleus	ATP + man -> ADP + H + man6p	Glycolysis/Gluconeogenesis	SPAC24H6.04	2.7.1.1
triose-phosphate isomerase	Nucleus	DHAP <-> G3P	Glycolysis/Gluconeogenesis	SPCC24B10.21	5.3.1.1
D-Fructose 1-phosphate D-glyceraldehyde-3-	Nucleus	flp <-> DHAP + GLYald	Glycolysis/Gluconeogenesis	SPBC19C2.07	4.1.2.13
phosphate-lyase		FDP <-> DHAP + G3P			
fructose-bisphosphate aldolase Sedoheptulose 1,7-bisphosphate D-	Nucleus		Glycolysis/Gluconeogenesis	SPBC19C2.07	4.1.2.13
glyceraldehyde-3-phosphate-lyase	Nucleus	s17bp <-> DHAP + E4P	Glycolysis/Gluconeogenesis	SPBC19C2.07	4.1.2.13
Diphosphoglyceromutase	Cytosol	13dpg <-> 23dpg + H	Glycolysis/Gluconeogenesis	SPAC26F1.06	5.4.2.1
enolase	Cytosol	2pg <-> H2O + PEP	Glycolysis/Gluconeogenesis	SPAC1687.21 SPBC1815.01	4.2.1.11
fructose-bisphosphate aldolase	Cytosol	FDP <-> DHAP + G3P	Glycolysis/Gluconeogenesis	SPBC19C2.07	4.1.2.13
D-Fructose 1-phosphate D-glyceraldehyde-3-	-				
phosphate-lyase	Cytosol	$flp \Leftrightarrow DHAP + GLYald$	Glycolysis/Gluconeogenesis	SPBC19C2.07	4.1.2.13
Sedoheptulose 1,7-bisphosphate D- glyceraldehyde-3-phosphate-lyase	Cytosol	$s17bp \Leftrightarrow DHAP + E4P$	Glycolysis/Gluconeogenesis	SPBC19C2.07	4.1.2.13
Glucose-6-phosphate isomerase	Cytosol	G6P <-> G6P-B	Glycolysis/Gluconeogenesis	SPBC1604.05	5.3.1.9
Glucose-6-phosphate isomerase	Cytosol	G6P-B <-> F6P	Glycolysis/Gluconeogenesis	SPBC1604.05	5.3.1.9
glyceraldehyde-3-phosphate dehydrogenase	Cytosol	G3P + NAD + Pi <-> 13dpg + H + NADH	Glycolysis/Gluconeogenesis	SPBC32F12.11	1.2.1.12
	-			SPBC354.12	
Glucokinase	Cytosol	$ATP + GLC \rightarrow ADP + G6P-B + H$	Glycolysis/Gluconeogenesis	SPAC4F8.07c SPAC4F8.07c	2.7.1.1
hexokinase (D-glucose:ATP)	Cytosol	$ATP + GLC \Rightarrow ADP + G6P + H$	Glycolysis/Gluconeogenesis	SPAC4F8.07c SPAC24H6.04	2.7.1.1
hexokinase (D-mannose:ATP)	Cytosol	$ATP + man \rightarrow ADP + H + man6p$	Glycolysis/Gluconeogenesis	SPAC24H6.04	2.7.1.1
hexokinase (D-fructose:ATP)	Cytosol	$ATP + fru \rightarrow ADP + F6P + H$	Glycolysis/Gluconeogenesis	SPAC24H6.04	2.7.1.1
pyruvate dehydrogenase (dihydrolipoamide	Mitochand	dulam + NAD > H + Incm + MADII	Glycolycie/Glycomen	SPBC3H7.03c	1.2.4.2,
dehydrogenase)	Mitochondria	dHlam + NAD -> H + lpam + NADH	Glycolysis/Gluconeogenesis	SPAC1002.09c SPBC776.15c	1.8.1.4, 2.3.1.61

				SPAC1002.09c SPCC794.07	1.8.1.4,
pyruvate dehydrogenase	Mitochondria	CoA + NAD + PYR -> ACCoA + CO2 + NADH	Glycolysis/Gluconeogenesis	SPBC30D10.13c, SPAC26F1.03	2.3.1.12, 1.2.4.1
	a	ATTR. ECR. ADD. EDD. W	a	SPCC1259.09c	
phosphofructokinase Phosphofructokinase	Cytosol Cytosol	$ATP + F6P \rightarrow ADP + FDP + H$ $ATP + taG6P-D \rightarrow ADP + H + taGDP-D$	Glycolysis/Gluconeogenesis Glycolysis/Gluconeogenesis	SPBC16H5.02 SPBC16H5.02	2.7.1.11 2.7.1.11
phosphofructokinase (s7p)	Cytosol	$ATP + s7p \rightarrow ADP + H + s17bp$	Glycolysis/Gluconeogenesis	SPBC16H5.02	2.7.1.11
glucose-6-phosphate isomerase	Cytosol	G6P <-> F6P	Glycolysis/Gluconeogenesis	SPBC1604.05	5.3.1.9
phosphoglycerate kinase	Cytosol	$13dpg + ADP \Leftrightarrow 3pg + ATP$	Glycolysis/Gluconeogenesis	SPBC14F5.04c	2.7.2.3
phosphoglycerate mutase	Cytosol	3pg <-> 2pg ADP + H + PEP -> ATP + PYR	Glycolysis/Gluconeogenesis	SPAC26F1.06 SPAC4H3.10c	5.4.2.1 2.7.1.40
pyruvate kinase triose-phosphate isomerase	Cytosol Cytosol	DHAP <-> G3P	Glycolysis/Gluconeogenesis Glycolysis/Gluconeogenesis	SPCC24B10.21	5.3.1.1
			. , . ,	SPAC13A11.06	
pyruvate decarboxylase	Cytosol	PYR + H -> ACAL + CO2	Glycolysis/Gluconeogenesis	SPAC3G9.11c SPAC186.09 SPAC1F8.07c	4.1.1.1
Dolichol kinase	Cytosol	$CTP + doliCHOL \rightarrow CDP + dolp + H$	Glycoprotein Metabolism	SPCC63.10c	2.7.1.108
Dolichol kinase	Endoplasmic Reticulum	$CTP + doliCHOL \rightarrow CDP + dolp + H$	Glycoprotein Metabolism	SPCC63.10c	2.7.1.108
Dolichyl-phosphate-mannoseprotein	Endoplasmic			SPAC22A12.07c	
mannosyltransferase	Reticulum	dolmanp -> dolp + H + mannan	Glycoprotein Metabolism	SPAPB1E7.09 SPBC16C6.09 SPAC31G5.16c,	2.4.1.109
Dolichyl-phosphate D-mannosyltransferase	Endoplasmic Reticulum	dolp[c] + GDPmann[c] -> dolmanp[r]+ GDP[c]	Glycoprotein Metabolism	SPBC21B10.11, SPBC1677.02 SPBC19C7.12c	2.4.1.83
GlycoliPid 1,2-alpha-D-mannosyltransferase	Golgi apparatus	GDPmann + m2maccHITPpdol -> GDP + H + M3MACCHITPPDOL	Glycoprotein Metabolism	SPBC17C7.12c SPBC17C7.12c SPBC19C7.12c	
GlycoliPid 1,2-alpha-D-mannosyltransferase	Golgi apparatus	GDPmann + M3MACCHITPPDOL -> GDP + H + m4maccHITPpdol	Glycoprotein Metabolism	SPBC1773.08c	
GlycoliPid 1,3-alpha-D-mannosyltransferase GlycoliPid 1,6-alpha-D-mannosyltransferase	Golgi apparatus Golgi apparatus	GDPmann + maccHITPpdol -> GDP + H + m1maccHITPpdol GDPmann + m1maccHITPpdol -> GDP + H + m2maccHITPpdol	Glycoprotein Metabolism Glycoprotein Metabolism		
Ureidoglycolate hydrolase	Nucleus	2 H + H2O + URDGLYC <-> CO2 + GLX + 2 NH4	Histidine Metabolism	SPAC19G12.04	3.5.3.19
Allantoate amidinohydrolase	Nucleus	alltt + H2O <-> URDGLYC + urea	Histidine Metabolism	SPAC1F7.09c	3.5.3.4
hnRNP arginine N-methyltransferase	Nucleus	SAM + HIS -> NPmeHis + SAH + H	Histidine Metabolism	SPAC890.07c	2.1.1
phosphoribosylpyrophosphate synthetase	Nucleus	ATP + R5P <-> AMP + H + PRPP	Histidine Metabolism	SPAC4A8.14	2.7.6.1
imidazoleglycerol-phosphate dehydratase	Nucleus	eiG3P -> H2O + imacp	Histidine Metabolism	SPBC21H7.07c	4.2.1.19
histidinol-phosphate transaminase 1-(5-phosphoribosyl)-5-[(5- phosphoribosylamino)methylideneamino)imidazoi	Nucleus	GLU + imacp -> AKG + Hisp prfp -> prlp	Histidine Metabolism  Histidine Metabolism	SPBC11B10.02c SPAC3F10.09	2.6.1.9 5.3.1.16
e-4-carboxamide isomerase					
Allantoate amidinohydrolase	Cytosol	alltt + H2O <-> URDGLYC + urea	Histidine Metabolism	SPAC1F7.09c	3.5.3.4
hnRNP arginine N-methyltransferase ATP phosphoribosyltransferase	Cytosol Cytosol	SAM + HIS -> NPmeHis + SAH + H ATP + PRPP -> PPi + prbATP	Histidine Metabolism Histidine Metabolism	SPAC890.07c SPAC25G10.05c	2.1.1 2.4.2.17
histidinol dehydrogenase	Cytosol	H2O + Histd + 2 NAD -> 3 H + HIS + 2 NADH	Histidine Metabolism	SPBC29A3.02c	1.1.1.23
instiditioi denydrogenase	Cytosoi	120 + 118tu + 2 NAD -> 3 H + 118 + 2 NADH	ristidile Metabolishi	SPBC1711.13 SPBC29A3.02c	1.1.1.23
histidinol dehydrogenase	Nucleus	H2O + Histd + 2 NAD -> 3 H + HIS + 2 NADH	Histidine Metabolism	SPBC1711.13	1.1.1.23
histidinol-phosphate transaminase	Cytosol	GLU + imacp -> AKG + Hisp	Histidine Metabolism	SPBC11B10.02c	2.6.1.9
imidazoleglycerol-phosphate dehydratase	Cytosol	eiG3P -> H2O + imacp	Histidine Metabolism	SPBC21H7.07c	4.2.1.19
phosphoribosyl-AMP cyclohydrolase	Cytosol	H2O + prbAMP -> prfp	Histidine Metabolism	SPBC29A3.02c SPBC1711.13	3.5.4.19, 3.6.1.31
phosphoribosyl-ATP pyrophosphatase	Cytosol	$H2O + prbATP \Rightarrow H + PPi + prbAMP$	Histidine Metabolism	SPBC29A3.02c SPBC1711.13	3.5.4.19, 3.6.1.31
phosphoribosyl-AMP cyclohydrolase	Nucleus	H2O + prbAMP -> prfp	Histidine Metabolism	SPBC29A3.02c	3.5.4.19,
				SPBC1711.13 SPBC29A3.02c	3.6.1.31 3.5.4.19,
phosphoribosyl-ATP pyrophosphatase	Nucleus	H2O + prbATP >> H + PPi + prbAMP	Histidine Metabolism	SPBC1711.13	3.6.1.31
1-(5-phosphoribosyl)-5-[(5- phosphoribosylamino)methylideneamino)imidazoi e-4-carboxamide isomerase	l Cytosol	prfp -> prlp	Histidine Metabolism	SPAC3F10.09	5.3.1.16
phosphoribosylpyrophosphate synthetase	Cytosol	ATP + R5P <-> AMP + H + PRPP	Histidine Metabolism	SPCC1620.06c SPAC4A8.14 SPBC3D6.06c	2.7.6.1
Ureidoglycolate hydrolase	Cytosol	2 H + H2O + URDGLYC <-> CO2 + GLX + 2 NH4	Histidine Metabolism	SPAC19G12.04	3.5.3.19
S-Formylglutathione hydralase	Cytosol	SfGLUttH + H2O <-> FORM + GTHrd + H	Methane Metabolism		3.1.2.12
5'-methylthioadenosine phosphorylase	Nucleus	$5mta + Pi \rightarrow 5mdrlp + ADE$	Methionine Metabolism	SPAC16C9.02c	2.4.2.28
methionine synthase	Nucleus	5mTHF + HCYS -> H + MET + THF	Methionine Metabolism	SPAC9.09	2.1.1.14
O-acetylhomoserine (thiol)-lyase metb1	Nucleus Nucleus	ACHMS + CH4S -> AC + H + MET ACHMS + CYS -> AC + cyst-L + H	Methionine Metabolism Methionine Metabolism	SPBC428.11 SPBC15D4.09c	2.5.1.49 2.5.1.48
O-acetylhomoserine (thiol)-lyase	Nucleus	ACHMS + H2S -> AC + H + HCYS	Methionine Metabolism	SPBC428.11	2.5.1.49
diphthine synthase	Nucleus	SAM + CAPHIS -> SAH + CMAPHIS + H	Methionine Metabolism	SPCC576.14	2.1.1.98
adenosylmethionine decarboxylase	Nucleus	SAM + H -> ametam + CO2	Methionine Metabolism	SPBP4H10.05c	4.1.1.50
methionine adenosyltransferase	Nucleus	ATP + H2O + MET > SAM + Pi + PPi	Methionine Metabolism	SPBC14F5.05c	2.5.1.6
2,3-diketo-5-methylthio-1-phosphopentane degradation reaction	Nucleus	$dkmpp + 3\ H2O -> 2kmb + FORM + 6\ H + Pi$	Methionine Metabolism	SPAC644.08 SPBC887.01	3.1.3.77, 1.13.11.53, 1.13.11.54
O-succinylhomoserine lyase (elimination)	Nucleus	H2O + SUCHMS <-> 2obut + H + NH4 + SUCC	Methionine Metabolism	SPBC15D4.09c	2.5.1.48
5-methyltetrahydropteroyltriglutamate- homocysteine S-methyltransferase	Nucleus	HCYS + MHPGLU -> HpGLU + MET	Methionine Metabolism	SPAC9.09	2.1.1.14
adenosylmethionine decarboxylase	Cytosol	SAM + H -> ametam + CO2	Methionine Metabolism	SPBP4H10.05c	4.1.1.50
adenosylhomocysteinase	Cytosol	SAH + H2O -> ADN + HCYS	Methionine Metabolism	SPBC8D2.18c	3.3.1.1
O-acetylhomoserine (thiol)-lyase	Cytosol	ACHMS + CH4S -> AC + H + MET	Methionine Metabolism	SPBC428.11	2.5.1.49
O-acetylhomoserine (thiol)-lyase	Cytosol	ACHMS + H2S -> AC + H + HCYS cyst-L + H2O -> HCYS + NH4 + PYR	Methionine Metabolism	SPBC428.11	2.5.1.49
cystathionine b-lyase cystathione b-lyase	Cytosol Peroxisome	cyst-L + H2O -> HCYS + NH4 + PYR cyst-L + H2O -> HCYS + NH4 + PYR	Methionine Metabolism Methionine Metabolism	SPCC11E10.01	4.4.1.8
diphthine synthase	Cytosol	SAM + CAPHIS -> SAH + CMAPHIS + H	Methionine Metabolism	SPCC576.14	2.1.1.98
2,3-diketo-5-methylthio-1-phosphopentane		dkmnn + 3 H2O -> 2kmh + EOPM + 6 H + D:	Methionine Matabalian	SPAC644.08	3.1.3.77,
degradation reaction	Cytosol	dkmpp + 3 H2O -> 2kmb + FORM + 6 H + Pi	Methionine Metabolism	SPBC887.01	1.13.11.53, 1.13.11.54
homoserine O-trans-acetylase	Cytosol	ACCoA + Hom-L <-> ACHMS + CoA	Methionine Metabolism	SPBC56F2.11	2.3.1.31
5-Methylthio-5-deoxy-D-ribulose 1-phosphate dehydratase	Cytosol	5mdru1p -> dkmpp + H2O	Methionine Metabolism		
methionine adenosyltransferase	Cytosol	ATP + H2O + MET -> SAM + Pi + PPi	Methionine Metabolism	SPBC14F5.05c	2.5.1.6
metb1	Cytosol	ACHMS + CYS -> AC + cyst-L + H	Methionine Metabolism	SPBC15D4.09c	2.5.1.48
methionine synthase 5-methyltetrahydropteroyltriglutamate-	Cytosol	5mTHF + HCYS -> H + MET + THF	Methionine Metabolism	SPAC9.09	2.1.1.14
homocysteine S-methyltransferase	Cytosol	HCYS + MHPGLU -> HpGLU + MET	Methionine Metabolism	SPAC9.09	2.1.1.14
5'-methylthioadenosine phosphorylase	Cytosol	5mta + Pi -> 5mdrlp + ADE	Methionine Metabolism	SPAC16C9.02c	2.4.2.28
5-methylthioribose-1-phosphate isomerase	Cytosol	5mdr1p <-> 5mdru1p	Methionine Metabolism		

O-succinylhomoserine lyase (L-cysteine)	Cytosol	CYS + SUCHMS -> cyst-L + H + SUCC	Methionine Metabolism		
O-succinylhomoserine lyase (elimination)	Cytosol	H2O + SUCHMS <-> 2obut + H + NH4 + SUCC	Methionine Metabolism	SPBC15D4.09c	2.5.1.48
2-keto-4-methylthiobutyrate transamination	Cytosol	2kmb + GLU -> AKG + MET	Methionine Metabolism		
NAD diphosphatase	Cytosol	$H2O + NAD \rightarrow AMP + 2 H + nmn$	NAD Biosynthesis	SPBC1778.03c	3.6.1.22
pURIne-nucleoside phosphorylase (Adenosine)	Nucleus	ADN + Pi <-> ADE + rlp	NAD Biosynthesis	SPAC1805.16c	2.4.2.1
nicotinate-nucleotide adenylyltransferase	Nucleus	ATP + H + nicrnt -> dNAD + PPi	NAD Biosynthesis	SPAC806.06c	2.7.7.1
nicotinamide-nucleotide adenylyltransferase	Nucleus	$ATP + H + nmn \rightarrow NAD + PPi$	NAD Biosynthesis	SPAC806.06c	2.7.7.1
ribosylnicotinamide kinase	Nucleus	$ATP + rnam \rightarrow ADP + H + nmn$	NAD Biosynthesis	SPBP22H7.06	2.7.1
pURIne-nucleoside phosphorylase (Guanosine)	Nucleus	GSN + Pi <-> GUA + rlp	NAD Biosynthesis	SPAC1805.16c	2.4.2.1
NAPRTase	Mitochondria	H + nac + PRPP -> nicrnt + PPi	NAD Biosynthesis	SPAC1486.06	2.4.2.11
NAPRTase	Nucleus	H + nac + PRPP -> nicrnt + PPi	NAD Biosynthesis	SPAC1486.06	2.4.2.11
NAD diphosphatase	Nucleus	H2O + NAD -> AMP + 2 H + nmn	NAD Biosynthesis	SPBC1778.03c	3.6.1.22
NAD kinase	Cytosol	$ATP + NAD \Rightarrow ADP + H + NADP$	NAD Biosynthesis	SPCC24B10.02c	2.7.1.23
NAD kinase	Mitochondria	$ATP + NAD \Rightarrow ADP + H + NADP$	NAD Biosynthesis	SPAC323.01c	2.7.1.86
			· · · · · · · · · · · · · · · · · · ·	SFAC323.01C	2.7.1.60
NADP phosphatase	Cytosol Mitochondria	H2O + NADP -> NAD + Pi H2O + NADP -> NAD + Pi	NAD Biosynthesis		
NADP phosphatase			NAD Biosynthesis		
NAD synthase (nh3)	Cytosol	$ATP + dNAD + NH4 \rightarrow AMP + H + NAD + PPi$	NAD Biosynthesis	SPCC553.02	6.3.5.1
NAD synthase (nh3)	Nucleus	$ATP + dNAD + NH4 \rightarrow AMP + H + NAD + PPi$	NAD Biosynthesis	SPCC553.02	6.3.5.1
nicotinamide-nucleotide adenylyltransferase	Cytosol	$ATP + H + nmn \Rightarrow NAD + PPi$	NAD Biosynthesis	SPAC806.06c	2.7.7.1
nicotinate-nucleotide adenylyltransferase	Cytosol	$ATP + H + nicrnt \rightarrow dNAD + PPi$	NAD Biosynthesis	SPAC806.06c	2.7.7.1
Nicotinamide N-methyltransferase	Cytosol	SAM + ncam -> 1mncam + SAH	NAD Biosynthesis	SPAC8F11.09c	2.1.1.1
pURIne-nucleoside phosphorylase	Cytosol	Pi + rnam <-> H + ncam + r1p	NAD Biosynthesis		
ribosylnicotinamide kinase	Cytosol	$ATP + rnam \rightarrow ADP + H + nmn$	NAD Biosynthesis	SPBP22H7.06	2.7.1
carbonate dehydratase	Cytosol	CO2 + H2O -> H2CO3	Nitrogen Metabolism	SPBP8B7.05c	4.2.1.1
Urea amidohydrolase	Cytosol	urea + H2O -> CO2 + 2 NH4	Nitrogen Metabolism	SPAC1952.11c	3.5.1.5
nitrilase	Nucleus	2 H2O + ind3acnl -> ind3ac + NH4	Nitrogen Metabolism	SPBC651.02 SPCC965.09	3.5
nitrilase	Cytosol	2 H2O + ind3acnl -> ind3ac + NH4	Nitrogen Metabolism	SPBC651.02 SPCC965.09	3.5
dinucleoside tetraphosphatase	Cytosol	$gp4g + H2O <\!$	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
P1,P4-Bis(5'-nucleosyl)-tetraphosphate	Cytosol	$xp4x + H2O \Leftrightarrow XTP + XMP$	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
nucleotidohydrolase	Cytosoi	APIA + 1120 (-> ATT + AMI	Nucleotide Sarvage Fairway	31 CC4G3.02	3.0.1.17
P1,P4-bis(5'-URIdyl)-tetraphosphate URIdylohydrolase	Cytosol	$up4u + H2O \Rightarrow UTP + UMP$	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
dinucleoside tetraphosphatase	Mitochondria	gp4g + H2O <-> GTP + GMP	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
P1,P4-Bis(5'-nucleosyl)-tetraphosphate					
nucleotidohydrolase	Mitochondria	xp4x + H2O <-> XTP + XMP	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
P1,P4-bis(5'-URIdyl)-tetraphosphate	Mitochondria	$up4u + H2O \rightarrow UTP + UMP$	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
URIdylohydrolase					
dinucleoside tetraphosphatase	Nucleus	gp4g + H2O <-> GTP + GMP	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
P1,P4-Bis(5'-nucleosyl)-tetraphosphate nucleotidohydrolase	Nucleus	$xp4x + H2O \Leftrightarrow XTP + XMP$	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
P1,P4-bis(5'-URIdyl)-tetraphosphate	Nucleus	up4u + H2O -> UTP + UMP	Nucleotide Salvage Pathway	SPCC4G3.02	3.6.1.17
URIdylohydrolase	Nucleus		Nucleotide Salvage Fattiway	SFCC4G5.02	3.0.1.17
Inosine ribohydrolase	Cytosol	$INS + H2O \Rightarrow HXAN + rib - D$	Nucleotide Salvage Pathway	SPBC1683.06c	3.2.2.1
Xanthosine ribohydrolase	Cytosol	$xtsn + H2O \Rightarrow XAN + rib - D$	Nucleotide Salvage Pathway	SPBC1683.06c	3.2.2.1
N-ribosylnicotinamide ribohydrolase	Cytosol	rnam + H2O -> ncam + rib-D	Nucleotide Salvage Pathway	SPBC1683.06c	3.2.2.1
Inosine ribohydrolase	Nucleus	INS + H2O -> HXAN + rib-D	Nucleotide Salvage Pathway	SPBC1683.06c	3.2.2.1
Xanthosine ribohydrolase	Nucleus	xtsn + H2O -> XAN + rib-D	Nucleotide Salvage Pathway	SPBC1683.06c	3.2.2.1
N-ribosylnicotinamide ribohydrolase	Nucleus	rnam + H2O -> ncam + rib-D	Nucleotide Salvage Pathway	SPBC1683.06c	3.2.2.1
nucleoside-diphosphatase (GDP)	Endoplasmic	$GDP + H2O \rightarrow GMP + H + Pi$	Nucleotide Salvage Pathway	SPAC824.08	
nucleoside-diphosphatase (GDF)	Reticulum	ODF + H2O -> GWF + H + FI	Nucleotide Salvage Fattiway	SFAC624.06	
guanine phosphoribosyltransferase	Endoplasmic Reticulum	GUA + PRPP -> GMP + PPi	Nucleotide Salvage Pathway	SPAC23C11.13c	
hypoxanthine phosphoribosyltransferase					
	Endoplasmic				
(Hypoxanthine)	Endoplasmic Reticulum	HXAN + PRPP -> IMP + PPi	Nucleotide Salvage Pathway	SPAC23C11.13c	
		$HXAN + PRPP \rightarrow IMP + PPi$ $ADE + H + H2O \rightarrow HXAN + NH4$	Nucleotide Salvage Pathway  Nucleotide Salvage Pathway	SPAC23C11.13c SPBC1198.02	3.5.4.4
(Hypoxanthine)	Reticulum				3.5.4.4 2.4.2.7
(Hypoxanthine) adenine deaminase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4	Nucleotide Salvage Pathway	SPBC1198.02	
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase	Reticulum Nucleus Nucleus	$\begin{aligned} ADE + H + H2O &> HXAN + NH4 \\ ADE + PRPP &> AMP + PPi \end{aligned}$	Nucleotide Salvage Pathway Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03	2.4.2.7
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase	Reticulum Nucleus Nucleus Nucleus	$\begin{aligned} &ADE+H+H2O >> HXAN+NH4\\ &ADE+PRPP >> AMP+PPi\\ &ADN+ATP >> ADP+AMP+H \end{aligned}$	Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14	2.4.2.7 2.7.1.20
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D	Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02	2.4.2.7 2.7.1.20 3.5.4.4
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP	Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3
(Hypoxanthine) adenine dearminase adenine phosphoribosyltransferase adenosine kinase Adenosine dearminase adenosine hydrolase adenylate kinase adentylate kinase	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O >> HXAN + NH4 $ADE + PRPP >> AMP + PPi$ $ADN + ATP >> ADP + AMP + H$ $ADN + H + H2O >> INS + NH4$ $ADN + H2O -> ADE + rib - D$ $AMP + ATP <>> 2 ADP$ $AMP + GTP <>> ADP + GDP$	Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3
(Hypoxanthine) adenine dearminase adenine phosphoribosyltransferase adenosine kinase Adenosine dearminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (ITP)	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP  AMP + GTP <> ADP + GDP  AMP + ITP <> ADP + IDP	Nucleotide Salvage Pathway Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP  AMP + GTP <> ADP + GDP  AMP + ITP <>> ADP + IDP  ATP + dTMP <>> ADP + IDP	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP)	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP  AMP - GTP <> ADP + GDP  AMP + ITP <> ADP + GDP  ATP + dTMP <> ADP + GDP  ATP + dTMP <>> ADP + GDP  ATP + dTMP <>> ADP + GDP  ATP + dTMP <>> ADP + GDP	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP)	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP - GTP -> ADP + GDP  AMP + ITP -> ADP + GDP  ATP + dTMP -> ADP + dTDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP)	Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP  AMP - GTP <> ADP + GDP  AMP + ITP <> ADP + GDP  ATP + dTMP <> ADP + GDP  ATP + dTMP <>> ADP + GDP  ATP + dTMP <>> ADP + GDP  ATP + dTMP <>> ADP + GDP	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adenylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP <>> ADP + IDP  AMP + GTP <>> ADP + IDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + IDP  ATP + GTMP -> ADP + IDP  ATP + GTMP -> ADP + BP  ATP + GTMP -> CMP + GDP  ATP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2 dr1p + ADE	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP <>> ADP + IDP  AMP + GTP <>> ADP + IDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + IDP  ATP + GTMP -> ADP + IDP  ATP + GTMP -> ADP + BP  ATP + GTMP -> CMP + GDP  ATP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2 dr1p + ADE	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase adenylate kinase (GTP). nucleus adenylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP)  Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + ITP -> ADP + IDP  ATP + GTMP -> ADP + IDP  ATP + GTMP -> ADP + BDP  ATP + GTMP -> ADP + BDP  ATP + GTMP -> ADP + GDP  AMP + H2O -> cyrd + Pi  cyrd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2dr1p + ADE  dCTP + H + H2O -> dUTP + NH4	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.12
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + IDP  ATP + GTMP -> ADP + IDP  ATP + GTMP -> ADP + GTDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2dr1p + ADE  dCTP + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dUTP + NH4  dGSN + Pi -> 2dr1p + GUA	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPAC23.13c SPAC1556.04c SPAC1805.16c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.12 3.5.4.5 2.4.2.1
(Hypoxanthine) adenine deaminase adenoine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + ITP -> ADP + IDP  ATP + dTMP -> ADP + dTDP  CMP + H2O -> cyrd + Pi  cyrd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2dr1p + ADE  dCTP + H + H2O -> dUTP + NH4  dcyr + H + H2O -> dURI + NH4  dGSN + Pi -> 2dr1p + GUA  din + Pi -> 2dr1p + GUA  din + Pi -> 2dr1p + GUA	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1683.02 SPBC1805.16c SPBC2G2.13c SPAC1805.16c SPAC1805.16c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.12 3.5.4.5
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) puRIne-nucleoside phosphorylase (Deoxyinosine) gnnuc	Reticulum Nucleus	ADE + H + H2O >> HXAN + NH4 $ADE + PRPP >> AMP + PPi$ $ADN + ATP >> ADP + AMP + H$ $ADN + H + H2O >> INS + NH4$ $ADN + H2O >> ADE + rib-D$ $AMP + ATP <>> 2 ADP$ $AMP + ATP <>> 2 ADP$ $AMP + ATP <>> ADP + GDP$ $AMP + ITP <>> ADP + IDP$ $ATP + dTMP <>> ADP + IDP$ $ATP + dTMP <>> ADP + GTP$ $CMP + H2O >> cytd + Pi$ $cytd + GTP >> CMP + GDP + H$ $dad-2 + H + H2O >> din + NH4$ $dad-2 + Pi <>> dUTP + NH4$ $dcyt + H + H2O >> dURI + NH4$	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1683.02 SPBC1805.16c SPBC2G2.13c SPAC1556.04c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.12 3.5.4.5 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adentylate kinase (GTP). furcleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP)  Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyinosine gnnuc guanine phosphoribosyltransferase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <>> 2 ADP  AMP + ATP <>> 2 ADP  AMP + GTP <>> ADP + GDP  AMP + ITP <>> ADP + IDP  ATP + GTMP <>> ADP + IDP  ATP + GTMP <>> ADP + GDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dcyt + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dUTP + NH4  dGSN + Pi <>> 2drlp + GUA  din + Pi <>> 2drlp + GUA  GSN + H2O -> GUA + rib-D  GUA + PRPP -> GMP + PPi	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC17G8.02 SPAC23C11.13c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxyctidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP  AMP + GTP <> ADP + GDP  AMP + GTP <> ADP + GDP  AMP + GTP <> ADP + IDP  ATP + GTMP <>> ADP + GTDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi <> 2 dTlp + ADE  dCTP + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dGSN + H2O -> GUA + rib-D  GUA + PRPP -> GMP + PPi  H2O + IMP -> INS + Pi	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC10.07 SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC17G8.02 SPAC17G8.02 SPAC17G8.02 SPAC17G8.02 SPAC23C11.13c SPBC30D10.03c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.12 3.5.4.5 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyaguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) spinuc guanine phosphoribosyltransferase 5'-nucleotidase (IMP) 5'-nucleotidase (UMP)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <>> 2 ADP  AMP + ATP <>> 2 ADP  AMP + GTP <>> ADP + GDP  AMP + ITP <>> ADP + IDP  ATP + GTMP <>> ADP + IDP  ATP + GTMP <>> ADP + GDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dcyt + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dUTP + NH4  dGSN + Pi <>> 2drlp + GUA  din + Pi <>> 2drlp + GUA  GSN + H2O -> GUA + rib-D  GUA + PRPP -> GMP + PPi	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC17G8.02 SPAC23C11.13c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.12 3.5.4.5 2.4.2.1 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (ITP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase S'-nucleotidase (IMP) 5'-nucleotidase (IMP) hypoxanthine phosphoribosyltransferase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP  AMP + GTP <> ADP + GDP  AMP + GTP <> ADP + GDP  AMP + GTP <> ADP + IDP  ATP + GTMP <>> ADP + GTDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi <> 2 dTlp + ADE  dCTP + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dGSN + H2O -> GUA + rib-D  GUA + PRPP -> GMP + PPi  H2O + IMP -> INS + Pi	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC10.07 SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC17G8.02 SPAC17G8.02 SPAC17G8.02 SPAC17G8.02 SPAC23C11.13c SPBC30D10.03c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.12 3.5.4.5 2.4.2.1 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP). proceed (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pura menucleoside phosphorylase (Deoxyguanosine)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + IDP  ATP + GTMP -> ADP + IDP  ATP + GTMP -> ADP + GDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2drlp + ADE  dCTP + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dUTI + NH4  dryt + H + H2O -> dUTI + NH4  dGSN + H2O -> GUA + Tib-D  GUA + PRPP -> GMP + PPi  H2O + IMP -> INS + Pi  H2O + UMP -> Pi + URI  HXAN + PRPP -> IMP + PPi	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC24B11.05 SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC17G8.02 SPAC17G8.02 SPAC17G8.02 SPAC23C11.13c SPAC24B11.05 SPAC24B11.05 SPAC24B11.05	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase S'-nucleotidase (IMP) 5'-nucleotidase (UMP) hypoxanthine phosphoribosyltransferase (Hypoxanthine) pURIne-nucleoside phosphorylase (Inosine)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + IDP  ATP + GTMP -> ADP + IDP  ATP + GTMP -> ADP + GDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2 dTlp + ADE  dCTP + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dUTP + NH4  dGSN + Pi -> 2drlp + GUA  din + Pi -> 2drlp + GUA  din + Pi -> CMP + PPi  H2O + IMP -> INS + Pi  H2O + UMP -> Pi + URI  HXAN + PRPP -> IMP + PPi  INS + Pi -> HXAN + rlp	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC162.11c SPBC1683.02 SPBC1198.02 SPBC1198.02 SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC17G8.02 SPAC1805.16c SPAC23C11.13c SPAC23C11.13c SPAC23C11.13c SPAC23C11.13c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1 2.4.2.1 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) by URIne-nucleoside phosphorylase gunnine guanine phosphoribosyltransferase 5'-nucleotidase (IMP) 5'-nucleotidase (IMP) 5'-nucleotidase (IMP) phypoxanthine phosphoribosyltransferase (Hypoxanthine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Inosine)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> ADP + GDP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + GDP  AMP + ITP -> ADP + IDP  ATP + GTMP -> ADP + GTDP  CMP + H2O -> cyrd + Pi  cyrd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2dr1p + ADE  dCTP + H + H2O -> dUTP + NH4  dcyr + H + H2O -> dUTP + NH4  dcyr + H + H2O -> duTP + GDP  GUA + PRPP -> GMP + PPi  H2O + MP -> GMP + PPi  H2O + MP -> FI + URI  HXAN + PRPP -> IMP + PPi  INS + Pi -> HXAN + r1p  Pi + xtsn -> r1p + XAN	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC1805.16c SPAC17G8.02 SPAC23C11.13c SPAC23C11.13c SPAC23C11.13c SPAC23C11.13c SPAC23C11.13c SPAC23C11.13c SPAC23C11.13c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) purine-nucleoside phosphorylase (Hypoxanthine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Xanthosine) Adenosine deaminase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <-> 2 ADP  AMP + ATP <-> 2 ADP  AMP + ATP <-> 2 ADP  AMP + ITP <-> ADP + IDP  ATP + dTMP <-> ADP + IDP  ATP + dTMP <-> ADP + IDP  ATP + dTMP <-> ADP + GTP  TOP + GTP >> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi <-> 2 dr1p + ADE  dCTP + H + H2O -> dUTP + NH4  dcy+ H + H2O -> dUTP + NH4  dcy+ H + H2O -> dUTP + NH4  dGSN + Pi <-> 2dr1p + GUA  din + Pi <-> 2dr1p + HXAN  GSN + H2O -> GUA + rib-D  GUA + PRPP -> GMP + PPi  H2O + IMP -> IMP + PPi  HXAN + PRPP -> IMP + PPi  INS + Pi <-> HXAN + r1p  Pi + xsia <-> r1p + Xsia  ADN + H + H2O -> INS + NH4	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC2G2.11 SPBC1683.02 SPBC21683.02 SPBC1198.02 SPAC1805.16c SPAC23C11.13c SPAC23C11.13c SPAC3C11.13c SPAC1805.16c	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1 3.1.3
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adenylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanine phosphoribosyltransferase 5'-nucleotidase (IMP) 5'-nucleotidase (IMP) hypoxanthine phosphoribosyltransferase (Hypoxanthine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Xanthosine) Adenosine deaminase	Reticulum Nucleus Cytosol	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <>> 2 ADP  AMP + ATP <>> 2 ADP  AMP + GTP <>> ADP + GDP  AMP + GTP <>> ADP + GDP  AMP + ITP <>> ADP + IDP  ATP + GTMP <>> ADP + GDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi <>> 2drlp + ADE  dCTP + H + H2O -> dUTP + NH4  dGSN + Pi <>> 2drlp + GUA  GSN + H2O -> GUA + rib-D  GUA + PRPP -> GMP + PPi  H2O + IMP -> IMP - PPi  H2O + IMP -> IMP + PPi  H2O + IMP -> IMP + PPi  H3N + PRP -> IMP + PPi  HXAN + PRPP -> IMP + PPi  INS + Pi <>> HXAN + IP  Pi + xtsn <>> rlp + XAN  ADN + H + H2O -> INS + NH4  ADE + H + H2O -> INS + NH4  ADE + H + H2O -> INS + NH4	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC1198.02 SPBC1198.02	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase adentylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxyctidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyinosine gunnine guanine phosphoribosyltransferase 5'-nucleotidase (UMP) hypoxanthine phosphoribosyltransferase (Hypoxanthine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Xanthosine) Adenosine deaminase adenine deaminase adenine deaminase	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP >> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <> 2 ADP  AMP + ATP <> 2 ADP  AMP + GTP <> ADP + GDP  AMP + GTP <> ADP + GDP  AMP + TTP <> ADP + IDP  ATP + GTMP <>> ADP + GTDP  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi <> 2 drlp + ADE  dCTP + H + H2O -> dUTP + NH4  dcyt + H + H2O -> dURI + NH4  dGSN + Pi <>> 2drlp + GUA  din + Pi <>> 2drlp + GUA  din + Pi <>> dUA  HXAN  GSN + H2O -> GUA + rib-D  GUA + PRPP >> GMP + PPi  H2O + IMP -> INS + Pi  H2O + UMP -> Pi + URI  HXAN + PRPP -> IMP + PPi  INS + Pi <>> HXAN + rlp  Pi + xtsn <> rlp + XAN  ADN + H + H2O -> INS + NH4  ADE + H + H2O -> INS + NH4  ADE + H + H2O -> INS + NH4  ADE + H + H2O -> INS + NH4  AMP + ATP <>> 2 ADP	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPBC1198.02 SPBC1198.02 SPBC1198.02	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1
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(Hypoxanthine) adenine deaminase adenosine kinase Adenosine deaminase adenosine hydrolase adenosine hydrolase adenylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP). pucleus adentylate kinase (GTP). dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase by URIne-nucleoside phosphorylase (Deoxyadenosine) pURIne-nucleoside phosphorylase (Deoxyadenosine) pURIne-nucleoside phosphorylase (Deoxyadenosine) pURIne-nucleoside phosphorylase (Deoxyadenosine) pURIne-nucleoside phosphorylase (Deoxyanosine) guanine phosphoribosyltransferase 5'-nucleotidase (IMP) 5'-nucleotidase (IMP) pyoxanthine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Xanthosine) Adenosine deaminase adenylate kinase adenylate kinase adenylate kinase adentylate kinase (GTP) adentylate kinase (GTP) adentylate kinase (GTP) adentylate kinase (GTP)	Reticulum Nucleus	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP <>> 2 ADP  AMP + ATP <>> 2 ADP  AMP + GTP <>> ADP + GDP  AMP + ITP <>> ADP + GDP  AMP + ITP <>> ADP + GDP  AMP + GTP <>> ADP + GDP  AMP + GTP -> CMP + GDP  AMP + GTP -> CMP + GDP + H  CMP + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  CMP + H2O -> din + NH4  CMP + H2O -> dUTP + NH4  CMP + H2O -> dUTP + NH4  CMP + H2O -> dUTP + NH4  CMP + H2O -> CMP + GDP  CMP + H2O -> CMP + GDP  CMP + H2O -> CMP + PPi  CMP + H2O -> CMP + PPi  CMP + M2O -> CMP + M2O -> M2D ->	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPCC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPAC4B11.05 SPAC23C11.13c SPAC4B11.05 SPAC4B11.05 SPAC4B11.05 SPAC4B11.05 SPAC4B11.05 SPAC4B11.05 SPAC4B11.05 SPAC4B11.05 SPAC4B11.05 SPAC4G9.01 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1 3.1.3 2.4.2.1 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3 2.7.4.3
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(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyguanosine) pURIne-nucleoside phosphorylase (Deoxyinosine) gunnic guanine phosphoribosyltransferase 5'-nucleotidase (IMP) 5'-nucleotidase (UMP) hypoxanthine phosphoribosyltransferase (Hypoxanthine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Xanthosine) Adenosine deaminase adenylate kinase adenylate kinase adenylate kinase adenylate kinase (GTP) adentylate kinase (GTP)	Reticulum Nucleus Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> CMP + GDP + H  ADD + H2O -> cytd + Pi  cytd + GTP -> CMP + GDP + H  dad-2 + H + H2O -> din + NH4  dad-2 + Pi -> 2 dTlp + ADE  dCTP + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dcyt + H + H2O -> dURI + NH4  dryt - H + H2O -> HXAN  GSN + H2O -> GUA + rib-D  GUA + PRPP -> GMP + PPi  H2O + IMP -> INS + Pi  H2O + IMP -> INS + Pi  H2O + UMP -> Pi + URI  HXAN + PRPP -> IMP + PPi  INS + Pi -> HXAN + rlp  Pi + xtsn -> rlp + xAN  ADN + H + H2O -> HXAN + NH4  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> ADP + GDP  AMP + ITP -> ADP + DDP  AMP + ITP -> ADP + DDP  AMP + ITP -> ADP + AMP + H	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPAC198.02 SPAC4G9.03	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1 3.1.3 2.4.2.1 2.7.4.3
(Hypoxanthine) adenine deaminase adenine phosphoribosyltransferase adenosine kinase Adenosine deaminase adenosine hydrolase adenylate kinase (GTP). nucleus adentylate kinase (GTP). nucleus adentylate kinase (GTP) dTMP kinase 5'-nucleotidase (CMP) cytidine kinase (GTP) Deoxyadenosine deaminase pURIne-nucleoside phosphorylase (Deoxyadenosine) dCTP deaminase deoxycytidine deaminase pURIne-nucleoside phosphorylase (Deoxyaguanosine) pURIne-nucleoside phosphorylase (Deoxyinosine) gnnuc guanine phosphoribosyltransferase 5'-nucleotidase (IMP) 5'-nucleotidase (IMP) 5'-nucleotidase (IMP) pypoxanthine phosphoribosyltransferase (Hypoxanthine) pURIne-nucleoside phosphorylase (Inosine) pURIne-nucleoside phosphorylase (Aanthosine) Adenosine deaminase adenylate kinase adenylate kinase adenylate kinase adentylate kinase (GTP) adentylate kinase (ITP) adentylate kinase (ITP) adenosine kinase adenosine hydrolase	Reticulum Nucleus Nucl	ADE + H + H2O -> HXAN + NH4  ADE + PRPP -> AMP + PPi  ADN + ATP -> ADP + AMP + H  ADN + H + H2O -> INS + NH4  ADN + H2O -> ADE + rib-D  AMP + ATP -> 2 ADP  AMP + GTP -> ADP + GDP  AMP + GTP -> CMP + GDP + H  AGO -> CMP + H2O -> CMP + GDP + H  AGO -> CMP + H2O -> CMP + GDP + H  AGO -> CMP + H2O -> GMP + MH4  AGO -> CMP + H2O -> CMP + MH4  AGO -> CMP + H2O -> CMP + MH4  AGO -> CMP + H2O -> CMP + MH4  AGO -> CMP + H2O -> CMP + MH4  AGO -> CMP + H2O -> CMP + MH4  AGO -> CMP + CMP -> CMP -> CMP + CMP ->	Nucleotide Salvage Pathway	SPBC1198.02 SPAC23A1.03 SPCC338.14 SPBC1198.02 SPAC17G8.02 SPAC4G9.03 SPAC4G9.03 SPAC4G9.03 SPCC70.07c SPAC24B11.05 SPC162.11c SPBC1683.02 SPBC1198.02 SPAC1805.16c SPBC2G2.13c SPAC1805.16c SPAC1805.16c SPAC1768.02 SPAC1805.16c SPAC1768.02 SPAC1805.16c SPAC1768.02 SPAC1805.16c SPAC1768.02 SPAC23C11.13c SPAC23C11.13c SPAC4G9.03	2.4.2.7 2.7.1.20 3.5.4.4 2.7.4.3 2.7.4.3 2.7.4.9 2.7.1.48 3.5.4.4 2.4.2.1 3.5.4.5 2.4.2.1 2.4.2.1 3.1.3 2.4.2.1 3.5.4.4 2.4.2.1 3.5.4.2 2.4.2.1 2.4.2.1 3.5.4.3 2.7.4.3

ATP maintenance requirement	Cytosol	$ATP + H2O \rightarrow ADP + H + Pi$	Nucleotide Salvage Pathway		
CMP nucleosidase	Cytosol	$CMP + H2O \rightarrow csn + R5P$	Nucleotide Salvage Pathway		
cytidine kinase (GTP)	Cytosol	$cytd + GTP \rightarrow CMP + GDP + H$	Nucleotide Salvage Pathway	SPCC162.11c	2.7.1.48
cytidylate kinase (CMP)	Cytosol	ATP + CMP <-> ADP + CDP	Nucleotide Salvage Pathway		
cytidylate kinase (dCMP)	Cytosol	ATP + dCMP <-> ADP + dCDP	Nucleotide Salvage Pathway		
Deoxyadenosine deaminase	Cytosol	$dad-2 + H + H2O \rightarrow din + NH4$	Nucleotide Salvage Pathway	SPBC1683.02 SPBC1198.02	3.5.4.4
deoxyadenylate kinase	Cytosol	ATP + dAMP <>> ADP + dADP	Nucleotide Salvage Pathway	SI BC1170.02	
dCTP deaminase	Cytosol	dCTP + H + H2O -> dUTP + NH4	Nucleotide Salvage Pathway	SPBC2G2.13c	3.5.4.12
deoxycytidine deaminase	Cytosol	$dcyt + H + H2O \rightarrow dURI + NH4$	Nucleotide Salvage Pathway	SPAC1556.04c	3.5.4.5
dTMP kinase	Cytosol	ATP + dTMP <-> ADP + dTDP	Nucleotide Salvage Pathway	SPCC70.07c	2.7.4.9
gnnuc	Cytosol	GSN + H2O -> GUA + rib-D	Nucleotide Salvage Pathway	SPAC17G8.02	
guanosine kinase	Cytosol	$ATP + GSN \rightarrow ADP + GMP + H$	Nucleotide Salvage Pathway		
guanine deaminase	Cytosol	GUA + H + H2O -> NH4 + XAN	Nucleotide Salvage Pathway	SPCC1672.03c	3.5.4.3
guanine phosphoribosyltransferase	Cytosol	$GUA + PRPP \rightarrow GMP + PPi$	Nucleotide Salvage Pathway	SPAC23C11.13c	
hypoxanthine phosphoribosyltransferase (Hypoxanthine)	Cytosol	$HXAN + PRPP \Rightarrow IMP + PPi$	Nucleotide Salvage Pathway	SPAC23C11.13c	
insosine kinase	Cytosol	ATP + INS -> ADP + H + IMP	Nucleotide Salvage Pathway		
nucleoside-diphosphatase (GDP)	Golgi apparatus	$GDP + H2O \Rightarrow GMP + H + Pi$	Nucleotide Salvage Pathway	SPAC824.08	
nucleoside-diphosphatase (dGDP)	Cytosol	$dGDP + H2O \Rightarrow dGMP + H + Pi$	Nucleotide Salvage Pathway		
nucleoside-diphosphate kinase (ATP:GDP)	Cytosol	ATP + GDP <-> ADP + GTP	Nucleotide Salvage Pathway	SPAC806.07	2.7.4.6
nucleoside-diphosphate kinase (ATP:UDP)	Cytosol	ATP + UDP < > ADP + UTP	Nucleotide Salvage Pathway	SPAC806.07	2.7.4.6
nucleoside-diphosphate kinase (ATP:CDP)	Cytosol	ATP + CDP <-> ADP + CTP	Nucleotide Salvage Pathway	SPAC806.07	2.7.4.6
nucleoside-diphosphate kinase (ATP:dTDP)	Cytosol	ATP + dTDP <> ADP + dTTP	Nucleotide Salvage Pathway	SPAC806.07	2.7.4.6
nucleoside-diphosphate kinase (ATP:dGDP)	Cytosol	ATP + dGDP <-> ADP + dGTP	Nucleotide Salvage Pathway		2.7.4.6
nucleoside-diphosphate kinase (ATP:dUDP)	Cytosol	ATP + dUDP <-> ADP + dUTP	Nucleotide Salvage Pathway	SPAC806.07	2.7.4.6
nucleoside-diphosphate kinase (ATP:dCDP)	Cytosol	ATP + dCDP <> ADP + dCTP	Nucleotide Salvage Pathway		2.7.4.6
nucleoside-diphosphate kinase (ATP:dADP)	Cytosol	ATP + dADP <-> ADP + dATP	Nucleotide Salvage Pathway	SPAC806.07	2.7.4.6
nucleoside-diphosphate kinase (ATP:IDP)	Cytosol	ATP + IDP <-> ADP + ITP	Nucleotide Salvage Pathway	SPAC806.07	2.7.4.6
5'-nucleotidase (dUMP)	Cytosol	dUMP + H2O -> dURI + Pi	Nucleotide Salvage Pathway		
5'-nucleotidase (XMP)	Cytosol	XMP + H2O -> xtsn + Pi	Nucleotide Salvage Pathway	SDBC30D10.03	3.1.3
5'-nucleotidase (IMP) 5'-nucleotidase (UMP)	Cytosol Cytosol	H2O + IMP -> INS + Pi H2O + UMP -> Pi + URI	Nucleotide Salvage Pathway Nucleotide Salvage Pathway	SPBC30D10.03c SPAC24B11.05	J.1.3
5-nucleotidase (UMP) 5'-nucleotidase (dCMP)	Cytosol	$dCMP + H2O \Rightarrow dcyt + Pi$	Nucleotide Salvage Pathway  Nucleotide Salvage Pathway	51 AC24D11.03	
5'-nucleotidase (CMP)	Cytosol	CMP + H2O -> cytd + Pi	Nucleotide Salvage Pathway	SPAC24B11.05	
5'-nucleotidase (dTMP)	Cytosol	dTMP + H2O -> Pi + THYMD	Nucleotide Salvage Pathway	5111021511.05	
5'-nucleotidase (dAMP)	Cytosol	dAMP + H2O -> dad-2 + Pi	Nucleotide Salvage Pathway		
5'-nucleotidase (AMP)	Cytosol	AMP + H2O -> ADN + Pi	Nucleotide Salvage Pathway		
5'-nucleotidase (dGMP)	Cytosol	$dGMP + H2O \rightarrow dGSN + Pi$	Nucleotide Salvage Pathway		
5'-nucleotidase (GMP)	Cytosol	$GMP + H2O \Rightarrow GSN + Pi$	Nucleotide Salvage Pathway		
nucleoside-triphosphatase (GTP)	Cytosol	$GTP + H2O \Rightarrow GDP + H + Pi$	Nucleotide Salvage Pathway		
nucleoside-triphosphatase (dGTP)	Cytosol	$dGTP + H2O \rightarrow dGDP + H + Pi$	Nucleotide Salvage Pathway		
pURIne-nucleoside phosphorylase (Adenosine)	Cytosol	ADN + Pi <-> ADE + r1p	Nucleotide Salvage Pathway	SPAC1805.16c	2.4.2.1
pURIne-nucleoside phosphorylase (Deoxyadenosine)	Cytosol	dad-2 + Pi <-> 2drlp + ADE	Nucleotide Salvage Pathway	SPAC1805.16c	2.4.2.1
pURIne-nucleoside phosphorylase (Guanosine)	Cytosol	GSN + Pi <-> GUA + rlp	Nucleotide Salvage Pathway	SPAC1805.16c	2.4.2.1
pURIne-nucleoside phosphorylase	=	·	Nucleotide Salvage Pathway		
(Deoxyguanosine)	Cytosol	$dGSN + Pi \Longleftrightarrow 2dr1p + GUA$		SPAC1805.16c	2.4.2.1
pURIne-nucleoside phosphorylase (Inosine)	Cytosol	INS + Pi <-> HXAN + rlp	Nucleotide Salvage Pathway	SPAC1805.16c	2.4.2.1
pURIne-nucleoside phosphorylase (Deoxyinosine)		din + Pi <-> 2drlp + HXAN	Nucleotide Salvage Pathway	SPAC1805.16c	2.4.2.1
pURIne-nucleoside phosphorylase (Xanthosine)	Cytosol	Pi + xtsn <-> rlp + XAN	Nucleotide Salvage Pathway	SPAC1805.16c	2.4.2.1
pyrimidine-nucleoside phosphorylase (uracil)	Cytosol	Pi + URI <-> rlp + ura	Nucleotide Salvage Pathway	SPAC7D4.07c	
ribonucleoside-diphosphate reductase (ADP)	Cytosol	$ADP + TRDrd \rightarrow dADP + H2O + TRDox$	Nucleotide Salvage Pathway	SPBC25D12.04+SPAC1F	
				7.05	
ribonucleoside-diphosphate reductase	Nucleus	ADP + TRDrd -> dADP + H2O + TRDox	Nucleotide Salvage Pathway	SPAC7D4.07c SPBC25D12.04+SPAC1F	
				7.05	
ribonuslassida direbondota radustasa (CDD)	Cutanal	CDB : TBD-d > dCDB : H2O : TBD-av	Nucleatide Calman Dathman	SPAC7D4.07c SPBC25D12.04+SPAC1F	
ribonucleoside-diphosphate reductase (GDP)	Cytosol	$GDP + TRDrd \rightarrow dGDP + H2O + TRDox$	Nucleotide Salvage Pathway	7.05	
				SPAC7D4.07c	
ribonucleoside-diphosphate reductase (GDP)	Nucleus	GDP + TRDrd >> dGDP + H2O + TRDox	Nucleotide Salvage Pathway	SPBC25D12.04+SPAC1F 7.05	
				7.05 SPAC7D4.07c	
ribonucleoside-diphosphate reductase (CDP)	Cytosol	$CDP + TRDrd \rightarrow dCDP + H2O + TRDox$	Nucleotide Salvage Pathway	SPBC25D12.04+SPAC1F	
				7.05 SPAC7D4.07c	
ribonucleoside-diphosphate reductase (CDP)	Nucleus	CDP + TRDrd -> dCDP + H2O + TRDox	Nucleotide Salvage Pathway	SPBC25D12.04+SPAC1F	
'			= *	7.05	
ribonucleoside-diphosphate reductase (UDP)	Cytosol	UDP + TRDrd -> dUDP + H2O + TRDox	Nucleotide Salvage Pathway	SPAC7D4.07c SPBC25D12.04+SPAC1F	
	J <del></del>			7.05	
ribonucleoside-dinhocobata radicateos (UDD)	Nucleue	IIDP + TPDrd -> dIIDP + U2O + TPDov	Nucleotide Solvens Dath	SPAC7D4.07c SPBC25D12.04+SPAC1F	
ribonucleoside-diphosphate reductase (UDP)	Nucleus	UDP + TRDrd -> dUDP + H2O + TRDox	Nucleotide Salvage Pathway	SPBC25D12.04+SPAC1F 7.05	
ribonucleoside-triphosphate reductase (ATP)	Cytosol	ATP + TRDrd -> dATP + H2O + TRDox	Nucleotide Salvage Pathway	SPAC7D4.07c	
ribonucleoside-triphosphate reductase (GTP)	Cytosol	GTP + TRDrd -> dGTP + H2O + TRDox	Nucleotide Salvage Pathway	SPAC7D4.07c	
ribonucleoside-triphosphate reductase (CTP)	Cytosol	CTP + TRDrd -> dCTP + H2O + TRDox	Nucleotide Salvage Pathway	SPAC7D4.07c	
ribonucleoside-triphosphate reductase (UTP)	Cytosol	$UTP + TRDrd \rightarrow dUTP + H2O + TRDox$	Nucleotide Salvage Pathway	SPAC7D4.07c	
UMP kinase	Cytosol	ATP + UMP <-> ADP + UDP	Nucleotide Salvage Pathway	SPCC1795.05c	
UMP kinase	Nucleus	ATP + UMP <-> ADP + UDP	Nucleotide Salvage Pathway	SPCC1795.05c	
URIdylate kinase (dUMP)	Cytosol	ATP + dUMP <-> ADP + dUDP	Nucleotide Salvage Pathway	SPCC1795.05c	
URIdylate kinase (dUMP)	Nucleus	ATP + dUMP <-> ADP + dUDP	Nucleotide Salvage Pathway	SPCC1795.05c	
	Cytosol	2 H2O + UTP -> 2 H + 2 Pi + UMP	Nucleotide Salvage Pathway	SPCC11E10.05c	
UTP diphosphohydrolase		$PRPP + XAN \Rightarrow PPi + XMP$	Nucleotide Salvage Pathway	SPAC23C11.13c	
xanthine phosphoribosyltransferase	Cytosol		0.1	an commercial	
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase	Cytosol	23cAMP + H + H2O -> AMP2P	Other	SPACUNK4.15	
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase 2-deoxyglucose-6-phosphatase	Cytosol Cytosol	$23cAMP + H + H2O \rightarrow AMP2P$ $2doxG6P + H2O \rightarrow 2dGLC + Pi$	Other		
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase	Cytosol	23cAMP + H + H2O -> AMP2P		SPACUNK4.15 SPAC25B8.09 SPAC25B8.10	
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase 2-deoxyglucose-6-phosphatase	Cytosol Cytosol	$23cAMP + H + H2O \rightarrow AMP2P$ $2doxG6P + H2O \rightarrow 2dGLC + Pi$	Other	SPAC25B8.09	
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase 2-deoxyglucose-6-phosphatase trans-aconitate 3-methyltransferase HCO3 equilibration reaction HCO3 equilibration reaction	Cytosol Cytosol Cytosol Cytosol Mitochondria	23cAMP + H + H2O -> AMP2P 2doxG6P + H2O -> 2dGLC + Pi acon-T + SAM -> acon5m + SAH CO2 + H2O <>> H + HCO3 CO2 + H2O <>> H + HCO3	Other Other Other Other	SPAC25B8.09	
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase 2-deoxyglucose-6-phosphatase trans-aconitate 3-methyltransferase HCO3 equilibration reaction	Cytosol Cytosol Cytosol	23cAMP + H + H2O -> AMP2P $2doxG6P + H2O -> 2dGLC + Pi$ $acon-T + SAM -> acon5m + SAH$ $CO2 + H2O <> H + HCO3$	Other Other	SPAC25B8.09 SPAC25B8.10	
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase 2-deoxyglucose-6-phosphatase trans-aconitate 3-methyltransferase HCO3 equilibration reaction HCO3 equilibration reaction	Cytosol Cytosol Cytosol Cytosol Mitochondria	23cAMP + H + H2O -> AMP2P 2doxG6P + H2O -> 2dGLC + Pi acon-T + SAM -> acon5m + SAH CO2 + H2O <>> H + HCO3 CO2 + H2O <>> H + HCO3	Other Other Other Other	SPAC25B8.09 SPAC25B8.10 SPCC576.03c	
xanthine phosphoribosyltransferase ADP-ribose 2,3-cyclic phosphodiesterase 2-deoxyglucose-6-phosphatase trans-aconitate 3-methyltransferase HCO3 equilibration reaction HCO3 equilibration reaction HCO3 equilibration reaction	Cytosol Cytosol Cytosol Cytosol Mitochondria Nucleus	23cAMP + H + H2O -> AMP2P 2doxG6P + H2O -> 2dGLC + Pi acon-T + SAM -> acon5m + SAH CO2 + H2O <>> H + HCO3 CO2 + H2O <> H + HCO3 CO2 + H2O <> H + HCO3	Other Other Other Other Other Other	SPAC25B8.09 SPAC25B8.10	

				SPAC7D4.07c	
Thioredoxin	Nucleus	H2O2 + TRDrd -> 2 H2O + TRDox	Other	SPBC1773.02c SPAC7D4.07c	
hydrogen peroxide reductase (thioredoxin)	Peroxisome	H2O2 + TRDrd <-> 2 H2O + TRDox	Other	SPCC330.06c	
Aminobutyraldehyde dehydrogenase, cytoplasm	Cytosol	$4abutn + H2O + NAD \rightarrow 4abut + 2 H + NADH$	Other Amino Acid Metabolism	SPAC9E9.09c	1.2.1.3
Aminobutyraldehyde dehydrogenase	Golgi apparatus	4abutn + H2O + NAD -> 4abut + 2 H + NADH	Other Amino Acid Metabolism	SPAC9E9.09c	1.2.1.3
Peptide alpha-N-acetyltransferase nitrilase	Mitochondria Mitochondria	ACCoA + PEPD -> APEP + CoA + H acybut + 2 H2O -> GLU + NH4	Other Amino Acid Metabolism Other Amino Acid Metabolism	SPBC106.07c SPAC26A3.11	
nitrilase	Mitochondria	aprop + 2 H2O -> ALA + NH4	Other Amino Acid Metabolism	SPAC26A3.11	
glutathione peridoxase	Nucleus	2 GTHrd + H2O2 <-> GTHox + 2 H2O	Other Amino Acid Metabolism	SPAC4F10.20	1.11.1.9
Aminobutyraldehyde dehydrogenase	Nucleus	4abutn + H2O + NAD -> 4abut + 2 H + NADH	Other Amino Acid Metabolism	SPBC32F12.03c SPAC9E9.09c	1.2.1.3
nitrilase	Nucleus	acybut + 2 H2O -> GLU + NH4	Other Amino Acid Metabolism	SPBC651.02 SPCC965.09	1.2.1.5
nitrilase	Nucleus	aprop + 2 H2O -> ALA + NH4	Other Amino Acid Metabolism	SPBC651.02 SPCC965.09	
gamma-glutamylcysteine synthetase	Nucleus	ATP + CYS + GLU -> ADP + GLUcys + H + Pi	Other Amino Acid Metabolism	SPAC22F3.10c	6.3.2.2
4-acetamidobutyrate deacetylase	Cytosol	4aabutn + H2O -> 4abut + ac	Other Amino Acid Metabolism		
Aminobutyraldehyde dehydrogenase N-acetylputrescine: oxygen oxireductase	Mitochondria	4abutn + H2O + NAD -> 4abut + 2 H + NADH	Other Amino Acid Metabolism	SPAC9E9.09c	1.2.1.3
(deaminating)	Cytosol	aprut + H2O + O2 -> H2O2 + n4abutn + NH4	Other Amino Acid Metabolism		
glycylpeptide N-tetradecanoyltransferase	Cytosol	$glp + C140CoA \rightarrow CoA + tglp$	Other Amino Acid Metabolism	SPBC2G2.11	2.3.1.9
gamma-glutamylcysteine synthetase	Cytosol	ATP + CYS + GLU -> ADP + GLUcys + H + Pi	Other Amino Acid Metabolism	SPAC22F3.10c SPBC17A3.07	6.3.2.2
glutathione oxidoreductase	Cytosol	$GTHox + H + NADPH >> 2 \ GTHrd + NADP$	Other Amino Acid Metabolism	SPAC4F10.20	1.8.1.7
				SPBC26H8.06 SPAC4F10.20	
glutathione peridoxase	Cytosol	2 GTHrd + H2O2 <-> GTHox + 2 H2O	Other Amino Acid Metabolism	SPBC32F12.03c	1.11.1.9
glutathione synthetase	Cytosol	ATP + GLUcys + GLY -> ADP + GTHrd + H + Pi	Other Amino Acid Metabolism	SPAC3F10.04	
N4-Acetylaminobutanal:NAD+ oxidoreductase	Cytosol	H2O + n4abutn + NAD -> 4aabutn + 2 H + NADH	Other Amino Acid Metabolism	SPBC651.02 SPCC965.09	1 .2.1.3
nitrilase	Cytosol	aprop + 2 H2O -> ALA + NH4	Other Amino Acid Metabolism	SPAC26A3.11	
nitrilase	Cytosol	acybut + 2 H2O -> GLU + NH4	Other Amino Acid Metabolism	SPBC651.02 SPCC965.09 SPAC26A3.11	
				SPAC222.12c	
				SPAC14C4.14 SPBC1734.13	
				SPCC1840.06 SPBC13E7.04	
				SPBC31F10.15c	
				ScpofMp09 ScpofMp06 SPBC1604.07 ScpofMp08	
				SPBC29A10.13	
ATP synthase	Mitochondria	ADP[m] + 3 H[c] + Pi[m] -> ATP[m] + 2 H[m] + H2O[m]	Oxidative Phosphorylation	SPBC1604.11 SPAC23C4.11	3.6.3.14 3.6.3.6
711 Synthase	Witocholdila	ADT [m] + 3 H[e] + H[m] +> ATT [m] + 2 H[m] + H2O[m]	Oxidative i nospilorylation	SPAC343.05	3.6.1.1
				SPAC637.05c SPAPB2B4.05	
				SPCC965.03	
				SPAC11E3.07 SPBC3B9.18c	
				SPBC1289.05c	
				SPAC16E8.07c SPAC17A2.03c	
				SPAC7D4 10	
Cytochrome c peroxidase	Mitochondria	2 focyte + H2O2 -> 2 ficyte + 2 H2O	Oxidative Phosphorylation	SPCC191.07 SPBC365.02c ScpofMp01	
				ScpofMp10 SPCC338.10c	
				SPAC1B2.04 SPAC1296.02	
				SPCC1739.09c	
cytochrome c oxidase	Mitochondria	4 focytc[m] + 6 H[m] + O2[m] -> 4 ficytc[m] + 6 H[c] + 2 H2O[m]	Oxidative Phosphorylation	SPCC1442.08c SPCC1259.05c	1.9.3.1
				SPAC24C9.16c	
				SPAC1420.04c SPAC22E12.10c	
				SPBC26H8.14c	
				ScpofMp04	
				SPBC29A3.18 SPCC613.10	
ubiquinol-6 cytochrome c reductase	Mitochondria	$2\ ficytc[m] + 1.5\ H[m] + Q6H2[m] -> 2\ focytc[m] + 1.5\ H[c] + Q6[m]$	Oxidative Phosphorylation	SPBC16C6.08c	1.10.2.2
				SPCC737.02c SPAC1782.07	
				SPCC1682.01	
formate dehydrogenaseic/mitochondrial	Mitochondria	$for[c] + H[c] + Q6[m] \rightarrow CO2[c] + Q6H2[m]$	Oxidative Phosphorylation	CDDDATIUUS	1.2.1.2
fumarate reductase	Mitochondria	FADH2 + FUM -> fad + SUCC	Oxidative Phosphorylation	SPAC17A2.05	
fumarase fumarase	Cytosol Mitochondria	FUM + H2O <-> MAL FUM + H2O <-> MAL	Oxidative Phosphorylation Oxidative Phosphorylation	SPCC18.18c SPCC18.18c	4.2.1.2 4.2.1.2
malate dehydrogenase	Cytosol	MAL + NAD <-> H + NADH + OAA	Oxidative Phosphorylation Oxidative Phosphorylation	SPCC18.18C	4.2.1.2
malate dehydrogenase	Mitochondria	MAL + NAD <-> H + NADH + OAA	Oxidative Phosphorylation	SPCC306.08c	
malate dehydrogenase	Peroxisome	MAL + NAD <-> H + NADH + OAA	Oxidative Phosphorylation		
NADH dehydrogenaseic/mitochondrial		$H[c] + NADH[c] + Q6[m] \rightarrow NAD[c] + Q6H2[m]$	Oxidative Phosphorylation	SPAC3A11.07 SPBC947.15c	
NADH dehydrogenase	Mitochondria	H + NADH + Q6 -> NAD + Q6H2	Oxidative Phosphorylation	SPAC3A11.07	
				SPBC947.15c SPAC23C11.05	
inorganic diphosphatase	Cytosol	$H2O + PPi \rightarrow H + 2 Pi$	Oxidative Phosphorylation	SPAC3A12.02	
				SPCC330.12c SPBP23A10.16	
succinate dehydrogenase	Mitochondria	fad + SUCC <-> FADH2 + FUM	Oxidative Phosphorylation	SPAC1556.02c	1.3.5.1
succinate dehydrogenase (ubiquinone-6)	Mitochondria	FADH2 + Q6 <-> fad + Q6H2	Oxidative Phosphorylation	SPAC140.01	
3-methyl-2-oxobutanoate				SDAC5III0.00	21211
hydroxymethyltransferase, mitochrondria	Mitochondria	3MOB + H2O + MLTHF -> 2DHP + THF	Pantothenate and CoA Biosynthesis	SPAC5H10.09c	2.1.2.11
CoA hydrolase biotin synthase	Mitochondria Mitochondria	$CoA + H2O \rightarrow 2 H + pan4p + PAP$ $dtbt + s \leftrightarrow btn + 2 H$	Pantothenate and CoA Biosynthesis Pantothenate and CoA Biosynthesis	SPAC6G9.05 SPCC1235.02	2.8.1.6
2-dehydropantoate 2-reductase	Nucleus	atot + s <-> otn + 2 H $2DHP + H + NADPH -> NADP + pant-R$	Pantothenate and CoA Biosynthesis	SPBPB2B2.09c	1.1.1.169
pantothenate synthase	Nucleus	ala-B + ATP + pant-R -> AMP + H + pnto-R + PPi	Pantothenate and CoA Biosynthesis	SPAC5H10.08c	6.3.2.1
aldehyde dehydrogenase (3-aminopropanal, NAD)	) Nucleus	aproa + H2O + NAD >> ala-B + 2 H + NADH	Pantothenate and CoA Biosynthesis	SPAC922.07c	1.2.1.5
aldehyde dehydrogenase (3-aminopropanal, NAD)	) Cytosol	aproa + H2O + NAD -> ala-B + 2 H + NADH	Pantothenate and CoA Biosynthesis	SPAC922.07c	1.2.1.5
					6.3.4.9,
		ATTENDED TO LANCE TO		app.cac=	6.3.4.10,
biotin-[acetyl-CoA-carboxylase] ligase	Cytosol	ATP + btn + H -> btAMP + PPi	Pantothenate and CoA Biosynthesis	SPBC30D10.07c	6.3.4.10, 6.3.4.11,
	Cytosol  Peroxisome	$ATP + btn + H \rightarrow btAMP + PPi$ $CoA + H2O \rightarrow 2H + pan4p + PAP$	Pantothenate and CoA Biosynthesis  Pantothenate and CoA Biosynthesis	SPBC30D10.07c SPAC6G9.05	6.3.4.10,
biotin-[acetyl-CoA-carboxylase] ligase  CoA hydrolase dephospho-CoA kinase			·		6.3.4.10, 6.3.4.11,

dephospho-CoA kinase	Mitochondria	$ATP + dpCoA \rightarrow ADP + CoA + H$	Pantothenate and CoA Biosynthesis		
2-dehydropantoate 2-reductase	Cytosol	2DHP + H + NADPH -> NADP + pant-R	Pantothenate and CoA Biosynthesis	SPBPB2B2.09c	1.1.1.169
pantothenate synthase	Cytosol	$ala\text{-}B + ATP + pant\text{-}R -\!\!> AMP + H + pnto\text{-}R + PPi$	Pantothenate and CoA Biosynthesis	SPAC5H10.08c	6.3.2.1
polyamine oxidase	Cytosol	N1aspmd + $H2O + O2 -> aproa + aprut + H2O2$	Pantothenate and CoA Biosynthesis		
poylamine oxidase	Cytosol	$N1sprm + H2O + O2 \rightarrow N1aspmd + aproa + H2O2$	Pantothenate and CoA Biosynthesis		
poylamine oxidase	Cytosol	$H2O + O2 + sprm \rightarrow aproa + H2O2 + spmd$	Pantothenate and CoA Biosynthesis		
phosphopantothenoylcysteine decarboxylase	Cytosol	4ppcys + H -> CO2 + pan4p	Pantothenate and CoA Biosynthesis		
phosphopantothenate-cysteine ligase	Cytosol	4ppan + CTP + CYS -> 4ppcys + CMP + H + PPi	Pantothenate and CoA Biosynthesis		
pantetheine-phosphate adenylyltransferase	Cytosol	$ATP + H + pan4p \rightarrow dpCoA + PPi$	Pantothenate and CoA Biosynthesis		
panthetheine-phosphate adenylyltransferase	Mitochondria	ATP + H + pan4p -> dpCoA + PPi	Pantothenate and CoA Biosynthesis	appace to	
phosphogluconate dehydrogenase	Mitochondria	6pgc + NADP -> CO2 + NADPH + ru5p-D	Pentose Phosphate Pathway Pentose Phosphate Pathway	SPBC660.16	1.1.1.44 3.1.1.31
6-phosphogluconolactonase Deoxyribokinase	Nucleus Nucleus	6pgl + H2O -> 6pgc + H ATP + drib -> 2dR5P + ADP + H	Pentose Phosphate Pathway  Pentose Phosphate Pathway	SPCC16C4.10 SPBC16G5.02c	3.1.1.31
ribokinase	Nucleus	ATP + rib-D -> ADP + H + R5P	Pentose Phosphate Pathway	SPBC16G5.02c	2.7.1.15
transketolase	Nucleus	E4P + xu5p-D <-> F6P + G3P	Pentose Phosphate Pathway	SPBC2G5.05	2.2.1.1
		•		SPBC32F12.10	
phosphoglucomutase	Nucleus	g1p <-> G6P	Pentose Phosphate Pathway	SPCC1840.05c SPBC32F12.10	5.4.2.2
phosphopentomutase	Nucleus	r1p <-> R5P	Pentose Phosphate Pathway	SPCC1840.05c	5.4.2.2
transketolase	Nucleus	R5P + xu5p-D <-> G3P + s7p	Pentose Phosphate Pathway	SPBC2G5.05	2.2.1.1
ribulose 5-phosphate 3-ePimerase	Nucleus	ru5p-D <-> xu5p-D	Pentose Phosphate Pathway	SPAC31G5.05c	5.1.3.1
Deoxyribokinase	Cytosol	$ATP + drib \Rightarrow 2dR5P + ADP + H$	Pentose Phosphate Pathway	SPBC16G5.02c	
glucose 6-phosphate dehydrogenase	Cytosol	G6P + NADP -> 6pgl + H + NADPH	Pentose Phosphate Pathway	SPCC794.01c SPAC3C7.13c	1.1.1.49
				SPAC3A12.18	
phosphogluconate dehydrogenase	Cytosol	6pgc + NADP -> CO2 + NADPH + ru5p-D	Pentose Phosphate Pathway	SPBC660.16	1.1.1.44
6-phosphogluconolactonase	Cytosol	6pgl + H2O -> 6pgc + H	Pentose Phosphate Pathway	SPCC16C4.10 SPBC32F12.10	3.1.1.31
phosphoglucomutase	Cytosol	$g1p \Leftrightarrow G6P$	Pentose Phosphate Pathway	SPCC1840.05c	5.4.2.2
phosphopentomutase	Cytosol	r1p <-> R5P	Pentose Phosphate Pathway	SPBC32F12.10 SPCC1840.05c	5.4.2.2
ribokinase	Cytosol	$ATP + rib - D \rightarrow ADP + H + R5P$	Pentose Phosphate Pathway	SPBC16G5.02c	2.7.1.15
ribulose 5-phosphate 3-ePimerase	Cytosol	ru5p-D <-> xu5p-D	Pentose Phosphate Pathway	SPAC31G5.05c	5.1.3.1
ribose-5-phosphate isomerase	Cytosol	R5P <-> ru5p-D	Pentose Phosphate Pathway	SPAC144.12	5.3.1.6
transaldolase	Cytosol	G3P + s7p <-> E4P + F6P	Pentose Phosphate Pathway	SPCC1020.06c	2.2.1.2
transketolase	Cytosol	R5P + xu5p-D <-> G3P + s7p	Pentose Phosphate Pathway	SPBC2G5.05	2.2.1.1
transketolase	Cytosol	E4P + xu5p-D <-> F6P + G3P	Pentose Phosphate Pathway	SPBC2G5.05	2.2.1.1
acyldihydroxyacetonephosphate reductase	Cytosol	1aGLY3p + H + NADPH -> 1AG3P + NADP	Phospholipid Biosynthesis	SPAC23D3.11	
1-Acyl-glycerol-3-phosphate acyltransferase	Cytosol	0.01 1AG3P + 0.02 C100CoA + 0.06 C120CoA + 0.17 C161CoA + 0.09 C182CoA + 0.24 C181CoA + 0.27 C160CoA + 0.05 C180CoA + 0.1	Phospholipid Biosynthesis	SPAC1851.02	
CDP-diacylglycerolserine O-	Mitochondria	C140CoA -> CoA + 0.01 pa CDPdag + GLYC3p <-> CMP + H + pgp	Phospholipid Biosynthesis	SPBP18G5.02	2.7.8.5
phosphatidyltransferae					2.7.6.3
choline phosphate cytididyltransferase	Cytosol	CHOLp + CTP + H -> CDPCHOL + PPi	Phospholipid Biosynthesis	SPCC1827.02c	
Choline kinase	Cytosol	ATP + CHOL -> ADP + CHOLp + H	Phospholipid Biosynthesis	SPAC13G7.12c	
diacylglycerol pyrophosphate phosphatase CDP-Diacylglycerol synthetase	Cytosol Cytosol	H2O + 0.01 pa -> 0.01 12dgr + Pi CTP + H + 0.01 pa <-> 0.01 CDPdag + PPi	Phospholipid Biosynthesis Phospholipid Biosynthesis	SPBC409.18 SPBC13A2.03	
CDP-Diacylglycerol synthetase	Mitochondria	CTP + H + 0.01 pa <>> 0.01 CDPdag + PPi	Phospholipid Biosynthesis	SPBC13A2.03	
Ethanolamine kinase	Cytosol	ATP + etHa -> ADP + etHAMP + H	Phospholipid Biosynthesis	SPAC13G7.12c	
Ethanolaminephosphotransferase	Cytosol	0.01 12dgr + CDPEA <-> CMP + H + 0.01 pe	Phospholipid Biosynthesis	SPAC22A12.10	
glycerol 3-phosphate acyltransferase (glycerol 3- phosphate)	Cytosol	0.02 C100CoA + 0.06 C120CoA + GLYC3p + 0.17 C161CoA + 0.09 C182CoA + 0.24 C181CoA + 0.27 C160CoA + 0.05 C180CoA + 0.1	Phospholipid Biosynthesis	SPBC1718.04	
glycerol 3-phosphate acyltransferase (glycerone	Cytosol	C140CoA -> 0.01 1AG3P + CoA 0.02 C100CoA + 0.06 C120CoA + DHAP + 0.17 C161CoA + 0.09 C182CoA + 0.24 C181CoA + 0.27 C160CoA + 0.05 C180CoA + 0.1	Phospholipid Biosynthesis	SPBC1718.04	
phosphate)  Lyso-phosphatidylcholine acyltransferase	Cytosol	C140CoA -> 0.01 1aGLY3p + CoA 0.01 1agpc + 0.02 C100CoA + 0.06 C120CoA + 0.17 C161CoA + 0.09 C182CoA + 0.24 C181CoA + 0.27 C160CoA + 0.05 C180CoA + 0.1	Phospholipid Biosynthesis		
acyltransferase	-	C140CoA -> CoA + 0.01 pc		apparent to	
liPid phosphate phosphatase	Cytosol	0.01 dagpy + H2O -> H + 0.01 pa + Pi	Phospholipid Biosynthesis	SPBC409.18	
methylene-fatty-acyl-phospholiPid synthase inositol-1,3,4,5,6-pentakisphosphate 2-kinase	Cytosol Nucleus	SAM $+$ 0.01 ptdmeeta $->$ SAH $+$ H $+$ 0.01 ptd2meeta ATP $+$ mi13456p $->$ ADP $+$ H $+$ minoHp	Phospholipid Biosynthesis Phospholipid Biosynthesis	SPBC337.16 SPCC4B3.10c	
inositol-1,3,4,5-triphosphate 6-kinase	Nucleus	ATP + mi1343op -> ADP + H + mi104p ATP + mi1345p -> ADP + H + mi13456p	Phospholipid Biosynthesis	SPAC607.04	
inositol-1,4,5,6- tetrakisphosphate 3-kinase	Nucleus	ATP + mi1456p -> ADP + H + mi13456p	Phospholipid Biosynthesis	SPAC607.04	
inositol-1,4,5-triphosphate 6-kinase	Nucleus	ATP + mi145p -> ADP + H + mi1456p	Phospholipid Biosynthesis	SPAC607.04	
inositol-1,4,5-trisphosphate 3-kinase	Nucleus	ATP + mi145p -> ADP + H + mi1345p	Phospholipid Biosynthesis	SPAC607.04	
myo-inositol 1-phosphatase	Cytosol	H2O + milp-D -> inost + Pi	Phospholipid Biosynthesis		
myo-Inositol-1-phosphate synthase	Cytosol	G6P -> mi1p-D	Phospholipid Biosynthesis		
phosphatidate kinase	Cytosol	$ATP + 0.01 \ pa >> ADP + 0.01 \ dagpy$	Phospholipid Biosynthesis		
phosphoethanolamine cytidyltransferase	Cytosol	$CTP + etHAMP + H \rightarrow CDPEA + PPi$	Phospholipid Biosynthesis	SPAC15E1.05c	
phosphatidylethanolamine N-methyltransferase	Cytosol	SAM + 0.01 pe -> $SAH + H + 0.01$ ptdmeeta	Phospholipid Biosynthesis	SPBC26H8.03	
Cho2 phosphatidylglycerol phosphate phosphatase A	Mitochondria	H2O + pgp -> pg + Pi	Phospholipid Biosynthesis		3.1.3.27
phosphatidyigiyeeror phosphate phosphatase A	Mitochondria	pg + CDPdag -> cl + CMP	Phospholipid Biosynthesis		3.1.3.27
1-phosphatidylinositol-3,5-bisphosphate 5-		W00 001 11071 Pr 2 2 2 2		SPAC3C7.01c	
phosphatase	Cytosol	H2O + 0.01 ptd135bp -> Pi + 0.01 ptd3ino	Phospholipid Biosynthesis	SPBC19F5.03 SPAC9G1.10c	2.7.1.150
phosphatidylinositol-3-phosphate 4-kinase	Cytosol	ATP + 0.01  ptd3ino -> ADP + H + 0.01  ptd134bp	Phospholipid Biosynthesis		
phosphatidylinositol-3-phosphate 5-kinase	Cytosol	ATP + 0.01 ptd3ino -> ADP + H + 0.01 ptd135bp	Phospholipid Biosynthesis	SPBC3E7.01	
1-phosphatidylinositol-4,5-bisphosphate 5-	Cytosol	H2O + 0.01 ptd145bp -> Pi + 0.01 ptd4ino	Phospholipid Biosynthesis	SPBC2G2.02	2.7.1.68
phosphatase 1-phosphatidylinositol-4,5-bisphosphate				SPBC577.13	
phosphodiesterase	Cytosol	$H2O + 0.01 \text{ ptd} 145\text{bp} \rightarrow 0.01 12\text{dgr} + H + mi145p$	Phospholipid Biosynthesis	SPAC22F8.11	
phosphatidylinositol-4-phosphate 5-kinase	Cytosol	$ATP + 0.01\ ptd4ino \rightarrow ADP + H + 0.01\ ptd145bp$	Phospholipid Biosynthesis	SPAC19G12.14	
1-phosphatidylinositol 3-kinase	Cytosol	$ATP + 0.01\ ptd1ino \rightarrow ADP + H + 0.01\ ptd3ino$	Phospholipid Biosynthesis	SPBC216.07c SPBC30D10.10C	
phosphatidylinositol 4-kinase	Cytosol	ATP + 0.01 ptd1ino -> ADP + H + 0.01 ptd4ino	Phospholipid Biosynthesis	SPAC22E12.16c SPBC577.06c	
phosphatidylinositol 4-kinase	Nucleus	ATP + 0.01 ptd1ino -> ADP + H + 0.01 ptd4ino	Phospholipid Biosynthesis	SPAC22E12.16c	
phosphatidylinositol synthase	Cytosol	0.01 CDPdag + inost -> CMP + H + 0.01 ptd1ino	Phospholipid Biosynthesis		
Phosphatidyl-N-methylethanolamine N-	Cytosol	SAM + 0.01 ptd2meeta -> SAH + H + 0.01 pc	Phospholipid Biosynthesis	SPBC337.16	
methyltransferase	.,			SPAC25B8.03	
phosphatidylserine decarboxylase	Golgi apparatus	H + 0.01 ps -> CO2 + 0.01 pe	Phospholipid Biosynthesis	SPBC16E9.18	
				SPAC31G5.15	
phosphatidylserine decarboxylase	Mitochondria	H + 0.01 ps -> CO2 + 0.01 pe	Phospholipid Biosynthesis	SPAC25B8.03 SPBC16E9.18	
				SPAC31G5.15	

phosphatidylserine decarboxylase	Vacuole	H + 0.01 ps -> CO2 + 0.01 pe	Phospholipid Biosynthesis	SPAC25B8.03 SPBC16E9.18	
phoenhatidulearina cunthaca	Cytosol	0.01 CDPdag + SER <-> CMP + H + 0.01 ps	Phospholipid Biosynthesis	SPAC31G5.15 SPCC1442.12	
phosphatidylserine synthase phosphatidylserine synthase	Mitochondria	0.01 CDPdag + SER <-> CMP + H + 0.01 ps 0.01 CDPdag + SER <-> CMP + H + 0.01 ps	Phospholipid Biosynthesis	SPCC1442.12 SPCC1442.12	
				SPAC1786.02	
phospholipase B (phosphatidylinositol)	Form all of the	H2O + 0.005 ptd1ino -> 0.02 C100 + 0.06 C120 + 0.5 G3Pi + H + 0.27	Physical Part I March - Parts	SPAC977.09C SPCC1450.09C	
(extracellular)	Extracellular	C160 + 0.17 C161 + 0.05 C180 + 0.24 C181 + 0.09 C182 + 0.1 C140	Phospholipid Metabolism	SPAC1A6.03C SPBC1348.10C	
				SPAC1A6.04C	
				SPAC1786.02 SPAC977.09C	
phospholipase B (phosphatidylcholine)	Cytosol	H2O + 0.005 pc -> 0.02 C100 + 0.06 C120 + 0.5 G3Pc + H + 0.27 C160	Phospholipid Metabolism	SPCC1450.09C	
		+ 0.17 C161 + 0.05 C180 + 0.24 C181 + 0.09 C182 + 0.1 C140		SPAC1A6.03C SPBC1348.10C	
				SPAC1A6.04C SPAC1786.02	
				SPAC977.09C	
phospholipase B (phosphatidylcholine) (extracellular)	Extracellular	H2O + 0.005 pc -> 0.02 C100 + 0.06 C120 + 0.5 G3Pc + H + 0.27 C160 + 0.17 C161 + 0.05 C180 + 0.24 C181 + 0.09 C182 + 0.1 C140	Phospholipid Metabolism	SPCC1450.09C SPAC1A6.03C	
				SPBC1348.10C SPAC1A6.04C	
phospholipase D	Cytosol	H2O + 0.01 pc -> CHOL + H + 0.01 pa	Phospholipid Metabolism	SPAC2F7.16c	
5-diphosphoinositol-1,2,3,4,6-pentakisphosphate diphosphohydrolase	Cytosol	H2O + ppmi12346p -> H + minoHp + Pi	Phospholipid Metabolism	SPAC13G6.14	
5-diphosphoinositol-1,2,3,4,6-pentakisphosphate	Cytosol	ATP + minoHp -> ADP + ppmi12346p	Phospholipid Metabolism	SPCC970.08	
synthase diphosphoinositol-1,3,4,6-tetrakisphosphate	•				
diphosphohydrolase	Cytosol	H2O + ppmi1346p -> H + mi13456p + Pi	Phospholipid Metabolism	SPAC13G6.14	
diphosphoinositol-1,3,4,6-tetrakisphosphate synthase	Cytosol	ATP + mi13456p -> ADP + ppmi1346p	Phospholipid Metabolism	SPCC970.08	
protoporphyrinogen oxidase	Cytosol	3 O2 + 2 pppg9 -> 6 H2O + 2 ppp9	Porphyrin and Chlorophyll Metabolism		1.3.3.4
protoporphyrinogen oxidase coproporphyrinogen oxidase (O2 required)	Nucleus Mitochondria	3 O2 + 2 pppg9 -> 6 H2O + 2 ppp9 cpppg3 + 2 H + O2 -> 2 CO2 + 2 H2O + pppg9	Porphyrin and Chlorophyll Metabolism Porphyrin and Chlorophyll Metabolism		1.3.3.4 1.3.3.3
porphobilinogen synthase	Nucleus	2 5aop -> H + 2 H2O + ppbng	Porphyrin and Chlorophyll Metabolism		4.2.1.24
uroporphyrinogen decarboxylase	Nucleus	4 H + uppg3 -> 4 CO2 + cpppg3	Porphyrin and Chlorophyll Metabolism		4.1.1.37
(uroporphyrinogen III) coproporphyrinogen oxidase (O2 required)	Nucleus	cpppg3 + 2 H + O2 -> 2 CO2 + 2 H2O + pppg9	Porphyrin and Chlorophyll Metabolism		1.3.3.3
sirohydrochlorin dehydrogenase	Nucleus	dscl + NADP -> H + NADPH + scl	Porphyrin and Chlorophyll Metabolism		1.3.1.76,
	Nucleus	fe2 + scl -> 3 H + sHEME			4.99.1.4 1.3.1.76,
sirohydrochlorin ferrochetalase			Porphyrin and Chlorophyll Metabolism		4.99.1.4
hydroxymethylbilane synthase uroporphyrinogen-III synthase	Nucleus Nucleus	H2O + 4 ppbng -> HMBIL + 4 NH4 HMBIL -> H2O + uppg3	Porphyrin and Chlorophyll Metabolism Porphyrin and Chlorophyll Metabolism		2.5.1.61 4.2.1.75
5-aminolevulinate synthase	Mitochondria	GLY + H + SUCCoA -> 5aop + CO2 + CoA	Porphyrin and Chlorophyll Metabolism		2.3.1.37
coproporphyrinogen oxidase (O2 required)	Cytosol	cpppg3 + 2 H + O2 -> 2 CO2 + 2 H2O + pppg9	Porphyrin and Chlorophyll Metabolism		1.3.3.3
Ferrochelatase Ferrochelatase	Cytosol Nucleus	fe2 + ppp9 -> 2 H + pHEME fe2 + ppp9 -> 2 H + pHEME	Porphyrin and Chlorophyll Metabolism Porphyrin and Chlorophyll Metabolism		4.99.1.1 4.99.1.1
Ferrochelatase	Mitochondria	fe2 + ppp9 -> 2 H + pHEME	Porphyrin and Chlorophyll Metabolism		4.99.1.1
Heme O monooxygenase	Mitochondria	hemeO + NADH + O2 -> H2O + hemeA + NAD	Porphyrin and Chlorophyll Metabolism	SPAC22E12.10c	
Heme O synthase	Mitochondria	FRPP + H2O + pHEME -> hemeO + PPi	Porphyrin and Chlorophyll Metabolism	3FBC3B6.01C	2.5.1
hydroxymethylbilane synthase	Cytosol	H2O + 4 ppbng -> HMBIL + 4 NH4	Porphyrin and Chlorophyll Metabolism		2.5.1.61
porphobilinogen synthase	Cytosol	2 5aop -> H + 2 H2O + ppbng	Porphyrin and Chlorophyll Metabolism		4.2.1.24
protoporphyrinogen oxidase	Mitochondria	3 O2 + 2 pppg9 -> 6 H2O + 2 ppp9	Porphyrin and Chlorophyll Metabolism		1.3.3.4 1.3.1.76,
sirohydrochlorin dehydrogenase	Cytosol	$dscl + NADP \rightarrow H + NADPH + scl$	Porphyrin and Chlorophyll Metabolism	SPAC4D7.06c	4.99.1.4
sirohydrochlorin ferrochetalase	Cytosol	$fe2 + sc1 \rightarrow 3 H + sHEME$	Porphyrin and Chlorophyll Metabolism	SPAC4D7.06c	1.3.1.76, 4.99.1.4
uroporphyrinogen methyltransferase	Cytosol	$2 \text{ SAM} + \text{uppg3} \Rightarrow 2 \text{ SAH} + \text{dscl} + \text{H}$	Porphyrin and Chlorophyll Metabolism		
uroporphyrinogen-III synthase uroporphyrinogen decarboxylase	Cytosol	HMBIL -> H2O + uppg3	Porphyrin and Chlorophyll Metabolism	SPAC31G5.08	4.2.1.75
(uroporphyrinogen III)	Cytosol	4 H + uppg3 -> 4 CO2 + cpppg3	Porphyrin and Chlorophyll Metabolism		4.1.1.37
phosphoribosylformylglycinamidine synthase Ap4A hydrolase	Golgi apparatus	ATP + fgar + GLN + H2O -> ADP + fgam + GLU + H + Pi	Purine and Pyrimidine Biosynthesis Purine and Pyrimidine Biosynthesis	SPAC6F12.10c	6.3.5.3
Fumarate dependent DHORD	Mitochondria Mitochondria	ap4a + H2O <-> 2 ADP + 2 H DHOR-S + FUM -> orot + SUCC	Purine and Pyrimidine Biosynthesis	SPCC4G3.02 SPAC57A10.12c	3.6.1.17 1.3.3.1
dihydoorotic acid dehydrogenase	Mitochondria	DHOR-S + O2 -> H2O2 + orot	Purine and Pyrimidine Biosynthesis	SPAC57A10.12c	1.3.3.1
yUMP synthetase	Mitochondria	R5P + ura <-> H2O + psd5p	Purine and Pyrimidine Biosynthesis	SPCC126.03 SPBC11C11.10	5.4.99.12
adenylosuccinate lyase	Nucleus	SAICAR <-> aicar + FUM	Purine and Pyrimidine Biosynthesis	SPBC14F5.09c	4.3.2.2
phosphoribosylaminoimidazolesuccinocarboxami e synthase	d Nucleus	CAIR + ASP + ATP < > SAICAR + ADP + H + Pi	Purine and Pyrimidine Biosynthesis	SPBC409.10	6.3.2.6
Ap4A hydrolase	Nucleus	ap4a + H2O <-> 2 ADP + 2 H	Purine and Pyrimidine Biosynthesis	SPCC4G3.02	3.6.1.17
adenylosuccinate synthase	Nucleus	$ASP + GTP + IMP \Rightarrow dcAMP + GDP + 2H + Pi$	Purine and Pyrimidine Biosynthesis	SPAC144.03	6.3.4.4
deoxyguanylate kinase (dGMP:ATP) guanylate kinase (GMP:ATP)	Nucleus Nucleus	ATP + dGMP <-> ADP + dGDP ATP + GMP <-> ADP + GDP	Purine and Pyrimidine Biosynthesis Purine and Pyrimidine Biosynthesis	SPBC1198.05 SPBC1198.05	2.7.4.8 2.7.4.8
URIdine kinase (ATP:URIdine)	Nucleus	ATP + URI -> ADP + H + UMP	Purine and Pyrimidine Biosynthesis	SPCC162.11c	2.7.1.48
3',5'-cyclic-nucleotide phosphodiesterase	Nucleus	cAMP + H2O -> AMP + H	Purine and Pyrimidine Biosynthesis	SPCC285.09c	3.1.4.17
cytidine deaminase	Nucleus	cytd + H + H2O -> NH4 + URI	Purine and Pyrimidine Biosynthesis	SPAC1556.04c	3.5.4.5
guanylate kinase (GMP:dATP)	Nucleus	dATP + GMP <>> dADP + GDP	Purine and Pyrimidine Biosynthesis	SPBC1198.05	2.7.4.8
adenylsuccinate lyase dCMP deaminase	Nucleus Nucleus	dcAMP < -> AMP + FUM dCMP + H + H2O < -> dUMP + NH4	Purine and Pyrimidine Biosynthesis Purine and Pyrimidine Biosynthesis	SPBC14F5.09c SPBC2G2.13c	4.3.2.2 3.5.4.12
deoxyURIdine phosphorylase	Nucleus	dURI + Pi <-> 2drlp + ura	Purine and Pyrimidine Biosynthesis	SPAC1805.16c	2.4.2.1
dUTP diphosphatase	Nucleus	dUTP + H2O -> dUMP + H + PPi	Purine and Pyrimidine Biosynthesis	SPAC644.05c	3.6.1.23
URIdine kinase (GTP:URIdine)	Nucleus	GTP + URI -> GDP + H + UMP	Purine and Pyrimidine Biosynthesis	SPCC162.11c SPBC3F6.03	2.7.1.48
thioredoxin reductase (NADPH)	Nucleus	H + NADPH + TRDox -> NADP + TRDrd	Purine and Pyrimidine Biosynthesis	SPAC7D4.07c	1.8.1.9
orotate phosphoribosyltransferase	Nucleus	H + orot5p -> CO2 + UMP	Purine and Pyrimidine Biosynthesis	SPCC330.05c	4.1.1.23 2.4.2.10
orotate phosphoribosyltransferase thymidine phosphorylase	Nucleus Nucleus	orot5p + PPi <-> orot + PRPP Pi + THYMD <-> 2dr1p + THYM	Purine and Pyrimidine Biosynthesis Purine and Pyrimidine Biosynthesis	SPBC725.15 SPAC1805.16c	2.4.2.10
				SPAC1002.17c	
uracil phosphoribosyltransferase	Nucleus	PRPP + ura -> PPi + UMP	Purine and Pyrimidine Biosynthesis	SPAC1399.04c SPAC1B3.01c	2.4.2.9
vLIMP synthetess	Nucleus	P5P + ura <>> H2O + ped5n	Purine and Purimidina Dissentant	SPCC16C4.06c	5.4.99.12
yUMP synthetase	Nucleus	R5P + ura <-> H2O + psd5p	Purine and Pyrimidine Biosynthesis	SPCC126.03 SPBC11C11.10	5.4.99.12
adenylate cyclase	Cytosol	ATP -> cAMP + PPi	Purine and Pyrimidine Biosynthesis	SPBC19C7.03	4.6.1.1
adenylsuccinate lyase adenylosuccinate lyase	Cytosol Cytosol	dcAMP <-> AMP + FUM SAICAR <-> aicar + FUM	Purine and Pyrimidine Biosynthesis Purine and Pyrimidine Biosynthesis	SPBC14F5.09c SPBC14F5.09c	4.3.2.2 4.3.2.2
adenylosuccinate tyase adenylosuccinate synthase	Cytosol	$ASP + GTP + IMP \rightarrow dcAMP + GDP + 2 H + Pi$	Purine and Pyrimidine Biosynthesis	SPAC144.03	6.3.4.4

phosphoribosylaminoimidazolecarboxamide					2.1.2.3,
formyltransferase	Cytosol	10FTHF + aicar <-> fprica + THF	Purine and Pyrimidine Biosynthesis	SPCPB16A4.03c	3.5.4.10
phosphoribosylaminoimidazole carboxylase	Cytosol	air + CO2 <-> CAIR + H	Purine and Pyrimidine Biosynthesis	SPCC1322.13	4.1.1.21
Adenosine monophosphate deaminase	Cytosol	$AMP + H + H2O \rightarrow IMP + NH4$	Purine and Pyrimidine Biosynthesis	SPBC106.04	3.5.4.6
Ap4A hydrolase	Cytosol	ap4a + H2O <-> 2 ADP + 2 H	Purine and Pyrimidine Biosynthesis	SPCC4G3.02	3.6.1.17
		ACD 1 T P	n	SPAC22G7.06c	6.3.5.5,
aspartate carbamoyltransferase	Cytosol	ASP + cbp -> cbasp + H + Pi	Purine and Pyrimidine Biosynthesis	SPAC16.03c SPBC56F2.09c	2.1.3.2
ATP adenylyltransferase	Cytosol	ADP + ATP + H -> ap4a + Pi	Purine and Pyrimidine Biosynthesis	51 BC501 2.07C	
CTP synthase (NH3)	Cytosol	ATP + NH4 + UTP -> ADP + CTP + 2 H + Pi	Purine and Pyrimidine Biosynthesis	SPAC10F6.03c	6.3.4.2
CTP synthase (glutamine)	Cytosol	ATP + GLN + H2O + UTP -> ADP + CTP + GLU + 2 H + Pi	Purine and Pyrimidine Biosynthesis	SPAC10F6.03c	6.3.4.2
cytidine deaminase	Cytosol	cytd + H + H2O -> NH4 + URI	Purine and Pyrimidine Biosynthesis	SPAC1556.04c	3.5.4.5
dCMP deaminase	Cytosol	dCMP + H + H2O <-> dUMP + NH4	Purine and Pyrimidine Biosynthesis	SPBC2G2.13c	3.5.4.12
deoxyguanylate kinase (dGMP:ATP)	Cytosol	ATP + dGMP <-> ADP + dGDP	Purine and Pyrimidine Biosynthesis	SPBC1198.05	2.7.4.8
dihydoorotic acid (ubiquinone-6)	Cytosor	DHOR-S[c] + Q6[m] -> orot[c] + Q6H2[m]	Purine and Pyrimidine Biosynthesis	SPAC57A10.12c	1.3.3.1
umydoorotte acid (doiquinone-o)		Briok-s[e] + Qo[iii] -> Grot[e] + Qoriz[iii]	Turne and Lymnanic Biosynthesis		6.3.5.5,
dihydroorotase	Cytosol	DHOR-S + H2O <-> cbasp + H	Purine and Pyrimidine Biosynthesis	SPAC22G7.06c SPAC16.03c	2.1.3.2,
deoxyURIdine kinase (ATP:DeoxyURIdine)	Cytosol	ATP + dURI -> ADP + dUMP + H	Purine and Pyrimidine Biosynthesis		3.5.2.3
deoxyURIdine phosphorylase	Cytosol	dURI + Pi <-> 2dr1p + ura	Purine and Pyrimidine Biosynthesis	SPAC1805.16c	2.4.2.1
dUTP diphosphatase	Cytosol	$dUTP + H2O \Rightarrow dUMP + H + PPi$	Purine and Pyrimidine Biosynthesis	SPAC644.05c	3.6.1.23
guanylate kinase (GMP:ATP)	Cytosol	ATP + GMP <-> ADP + GDP	Purine and Pyrimidine Biosynthesis	SPBC1198.05	2.7.4.8
guanylate kinase (GMP:dATP)	Cytosol	dATP + GMP <-> dADP + GDP	Purine and Pyrimidine Biosynthesis	SPBC1198.05	2.7.4.8
glutamine phosphoribosyldiphosphate	-				
amidotransferase	Cytosol	$GLN + H2O + PRPP \rightarrow GLU + PPi + pram$	Purine and Pyrimidine Biosynthesis	SPAC4D7.08c	2.4.2.14
GMP synthase	Cytosol	$ATP + GLN + H2O + XMP \Rightarrow AMP + GLU + GMP + 2H + PPi$	Purine and Pyrimidine Biosynthesis	SPAP7G5.02c	6.3.5.2
IMP cyclohydrolase	Cytosol	H2O + IMP <-> fprica	Purine and Pyrimidine Biosynthesis	SPCPB16A4.03c	2.1.2.3,
	-	•	Purine and Pyrimidine Biosynthesis		3.5.4.10
IMP dehydrogenase	Cytosol	H2O + IMP + NAD -> H + NADH + XMP		SPBC2F12.14c	1.1.1.205
orotidine-5'-phosphate decarboxylase	Cytosol	H + orot5p -> CO2 + UMP	Purine and Pyrimidine Biosynthesis	SPCC330.05c	4.1.1.23
orotate phosphoribosyltransferase	Cytosol	orot5p + PPi <-> orot + PRPP	Purine and Pyrimidine Biosynthesis	SPBC725.15	2.4.2.10
3',5'-cyclic-nucleotide phosphodiesterase	Cytosol	$cAMP + H2O \rightarrow AMP + H$	Purine and Pyrimidine Biosynthesis	SPCC285.09c	3.1.4.17
3',5'-cyclic-nucleotide phosphodiesterase	Cytosol	$35cdAMP + H2O \rightarrow dAMP + H$	Purine and Pyrimidine Biosynthesis	SPCC285.09c	3.1.4.17
3',5'-cyclic-nucleotide phosphodiesterase	Cytosol	$35cIMP + H2O \rightarrow H + IMP$	Purine and Pyrimidine Biosynthesis	SPCC285.09c	3.1.4.17
3',5'-cyclic-nucleotide phosphodiesterase	Cytosol	35cGMP + H2O -> GMP + H	Purine and Pyrimidine Biosynthesis	SPCC285.09c	3.1.4.17
		35cCMP + H2O -> CMP + H	Purine and Pyrimidine Biosynthesis	SPCC285.09c	3.1.4.17
3',5'-cyclic-nucleotide phosphodiesterase phosphoribosylglycinamide synthase	Cytosol Cytosol	ATP + GLY + pram <-> ADP + gar + H + Pi	Purine and Pyrimidine Biosynthesis	SPBC405.01	6.3.4.13,
	•				6.3.3.1 6.3.4.13,
phosphoribosylaminoimidazole synthase	Cytosol	$ATP + fgam \rightarrow ADP + air + 2 H + Pi$	Purine and Pyrimidine Biosynthesis	SPBC405.01	6.3.3.1
phosphoribosylaminoimidazolesuccinocarboxamid e synthase	Cytosol	CAIR + ASP + ATP <-> SAICAR + ADP + H + Pi	Purine and Pyrimidine Biosynthesis	SPBC409.10	6.3.2.6
phosphoribosylformylglycinamidine synthase	Cytosol	ATP + fgar + GLN + H2O -> ADP + fgam + GLU + H + Pi	Purine and Pyrimidine Biosynthesis	SPAC6F12.10c	6.3.5.3
thymidine kinase (ATP:thymidine)	Cytosol	ATP + THYMD -> ADP + dTMP + H	Purine and Pyrimidine Biosynthesis		
	=			CDAC1905 160	2.4.2.1
thymidine phosphorylase	Cytosol	Pi + THYMD <-> 2dr1p + THYM	Purine and Pyrimidine Biosynthesis	SPAC1805.16c	
thymidylate synthase	Cytosol	$dUMP + MLTHF \Rightarrow DHF + dTMP$	Purine and Pyrimidine Biosynthesis	SPAC15E1.04	2.1.1.45
thioredoxin reductase (NADPH)	Cytosol	$H + NADPH + TRDox \rightarrow NADP + TRDrd$	Purine and Pyrimidine Biosynthesis	SPBC3F6.03 SPAC7D4.07c	1.8.1.9
thioredoxin reductase (NADPH)	Mitochondria	H + NADPH + TRDox -> NADP + TRDrd	Purine and Pyrimidine Biosynthesis	SPBC3F6.03	1.8.1.9
uracil phosphoribosyltransferase	Cytosol	PRPP + ura -> PPi + UMP	Purine and Pyrimidine Biosynthesis	SPBC12D12.07c SPAC1002.17c SPAC1399.04c	2.4.2.9
				SPAC1B3.01c	
URIdine kinase (ATP:URIdine)	Cytosol	$ATP + URI \rightarrow ADP + H + UMP$	Purine and Pyrimidine Biosynthesis	SPCC162.11c	2.7.1.48
URIdine kinase (GTP:URIdine)	Cytosol	$GTP + URI \rightarrow GDP + H + UMP$	Purine and Pyrimidine Biosynthesis	SPCC162.11c	2.7.1.48
yUMP synthetase	Cytosol	R5P + ura <-> H2O + psd5p	Purine and Pyrimidine Biosynthesis	SPCC16C4.06c	5.4.99.12
hypothetical enyme	Cytosol	H2O + pyam5p -> Pi + pydam	Pyridoxine Metabolism		
O-Phospho-4-hydroxy-L-threonine:2-oxoglutarate	Cytosol	GLU + oHpb <-> AKG + PHTHR	Pyridoxine Metabolism	SPAC1F12.07	2.6.1.52
aminotransferase	-	-	•		
pyridoxine 5'-phosphate oxidase	Cytosol	O2 + pdx5p  <-> H2O2 + pydx5p	Pyridoxine Metabolism	SPAC1093.02	1.4.3.5
pyridoxamine 5'-phosphate oxidase	Cytosol	$H2O + O2 + pyam5p \Rightarrow H2O2 + NH4 + pydx5p$	Pyridoxine Metabolism	SPAC1093.02	1.4.3.5
pyridoxamine kinase	Cytosol	$ATP + pydam \rightarrow ADP + H + pyam5p$	Pyridoxine Metabolism		2.7.1.35
pyridoxal kinase	Cytosol	ATP + pydx -> ADP + H + pydx5p	Pyridoxine Metabolism		
pyridoxine kinase	Cytosol	$ATP + pydxn \rightarrow ADP + H + pdx5p$	Pyridoxine Metabolism		2.7.1.35
pyridoxine oxidase	Cytosol	O2 + pydxn <-> H2O2 + pydx	Pyridoxine Metabolism	SPAC1093.02	1.4.3.5
pyridoxal oxidase pyridoxal oxidase	-	2 H2O + NH4 + 0.5 O2 + pydx <-> 2 H2O2 + pydam	Pyridoxine Metabolism	SPAC1093.02 SPAC1093.02	1.4.3.5
**	Cytosol	2 ficytc + dLAC -> 2 focytc + PYR	· ·		1.4.3.3
D-lactate dehydrogenase	Cytosol		Pyruvate Metabolism	SPCC191.07	
D-lactate dehydrogenase	Mitochondria	2 ficytc + dLAC -> 2 focytc + PYR	Pyruvate Metabolism	SPCC191.07	
D-lactate dehydrogenase	Nucleus	2 ficytc + dLAC -> 2 focytc + PYR	Pyruvate Metabolism	SPCC191.07	
aldehyde dehydrogenase (acetylaldehyde, NAD)	Cytosol	$ACAL + H2O + NAD \rightarrow AC + 2H + NADH$	Pyruvate Metabolism	SPAC9E9.09c	1.2.1.3
homocitrate synthase	Cytosol	$ACCoA + AKG + H2O \Rightarrow CoA + H + HCIT$	Pyruvate Metabolism	SPBC1105.02c	2.3.3.14
acetyl-CoA hydrolase, cytoplasm	Cytosol	$ACCoA + H2O \Rightarrow AC + CoA + H$	Pyruvate Metabolism	SPAC1952.09c	3.1.2.1
aldehyde dehydrogenase (acetylaldehyde, NAD)	Golgi apparatus	ACAL + H2O + NAD -> AC + 2 H + NADH	Pyruvate Metabolism	SPAC9E9.09c	1.2.1.3
aldehyde dehydrogenase (acetylaldehyde, NADP)	Golgi apparatus	ACAL + H2O + NADP -> AC + 2 H + NADPH	Pyruvate Metabolism	SPAC9E9.09c	1.2.1.3
				SPCC13B11.04c	
alcohol dehydrogenase (ethanol)	Mitochondria	ETOH + NAD <-> ACAL + H + NADH	Pyruvate Metabolism	SPBC1539.07c	1.1.1.284
formaldehyde dehydrogenase	Mitochondria	fald + GTHrd + NAD <-> SfGLUttH + H + NADH	Pyruvate Metabolism	SPCC13B11.04c SPRC1539.07c	1.1.1.284
aldehyde dehydrogenase (acetylaldehyde, NAD)	Nucleus	ACAL + H2O + NAD -> AC + 2 H + NADH	Pyruvate Metabolism	SPBC1539.07c SPAC9E9.09c	1.2.1.3
aldehyde dehydrogenase (acetaldehyde, NADP)	Nucleus	ACAL + H2O + NADP -> AC + 2 H + NADPH	Pyruvate Metabolism	SPAC9E9.09c	1.2.1.3
				SPAC9E9.09c SPCC13B11.04c	
alcohol dehydrogenase (ethanol)	Nucleus	ETOH + NAD <-> ACAL + H + NADH	Pyruvate Metabolism	SPBC1539.07c	1.1.1.284
formaldehyde dehydrogenase	Nucleus	fald + GTHrd + NAD <-> SfGLUttH + H + NADH	Pyruvate Metabolism	SPCC13B11.04c SPBC1539.07c	1.1.1.284
acetyl-CoA hydrolase	Mitochondria	$ACCoA + H2O \rightarrow AC + CoA + H$	Pyruvate Metabolism	SPAC1952.09c	3.1.2.1
acetyl-CoA synthetase	Cytosol	AC + ATP + CoA -> ACCoA + AMP + PPi	Pyruvate Metabolism	SPCC191.02c	6.2.1.1
acetyl-CoA synthetase	Mitochondria	AC + ATP + CoA -> ACCoA + AMP + PPi	Pyruvate Metabolism	SPCC191.02c	6.2.1.1
acetyl-CoA synthetase	Peroxisome	AC + ATP + CoA -> ACCoA + AMP + PPi	Pyruvate Metabolism	SPCC191.02c	6.2.1.1
alcohol dehydrogenase, forward rxn (ethanol -> acetaldehyde)	Cytosol	$ETOH + NAD \rightarrow ACAL + H + NADH$	Pyruvate Metabolism	SPCC13B11.01	1.1.1.1
alcohol dehydrogenase, reverse rxn (acetaldehyde					
	Cytosol	ACAL + H + NADH -> ETOH + NAD	Pyruvate Metabolism	SPAC5H10.06c	1,1,1,1
<ul> <li>-&gt; ethanol)</li> <li>alcohol dehydrogenase, reverse rxn (acetaldehyde</li> </ul>	Cytosol	ACAL + H + NADH -> ETOH + NAD	Pyruvate Metabolism	SPAC5H10.06c	1.1.1.1
-> ethanol) alcohol dehydrogenase, reverse rxn (acetaldehyde -> ethanol)	Cytosol Mitochondria	$\label{eq:acal} \begin{split} & ACAL + H + NADH -> ETOH + NAD \\ & ACAL + H + NADH -> ETOH + NAD \end{split}$	Pyruvate Metabolism  Pyruvate Metabolism	SPCC13B11.01	1.1.1.1
alcohol dehydrogenase, reverse rxn (acetaldehyde	•			SPCC13B11.01 SPCC13B11.04c	
alcohol dehydrogenase, reverse rxn (acetaldehyde -> ethanol) alcohol dehydrogenase (ethanol)	Mitochondria Cytosol	$\label{eq:acal} \begin{split} ACAL + H + NADH -> ETOH + NAD \\ ETOH + NAD <> ACAL + H + NADH \end{split}$	Pyruvate Metabolism Pyruvate Metabolism	SPCC13B11.01 SPCC13B11.04c SPBC1539.07c	1.1.1.1 1.1.1.284
alcohol dehydrogenase, reverse rxn (acetaldehyde -> ethanol)	Mitochondria	ACAL + H + NADH -> ETOH + NAD	Pyruvate Metabolism	SPCC13B11.01 SPCC13B11.04c	1.1.1.1

aldehyde dehydrogenase (acetylaldehyde, NADP)	Mitochondria	$ACAL + H2O + NADP \Rightarrow AC + 2H + NADPH$	Pyruvate Metabolism	SPAC9E9.09c	1.2.1.3
formaldehyde dehydrogenase	Cytosol	fald + GTHrd + NAD <-> SfGLUttH + H + NADH	Pyruvate Metabolism	SPCC13B11.04c SPBC1539.07c	1.1.1.284
homocitrate synthase	Mitochondria	ACCoA + AKG + H2O -> CoA + H + HCIT	Pyruvate Metabolism	SPBC1105.02c	2.3.3.14
homocitrate synthase	Nucleus	ACCoA + AKG + H2O -> CoA + H + HCIT	Pyruvate Metabolism	SPBC1105.02c	2.3.3.14
•	rucicus		-	SPCC191.07	
L-Lactate dehydrogenaseic		2 ficytc[m] + LAC[c] -> 2 focytc[m] + PYR[c]	Pyruvate Metabolism	SPAPB1A11.03	1.1.2.3
				SPCC4G3.04c	
2-hexaprenyl-3-methyl-5-hydroxy-6-methoxy-1,4				SPBC337.15c SPAC19G12.11	
benzoquinone methyltransferase	Mitochondria	$2OMHMB + SAM \rightarrow SAH + H + Q6$	Quinone Biosynthesis	SPBC2D10.18	2.1.1.114
				SPBC146.12 SPCC162.05	
				SPBC1347.09	
				SPCC4G3.04c SPBC337.15c	
2.11	Marchaella	20DMB - 02 - 20DMB - 1120	Ociona Birondonia	SPAC19G12.11	211114
2-Hexaprenyl-6-methoxyphenol monooxygenase	Mitochondria	$2OPMP + O2 \rightarrow 2OPMB + H2O$	Quinone Biosynthesis	SPBC2D10.18	2.1.1.114
				SPBC146.12 SPCC162.05	
				SPBC1347.09 SPCC4G3.04c	
				SPBC337.15c	
2-hexaprenyl-6-methoxy-1,4-benzoquinone	Mitochondria	2OPMB + SAM -> 2OPMMB + SAH + H	Quinone Biosynthesis	SPAC19G12.11	2.1.1.114
methyltransferase			<b>2</b>	SPBC2D10.18 SPBC146.12 SPCC162.05	
				SPBC1347.09	
				SPCC4G3.04c	
				SPBC337.15c	
2-hexaprenyl-3-methyl-6-methoxy-1,4- benzoquinone monooxygenase	Mitochondria	2OPMMB + 0.5 O2 -> 2OMHMB	Quinone Biosynthesis	SPAC19G12.11 SPBC2D10.18	2.1.1.114
benzoquinone monooxygenase				SPBC146.12 SPCC162.05	
				SPBC1347.09	
3-(4-hydroxyphenyl-)lactate formation	Mitochondria	$34Hpp + H + NADH \rightarrow 34Hpl + NAD$	Quinone Biosynthesis		
				SPCC4G3.04c	
S-adenosyl-L-methionine:3-hexaprenyl-4,5-				SPBC337.15c SPAC19G12.11	
dihydroxylate O-methyltransferase	Mitochondria	$3H45DHBZ + SAM \rightarrow 3H4H5MOBZ + SAH + H$	Quinone Biosynthesis	SPBC2D10.18	2.1.1.114
,,				SPBC146.12 SPCC162.05	
				SPBC1347.09	
3-Hexaprenyl-4-hydroxy-5-methoxybenzoate decarboxylase	Mitochondria	3H4H5MOBZ -> 2OPMP + CO2	Quinone Biosynthesis		
3-Hexaprenyl-4,5-dihydroxybenzoate hydroxylaso	Cutocol	O4HBZ + 0.5 O2 -> 3H45DHBZ	Quinone Biosynthesis		
4-hydroxybenzoyl-CoA formation	Mitochondria	CoA + couCoA + H2O + NAD -> 4HbzCoA + ACCoA + H + NADH	Quinone Biosynthesis		
			•		
4-hydroxybenzoate formation	Mitochondria	4HbzCoA + H2O -> 4Hbz + CoA + H	Quinone Biosynthesis		
Chorismate pyruvate lyase	Cytosol	CHOR -> 4Hbz + PYR	Quinone Biosynthesis		
p-coumaroyl-CoA formation	Mitochondria	T4Hcinnm + ATP + CoA -> AMP + couCoA + PPi	Quinone Biosynthesis		
geranylgeranyltranstransferase	Cytosol	GGPP + IPPP -> PNPP + PPi	Quinone Biosynthesis		
Hydroxybenzoate C080prenyltransferase	Mitochondria	4Hbz + HXPP -> O4HBZ + PPi	Quinone Biosynthesis	SPAC56F8.04c SPBPJ4664.01	2.1.1.114
trans-pentaprenyltranstransferase	Mitochondria	$IPPP + PNPP \Rightarrow HXPP + PPi$	Quinone Biosynthesis	SPAC19G12.12	2.5.1.33
Quinolinate Synthase (Eukaryotic)	Cytosol	cmuSA -> H + H2O + Quln	Quinone Biosynthesis		
4-hydroxycinnamate formation	Mitochondria	34Hpl -> T4Hcinnm + H2O	Quinone Biosynthesis		
	Cytosol	FRPP + IPPP -> GGPP + PPi	Quinone Biosynthesis		
	ř		,	SPBP4G3.02	
acid phosphatase	Golgi apparatus	fmn + H2O -> Pi + ribfly	Riboflavin Metabolism	SPBC428.03c	3.1.3.2
and proof-man-	Gorgi apparatus				
	солд прринция			SPBC21H7.03c	
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone	Mitochondria	25dtHpp + H + H2O -> 5aprbu + NH4	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c	
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase	Mitochondria	25dtHpp + H + H2O >> 5aprbu + NH4	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16	
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone	Mitochondria Mitochondria			SPBC21H7.03c SPAC18B11.02c	
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase	Mitochondria Mitochondria Endoplasmic	25dtHpp + H + H2O >> 5aprbu + NH4	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase	Mitochondria Mitochondria Endoplasmic Reticulum	25dtHpp + H + H2O -> 5aprbu + NH4 $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$	Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase	Mitochondria Mitochondria Endoplasmic	25dtHpp + H + H2O -> 5aprbu + NH4 $ru5p-D -> db4p + FORM + H$	Riboflavin Metabolism Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone	Mitochondria Mitochondria Endoplasmic Reticulum	25dtHpp + H + H2O -> 5aprbu + NH4 $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$	Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus	$25dtHpp + H + H2O -> 5aprbu + NH4$ $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$ $2 \ dmlz -> 4r5au + ribflv$ $25dHpp + H + NADPH -> 25dtHpp + NADP$	Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus	$25dtHpp + H + H2O -> 5aprbu + NH4$ $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$ $2 \ dmlz -> 4r5au + ribflv$	Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus	$25dtHpp + H + H2O -> 5aprbu + NH4$ $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$ $2 \ dmlz -> 4r5au + ribflv$ $25dHpp + H + NADPH -> 25dtHpp + NADP$	Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus	25dtHpp + H + H2O -> 5aprbu + NH4 $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$ $2 dmlz -> 4r5au + ribflv$ $25dHpp + H + NADPH -> 25dtHpp + NADP$ $25dtHpp + H + H2O -> 5aprbu + NH4$	Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4d3.16 SPBC23E6.06c SPBC23E6.06c SPBC28.03c SPBC21H7.03c SPCC1450.13c SPPC21C3.10c SPAC18B11.02c SPCC4d3.16	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus	25dtHpp + H + H2O -> 5aprbu + NH4 $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$ $2 dmlz -> 4r5au + ribflv$ $25dHpp + H + NADPH -> 25dtHpp + NADP$ $25dtHpp + H + H2O -> 5aprbu + NH4$ $4r5au + db4p -> dmlz + 2 H2O + Pi$	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC248.03c SPBC21H7.03c SPCC1450.13c SPAC18B11.02c SPCC463.16 SPBC409.13	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus	25dtHpp + H + H2O -> 5aprbu + NH4 $ru5p-D -> db4p + FORM + H$ $fmn + H2O -> Pi + ribflv$ $2 dmlz -> 4r5au + ribflv$ $25dHpp + H + NADPH -> 25dtHpp + NADP$ $25dtHpp + H + H2O -> 5aprbu + NH4$ $4r5au + db4p -> dmlz + 2 H2O + Pi$ $ATP + ribflv -> ADP + fmn + H$	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPC24G3.16 SPBC23E6.06c SPBP4G3.02 SPBC248.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPC4G3.16 SPBC409.13 SPCC18.16c	3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase riboflavin kinase FMN reductase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	$25dtHpp + H + H2O \Rightarrow 5aprbu + NH4$ $ru5p-D \Rightarrow db4p + FORM + H$ $fmn + H2O \Rightarrow Pi + ribflv$ $2 dmlz \Rightarrow 4r5au + ribflv$ $25dHpp + H + NADPH \Rightarrow 25dtHpp + NADP$ $25dtHpp + H + H2O \Rightarrow 5aprbu + NH4$ $4r5au + db4p \Rightarrow dmlz + 2 H2O + Pi$ $ATP + ribflv \Rightarrow ADP + fmn + H$ $fmn + H + NADPH \Rightarrow fmnH2 + NADP$	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC463.16 SPBC23E6.06c SPBP4G3.02 SPBC248.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPAC18B11.02c SPCC463.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPACP27G11.09c SPBC23E6.06c	
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv 2 dmlz -> 4r5au + ribflv 25dHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC24S.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPCC1450.13c SPCC463.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC27G11.09c SPBC23E6.06c SPBP4G3.02	3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase riboflavin synthase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv 2 dmlz -> 4r5au + ribflv 25dHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC4B.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC2B1.09c SPAC2B1.09c SPBC23E6.06c SPAC23E6.06c SPAC3E6.06c SPBC4B3.02 SPBC4B3.02 SPBC4B3.03c	
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Extracellular	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv 2 dmlz -> 4r5au + ribflv 25dHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC463.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPACP27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC218.10c SPBC418.10c SPBC4B3.06c SPBP4G3.02 SPBC418.10c SPBC43.05 SPBC418.10c SPBC43.05 SPBC418.10c SPBC43.05 SPBC418.10c	3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Extracellular	25dtHpp + H + H2O -> 5aprbu + NH4 rru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> mnH2 + NADP  GTT + 3 H2O -> 25dtPp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H  fmn + H2O -> Pi + ribflv ru5p-D -> db4p + FORM + H	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC463.16 SPBC23E6.06c SPBP4G3.02 SPBC248.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPAC18B11.02c SPCC463.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC18B1.02c SPC2B3.06c SPAC18B1.02c SPC2B3.06c SPAC18B1.03c SPBC2B3.06c SPBC4B3.06c SPBC4B3.05 SPBC23E6.06c	3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Extracellular	25dtHpp + H + H2O -> 5aprbu + NH4 rru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmnH2 + NADP  GTT + 3 H2O -> 25dtPp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPCC463.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC18B1.02c SPC2B3.06c SPBC4B3.06c SPBC4B3.06c SPBC4B3.06c SPBC4B3.06c SPBC4B3.05 SPBC21B1.09c SPBC23E6.06c SPBC42B.03c SPBC21B1.03c SPBC21B1.03c SPBC21B1.03c SPBC21B1.03c SPBC21B1.03c SPBC21B1.03c SPBC21B1.03c SPBC21B1.03c	3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv 2 dmlz -> 4r5au + ribflv 25dHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC24S.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPCC1450.13c SPCC463.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPBC27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC42S.03c SPBC21H7.03c SPBC21H7.03c SPBC21E6.06c SPBC21C3.10c SPBC21C3.10c SPAC18B11.02c	3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Sucleus Nucleus Cytosol Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv 2 dmlz -> 4r5au + ribflv 25dHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmlt2 + NADP GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv ru5p-D -> db4p + FORM + H 25dHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + H2O -> 5aprbu + NH4	Riboflavin Metabolism	SPBC21H7.03c SPBC418B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC20E.16c SPCC4B3.06c SPAC27B11.09c SPBC23E6.06c SPBP4G3.02 SPBC24E0.3c SPBC21H7.03c SPBC21H7.03c SPBC21H7.03c SPBC21H7.03c SPBC21C3.10c SPBC21C3.10c SPBC1C3.10c SPAC18B11.02c SPCC4G3.16	3.5.4.25 3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Cytosol Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBC4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPCC1450.13c SPCC18.16c SPBC4B11.02c SPCC4G3.16 SPCC4B3.06c SPAC2B11.09c SPBC4B2.03c SPBC4B2.03c SPBC4B2.03c SPBC4B2.03c SPBC4B2.03c SPBC4B2.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPCC4G3.16 SPCC4G3.16	3.5.4.25 3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase riboflavin synthase riboflavin synthase fMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Cytosol Cytosol Cytosol Nucleus	25dtHpp + H + H2O -> 5aprbu + NH4 rru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> rmh2 + NADP  GTP -3 H2O -> 25dtHpp + FORM + 2 H + PPi rru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  rru5p-D -> db4p + FORM + H  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi  ATP + fmn + H -> fad + PPi	Riboflavin Metabolism	SPBC21H7.03c SPBC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPACP27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21B.10c SPBC428.03c SPBC21B.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPCC1235.04c	3.5.4.25 3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4t5au + ribflv  25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  4t5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> ronHu2 + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + POPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H -> fad + PPi fmn + H -> fad + PPi fmn + H -> NADPH -> fmnH2 + NADP	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPC4G3.16 SPBC4G3.02 SPBC4G3.02 SPBC4E3.03c SPBC2H7.03c SPCC1450.13c SPCC1450.13c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAP27G11.09c SPAC2B3.06c SPBC4B1.02c SPBC4B3.06c SPBC4CG3.16 SPCC13.10c SPBC428.03c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv 2 dmlz -> 4r5au + ribflv 25dHpp + H + NADPH -> 25dtHpp + NADP 25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv ru5p-D -> db4p + FORM + H 25dHpp + H + NADPH -> 5aprbu + NADP 25dtHpp + H + NADPH -> 5aprbu + NADP 25dtHpp + H + H2O -> 5aprbu + NH4 ATP + fmn + H -> fad + PPi ATP + fmn + H -> fad + PPi fmn + H -> Fad + PPi fmn + H -> NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi fmn + H -> NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi	Riboflavin Metabolism	SPBC21H7.03c SPBC18B11.02c SPCC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPACP27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21B.10c SPBC428.03c SPBC21B.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPCC1235.04c	3.5.4.25 3.1.3.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmht2 + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 5aprbu + NH4  ATP + fmn + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H -> fad + PPi fmn + H -> NADPH -> fmnH2 + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi fmn + H -> NADPH -> fmnH2 + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi	Riboflavin Metabolism	SPBC21H7.03c SPBC21H7.03c SPCC463.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC24G3.16 SPBC24G3.16 SPBC49.13 SPCC4B3.06c SPAP27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC24E0.05 SPBC21H7.03c SPBC21H7.03c SPBC21H7.03c SPBC21C3.10c SPBC21C3.06c SPCC4G3.16 SPCC1235.04c SPCC4B3.06c SPAP27G11.09c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 ATP + fmn + H -> fad + PPi ATP + fmn + H -> fad + PPi fmn + H -NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPCC1450.13c SPCC18.16c SPAC18B11.02c SPCC4G3.16 SPCC4B3.06c SPAC2B11.09c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B.03c SPBC2B.06c SPBC4B1.03c SPBC4B1.03c SPBC2B.06c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPBC4B1.03c SPCC4B3.06c SPBC4B3.06c SPBC4B1.02c SPCC4B3.06c SPBC4B1.02c SPCC4B3.06c SPAC1B1.02c SPCC4B3.06c SPAC1B1.02c SPCC4B3.06c SPAC1B1.09c SPCC4B3.06c SPAC1B1.09c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase riboflavin synthase riboflavin synthase from reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 rru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H  fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H -NADPH -> fmnH2 + NADP  GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H  ATP + ribflv -> ADP + fmn + H	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC18B11.02c SPC2B5.06c SPBC4B3.06c SPCC4B3.06c SPAP27G11.09c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin synthase riboflavin synthase riboflavin synthase riboflavin synthase riboflavin synthase acid phosphatase 13,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin kinase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4t5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4t5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> rmNL + NADP GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dttHpp + NADP  25dtHpp + H + NADPH -> 25dttHpp + NADP  25dtHpp + H + NADPH -> 25dttHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 ATP + fmn + H -> fad + PPi ATP + fmn + H -> fad + PPi fmn + H - NADPH -> fmnH2 + NADP GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4t5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H	Riboflavin Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC248.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC27G11.09c SPAC28.03c SPBC21C3.10c SPBC428.03c SPBC428.03c SPBC428.03c SPBC428.03c SPBC428.03c SPBC428.03c SPBC21G3.10c SPAC18B11.02c SPCC4G3.16 SPCC1B3.04c SPCC4G3.16 SPCC1B3.04c SPCC4B3.06c SPAC27G11.09c SPCC1B3.04c SPCC4B3.06c SPAC27G11.09c SPCC1B3.04c SPCC4B3.06c SPAC27G11.09c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribbusylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmht2 + NADP  GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi ATP + fmn + H -> fad + PPi fmn + H -> NADPH -> fmnHz + NADP  GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H 4r5au + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv	Riboflavin Metabolism	SPBC21H7.03c SPBC21H7.03c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAP27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPBC21H7.03c SPBC21H7.03c SPBC21C3.10c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPCC4B3.06c SPBC11C3.10c SPAC18B11.02c SPCC4G3.16 SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC1B1.06c SPAP27G11.09c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase Sulfatide sulfohydrolase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmH2 + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 5aprbu + NH4  ATP + fmn + H2O -> 5aprbu + NH4  ATP + fmn + H> fad + PPi fmn + H + NADPH -> 5aprbu + NH4  ATP + fmn + H> fad + PPi fmn + H + NADPH -> fmH2 + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATSau + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv gala + SO4 -> sft + H2O	Riboflavin Metabolism	SPBC21H7.03c SPBC21H7.03c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC409.13 SPBC21C3.16c SPBC409.13 SPBC21B.1.02c SPCC4B3.06c SPAC18B11.02c SPBC428.03c SPBC23E6.06c SPBP4G3.02 SPBC23E6.06c SPBC21H7.03c SPBC21H7.03c SPBC23E6.06c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC21C3.10c SPCC4B3.16 SPCC1C35.04c SPCC1C	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribbusylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmht2 + NADP  GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi ATP + fmn + H -> fad + PPi fmn + H -> NADPH -> fmnHz + NADP  GTP + 3 H2O -> 25dHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H 4r5au + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv	Riboflavin Metabolism	SPBC21H7.03c SPBC21H7.03c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAP27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPBC21H7.03c SPBC21H7.03c SPBC21G3.10c SPBC41B811.02c SPCC4G3.16 SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC1B3.06c SPAP27G11.09c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase Sulfatide sulfohydrolase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Mitochondria Cytosol Cytosol Cytosol Mitochondria Cytosol Cytosol Nucleus Endoplasmic	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> fmH2 + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 5aprbu + NH4  ATP + fmn + H2O -> 5aprbu + NH4  ATP + fmn + H> fad + PPi fmn + H + NADPH -> 5aprbu + NH4  ATP + fmn + H> fad + PPi fmn + H + NADPH -> fmH2 + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATSau + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv gala + SO4 -> sft + H2O	Riboflavin Metabolism	SPBC21H7.03c SPBC21H7.03c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC409.13 SPBC21C3.16c SPBC409.13 SPBC21B.1.02c SPCC4B3.06c SPAC18B11.02c SPBC428.03c SPBC23E6.06c SPBP4G3.02 SPBC23E6.06c SPBC21H7.03c SPBC21H7.03c SPBC23E6.06c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC21C3.10c SPCC4B3.16 SPCC1C35.04c SPCC1C	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase riboflavin kinase riboflavin kinase riboflavin kinase riboflavin synthase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> FmhHz + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 5aprbu + NH4  ATP + fmn + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H + NADPH -> FmhHz + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi fmn + H + NADPH -> FmhHz + NADP  GTP +3 H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATSau + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv gala + SO4 -> sft + H2O gala + SO4 -> sft + H2O dgala + H2O -> gala + gal	Riboflavin Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPBC21C3.10c SPAC18B11.02c SPCC4B3.06c SPAC2B1.09c SPBC42B3.06c SPAC2B1.09c SPBC23E6.06c SPBP4G3.02 SPBC23E6.06c SPBC21H7.03c SPBC21H7.03c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC4B8.10c SPCC1B1.09c SPCC1C35.04c SPCC1	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin kinase riboflavin synthase riboflavin synthase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase alpha-galactosidase, melibiase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> FmNH2 + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 5aprbu + NH4  ATP + fmn + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H + NADPH -> FmH2 + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi fmn + H + NADPH -> fmH2 + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv ->	Riboflavin Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPBC21H7.03c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC4G9.13 SPBC21C3.10c SPBC4G9.13 SPBC218.16c SPCC4B3.06c SPAC27G11.09c SPBC23E6.06c SPBP4G3.02 SPBC23E6.06c SPBC21H7.03c SPBC21H7.03c SPBC21C3.10c SPBC	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase riboflavin kinase riboflavin kinase riboflavin kinase riboflavin synthase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> FmhHz + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 5aprbu + NH4  ATP + fmn + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H + NADPH -> FmhHz + NADP  GTP +3 H2O -> 25dtHpp + FORM + 2 H + PPi fmn + H + NADPH -> FmhHz + NADP  GTP +3 H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATP + ribflv -> ADP + fmn + H ATSau + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv gala + SO4 -> sft + H2O gala + SO4 -> sft + H2O dgala + H2O -> gala + gal	Riboflavin Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPBC21C3.10c SPAC18B11.02c SPCC4B3.06c SPAC2B1.09c SPBC42B3.06c SPAC2B1.09c SPBC23E6.06c SPBP4G3.02 SPBC23E6.06c SPBC21H7.03c SPBC21H7.03c SPBC21C3.10c SPBC21C3.10c SPBC21C3.10c SPBC4B8.10c SPCC1B1.09c SPCC1C35.04c SPCC1	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase sulfatide sulfohydrolase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase lnositol phosphorylceramide synthase (ceramide- 1, 24C) lnositol phosphorylceramide synthase (ceramide- 1, 10stict) phosphorylceramide synthase (ceramide- 1, 24C)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O > 5aprbu + NH4 ru5p-D > db4p + FORM + H fmn + H2O > Pi + ribflv  2 dmlz > 4r5au + ribflv  25dHpp + H + NADPH > 25dtHpp + NADP  25dtHpp + H + H2O > 5aprbu + NH4 4r5au + db4p > dmlz + 2 H2O + Pi ATP + ribflv > ADP + fmn + H fmn + H + NADPH > FoRM + 2 H + PPi ru5p-D > db4p + FORM + H fmn + H2O > Pi + ribflv  ru5p-D > db4p + FORM + H 25dHpp + H + NADPH > 5aprbu + NADP  25dtHpp + H + NADPH > 5aprbu + NADP  35dtHpp + H + NADPH > 25dtHpp + NADP  25dtHpp + H + NADPH > 25dtHpp + NADP  25dtHpp + H + H2O > 5aprbu + NH4  ATP + fmn + H > fad + PPi ATP + fmn + H > fad + PPi fmn + H + NADPH > 5aprbu + NADP  GTP + 3 H2O > 25dHpp + FORM + 2 H + PPi 5aprbu + H2O > 4r5au + Pi ATP + ribflv > ADP + fmn + H ATP + ribflv > ADP + fmn + H 4r5au + db4p > dmlz + 2 H2O + Pi 2 dmlz > 4r5au + ribflv gala + SO4 > sft + H2O gala + SO4 > gala + gal dgala + H2O > gala + gal dcer124 + 0.01 ptd lino > 0.01 12dgr + 0.01 ipc124	Riboflavin Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC248.03c SPBC21H7.03c SPCC1450.13c SPC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC2FG11.09c SPAC2FG11.09c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPAC18B11.02c SPBC21C3.10c SPAC18B11.02c SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC18.16c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribityalmino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN raductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase Sulfatide sulfohydrolase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase Inositol phosphorylceramide synthase (ceramide- 1, 24C) Inositol phosphorylceramide synthase (ceramide- 1, 24C)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Nucleus Endoplasmic Reticulum Extracellular Golgi apparatus	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H  fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H -> NaDP +> FORM + 2 H + PPi saprbu + H2O -> 4r5au + Pi ATP + fmn + H -> fad + PPi fmn + H + NADPH -> fmnH2 + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H  ATP + ribflv -> ADP + fmn + H  4r5au + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv gala + SO4 -> sft + H2O gala + SO4 -> sft + H2O dgala + H2O -> gala + gal dgala + H2O -> gala + gal dgala + H2O -> gala + gal cer124 + 0.01 ptd1ino -> 0.01 12dgr + 0.01 ipc124 cer126 + 0.01 ptd1ino -> 0.01 12dgr + 0.01 ipc126	Riboflavin Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC2B1.06c SPBC428.03c SPBC21B1.03c SPCC1B1.03c SPBCB1.03c SPAC869.07c SPAC869.07c SPAC3H8.06	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase sulfatide sulfohydrolase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase lnositol phosphorylceramide synthase (ceramide- 1, 24C) lnositol phosphorylceramide synthase (ceramide- 1, 10stict) phosphorylceramide synthase (ceramide- 1, 24C)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O > 5aprbu + NH4 ru5p-D > db4p + FORM + H fmn + H2O > Pi + ribflv  2 dmlz > 4r5au + ribflv  25dHpp + H + NADPH > 25dtHpp + NADP  25dtHpp + H + H2O > 5aprbu + NH4 4r5au + db4p > dmlz + 2 H2O + Pi ATP + ribflv > ADP + fmn + H fmn + H + NADPH > FoRM + 2 H + PPi ru5p-D > db4p + FORM + H fmn + H2O > Pi + ribflv  ru5p-D > db4p + FORM + H 25dHpp + H + NADPH > 5aprbu + NADP  25dtHpp + H + NADPH > 5aprbu + NADP  35dtHpp + H + NADPH > 25dtHpp + NADP  25dtHpp + H + NADPH > 25dtHpp + NADP  25dtHpp + H + H2O > 5aprbu + NH4  ATP + fmn + H > fad + PPi ATP + fmn + H > fad + PPi fmn + H + NADPH > 5aprbu + NADP  GTP + 3 H2O > 25dHpp + FORM + 2 H + PPi 5aprbu + H2O > 4r5au + Pi ATP + ribflv > ADP + fmn + H ATP + ribflv > ADP + fmn + H 4r5au + db4p > dmlz + 2 H2O + Pi 2 dmlz > 4r5au + ribflv gala + SO4 > sft + H2O gala + SO4 > gala + gal dgala + H2O > gala + gal dcer124 + 0.01 ptd lino > 0.01 12dgr + 0.01 ipc124	Riboflavin Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC248.03c SPBC21H7.03c SPCC1450.13c SPC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC2FG11.09c SPAC2FG11.09c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPAC18B11.02c SPBC21C3.10c SPAC18B11.02c SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC1235.04c SPCC18.16c	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase riboflavin kinase riboflavin kinase riboflavin kinase riboflavin synthase Sulfatide sulfohydrolase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase Inositol phosphorylceramide synthase (ceramide-1, 24C) Inositol phosphorylceramide synthase (ceramide-2, 24C) Inositol phosphorylceramide synthase (ceramide-2, 24C) Inositol phosphoryceramide synthase (ceramide-2, 10sitol phosphoryceramide synthase (ceramide-2, 24C)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 5aprbu + NH4 ATP + fmn + H2O -> 5aprbu + NH4 ATP + fmn + H2O -> 5aprbu + NH4 ATP + fmn + H -> fad + PPi ATP + fmn + H -> fad + PPi fmn + H + NADPH -> fmh2 + NADP GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H	Riboflavin Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBC4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPCC1450.13c SPCC18.16c SPCC4G3.16 SPCC4G3.16 SPCC4G3.16 SPCC4G3.16 SPCC4G3.16 SPC4B3.06c SPAC2FI1.09c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC4C4G3.16 SPCC4G3.16 SPCC1C3.10c SPBC4C8B1.02c SPBC4C8B1.02c SPCC4G3.16 SPCC1C3.04c SPCC4G3.06 SPAC3.06 SPAC3.06 SPAC3.06 SPAC3.06 SPAC3.06 SPAC3.07 SPAC869.07c SPAC869.07c SPAC3.06	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin synthase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN reductase GTP cyclohydrolase II pyrimidine phosphatase riboflavin kinase riboflavin kinase riboflavin synthase riboflavin synthase sulfatide sulfohydrolase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase Inositol phosphorylceramide synthase (ceramide-1, 24C) Inositol phosphorylceramide synthase (ceramide-1, 24C) Inositol phosphorylceramide synthase (ceramide-1, 24C) Inositol phosphorylceramide synthase (ceramide-2, 24C) Inositol phosphorylceramide synthase (ceramide-2, 24C) Inositol phosphorylceramide synthase (ceramide-2, 26C)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol Ogytosol Cytosol Cytos	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H  fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4  ATP + fmn + H -> fad + PPi fmn + H -> NaDP +> FORM + 2 H + PPi saprbu + H2O -> 4r5au + Pi ATP + fmn + H -> fad + PPi fmn + H + NADPH -> fmnH2 + NADP  GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H  ATP + ribflv -> ADP + fmn + H  4r5au + db4p -> dmlz + 2 H2O + Pi 2 dmlz -> 4r5au + ribflv gala + SO4 -> sft + H2O gala + SO4 -> sft + H2O dgala + H2O -> gala + gal dgala + H2O -> gala + gal dgala + H2O -> gala + gal cer124 + 0.01 ptd1ino -> 0.01 12dgr + 0.01 ipc124 cer126 + 0.01 ptd1ino -> 0.01 12dgr + 0.01 ipc126	Riboflavin Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBP4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPBC21C3.10c SPAC18B11.02c SPCC4G3.16 SPBC409.13 SPCC18.16c SPCC4B3.06c SPAC2B1.06c SPBC428.03c SPBC21B1.03c SPCC1B1.03c SPBCB1.03c SPAC869.07c SPAC869.07c SPAC3H8.06	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22
2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase riboflavin synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase riboflavin kinase FMN reductase GTP cyclohydrolase II 3,4-Dihydroxy-2-butanone-4-phosphate synthase acid phosphatase 3,4-Dihydroxy-2-butanone-4-phosphate synthase 2,5-diamino-6-ribosylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate reductase (nADPh) 2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate deaminase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase FMN adenylyltransferase riboflavin kinase riboflavin kinase riboflavin kinase riboflavin synthase Sulfatide sulfohydrolase Sulfatide sulfohydrolase Sulfatide sulfohydrolase alpha-galactosidase, melibiase Inositol phosphorylceramide synthase (ceramide-1, 24C) Inositol phosphorylceramide synthase (ceramide-2, 24C) Inositol phosphorylceramide synthase (ceramide-2, 24C) Inositol phosphoryceramide synthase (ceramide-2, 10sitol phosphoryceramide synthase (ceramide-2, 24C)	Mitochondria Mitochondria Endoplasmic Reticulum Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Cytosol	25dtHpp + H + H2O -> 5aprbu + NH4 ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  2 dmlz -> 4r5au + ribflv  25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + H2O -> 5aprbu + NH4 4r5au + db4p -> dmlz + 2 H2O + Pi ATP + ribflv -> ADP + fmn + H fmn + H + NADPH -> 25dtHpp + FORM + 2 H + PPi ru5p-D -> db4p + FORM + H fmn + H2O -> Pi + ribflv  ru5p-D -> db4p + FORM + H 25dtHpp + H + NADPH -> 25dtHpp + NADP  25dtHpp + H + NADPH -> 5aprbu + NH4 ATP + fmn + H2O -> 5aprbu + NH4 ATP + fmn + H2O -> 5aprbu + NH4 ATP + fmn + H -> fad + PPi ATP + fmn + H -> fad + PPi fmn + H + NADPH -> fmh2 + NADP GTP + 3 H2O -> 25dtHpp + FORM + 2 H + PPi 5aprbu + H2O -> 4r5au + Pi ATP + ribflv -> ADP + fmn + H	Riboflavin Metabolism Sphingolipid Metabolism	SPBC21H7.03c SPAC18B11.02c SPAC18B11.02c SPC4G3.16 SPBC23E6.06c SPBC4G3.02 SPBC428.03c SPBC21H7.03c SPCC1450.13c SPCC1450.13c SPCC1450.13c SPCC18.16c SPCC4G3.16 SPCC4G3.16 SPCC4G3.16 SPCC4G3.16 SPCC4G3.16 SPC4B3.06c SPAC2FI1.09c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC428.03c SPBC21C3.10c SPBC4C4G3.16 SPCC4G3.16 SPCC1C3.10c SPBC4C8B1.02c SPBC4C8B1.02c SPCC4G3.16 SPCC1C3.04c SPCC4G3.06 SPAC3.06 SPAC3.06 SPAC3.06 SPAC3.06 SPAC3.06 SPAC3.07 SPAC869.07c SPAC869.07c SPAC3.06	3.5.4.25 3.1.3.2 2.7.7.2 2.7.7.2 3.5.4.25 3.1.6.1 3.1.6.1 3.2.1.22

Inositol phosphorylceramide synthase (ceramide- 3, 26C)	Golgi apparatus	cer326 + 0.01 ptd1ino -> 0.01 12dgr + 0.01 ipc326	Sphingolipid Metabolism	SPAC3H8.06	
mannose-inositiol phophorylceramide synthase (ceramide-1, 24C)	Golgi apparatus	GDPmann + 0.01 ipc124 -> GDP + H + 0.01 mipc124	Sphingolipid Metabolism	SPCC4F11.04c SPAC17G8.11c	
mannose-inositol phosphorylceramide synthase (ceramide-1, 26C)	Golgi apparatus	GDPmann + 0.01 ipc126 -> GDP + H + 0.01 mipc126	Sphingolipid Metabolism	SPAC2F3.01 SPCC4F11.04c SPAC17G8.11c	
mannose-inositol phosphorylceramide synthase (ceramide-2, 24C)	Golgi apparatus	GDPmann + 0.01 ipc224 -> GDP + H + 0.01 mipc224	Sphingolipid Metabolism	SPAC2F3.01 SPCC4F11.04c SPAC17G8.11c	
mannose-inositol phosphorylceramide synthase (ceramide-2, 26C)	Golgi apparatus	GDPmann + 0.01 ipc226 -> GDP + H + 0.01 mipc226	Sphingolipid Metabolism	SPAC2F3.01 SPCC4F11.04c SPAC17G8.11c	
mannose-inositol phosphorylceramide synthase (ceramide-3, 24C)	Golgi apparatus	GDPmann + 0.01 ipc324 -> GDP + H + 0.01 mipc324	Sphingolipid Metabolism	SPAC2F3.01 SPCC4F11.04c SPAC17G8.11c	
mannose-inositol phosphorylceramide synthase (ceramide-3, 26C)	Golgi apparatus	GDPmann + 0.01 ipc326 -> GDP + H + 0.01 mipc326	Sphingolipid Metabolism	SPAC2F3.01 SPCC4F11.04c SPAC17G8.11c	
mannose-inositiol phophorylceramide synthase (ceramide-1, 24C)	Endoplasmic Reticulum	GDPmann + 0.01 ipc124 -> GDP + H + 0.01 mipc124	Sphingolipid Metabolism	SPAC2F3.01 SPCC4F11.04c SPAC17G8.11c	
mannose-inositol phosphorylceramide synthase (ceramide-1, 26C)	Endoplasmic Reticulum	GDPmann + 0.01 ipc126 -> GDP + H + 0.01 mipc126	Sphingolipid Metabolism	SPCC4F11.04c SPAC17G8.11c	
mannose-inositol phosphorylceramide synthase	Endoplasmic	GDPmann + 0.01 ipc224 -> GDP + H + 0.01 mipc224	Sphingolipid Metabolism	SPCC4F11.04c	
(ceramide-2, 24C) mannose-inositol phosphorylceramide synthase	Reticulum Endoplasmic	GDPmann + 0.01 ipc226 -> GDP + H + 0.01 mipc226	Sphingolipid Metabolism	SPAC17G8.11c SPCC4F11.04c	
(ceramide-2, 26C) mannose-inositol phosphorylceramide synthase	Reticulum Endoplasmic			SPAC17G8.11c SPCC4F11.04c	
(ceramide-3, 24C) mannose-inositol phosphorylceramide synthase	Reticulum Endoplasmic	GDPmann + 0.01 ipc324 -> GDP + H + 0.01 mipc324	Sphingolipid Metabolism	SPAC17G8.11c SPCC4F11.04c	
(ceramide-3, 26C)	Reticulum	GDPmann + 0.01 ipc326 -> GDP + H + 0.01 mipc326	Sphingolipid Metabolism	SPAC17G8.11c	
Mannose-inositol phosphorylceramide, ceramide (24C) phospholipase C	<sup>1</sup> Mitochondria	H2O + 0.01 mipc124 -> cer124 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
Mannose-inositol phosphorylceramide, ceramide (26C) phospholipase C	Mitochondria	H2O + 0.01 mipc126 -> cer126 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
Mannose-inositol phosphorylceramide, ceramide-	Mitochondria	H2O + 0.01 mipc224 -> cer224 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
(24C) phospholipase C Mannose-inositol phosphorylceramide, ceramide-	Mitochondria	H2O + 0.01 mipc226 -> cer226 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
(26C) phospholipase C Mannose-inositol phosphorylceramide, ceramide		H2O + 0.01 mipc324 -> cer324 + H + manmi1p-D			
(24C) phospholipase C Mannose-inositol phosphorylceramide, ceramide	3		Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
(26C) phospholipase C	Mitochondria	H2O + 0.01 mipc326 -> cer326 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
Phytosphingosine synthesis	Endoplasmic Reticulum	$H + NADPH + O2 + spHgn \rightarrow H2O + NADP + pspHings$	Sphingolipid Metabolism	SPBC887.15c	1.14
serine C-palmitoyltransferase	Endoplasmic Reticulum	H+C160CoA+SER->3dspHgn+CO2+CoA	Sphingolipid Metabolism	SPAC21E11.08+SPBC18 E5.02c	2.3.1.50
Mannose-inositol phosphorylceramide, ceramide	1 Endoplasmic	H2O + 0.01 mipc124 -> cer124 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
(24C) phospholipase C Mannose-inositol phosphorylceramide, ceramide-		H2O + 0.01 mipc126 -> cer126 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
(26C) phospholipase C Mannose-inositol phosphorylceramide, ceramide-	Reticulum 2 Endoplasmic				
(24C) phospholipase C Mannose-inositol phosphorylceramide, ceramide	Reticulum	H2O + 0.01 mipc224 -> cer224 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
(26C) phospholipase C	Reticulum	H2O + 0.01 mipc226 -> cer226 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
Mannose-inositol phosphorylceramide, ceramide (24C) phospholipase C	3 Endoplasmic Reticulum	H2O + 0.01 mipc324 -> cer324 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
Mannose-inositol phosphorylceramide, ceramide (26C) phospholipase C	3 Endoplasmic Reticulum	H2O + 0.01 mipc326 -> cer326 + H + manmi1p-D	Sphingolipid Metabolism	SPBC32F12.01c	3.1.4
Ceramide-1 hydroxylase (24C)	Cytosol	cer124 + H + NADPH + O2 -> cer224 + H2O + NADP	Sphingolipid Metabolism	SPBC887.15c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C)	Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP	Sphingolipid Metabolism Sphingolipid Metabolism	SPBC887.15c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C)	Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP	Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (26C)	Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP	Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C)	Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP	Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (26C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C)	Cytosol Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP	Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C)	Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D	Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (26C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C	Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C	Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer324 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (26C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP der224 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (26C) Ceramide-2' synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C	Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer324 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-3' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP der224 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP $cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP$ $cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP$ $cer224 + H + NADPH + O2 -> cer3'24 + H2O + NADP$ $cer226 + H + NADPH + O2 -> cer3'26 + H2O + NADP$ $H2O + 0.01 ipc124 -> cer124 + H + milp-D$ $H2O + 0.01 ipc126 -> cer126 + H + milp-D$ $H2O + 0.01 ipc224 -> cer126 + H + milp-D$ $H2O + 0.01 ipc226 -> cer226 + H + milp-D$ $H2O + 0.01 ipc226 -> cer226 + H + milp-D$ $H2O + 0.01 ipc324 -> cer324 + H + milp-D$ $H2O + 0.01 ipc324 -> cer324 + H + milp-D$ $H2O + 0.01 ipc324 -> cer324 + H + milp-D$	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (26C) Ceramide-2' synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) inositol phosphoryleeramide, ceramide-1 (24C) phospholipase C inositol phosphoryleeramide, ceramide-1 (26C) phospholipase C inositol phosphoryleeramide, ceramide-2 (24C) phospholipase C inositol phosphoryleeramide, ceramide-2 (26C) phospholipase C inositol phosphoryleeramide, ceramide-3 (24C) phospholipase C inositol phosphoryleeramide, ceramide-3 (26C) phospholipase C inositol phosphoryleeramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP $cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP$ $cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP$ $cer224 + H + NADPH + O2 -> cer324 + H2O + NADP$ $cer226 + H + NADPH + O2 -> cer326 + H2O + NADP$ $H2O + 0.01  ipc124 -> cer124 + H + milp-D$ $H2O + 0.01  ipc126 -> cer126 + H + milp-D$ $H2O + 0.01  ipc224 -> cer224 + H + milp-D$ $H2O + 0.01  ipc226 -> cer226 + H + milp-D$ $H2O + 0.01  ipc226 -> cer226 + H + milp-D$ $H2O + 0.01  ipc226 -> cer226 + H + milp-D$ $H2O + 0.01  ipc326 -> cer326 + H + milp-D$ $H2O + 0.01  ipc326 -> cer326 + H + milp-D$ $H2O + 0.01  ipc326 -> cer326 + H + milp-D$	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-2 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer324 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + mi1p-D H2O + 0.01 ipc126 -> cer126 + H + mi1p-D H2O + 0.01 ipc226 -> cer226 + H + mi1p-D H2O + 0.01 ipc324 -> cer224 + H + mi1p-D H2O + 0.01 ipc326 -> cer326 + H + mi1p-D H2O + 0.01 ipc326 -> cer326 + H + mi1p-D H2O + 0.01 ipc326 -> cer326 + H + mi1p-D H2O + 0.01 ipc326 -> cer326 + H + mi1p-D H2O + 0.01 ipc326 -> cer326 + H + mi1p-D H2O + 0.01 ipc326 -> cer326 + H + mi1p-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer226 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc224 -> cer126 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (26C) Ceramide-2' synthase (26C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphoryleeramide, ceramide-1 (24C) phospholipase C inositol phosphoryleeramide, ceramide-1 (26C) phospholipase C inositol phosphoryleeramide, ceramide-2 (24C) phospholipase C inositol phosphoryleeramide, ceramide-2 (26C) phospholipase C inositol phosphoryleeramide, ceramide-3 (24C) phospholipase C inositol phosphoryleeramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c224 -> cer226 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer226 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c224 -> cer226 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer226 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, seramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, seramide-3 (26C) phospholipase C	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D H2O + 0.01 ipc324 -> cer324 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c224 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer226 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 imp2c124 -> cer324 + H + man2milp-D H2O + 0.01 mip2c126 -> cer226 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D H2O + 0.01 mip2c324 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (26C) Ceramide-2' synthase (26C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphoryleeramide, ceramide-1 (24C) phospholipase C inositol phosphoryleeramide, ceramide-1 (26C) phospholipase C inositol phosphoryleeramide, ceramide-2 (24C) phospholipase C inositol phosphoryleeramide, ceramide-2 (26C) phospholipase C inositol phosphoryleeramide, ceramide-3 (24C) phospholipase C inositol phosphoryleeramide, ceramide-3 (24C) phospholipase C inositol phosphoryleeramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer126 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c126 -> cer326 + H + milp-D H2O + 0.01 mip2c126 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer124 + H + milp-D H2O + 0.01 mip2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c226 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D H2O + 0.01 mip2c324 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer126 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + man2milp-D H2O + 0.01 mip2c126 -> cer226 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (26C) Ceramide-2' synthase (26C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + malp-D H2O + 0.01 mip2c126 -> cer226 + H + malp-D H2O + 0.01 mip2c224 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c324 + 0.01 ptdlino -> 0.01 l2dgr + 0.01 mip2c324 H3O + 0.01 mip2c326 -> cer326 + 0.01 ptdlino -> 0.01 l2dgr + 0.01 mip2c324 H3O + 0.01 mip2c326 -> cer326 + 0.01 ptdlino -> 0.01 l2dgr + 0.01 mip2c324	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer126 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + man2milp-D H2O + 0.01 mip2c126 -> cer226 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	3.1.3
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer324 + H + malp-D H2O + 0.01 mip2c126 -> cer226 + H + malp-D H2O + 0.01 mip2c224 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c326 -> cer326 + H + man2milp-D H3O + 0.01 mip2c324 + 0.01 ptdlino -> 0.01 l2dgr + 0.01 mip2c324 H3O + 0.01 mip2c326 -> cer326 + 0.01 ptdlino -> 0.01 l2dgr + 0.01 mip2c324 H3O + 0.01 mip2c326 -> cer326 + 0.01 ptdlino -> 0.01 l2dgr + 0.01 mip2c324	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPBC32F12.01c	3.1.3 3.1.3
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 26C) sphingoid base-phosphate phosphatase (sphinganine 1-phosphatase)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer126 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c226 -> cer226 + H + man2milp-D H2O + 0.01 mip2c36 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 26C) sphingoid base-phosphate phosphatase (sphinganine 1-phosphatase)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer126 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 mip2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c126 -> cer126 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	3.1.3
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 26C) sphingoid base-phosphate phosphatase (sphinganine 1-phosphatase) sphingoid base-phosphatae) sphingoid base-phosphatae) sphingoid base-phosphatae (sphinganine 1-phosphatae) sphingoid base-phosphatae (sphinganine 1-phosphatae) sphingoid base-phosphatae (sphinganine 1-phosphatae)	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer2'24 + H2O + NADP cer126 + H + NADPH + O2 -> cer2'26 + H2O + NADP cer224 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP cer226 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 imp2c124 -> cer324 + H + man2milp-D H2O + 0.01 mip2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c224 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + 0.01 mip2c326 -> cer326 + H - man2milp-D H2O + ph1lp -> Pi + spHing H2O + ph1lp -> Pi + spHings H3DGLCn + H2O -> GLC H3DGLCn + H2O -> GLC COA + H + HmgCoA -> AACoA + ACCOA + H2O	Sphingolipid Metabolism Starch and Sucrose Metabolism Starch and Sucrose Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	3.1.3 3.2.1.58 3.2.1.58 2.3.3.10
Ceramide-1 hydroxylase (24C) Ceramide-1 hydroxylase (26C) Ceramide-2' synthase (24C) Ceramide-2' synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (24C) Ceramide-3 synthase (26C) inositol phosphorylceramide, ceramide-1 (24C) phospholipase C inositol phosphorylceramide, ceramide-1 (26C) phospholipase C inositol phosphorylceramide, ceramide-2 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (24C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C inositol phosphorylceramide, ceramide-3 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-1 (26C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-2 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, ceramide-3 (24C) phospholipase C Mannose-(inositol-P)2-ceramide, seramide-3 (26C) phospholipase C mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-2, 26C) mannose-(inositol-P)2-ceramide synthase (ceramide-3, 24C) mannose-(inositol-P)2-ceramide synthase (ceramide-1,	Cytosol	cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer124 + H + NADPH + O2 -> cer224 + H2O + NADP cer126 + H + NADPH + O2 -> cer226 + H2O + NADP cer126 + H + NADPH + O2 -> cer324 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP cer224 + H + NADPH + O2 -> cer326 + H2O + NADP H2O + 0.01 ipc124 -> cer124 + H + milp-D H2O + 0.01 ipc126 -> cer126 + H + milp-D H2O + 0.01 ipc224 -> cer224 + H + milp-D H2O + 0.01 ipc226 -> cer226 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 ipc326 -> cer326 + H + milp-D H2O + 0.01 imj2c124 -> cer124 + H + man2milp-D H2O + 0.01 mip2c224 -> cer224 + H + man2milp-D H2O + 0.01 mip2c226 -> cer226 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + 0.01 mip2c324 -> cer324 + H + man2milp-D H2O + 0.01 mip2c326 -> cer326 + H + man2milp-D H2O + o.01 mip2c326 -> cer326 + H + man2milp-D H2O + o.01 mip2c326 -> cer326 + H + man2milp-D H2O + o.01 mip2c326 -> cer326 + H + man2milp-D	Sphingolipid Metabolism	SPBC887.15c SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.08 SPAC19G12.01c SPBC32F12.01c	3.1.3 3.2.1.58 3.2.1.58

Hydroxymethylglutaryl CoA reductase	Endoplasmic Reticulum	CoA + mev-R + 2 NADP <-> 2 H + HmgCoA + 2 NADPH	Sterol Metabolism	SPCC162.09c	1.1.1.34
Hydroxymethylglutaryl CoA reductase	Nucleus	CoA + mev-R + 2 NADP <-> 2 H + HmgCoA + 2 NADPH	Sterol Metabolism	SPCC162.09c	1.1.1.34
Hydroxymethylglutaryl CoA synthase	Cytosol	CoA + H + HmgCoA <-> AACoA + ACCoA + H2O	Sterol Metabolism	SPAC4F8.14c	2.3.3.10
Hydroxymethylglutaryl CoA synthase	Endoplasmic	CoA + H + HmgCoA <-> AACoA + ACCoA + H2O	Sterol Metabolism	SPAC4F8.14c	2.3.3.10
mevalonate kinase (ATP)	Reticulum Cytosol	ATP + mev-R -> 5pmev + ADP + H	Sterol Metabolism	SPAC13G6.11c	2.7.1.36
mevalonate kinase (ATP)	Nucleus	ATP + mev-R -> 5pmev + ADP + H	Sterol Metabolism	SPAC13G6.11c	2.7.1.36
mevalonate kinase (CTP)	Cytosol	$CTP + mev-R \rightarrow 5pmev + CDP + H$	Sterol Metabolism	SPAC13G6.11c	2.7.1.36
mevalonate kinase (GTP)	Cytosol	$GTP + mev-R \rightarrow 5pmev + GDP + H$	Sterol Metabolism	SPAC13G6.11c	2.7.1.36
mevalonate kinase (GTP)	Nucleus	$GTP + mev-R \rightarrow 5pmev + GDP + H$	Sterol Metabolism	SPAC13G6.11c	2.7.1.36
mevalonate kinase (UTP)	Cytosol	UTP + mev-R -> 5pmev + UDP + H	Sterol Metabolism	SPAC13G6.11c	2.7.1.36
mevalonate kinase (UTP) phosphomevalonate kinase	Nucleus Cytosol	UTP + mev-R -> 5pmev + UDP + H 5pmev + ATP -> 5dpmev + ADP	Sterol Metabolism Sterol Metabolism	SPAC13G6.11c SPAC343.01c	2.7.1.36 2.7.4.2
phosphomevalonate kinase	Mitochondria	5pmev + ATP -> 5dpmev + ADP  5pmev + ATP -> 5dpmev + ADP	Sterol Metabolism	SPAC343.01c	2.7.4.2
phosphomevalonate kinase	Nucleus	5pmev + ATP -> 5dpmev + ADP	Sterol Metabolism	SPAC343.01c	2.7.4.2
diphosphomevalonate decarboxylase	Cytosol	5dpmev + ATP -> ADP + CO2 + IPPP + Pi	Sterol Metabolism	SPAC24C9.03	4.1.1.33
diphosphomevalonate decarboxylase	Nucleus	5dpmev + ATP -> ADP + CO2 + IPPP + Pi	Sterol Metabolism	SPAC24C9.03	4.1.1.33
isopentenyl-diphosphate D-isomerase	Cytosol	IPPP <-> DMPP	Sterol Metabolism	SPBC106.15	5.3.3.2
isopentenyl-diphosphate D-isomerase	Nucleus	IPPP <-> DMPP	Sterol Metabolism	SPBC106.15	5.3.3.2
dimethylallyltranstransferase	Cytosol	$DMPP + IPPP \rightarrow grdp + PPi$	Sterol Metabolism	SPBC36.06c SPAC6F12.13c	2.5.1.10
dimethylallyltranstransferase	Nucleus	DMPP + IPPP -> grdp + PPi	Sterol Metabolism	SPBC36.06c	2.5.1.10
geranyltranstransferase	Cytosol	grdp + IPPP -> FRPP + PPi	Sterol Metabolism	SPAC6F12.13c SPBC36.06c	2.5.1.10
geranyltranstransferase	Nucleus	grdp + IPPP -> FRPP + PPi	Sterol Metabolism	SPAC6F12.13c SPBC36.06c	2.5.1.10
geranyitranstransierase		grap + IPPP -> PRPP + PPI	Steroi Metabolism	SPAC6F12.13c	2.5.1.10
Squalene synthase	Endoplasmic Reticulum	2 FRPP + H + NADPH -> NADP + 2 PPi + SQL	Sterol Metabolism	SPBC646.05c	2.5.1.21
Squalene epoxidase (NADP)	Endoplasmic Reticulum	FADH2 + O2 + SQL -> SQ23EPX + H2O + FAD	Sterol Metabolism	SPBC713.12	1.14.99.7
lanosterol synthase	Cytosol	SQ23EPX -> lanost	Sterol Metabolism	SPAC13G7.01c	5.4.99.7
lanosterol synthase	Endoplasmic Reticulum	SQ23EPX -> lanost	Sterol Metabolism	SPAC13G7.01c	5.4.99.7
Acyl-CoA:lanosterol acyltransferase	Endoplasmic	0.655 C161CoA + 0.01 lanost + 0.27 C181CoA + 0.02 C160CoA + 0.03	Sterol Metabolism	SPAC13G7.05	2.3.1.26
	Reticulum	C180CoA + 0.015 C140CoA -> CoA + 0.01 lanostest H2O + 0.01 lanostest -> H + 0.02 C160 + 0.655 C161 + 0.01 lanost +		SPCP1E11.05 SPCC1672.09	2.3.1.20
lanosterol ester hydrolase	Cytosol	0.03 C180 + 0.27 C181 + 0.015 C140	Sterol Metabolism	SPBC14C8.15 SPBC16A3.12c	
lanosterol ester hydrolase (extracellular)	Extracellular	H2O + 0.01 lanostest -> H + 0.02 C160 + 0.655 C161 + 0.01 lanost + 0.03 C180 + 0.27 C181 + 0.015 C140	Sterol Metabolism	apagi (72 00	
lanosterol ester hydrolase	Golgi apparatus	$H2O + 0.01 \ lanostest \rightarrow H + 0.02 \ C160 + 0.655 \ C161 + 0.01 \ lanost + \\ 0.03 \ C180 + 0.27 \ C181 + 0.015 \ C140$	Sterol Metabolism	SPCC1672.09 SPBC14C8.15 SPBC16A3.12c	
cytochrome P450 lanosterol 14-alpha-demethylase		3 H + lanost + 3 NADPH + 3 O2 -> 44mctr + FORM + 4 H2O + 3	Sterol Metabolism	SPAC13A11.02c	1.14.13.70,
(NADP) C-14 sterol reductase	Reticulum Endoplasmic	NADP 44mctr + H + NADPH -> 44mzym + NADP	Sterol Metabolism	SPBC16G5.18	1.6.2.4 1.3.1.70
C-4 sterol methyl oxidase (4,4-	Reticulum Endoplasmic	•			1.14.13.72
dimethylzymosterol)	Reticulum	44mzym + 3 H + 3 NADPH + 3 O2 -> 44mzymc + 4 H2O + 3 NADP	Sterol Metabolism	SPAC630.08c	1.14.13.72
C-3 sterol dehydrogenase (4-methylzymosterol)	Endoplasmic Reticulum	44mzymc + NAD -> 3k4mzym + CO2 + H + NADH	Sterol Metabolism	SPBC3F6.02c	1.1.1.170
C-3 sterol dehydrogenase (4- methylzymosterol),golgi	Golgi apparatus	44mzymc + NAD -> 3k4mzym + CO2 + H + NADH	Sterol Metabolism	SPBC3F6.02c	1.1.1.170
C-3 sterol keto reductase (4-methylzymosterol)	Endoplasmic	3k4mzym + H + NADPH -> 4mzym + NADP	Sterol Metabolism	SPBC1709.07	1.1.1.270
	Reticulum Endoplasmic	·		GB 1 G 200 00	
C-4 sterol methyl oxidase (4-methylzymosterol) C-3 sterol dehydrogenase (zymosterol),	Reticulum Endoplasmic	4mzym + 3 H + 3 NADPH + 3 O2 -> zym_intl + 4 H2O + 3 NADP	Sterol Metabolism	SPAC630.08c	1.14.13.72
endoplamsic reticulum	Reticulum	NAD + zym_int1 -> CO2 + H + NADH + zym_int2	Sterol Metabolism	SPBC3F6.02c	1.1.1.170
C-3 sterol dehydrogenase (zymosterol)	Golgi apparatus	$NAD + zym\_int1 -> CO2 + H + NADH + zym\_int2$	Sterol Metabolism	SPBC3F6.02c	1.1.1.170
C-3 sterol keto reductase (zymosterol)	Endoplasmic Reticulum	$H + NADPH + zym_int2 -> NADP + zymst$	Sterol Metabolism	SPBC1709.07	1.1.1.270
Acyl-CoA:zymosterol acyltransferase	Endoplasmic	$0.655\ C161CoA + 0.27\ C181CoA + 0.02\ C160CoA + 0.03\ C180CoA +$	Sterol Metabolism	SPAC13G7.05	2.3.1.26
Acyr-cox.zymosteror acytransiciase	Reticulum	0.015 C140CoA + 0.01 zymst -> CoA + 0.01 zymstest	Steror Metabolishi	SPCP1E11.05 SPCC1672.09	2.3.1.20
zymosterol ester hydrolase	Cytosol	H2O + 0.01 zymstest -> H + 0.02 C160 + 0.655 C161 + 0.03 C180 + 0.27 C181 + 0.015 C140 + 0.01 zymst	Sterol Metabolism	SPBC16A3.12c SPBC14C8.15	
zymosterol ester hydrolase (extracellular)	Extracellular	H2O + 0.01 zymstest -> H + 0.02 C160 + 0.655 C161 + 0.03 C180 + 0.27 C181 + 0.015 C140 + 0.01 zymst	Sterol Metabolism	51261166.13	
S-adenosyl-methionine delta-24-sterol-c-	Endoplasmic	SAM + zymst -> SAH + fecost + H	Sterol Metabolism	SPBC16E9.05	2.1.1.41
methyltransferase S-adenosyl-methionine delta-24-sterol-c-	Reticulum	•			
methyltransferase	Nucleus	SAM + zymst -> SAH + fecost + H	Sterol Metabolism	SPBC16E9.05	2.1.1.41
Acyl-CoA:fecosterol acyltransferase	Endoplasmic Reticulum	0.01 fecost + 0.655 C161CoA + 0.27 C181CoA + 0.02 C160CoA + 0.03 C180CoA + 0.015 C140CoA -> CoA + 0.01 fecostest	Sterol Metabolism	SPAC13G7.05 SPCP1E11.05 SPCC1672.09	2.3.1.26
fecosterol ester hydrolase	Cytosol	$0.01\ fecostest + H2O -> 0.01\ fecost + H + 0.02\ C160 + 0.655\ C161 + 0.03\ C180 + 0.27\ C181 + 0.015\ C140$	Sterol Metabolism	SPBC14C8.15 SPBC16A3.12c	
fecosterol ester hydrolase (extracellular	Extracellular	$0.01\ fecostest + H2O -> 0.01\ fecost + H + 0.02\ C160 + 0.655\ C161 + 0.03\ C180 + 0.27\ C181 + 0.015\ C140$	Sterol Metabolism		
fecosterol ester hydrolase	Golgi apparatus	$0.01\ fecostest + H2O -> 0.01\ fecost + H + 0.02\ C160 + 0.655\ C161 + 0.03\ C180 + 0.27\ C181 + 0.015\ C140$	Sterol Metabolism	SPCC1672.09 SPBC14C8.15	
C-8 sterol isomerase	Endoplasmic Reticulum	fecost -> ePist	Sterol Metabolism	SPBC16A3.12c SPAC20G8.07c	
Acyl-CoA:ePisterol acyltransferase	Cytosol	0.01 ePist + 0.655 C161CoA + 0.27 C181CoA + 0.02 C160CoA + 0.03 C180CoA + 0.015 C140CoA -> CoA + 0.01 ePistest	Sterol Metabolism	SPAC13G7.05 SPCP1E11.05	2.3.1.26
ePisterol ester hydrolase	Cytosol	0.01 ePistest + H2O -> 0.01 ePist + H + 0.02 C160 + 0.655 C161 + 0.03 C180 + 0.27 C181 + 0.015 C140	Sterol Metabolism	SPCC1672.09 SPBC14C8.15	
ePisterol ester hydrolase (extracellular)	Extracellular	0.01 ePistest + H2O -> 0.01 ePist + H + 0.02 C160 + 0.655 C161 + 0.03	Sterol Metabolism	SPBC16A3.12c	
ePisterol ester hydrolase	Golgi apparatus	C180 + 0.27 C181 + 0.015 C140  0.01 ePistest + H2O -> 0.01 ePist + H + 0.02 C160 + 0.655 C161 + 0.03	Sterol Metabolism	SPCC1672.09 SPBC14C8.15	
cholestenol delta-isomerase, lumped reaction	Cytosol	C180 + 0.27 C181 + 0.015 C140 SAM + O2 + zymst -> SAH + ergtetrol + H + 2 H2O	Sterol Metabolism	SPBC16A3.12c	
C-s24 sterol reductase	Endoplasmic	ergtetrol + H + NADPH -> ergst + NADP	Sterol Metabolism	SPAC20G4.07c	1.3.1.71
	Reticulum Endoplasmic	ergtetrol + H + NADPH -> ergst + NADP 0.01 ergst + 0.655 C161CoA + 0.27 C181CoA + 0.02 C160CoA + 0.03		SPAC20G4.07c SPAC13G7.05	
Acyl-CoA:ergosterol acyltransferase	Reticulum	C180CoA + 0.015 C140CoA -> CoA + 0.01 ergstest	Sterol Metabolism	SPCP1E11.05	2.3.1.26
ergosterol ester hydrolase	Cytosol	0.01 ergstest + H2O -> 0.01 ergst + H + 0.02 C160 + 0.655 C161 + 0.03	Sterol Metabolism	SPCC1672.09 SPBC14C8.15	
g	.,	C180 + 0.27 C181 + 0.015 C140		SPBC16A3.12c	
ergosterol ester hydrolase (extracellular)	Extracellular	0.01 ergstest + H2O -> 0.01 ergst + H + 0.02 C160 + 0.655 C161 + 0.03 C180 + 0.27 C181 + 0.015 C140	Sterol Metabolism		

ergosterol ester hydrolase aparatus	Golgi apparatus	$0.01\ ergstest + H2O -> 0.01\ ergst + H + 0.02\ C160 + 0.655\ C161 + 0.03$ $C180 + 0.27\ C181 + 0.015\ C140$	Sterol Metabolism	SPCC1672.09 SPBC14C8.15 SPBC16A3.12c	
UDP-glucose:ergosterol glucosyltransferase	Cytosol	ergst + UDPg -> ergst3GLC + H + UDP	Sterol Metabolism	SFBC10A3.12c	
Sucrose 6-phosphate fructohydrolase	Extracellular	$sucr6p + H2O \Rightarrow fru + G6P$	Sucrose and Starch Metabolism	SPCC191.11	3.2.1.26
Sucrose 6-phosphate fructohydrolase	Cytosol	$sucr6p + H2O \Rightarrow fru + G6P$	Sucrose and Starch Metabolism	SPAC8E11.01c	3.2.1.26
TaURIne dioxygenase	Cytosol	$AKG + O2 + taur \rightarrow aacald + CO2 + H + SO3 + SUCC$	Taurine Metabolism	SPBP4G3.02	
thiamin phosphatase	Endoplasmic Reticulum	H2O + THMMP -> Pi + THM	Thiamine Metabolism	SPBC428.03c SPBC21H7.03c	3.1.3.2
thiamin phosphatase	Golgi apparatus	$H2O + THMMP \Rightarrow Pi + THM$	Thiamine Metabolism	SPBC428.03c	3.1.3.2
4-amino-5-hydroxymethyl-2-methylpyrimidine synthetase	Cytosol	air + 2 H -> 4AHMMP + gcald + Pi	Thiamine Metabolism		
hydroxyethylthiazole kinase	Cytosol	$4mHetz + ATP \rightarrow 4mpetz + ADP + H$	Thiamine Metabolism	SPAC23H4.10c	2.7.1.50
thiamin diphosphatase	Extracellular	2 H2O + THMPP -> H + 2 Pi + THM	Thiamine Metabolism	SPBP4G3.02 SPBC428.03c SPBC21H7.03c	3.1.3.2
thiamin phosphatase	Extracellular	H2O + THMMP -> Pi + THM	Thiamine Metabolism	SPBP4G3.02 SPBC428.03c	3.1.3.2
thiazole phosphate synthesis (xylulose 5-	Cytosol	ACHMS + CYS + GLY + H + xu5p-D -> 4abut + 4mpetz + AC + CO2 +	Thiamine Metabolism	SPBC21H7.03c	
phosphate)	•	3 H2O + NH4 + PYR ACHMS + CYS + GLY + H + R5P -> 4abut + 4mpetz + AC + CO2 + 3	Thiamine Metabolism		
thiazole phosphate synthesis (ribose 5-phosphate)	Cytosol	H2O + NH4 + PYR			
thiamine diphosphokinase	Cytosol	ATP + THMPP > APP + THMPP	Thiamine Metabolism	SPAC6F12.05c	2.7.6.2
thiamine-diphosphate kinase thiaminase	Cytosol Cytosol	ATP + THMPP -> ADP + THMTP H2O + THM -> 4AHMMP + 4mHetz + H	Thiamine Metabolism Thiamine Metabolism	SPAC6F12.05c	2.7.6.2
thiamine-phosphate kinase	Cytosol	ATP + THMMP <-> ADP + THMPP	Thiamine Metabolism		
thiamine-phosphate diphosphorylase	Cytosol	2maHmp + 4mpetz + H -> PPi + THMMP	Thiamine Metabolism	SPAC23H4.10c	2.7.1.50
homoisocitrate dehydrogenase	Cytosol	HICIT + NAD <-> H + NADH + oxag	Threonine and Lysine Metabolism	SPAC31G5.04	1.1.1.87
L-allo-Threonine Aldolase	Nucleus	aTHR -> ACAL + GLY	Threonine and Lysine Metabolism	SPAC23H3.09c	4.1.2.5
threonine synthase	Nucleus	H2O + PHOM -> Pi + THR	Threonine and Lysine Metabolism	SPAC9E9.06c	4.2.3.1
4-Hydroxy-L-threonine synthase	Nucleus	H2O + PHTHR -> 4HtHr + Pi	Threonine and Lysine Metabolism	SPAC9E9.06c	4.2.3.1
Threonine aldolase	Nucleus	THR -> ACAL + GLY	Threonine and Lysine Metabolism	SPAC23H3.09c	4.1.2.5
4-Hydroxy-L-threonine synthase	Cytosol	$H2O + PHTHR \rightarrow 4HtHr + Pi$	Threonine and Lysine Metabolism	SPAC9E9.06c	4.2.3.1
L-aminoadipate-semialdehyde dehydrogenase	Cytosol	L2aADP + ATP + H + NADPH -> L2aADP6SA + AMP + NADP + PPi	Threonine and Lysine Metabolism	SPAP7G5.04c	1.2.1.31
(NADPH) L-aminoadipate-semialdehyde dehydrogenase	Cytosol	L2aADP + ATP + H + NADH -> L2aADP6SA + AMP + NAD + PPi	Threonine and Lysine Metabolism	SPAP7G5.04c	1.2.1.31
(NADH) 2-aminoadipate transaminase	Cytosol	2oxoADP + GLU <-> L2aADP + AKG	Threonine and Lysine Metabolism		
L-2-amino-3-oxobutanoate decarboxylation	Cytosol	2aobut + H -> aact + CO2	Threonine and Lysine Metabolism		
L-allo-threonine dehydrogenase	Cytosol	aTHR + NADP <-> 2aobut + H + NADPH	Threonine and Lysine Metabolism	SPAC521.03	
glycine C-acetyltransferase	Cytosol	2aobut + CoA -> ACCoA + GLY	Threonine and Lysine Metabolism		2.3.1.29
homoacontinate hydratase	Mitochondria	b124tc + H2O <-> HICIT	Threonine and Lysine Metabolism	SPAC343.16	4.2.1.36
homoisocitrate dehydrogenase	Mitochondria	HICIT + NAD <-> H + NADH + oxag	Threonine and Lysine Metabolism	SPAC31G5.04	1.1.1.87
2-methylcitrate dehydratase	Mitochondria	HCIT <-> b124tc + H2O	Threonine and Lysine Metabolism		
2-Oxobutanoate dehydrogenase	Mitochondria	$2obut + CoA + NAD \rightarrow CO2 + NADH + ppCoA$	Threonine and Lysine Metabolism		1.2.7.2
non-enzymatic reaction	Mitochondria	H + oxag <-> 2oxoADP + CO2	Threonine and Lysine Metabolism		
saccharoPine dehydrogenase (NADP, L-glutamate forming)	Cytosol	$L2aADP6SA+GLU+H+NADPH<\!\!\!\!->H2O+NADP+SAccrp\text{-}L$	Threonine and Lysine Metabolism	SPBC3B8.03	1.5.1.10
saccharoPine dehydrogenase (NAD, L-lysine forming)	Cytosol	H2O + NAD + SAccrp-L <-> AKG + H + LYS + NADH	Threonine and Lysine Metabolism	SPAC227.18	1.5.1.7
saccharoPine dehydrogenase (NAD, L-lysine forming) L-allo-Threonine Aldolase	-	•	•	SPAC227.18 SPAC23H3.09c	1.5.1.7 4.1.2.5
forming)	Cytosol Cytosol	H2O + NAD + SAccep-L <>> AKG + H + LYS + NADH aTHR $> ACAL + GLY$ THR $> ACAL + GLY$	Threonine and Lysine Metabolism Threonine and Lysine Metabolism Threonine and Lysine Metabolism		
forming) L-allo-Threonine Aldolase Threonine aldolase	Cytosol Cytosol	aTHR -> ACAL + GLY THR -> ACAL + GLY	Threonine and Lysine Metabolism Threonine and Lysine Metabolism	SPAC23H3.09c SPAC23H3.09c SPCC320.14	4.1.2.5 4.1.2.5
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase	Cytosol Cytosol	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4	Threonine and Lysine Metabolism Threonine and Lysine Metabolism Threonine and Lysine Metabolism	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase	Cytosol Cytosol Cytosol Mitochondria	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4	Threonine and Lysine Metabolism Threonine and Lysine Metabolism Threonine and Lysine Metabolism Threonine and Lysine Metabolism	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase	Cytosol Cytosol	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR	Threonine and Lysine Metabolism	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase d-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion	Cytosol Cytosol Cytosol Mitochondria Cytosol	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 2obut + NH4 THR -> 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] -> 6pgl[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 2obut + NH4 THR -> 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer126[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Membrane Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 2obut + NH4 THR -> 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer126[r] cer224[c] <>> cer224[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane Membrane Membrane Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer126[r] cer224[c] <>> cer224[r] cer226[c] <>> cer226[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane Membrane Membrane Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 2obut + NH4 THR -> 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer126[r] cer224[c] <>> cer224[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane Membrane Membrane Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer126[r] cer224[c] <>> cer224[r] cer226[c] <>> cer226[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport aproton symport ergosterol endoplasmic reticular transport Ergosta-5,6,22,24,(28)-tetraen-3beta-ol endoplamic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane Membrane Membrane Membrane Membrane Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 2obut + NH4 THR -> 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer126[r] cer224[c] <>> cer224[r] cer226[c] <>> cer226[r] dolp[c] + H[c] <>> dolp[r] + H[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport in groton symport ergosterol endoplasmic reticular transport Ergosta-5,6,22,24,(28)-tetraen-3beta-ol	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane Membrane Membrane Membrane Membrane Membrane Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer124[r] cer224[c] <>> cer224[r] cer226[c] <>> cer26[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport Ergosta-5,6,22,24,(28)-tetraen-3beta-ol endoplamic reticular transport glucose 6-phosphate endoplasmic reticular	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer226[r] cer224[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergettol[c] <> cergtetrol[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport Ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport mannan endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer126[r] cer224[c] <> cer224[r] cer226[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] G6P[c] <> G6P[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H20 endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer224[c] <> cer224[r] cer226[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergettrol[c] <> cer6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport Ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport mannan endoplasmic reticulum transport	Cytosol Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer126[r] cer124[c] <> cer126[r] cer224[c] <> cer224[r] cer226[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergetrol[c] <> cerfol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H20 endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport	Cytosol Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 2obut + NH4 THR -> 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer126[r] cer224[c] <> cer224[r] cer224[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergettrol[c] <> cer26[r] dolp[c] + M[c] <> box dolp[r] + H[r] ergst[r] <> cergst[c] ergettrol[c] <> cergtetrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] >> pspH1p[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H20 endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer126[r] cer224[c] <> cer224[r] cer224[c] <> cer224[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergettrol[c] <> cer26[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> orgst[c] ergettrol[c] <> psgt[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport Ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR > ACAL + GLY THR > 2obut + NH4 THR > 2obut + NH4 H2O + PHOM > Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer226[c] <> cer224[r] cer226[c] <> cer224[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergettrol[c] <> cer5 ergettrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] >> spH1p[r] SQ23EPX[r] <<> SQ23EPX[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport spainganine 1-phosphate endoplasmic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer126[r] cer224[c] <> cer126[r] cer224[c] <> cer224[r] cer226[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergetrol[c] <> ergtetrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <<> SQ23EPX[c] SQL[c] <> SQL[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport aproton symport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport diffusion H2O endoplasmic reticulum transport wannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport squalene endoplamic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer124[r] cer224[c] <>> cer224[r] cer226[c] <>> cer224[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[c] crgetrol[c] <>> cefterol[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[r] spgt[r] <>> ergst[r] H2O[c] <>> G6P[r] h2O[c] <>> H2O[r] mannan[c] <>> mannan[r] O2[c] <>> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] spU[c] <>> SQ3EPX[r] <<>> SQ3EPX[r] SQ2EPX[r] <>> SQ1[r] PPi[c] <>> PPi[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ia proton symport ergosterol endoplasmic reticular transport Ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport diffusion H20 endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport Squalene-2,3-epoxide endoplasmic reticular transport squalene endoplasmic reticular transport Squalene endoplamic reticular transport Diphosphate endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer126[r] cer224[c] <> cer126[r] cer224[c] <> cer224[r] cer226[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergetrol[c] <> ergtetrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <<> SQ23EPX[c] SQL[c] <> SQL[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport aproton symport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport diffusion H2O endoplasmic reticulum transport wannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport squalene endoplamic reticular transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer226[c] <> cer224[r] cer226[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergtetrol[c] <> certetrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <> SQ23EPX[c] SQL[c] <> SQL[r] PPi[c] <> PPi[r] FAD[m] <> FAD[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C26) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport Ergosta-5,6,22,24,(28)-tetraen-3beta-ol endoplamic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H20 endoplasmic reticulum transport mannan endoplasmic reticulum transport diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport Spulaene-2,5-epoxide endoplasmic reticular transport Spulaene endoplasmic reticulum transport FAD endoplasmic reticulum transport Proton endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR > ACAL + GLY THR > 2obut + NH4 THR > 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer224[c] <> cer224[r] cer224[c] <> cer224[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergtetrol[c] <> ergtetrol[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergtetrol[c] <> pght[r] H2O[c] <> G6P[r] H2O[c] <> G2[r] mannan[r] O2[c] <> O2[r] pspH1p[c] >> pspH1p[r] spH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <> SQ23EPX[c] SQU_c] <> SQU_c  PP[c] <> PP[r] FAD[m] <> FAD[r] h[c] <> h[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H20 endoplasmic reticulum transport diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport Squalene-2,3-spoxide endoplasmic reticular transport Squalene-2,3-spoxide endoplasmic reticular transport Diphosphate endoplasmic reticulum transport Proton endoplasmic reticulum transport Proton endoplasmic reticulum transport FAD endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR > ACAL + GLY THR > ACAL + GLY THR > 20but + NH4 THR > 20but + NH4 H2O + PHOM > Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer226[c] <> cer224[r] cer226[c] <> cer224[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergettrol[c] <> ergettrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] >> pspH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <<> SQ24EPX[c] SQL[c] <> SQL[r] PPi[c] <> PPi[r] FAD[m] <> FAD[r] h[c] <> ph[r] FORM[c] <> FORM[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport aproton symport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport mannan endoplasmic reticulum transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport squalene -2,5-epoxide endoplasmic reticular transport squalene endoplasmic reticulum transport Diphosphate endoplasmic reticulum transport FAD endoplasmic reticulum transport FAD endoplasmic reticulum transport Fromate endoplasmic reticulum transport Formate endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer224[c] <> cer224[r] cer224[c] <> cer224[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergetrol[c] <> ergetrol[r] dolp[c] + World   dolp[c] + World   dolp[c] + World   ergst[r] <> ergst[c] ergetrol[c] <> ergetrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] -> spH1p[r] spH1p[c] -> spH1p[r] SQ23EPX[r] <> SQ23EPX[c] SQL[c] <> SQL[r] PPf[c] <> PP[r] FAD[m] <> FAD[r] h[c] <> h[r] FORM[c] <> FORM[r] FADH2[m] <> FADH2[r] FADH2[m] <> FADH2[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport is proton symport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport diffusion H2O endoplasmic reticulum transport waiffusion O2 transport sphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport syndiene-2,3-epoxide endoplasmic reticular transport squalene-2,3-epoxide endoplasmic reticular transport squalene endoplasmic reticular transport phytosphinganine reticular transport phytosphinganine reticular transport squalene endoplasmic reticular transport phytosphinganine reticulum transport phytosphinganine reticulum transport phytosphinganine reticulum transport proton endoplasmic reticulum transport proton endoplasmic reticulum transport phytosphinganine reticulum transport proton endoplasmic reticulum transport phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphingan	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer124[r] cer226[c] <>> cer224[r] cer226[c] <>> cer224[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[c] dolp[c] + W[c] <>> dolp[r] + H[r] ergst[r] <>> ergtetrol[r] G6P[c] <>> 66P[r] H2O[c] <>> H2O[r] mannan[c] <>> mannan[r] O2[c] <>> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <>> SQ23EPX[c] SQL_[c] <>> SQL_[r] PP[c] <>> PP[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FORM[c] <>> FORM[r] FADH2[m] <>> FADH2[r] NADH[c] <>> NADH[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport Ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport Squalene-2,3-epoxide endoplasmic reticular transport Squalene-2,3-epoxide endoplasmic reticular transport Poton endoplasmic reticulum transport Proton endoplasmic reticulum transport FAD endoplasmic reticulum transport FAD endoplasmic reticulum transport FADH2 endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer124[r] cer226[c] <>> cer224[r] cer226[c] <>> cer224[r] cer226[c] <>> cer226[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[c] ergetrol[c] <>> ergtetrol[r] G6P[c] <>> G6P[r] H2O[c] <>> H2O[r] mannan[c] <>> mannan[r] O2[c] <>> O2[r] pspH1p[c] >> pspH1p[r] spH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <>> SQ23EPX[c] SQL[e] <>> SQL[r] PPi[c] <>> PPi[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FADH2[m] <>> FADH2[r] NADH[c] <>> NADH[r] NAD[c] <>> NADH[r] NAD[c] <>> NADH[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport aproton symport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport mannan endoplasmic reticulum transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport squalene-2,5-epoxide endoplasmic reticular transport squalene-2,5-epoxide endoplasmic reticular transport squalene-2,5-epoxide endoplasmic reticular transport phytosphinganine reticulum transport PAD endoplasmic reticulum transport FAD endoplasmic reticulum transport FADH2 endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport NAD endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer126[r] cer124[c] <>> cer126[r] cer224[c] <>> cer224[r] cer226[c] <>> cer224[r] cer226[c] <>> cer226[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[c] ergetrol[c] <>> ergetrol[r] G6P[c] <>> G6P[r] H2O[c] <>> H2O[r] mannan[c] <>> mannan[r] O2[c] <>> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <>> SQ23EPX[c] SQL[c] <>> SQL[r] PPf[c] <>> PP[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FORM[c] <>> FORM[r] FADH2[m] <>> FADH2[r] NADH[c] <>> NADH[r] NAD[c] <>> NAD[r] CO2[c] <>> CO2[r] SAH[c] <>> SAH[r] SMOP[e] <>> SAH[r] SMOP[e] <>> SAH[r] SMOP[e] <>> SAH[r] SMOP[e] <>> SAH[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport via proton symport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport sphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport squalene endoplasmic reticular transport squalene endoplasmic reticulum transport phytosphinganine reticulum transport proton endoplasmic reticulum transport proton endoplasmic reticulum transport phytosphinganine phytosphinganine reticulum transport phytosphinganine phytosphinganine reticulum transport phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytosphinganine phytos	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer126[c] <> cer224[r] cer226[c] <> cer224[r] cer226[c] <> cer224[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergtetrol[c] <> ergtetrol[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[r] ergtetrol[c] <> ergtetrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] -> spH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <> SQ23EPX[c] SQL[c] <> SQL[r] PPi[c] <> PPi[r] FAD[m] <> FAD[r] h[c] <> h[r] FAD[m] <> FAD[r] h[c] <> NAD[r] NAD[c] <> NADH[r] NAD[c] <> NADH[r] NAD[c] <> NAD[r] SAH[c] <> SAH[r] SAMOP[e] <> SMOP[c] ACAL[e] <> ACAL[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport is proton symport ergosterol endoplasmic reticular transport Ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport squalene endoplasmic reticular transport squalene endoplasmic reticulum transport phytosphinganine 1-phosphate endoplasmic reticular transport squalene endoplasmic reticulum transport Poton endoplasmic reticulum transport FAD endoplasmic reticulum transport FAD endoplasmic reticulum transport Formate endoplasmic reticulum transport FADH2 endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport acetaldehyde reversible transport via proton symport acetaldehyde reversible transport via proton symport acetaldehyde reversible transport via proton symport	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol  Membrane	aTHR -> ACAL + GLY THR > ACAL + GLY THR > 2obut + NH4 THR > 2obut + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer124[r] cer224[c] <> cer224[r] cer224[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergetrol[c] <> cergterol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] FAD[m] <> FAD[r] h[c] <>> SQ32EPX[r] FORM[c] <>> FORM[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FAD[m] <>> FAD[r] h[c] <>> NAD[r] NAD[c] <>> NAD[r] NAD[c] <>> NAD[r] NAD[c] <>> NAD[r] SAH[c] <>> SAH[r] SAM[c] <>> SAH[r]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport Ergosterol endoplasmic reticular transport Ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport diffusion H20 endoplasmic reticulum transport mannan endoplasmic reticulum transport via diffusion O2 transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport Squalene-2,3-epoxide endoplasmic reticular transport squalene endoplasmic reticulum transport FAD endoplasmic reticulum transport FAD endoplasmic reticulum transport FADH2 endoplasmic reticulum transport FADH2 endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport SAH endoplasmic reticulum transport	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR > ACAL + GLY THR > ACAL + GLY THR > 20but + NH4 THR > 20but + NH4 H2O + PHOM > Pi + THR 6pgl[c] <> 6pgl[r] cer124[c] <> cer124[r] cer126[c] <> cer126[r] cer224[c] <> cer224[r] cer226[c] <> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergtetrol[c] <> ergtetrol[r] G6P[c] <> G6P[r] H2O[c] <> H2O[r] mannan[c] <> mannan[r] O2[c] <> O2[r] pspH1p[c] >> spH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <>> SQ24EPX[c] SQL[c] <>> SQL[r] PPi[c] <> PSP[r] FAD[m] <> FAD[r] h[c] <> NADH[r] FORM[c] <> FORM[r] FADH2[m] <> NADH[r] NADIc] <> NADH[r] NADIc] <> NADH[r] O2[c] <> SAH[r] SAH[c] <> SAH[r] SAMOP[c] <> SAH[r] SAMOP[c] <> SAH[r] SAMOP[c] <> SAH[r] SAMOP[c] <> SACAL[c] ac[e] <> ac[c] + H[c] <> ac[c] + H[c] ac[e] <> ac[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport phytosphinganine 1-phosphate endoplasmic reticular transport phytosphinganine 1-phosphate endoplasmic reticular transport Sphinganine 1-phosphate endoplasmic reticular transport Sphinganine 1-phosphate endoplasmic reticular transport Squalene-2,3-epoxide endoplasmic reticular transport phytosphinganine treticular transport Squalene endoplasmic reticulum transport FAD endoplasmic reticulum transport FAD endoplasmic reticulum transport FADH2 endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport son de	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer124[r] cer226[c] <>> cer224[r] cer226[c] <>> cer224[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[c] ergtetrol[c] <>> ergtetrol[r] G6P[c] <>> G6P[r] H2O[c] <>> H2O[r] mannan[c] <>> mannan[r] O2[c] <>> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <<> SQ23EPX[c] SQL[c] <>> SQL[r] PPi[c] <>> PD[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FORM[c] <>> FAD[r] NADH[c] <>> NADH[r] NADH[c] <>> NADH[r] NADH[c] <>> NADH[r] SAH[c] <>> SAH[r] SMOP[c] <>> SACAL[c] ac[c] + H[c] <> ACAL[c] ac[c] + H[c] <> ACE[c] + H[c] ADE[c] + H[c] <> ADE[c] + H[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport aproton symport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport mannan endoplasmic reticulum transport phytosphinganine 1-phosphate endoplasmic reticular transport sphinganine 1-phosphate endoplasmic reticular transport squalene-2,5-epoxide endoplasmic reticular transport squalene-endoplasmic reticulum transport PAD endoplasmic reticulum transport FAD endoplasmic reticulum transport FAD endoplasmic reticulum transport FADH2 endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport NAD endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport som preversible transport acetate reversible transport via proton symport acetate transporter adenine transport in via proton symport	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer126[r] cer124[c] <>> cer126[r] cer224[c] <>> cer224[r] cer226[c] <>> cer224[r] cer226[c] <>> cer226[r] dolp[c] + H[c] <> dolp[r] + H[r] ergst[r] <> ergst[c] ergetrol[c] <>> ergetrol[r] G6P[c] <>> G6P[r] H2O[c] <>> H2O[r] mannan[c] <>> mannan[r] O2[c] <>> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <>> SQ23EPX[c] SQL[c] <>> SQL[r] PPf[c] <>> PP[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FADH2[m] <>> FADH2[r] NADH[c] <>> NADH[r] NAD[c] <>> NAD[r] CO2[c] <> CO2[r] SAH[c] <>> SAH[r] SMOP[e] <>> SAH[r] SMOP[e] <>> SAH[r] SMOP[e] <>> SAH[r] SMOP[e] <>> ACAL[c] ce[c] + H[c] <> ac[c] + H[c] ac[e] <> ac[c] + H[c] aDN[e] + H[e] >> ADN[c] + H[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19
forming) L-allo-Threonine Aldolase Threonine aldolase L-threonine deaminase L-threonine deaminase L-threonine deaminase threonine synthase 6-phospho-D-glucono-1,5-lactone endoplasmic reticular transport via diffusion ceramide-1 (C24) endoplasmic reticular transport ceramide-2 (C24) endoplasmic reticular transport ceramide-2 (C26) endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport dolichol phosphate endoplasmic reticular transport ergosterol endoplasmic reticular transport ergosterol endoplasmic reticular transport glucose 6-phosphate endoplasmic reticular transport via diffusion H2O endoplasmic reticulum transport mannan endoplasmic reticulum transport phytosphinganine 1-phosphate endoplasmic reticular transport phytosphinganine 1-phosphate endoplasmic reticular transport Sphinganine 1-phosphate endoplasmic reticular transport Sphinganine 1-phosphate endoplasmic reticular transport Squalene-2,3-epoxide endoplasmic reticular transport phytosphinganine treticular transport Squalene endoplasmic reticulum transport FAD endoplasmic reticulum transport FAD endoplasmic reticulum transport FADH2 endoplasmic reticulum transport NADH endoplasmic reticulum transport NADH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport SAH endoplasmic reticulum transport son de	Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Membrane	aTHR -> ACAL + GLY THR -> ACAL + GLY THR -> ACAL + GLY THR -> 20but + NH4 THR -> 20but + NH4 H2O + PHOM -> Pi + THR 6pgl[c] <>> 6pgl[r] cer124[c] <>> cer124[r] cer126[c] <>> cer124[r] cer226[c] <>> cer224[r] cer226[c] <>> cer224[r] dolp[c] + H[c] <>> dolp[r] + H[r] ergst[r] <>> ergst[c] ergtetrol[c] <>> ergtetrol[r] G6P[c] <>> G6P[r] H2O[c] <>> H2O[r] mannan[c] <>> mannan[r] O2[c] <>> O2[r] pspH1p[c] -> pspH1p[r] spH1p[c] >> spH1p[r] SQ23EPX[r] <<> SQ23EPX[c] SQL[c] <>> SQL[r] PPi[c] <>> PD[r] FAD[m] <>> FAD[r] h[c] <>> h[r] FORM[c] <>> FAD[r] NADH[c] <>> NADH[r] NADH[c] <>> NADH[r] NADH[c] <>> NADH[r] SAH[c] <>> SAH[r] SMOP[c] <>> SACAL[c] ac[c] + H[c] <> ACAL[c] ac[c] + H[c] <> ACE[c] + H[c] ADE[c] + H[c] <> ADE[c] + H[c]	Threonine and Lysine Metabolism Transport, Endoplasmic Reticulum	SPAC23H3.09c SPAC23H3.09c SPCC320.14 SPBC1677.03c SPBC1677.03c	4.1.2.5 4.1.2.5 4.3.1.19 4.3.1.19

L-alanine reversible transport via proton symport	Membrane	ALA[e] + H[e] <-> ALA[c] + H[c]	Transport, Extracellular	
allantoin uniport	Membrane	$alltn[e] \Rightarrow alltn[c]$	Transport, Extracellular	
allantoate uniport	Membrane	alltt[e] -> alltt[c]	Transport, Extracellular	
D-arabinose reversible transport	Membrane	arab-D[e] <-> arab-D[c]	Transport, Extracellular	
L-arabinoase extracellular transport	Membrane	arab-L[e] <-> arab-L[c]	Transport, Extracellular	
L-arganine reversible transport via proton symport	Membrane	ARG[e] + H[e] <-> ARG[c] + H[c]	Transport, Extracellular	
L-asparagine reversible transport via proton symport	Membrane	ASN[e] + H[e] <-> ASN[c] + H[c]	Transport, Extracellular	
L-aspartate reversible transport via proton symport	Membrane	ASP[e] + H[e] <-> ASP[c] + H[c]	Transport, Extracellular	
ATPaseic	Membrane	$ATP[c] + H2O[c] \rightarrow ADP[c] + H[e] + Pi[c]$	Transport, Extracellular	
Biotin uptake	Membrane	$btn[e] + H[e] \Rightarrow btn[c] + H[c]$	Transport, Extracellular	
choline transport via proton symport	Membrane	$CHOL[e] + H[e] \rightarrow CHOL[c] + H[c]$	Transport, Extracellular	
citrate reversible transport via symport	Membrane	CIT[e] + H[e] <-> CIT[c] + H[c]	Transport, Extracellular	
CO2 transporter via diffusion	Membrane	CO2[e] <-> CO2[c]	Transport, Extracellular	
cytosine transport in via proton symport	Membrane	$csn[e] + H[e] \rightarrow csn[c] + H[c]$	Transport, Extracellular	
L-cysteine reversible transport via proton symport	Membrane	CYS[e] + H[e] <-> CYS[c] + H[c]	Transport, Extracellular	
cytidine transport in via proton symport	Membrane	$cytd[e] + H[e] \rightarrow cytd[c] + H[c]$	Transport, Extracellular	
D-lactate transport via proton symport	Membrane	H[e] + dLAC[e] <-> H[c] + dLAC[c]	Transport, Extracellular	
deoxyadenosine transport in via proton symport	Membrane	dad-2[e] + H[e] -> dad-2[c] + H[c]	Transport, Extracellular	
deoxycytidine transport in via proton symport	Membrane	dcyt[e] + H[e] -> dcyt[c] + H[c]	Transport, Extracellular	
deoxyguanosine transport in via proton symport	Membrane	$dGSN[c] + H[c] \rightarrow dGSN[c] + H[c]$	Transport, Extracellular	
deoxyinosine transport in via proton symport	Membrane	$din[e] + H[e] \rightarrow din[c] + H[c]$	Transport, Extracellular	
dTTP reversible uniport	Membrane	dTTP[e] <-> dTTP[c]	Transport, Extracellular	
deoxyURIdine transport in via proton symport	Membrane	$dURI[e] + H[e] \rightarrow dURI[c] + H[c]$	Transport, Extracellular	
ethanol reversible transport	Membrane	ETOH[e] <-> ETOH[c]	Transport, Extracellular	
	Membrane			
iron (II) transport		fe2[e] -> fe2[c]	Transport, Extracellular	
formate transport via diffusion  Defructose transport in via proton symport	Membrane Membrane	for[e] <-> for[c] fm[e] + H[e] <> fm[c] + H[c]	Transport, Extracellular	
D-fructose transport in via proton symport	Membrane	fru[e] + H[e] -> fru[c] + H[c]	Transport, Extracellular	
D-galactose transport in via proton symport	Membrane	gal[e] + H[e] -> gal[c] + H[c]	Transport, Extracellular	
Glycoaldehydye reversible transport	Membrane	gcald[e] <-> gcald[c]	Transport, Extracellular	SPCC548.07C
				SPAC1F8.01
				SPBC4B4.08
glucose transport (uniport)	Membrane	$GLC[e] \rightarrow GLC[c]$	Transport, Extracellular	SPBC1683.08
				SPCC1235.13 SPCC1235.14
				SPCC548.06c
L-glutamine reversible transport via proton	Membrane	$GLN[e] + H[e] \Leftrightarrow GLN[c] + H[c]$	Transport, Extracellular	
L-glutamate transport via proton symport	Membrane	$GLU[e] + H[e] \Leftrightarrow GLU[c] + H[c]$	Transport, Extracellular	
glyoxylate transport	Membrane	GLX[c] <-> GLX[e]	Transport, Extracellular	
glycerol transport via channel	Membrane	GLYC[c] <-> GLYC[e]	Transport, Extracellular	
glycerol transport via symport	Membrane	GLYC[e] + H[e] -> GLYC[c] + H[c]	Transport, Extracellular	
glycine reversible transport via proton symport	Membrane	GLY[e] + H[e] <-> GLY[c] + H[c]	Transport, Extracellular	
guanosine transport in via proton symport	Membrane	GSN[e] + H[e] -> GSN[c] + H[c]	Transport, Extracellular	
oxidized glutathione uniport	Membrane	GTHox[e] -> GTHox[c]	Transport, Extracellular	
glutathione transport	Membrane	GTHrd[e] -> GTHrd[c]	Transport, Extracellular	
guanine reversible transport via proton symport	Membrane	GUA[e] + H[e] <-> GUA[c] + H[c]	Transport, Extracellular	
H2O transport via diffusion	Membrane		Transport, Extracellular	
Hexadecanoate (n-C16:0) transport in via uniport		H2O[e] <> H2O[c]	=	
	Membrane	C160[e] -> C160[c]	Transport, Extracellular	
hexadecenoate (n-C16:1) transport in via uniport	Membrane	C161[e] -> C161[c]	Transport, Extracellular	
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport	Membrane Membrane	C161[e] -> C161[c] H[e] + HIS[e] <-> H[c] + HIS[c]	Transport, Extracellular Transport, Extracellular	
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxanthine reversible transport via proton	Membrane Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \end{split}$	Transport, Extracellular Transport, Extracellular Transport, Extracellular	
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinie reversible transport via proton C-BOEUcine reversible transport via proton symport	Membrane Membrane Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} <> \text{H[c]} + \text{ILE[c]} \end{split}$	Transport, Extracellular Transport, Extracellular Transport, Extracellular Transport, Extracellular	
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxanthine reversible transport via proton E-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular	Membrane Membrane Membrane Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} <> \text{H[c]} + \text{ILE[c]} \\ & \text{ind3etH[c]} <> \text{ind3etH[e]} \end{split}$	Transport, Extracellular Transport, Extracellular Transport, Extracellular Transport, Extracellular Transport, Extracellular	
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantnine reversible transport via proton L-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport	Membrane Membrane Membrane Membrane Membrane	$\begin{split} & \text{C161[e]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[e]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} <> \text{H[c]} + \text{ILE[c]} \\ & \text{ind3etH[c]} <> \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \end{split}$	Transport, Extracellular Transport, Extracellular Transport, Extracellular Transport, Extracellular Transport, Extracellular Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxanthine reversible transport via proton C-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport	Membrane Membrane Membrane Membrane Membrane Membrane Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} < \rightarrow \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} < \rightarrow \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} < \rightarrow \text{H[c]} + \text{ILE[c]} \\ & \text{ind3etH[c]} < \rightarrow \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} < \rightarrow \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} < \rightarrow \text{H[c]} + \text{LAC[c]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton E-1806@cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport	Membrane Membrane Membrane Membrane Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} <> \text{H[c]} + \text{ILE[e]} \\ & \text{ind3etH[e]} <> \text{h[c]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[e]} + \text{k[e]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[e]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[e]} + \text{LEU[c]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton E-1806@cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport	Membrane Membrane Membrane Membrane Membrane Membrane Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HLE[e]} <> \text{H[c]} + \text{HLE[c]} \\ & \text{ind3etH[c]} <> \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[c]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LYS[e]} <> \text{H[c]} + \text{LYS[c]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton E-1806@cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport	Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} <> \text{H[c]} + \text{ILE[e]} \\ & \text{ind3etH[e]} <> \text{h[c]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[e]} + \text{k[e]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[e]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[e]} + \text{LEU[c]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantinne reversible transport via proton L-1800Edcine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport	Membrane	$\begin{split} & \text{C161[e]} > \text{C161[e]} \\ & \text{H[e]} + \text{HIS[e]} < > \text{H[e]} + \text{HIS[e]} \\ & \text{H[e]} + \text{HXAN[e]} < > \text{H[e]} + \text{HXAN[e]} \\ & \text{H[e]} + \text{ILE[e]} < > \text{H[e]} + \text{ILE[e]} \\ & \text{ind3eH[e]} < > \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} < > \text{H[e]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} < > \text{H[e]} + \text{kC[e]} \\ & \text{H[e]} + \text{LAC[e]} < > \text{H[e]} + \text{LAC[e]} \\ & \text{H[e]} + \text{LYS[e]} < > \text{H[e]} + \text{LYS[e]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[e]} + \text{MALT[e]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[e]} + \text{MALT[e]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton C-HSOEMcune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport maltose transport in via proton symport D-mannose transport in via proton symport	Membrane	$\begin{split} & \text{C161[c]} \rightarrow \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[e]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HLE[e]} \\ & \text{ind3etH[c]} <> \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LEV[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LYS[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton E-1806@cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-maltos reversible transport via proton symport L-maltose transport in via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport L-methionine reversible transport via proton symport	Membrane	$\begin{split} & \text{C161[e]} > \text{C161[e]} \\ & \text{H[e]} + \text{HIS[e]} < > \text{H[e]} + \text{HIS[e]} \\ & \text{H[e]} + \text{HXAN[e]} < > \text{H[e]} + \text{HXAN[e]} \\ & \text{H[e]} + \text{ILE[e]} < > \text{H[e]} + \text{ILE[e]} \\ & \text{ind3eH[e]} < > \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} < > \text{H[e]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} < > \text{H[e]} + \text{kC[e]} \\ & \text{H[e]} + \text{LAC[e]} < > \text{H[e]} + \text{LAC[e]} \\ & \text{H[e]} + \text{LYS[e]} < > \text{H[e]} + \text{LYS[e]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[e]} + \text{MALT[e]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[e]} + \text{MALT[e]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantinne reversible transport via proton L-istoleune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport	Membrane	$\begin{split} & \text{C161[e]} > \text{C161[e]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[e]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} <> \text{H[c]} + \text{ILE[c]} \\ & \text{ind3eH[e]} <> \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{kAC[e]} <> \text{H[c]} + \text{LAC[e]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LYS[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{man[e]} > \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton C-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HLE[e]} <> \text{H[c]} + \text{HLE[c]} \\ & \text{ind3eH[e]} <> \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[e]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{man[e]} > \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \\ & \text{nac[e]} <> \text{nac[c]} \end{split}$	Transport, Extracellular	SPAC105.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantinne reversible transport via proton L-istoleune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport	Membrane	$\begin{split} & \text{C161[e]} > \text{C161[e]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[e]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{ILE[e]} <> \text{H[c]} + \text{ILE[c]} \\ & \text{ind3eH[e]} <> \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{kAC[e]} <> \text{H[c]} + \text{LAC[e]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LYS[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{man[e]} > \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \end{split}$	Transport, Extracellular	
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton C-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HLE[e]} <> \text{H[c]} + \text{HLE[c]} \\ & \text{ind3eH[e]} <> \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[e]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{man[e]} > \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \\ & \text{nac[e]} <> \text{nac[c]} \end{split}$	Transport, Extracellular	SPAC105.01C  SPAC977.10 SPAC15A10.06
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton S-HSOEducine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1)	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HZ[e]} <> \text{H[c]} + \text{HZ[e]} \\ & \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[e]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} >+ \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MaLT[e]} >+ \text{H[c]} + \text{MaLT[c]} \\ & \text{H[e]} + \text{MaT[e]} >> \text{H[c]} + \text{MaT[c]} \\ & \text{H[e]} + \text{MAT[e]} <> \text{H[c]} + \text{MET[e]} \\ & \text{MaC[e]} <> \text{nac[c]} \\ & \text{NaDP[c]} <> \text{NaDP[e]} \\ & \text{H[e]} + \text{na1[c]} <> \text{H[c]} + \text{na1[e]} \\ \end{split}$	Transport, Extracellular	SPAC977.10
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton S-HSOEducine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1)	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXE[c]} \\ & \text{ind3eH[e]} <> \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LYS[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{man[e]} >> \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \\ & \text{nac[e]} <> \text{nac[c]} \\ & \text{NADP[c]} <> \text{NADP[e]} \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxanthine reversible transport via proton c-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular)	Membrane	$\begin{split} & \text{C161[e]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HLE[e]} <> \text{H[c]} + \text{HLE[c]} \\ & \text{ind3eH[e]} <> \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{LYS[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[e]} \\ & \text{H[e]} + \text{MaLT[e]} > \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MaT[e]} <> \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MaT[e]} <> \text{M[c]} + \text{MaT[c]} \\ & \text{nac[e]} <> \text{nac[c]} \\ & \text{NADP[c]} <> \text{NADP[e]} \\ & \text{H[e]} + \text{nal[c]} <> \text{H[c]} + \text{nal[e]} \\ & \text{Nbfortyr[c]} >> \text{Nbfortyr[e]} \\ \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton S-HSOEducine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1)	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HZ[e]} <> \text{H[c]} + \text{HZ[e]} \\ & \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[e]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} >+ \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MaLT[e]} >+ \text{H[c]} + \text{MaLT[c]} \\ & \text{H[e]} + \text{MaT[e]} >> \text{H[c]} + \text{MaT[c]} \\ & \text{H[e]} + \text{MAT[e]} <> \text{H[c]} + \text{MET[e]} \\ & \text{MaC[e]} <> \text{nac[c]} \\ & \text{NaDP[c]} <> \text{NaDP[e]} \\ & \text{H[e]} + \text{na1[c]} <> \text{H[c]} + \text{na1[e]} \\ \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-leucine reversible transport via proton symport L-maltate reversible transport via proton symport L-maltate reversible transport via proton symport L-maltose transport in via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HLE[e]} \\ & \text{ind3etH[e]} <> \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[e]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[e]} + \text{k[e]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LEU[c]} \\ & \text{H[e]} + \text{LYS[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{Man[e]} > \text{H[c]} + \text{Man[c]} \\ & \text{H[e]} + \text{Man[e]} > \text{H[c]} + \text{Mat[c]} \\ & \text{H[e]} + \text{Man[e]} <> \text{M[c]} + \text{MET[c]} \\ & \text{nac[e]} <> \text{nac[c]} \\ & \text{NADP[c]} <> \text{NADP[e]} \\ & \text{H[e]} + \text{nal[c]} <> \text{H[c]} + \text{nal[e]} \\ & \text{Nbfortyr[c]} > \text{Nbfortyr[e]} \\ & \text{NH4[e]} <<> \text{NH4[e]} <<> \text{NH4[c]} \\ & \end{aligned}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxanthine reversible transport via proton S-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport maltose transport in via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HLE[e]} <> \text{H[c]} + \text{HLE[c]} \\ & \text{ind3eH[e]} <> \text{ind3eH[e]} \\ & \text{H[e]} + \text{K[e]} <> \text{H[c]} + \text{K[c]} \\ & \text{H[e]} + \text{K[e]} <> \text{H[c]} + \text{K[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAV[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MaLT[e]} > \text{H[c]} + \text{MaLT[c]} \\ & \text{H[e]} + \text{MaLT[e]} > \text{H[c]} + \text{MaLT[c]} \\ & \text{H[e]} + \text{MaLT[e]} > \text{H[c]} + \text{MaLT[c]} \\ & \text{H[e]} + \text{MaT[e]} <> \text{H[c]} + \text{MaT[c]} \\ & \text{MaDP[c]} <> \text{NADP[e]} \\ & \text{Hel]} + \text{ma1[c]} <> \text{H[c]} + \text{ma1[e]} \\ & \text{Nbfortyr[c]} > \text{Nbfortyr[e]} \\ & \text{Nh4[e]} <> \text{NH4[c]} \\ & \text{H[e]} + \text{nmn[e]} > \text{H[c]} + \text{nmn[c]} \\ \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-leucine reversible transport via proton symport L-maltate reversible transport via proton symport L-maltate reversible transport via proton symport L-maltose transport in via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} < > \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} < > \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HLE[e]} < > \text{H[c]} + \text{HLE[c]} \\ & \text{ind3eH[e]} < > \text{ind3eH[e]} \\ & \text{H[e]} + \text{k[e]} < > \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{k[e]} < > \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} < > \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAV[e]} < > \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} < > \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[e]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MaLT[c]} \\ & \text{H[e]} + \text{MaLT[e]} > \text{H[c]} + \text{MaT[c]} \\ & \text{H[e]} + \text{MaT[c]} > \text{M[c]} + \text{MET[c]} \\ & \text{nac[e]} < > \text{nac[c]} \\ & \text{NADP[c]} < > \text{NADP[e]} \\ & \text{H[e]} + \text{nal[c]} < > \text{H[c]} + \text{nal[e]} \\ & \text{Nbfortyr[c]} > \text{Nbfortyr[e]} \\ & \text{Nhfortyr[e]} > \text{NH4[c]} \\ & \text{H[e]} + \text{nnn[e]} > \text{H[c]} + \text{nnn[c]} \\ & \text{O2[e]} < > \text{O2[c]} \\ \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton S'#80E@cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HLE[e]} <> \text{H[c]} + \text{HLE[e]} \\ & \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LEU[e]} <> \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MAL[e]} >+ \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MALT[e]} >+ \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MaT[e]} >> \text{H[c]} + \text{MAT[c]} \\ & \text{H[e]} + \text{MET[e]} <> \text{H[c]} + \text{MET[c]} \\ & \text{nac[e]} <> \text{nac[c]} \\ & \text{NDP[c]} <> \text{NADP[e]} \\ & \text{H[e]} + \text{na1[c]} <> \text{H[c]} + \text{na1[e]} \\ & \text{Nbfortyr[c]} >> \text{Nbfortyr[e]} \\ & \text{NH4[e]} <> \text{NH4[c]} \\ & \text{H[e]} + \text{nnn[e]} >> \text{H[c]} + \text{nnn[c]} \\ & \text{O2[e]} <> \text{O2[c]} \\ & \text{OAA[c]} << \text{OAA[e]} \\ \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton S-HSOEde.ine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport N-mannose transport in via proton symport Sicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} <> \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} <> \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HZAN[e]} <> \text{H[c]} + \text{HZAN[c]} \\ & \text{H[e]} + \text{Hz[e]} <> \text{H[c]} + \text{Hz[e]} \\ & \text{ind3etH[e]} <> \text{ind3etH[e]} \\ & \text{H[e]} + \text{k[e]} <> \text{H[c]} + \text{k[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} <> \text{H[c]} + \text{LAU[c]} \\ & \text{H[e]} + \text{LAU[e]} <> \text{H[c]} + \text{LU[e]} \\ & \text{H[e]} + \text{MAL[e]} <> \text{H[c]} + \text{MAL[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MaT[e]} >> \text{H[c]} + \text{MAT[c]} \\ & \text{H[e]} + \text{MaT[e]} >> \text{H[c]} + \text{MET[c]} \\ & \text{nac[e]} <> \text{nac[c]} \\ & \text{NaDP[c]} <> \text{NaDP[e]} \\ & \text{H[e]} + \text{na1[e]} <> \text{H[c]} + \text{na1[e]} \\ & \text{Nbfortyr[c]} >> \text{Nbfortyr[e]} \\ & \text{NH4[e]} <> \text{NH4[c]} \\ & \text{H[e]} + \text{nmn[e]} >> \text{H[c]} + \text{nmn[c]} \\ & \text{O2[e]} <> \text{O2[c]} \\ & \text{OAA[c]} <> \text{OAA[e]} \\ & \text{C180[e]} >> \text{C180[c]} \\ \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantinne reversible transport via proton symovat Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decenoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eHIc[ >> ind3eHIe]  H[e] + k]e[ <> H[c] + k]e[  H[e] + k]e[ <> H[c] + k]e[  H[e] + k]e[ <> H[c] + k]e[  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MALT[e] >> H[c] + MALT[c]  H[e] + MALT[e] >> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MET[e] <> H[c] + MET[c]  nac[e] <> nac[c]  NADP[c] <> NADP[e]  H[e] + nal[c] <> H[c] + nal[e]  Nbfortyr[c] >> Nbfortyr[e]  NH4[e] <> NH4[c]  H[e] + nnn[e] >> H[c] + nnn[c]  O2[e] <> O2(e]  OAA[c] <> OAA[e]  C180[e] >> C180[c]  C181[e] >> C181[c]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton S'#80f2@cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport Nachtine transport in via proton symport Swipport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decenoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport C080decenoate (n-C18:2) transport in via uniport	Membrane	$\begin{split} & \text{C161[c]} > \text{C161[c]} \\ & \text{H[e]} + \text{HIS[e]} < > \text{H[c]} + \text{HIS[c]} \\ & \text{H[e]} + \text{HXAN[e]} < > \text{H[c]} + \text{HXAN[c]} \\ & \text{H[e]} + \text{HE[e]} < > \text{H[c]} + \text{HE[c]} \\ & \text{ind3eH[e]} < > \text{ind3eH[e]} \\ & \text{H[e]} + \text{K[e]} < > \text{H[c]} + \text{K[c]} \\ & \text{H[e]} + \text{K[e]} < > \text{H[c]} + \text{K[c]} \\ & \text{H[e]} + \text{KAC[e]} < > \text{H[c]} + \text{LAC[c]} \\ & \text{H[e]} + \text{LAC[e]} < > \text{H[c]} + \text{LAV[c]} \\ & \text{H[e]} + \text{LEU[e]} < > \text{H[c]} + \text{LYS[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MALT[e]} > \text{H[c]} + \text{MALT[c]} \\ & \text{H[e]} + \text{MaLT[e]} > \text{H[c]} + \text{man[c]} \\ & \text{H[e]} + \text{MaT[e]} > \text{H[c]} + \text{MaT[c]} \\ & \text{H[e]} + \text{MaT[e]} < > \text{H[c]} + \text{MaT[c]} \\ & \text{MaDP[c]} < > \text{NADP[e]} \\ & \text{MaDP[c]} < > \text{NADP[e]} \\ & \text{Hel]} + \text{na1[c]} < > \text{H[c]} + \text{na1[e]} \\ & \text{Nbfortyr[c]} > \text{Nbfortyr[e]} \\ & \text{Nh4[e]} < > \text{Nh4[c]} \\ & \text{H[e]} + \text{nmn[e]} > \text{H[c]} + \text{nmn[c]} \\ & \text{O2[e]} < > \text{O2[e]} \\ & \text{OAA[c]} < \text{OAA[e]} \\ & \text{C180[e]} > \text{C180[e]} \\ & \text{C181[e]} > \text{C182[c]} \\ \end{split}$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxanthune reversubie transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nanose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport orntutine reversible transport in via uniport orntutine reversible transport in via uniport	Membrane	$C161[e] > C161[c] \\ H[e] + HIS[e] <> H[c] + HIS[c] \\ H[e] + HXAN[e] <> H[c] + HXAN[c] \\ H[e] + HXAN[e] <> H[c] + HXAN[c] \\ H[e] + HLE[e] <> hIG+ HLE[e] \\ ind3etH[e] <> ind3etH[e] \\ H[e] + k[e] <> H[c] + k[c] \\ H[e] + k[e] <> H[c] + k[c] \\ H[e] + LAC[e] <> H[c] + LAC[c] \\ H[e] + LEU[e] <> H[c] + LAC[e] \\ H[e] + LEU[e] <> H[c] + LYS[c] \\ H[e] + MALT[e] <> H[c] + MALT[e] \\ H[e] + MALT[e] > H[c] + MALT[e] \\ H[e] + MALT[e] >> H[c] + MALT[e] \\ H[e] + MAT[e] <> H[c] + MET[c] \\ nac[e] <> nac[c] \\ NADP[c] <> NADP[e] \\ H[e] + nal[c] <> H[c] + nal[e] \\ Nbfortyr[c] >> Nbfortyr[e] \\ NH4[e] <> NH4[c] \\ H[e] + nnn[e] >> H[c] + nnn[c] \\ O2[e] <> O2[c] \\ OAA[e] <> C182[e] > C182[e] \\ H[e] + ORN[e] <> H[c] + ORN[e] <$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton S-18002 cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport orntumner eversible transport in via proton sumoort	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[e] <> hIc] + K[e]  H[e] + K[e] <> H[c] + K[e]  H[e] + K[e] <> H[c] + K[e]  H[e] + LAC[e] <> H[c] + K[e]  H[e] + LAC[e] <> H[c] + LAC[c]  H[e] + LEU[e] <> H[c] + LAC[e]  H[e] + LYS[e] <> H[c] + LYS[e]  H[e] + MAL[e] <> H[c] + MAL[e]  H[e] + MAL[e] <> H[c] + MAL[e]  H[e] + MAL[e] >> H[c] + MALT[e]  H[e] + MAT[e] >> H[c] + MAT[e]  H[e] + MAT[e] <> H[c] + MET[e]  NADP[c] <> NADP[e]  H[e] + MAT[e] <> H[c] + man[e]  H[e] + man[e] <> H[c] + man[e]  Nbfortyr[e] >> Nbfortyr[e]  Nhd[e] <> NHd[e]  H[e] + nmn[e] >> H[c] + nmn[c]  O2[e] <> O2[e]  OAA[c] <> OAA[e]  C180[e] >> C180[e]  H[e] + ORN[e] <> H[e] + ORN[e]  H[e] + ORN[e] <>> H[e] + ORN[e]  PACALD[e] <> PACALD[e]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantune reversible transport via proton S-HSOEM: ne reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport D-mannose transport in via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport C080decenoate (n-C18:1) transport in via uniport C080decanoate (n-C18:1) transport in via uniport	Membrane	C161[c] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[e]  ind3etH[c] <> ind3etH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LEU[c]  H[e] + LEU[e] <> H[c] + LEU[c]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAT[e] <> H[c] + MET[c]  nac[e] <> nac[c]  NADP[c] <> NADP[e]  H[e] + nal[c] <> H[c] + nal[e]  Nbfortyr[c] <> Nbfortyr[e]  Nh4[e] <> NH4[c]  H[e] + nmn[e] <> H[c] + nmn[c]  O2[e] <> O2[c]  OAA[c] <> OAA[e]  C181[e] >> C181[c]  C182[e] >> C182[c]  H[e] + ORN[e] <> H[c] + ORN[c]  PACALD[c] <> PACALD[c]  PAP[e] <>> PAP[c]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantinne reversibe transport via proton c-1800@cune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport N-mannose transport in via proton symport L-methionine reversible transport via proton symport N-mannose transport in via proton symport L-methionine reversible transport via proton symport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport contunne reversible transport in via uniport ortitume reversible transport in via proton symport PAP reversible uniport peptide transport in via proton symport	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[e] <>> H[c] + K[e]  H[e] + K[e] <>> H[c] + K[e]  H[e] + K[e] <>> H[c] + K[e]  H[e] + K[e] <>> H[c] + K[e]  H[e] + LAC[e] <>> H[c] + LAC[e]  H[e] + LEU[e] <>> H[c] + LEU[c]  H[e] + LYS[e] <>> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[e]  H[e] + MALT[e] <> H[c] + MALT[e]  H[e] + MET[e] <>> H[c] + MET[e]  NaDP[c] <>> NADP[e]  NADP[e] <>> NADP[e]  Nh4[e] <>> NH4[e]  NH4[e] <>> NH4[e]  NH4[e] <>> NH4[e]  H[e] + nnn[e] <>> H[e] + nnn[e]  C2[e] <>> O2[e]  O2A[c] <>> O2A[c]  C182[e] > C182[e]  H[e] + ONN[e]  PACALD[e] <>> PACP[e]  H[e] + PACALD[e]  PAP[e] <>> PAP[e]  H[e] + PEPD[e] <>> H[e] + PEDD[e]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxanthine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport N-mannose transport in via proton symport L-methionine reversible transport via proton symport N-mannose transport in via proton symport N-mannose transport in via proton symport N-mannose transport in via proton symport N-mannose transport (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decynoate (n-C18:1) transport in via uniport continue reversible transport in via proton symport Phenylacetaldehyde transport (extracellular) PAP reversible uniport petide transport in via proton symport Phenethyl acetate transport (extracellular)	Membrane	C161[c] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[e]  ind3etH[c] <> ind3etH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LEU[c]  H[e] + LEU[e] <> H[c] + LEU[c]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAT[e] <> H[c] + MET[c]  nac[e] <> nac[c]  NADP[c] <> NADP[e]  H[e] + nal[c] <> H[c] + nal[e]  Nbfortyr[c] <> Nbfortyr[e]  Nh4[e] <> NH4[c]  H[e] + nmn[e] <> H[c] + nmn[c]  O2[e] <> O2[c]  OAA[c] <> OAA[e]  C181[e] >> C181[c]  C182[e] >> C182[c]  H[e] + ORN[e] <> H[c] + ORN[c]  PACALD[c] <> PACALD[c]  PAP[e] <>> PAP[c]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantinne reversibe transport via proton c-1800@cune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport N-mannose transport in via proton symport L-methionine reversible transport via proton symport N-mannose transport in via proton symport L-methionine reversible transport via proton symport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport contunne reversible transport in via uniport ortitume reversible transport in via proton symport PAP reversible uniport peptide transport in via proton symport	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[e] <>> H[c] + K[e]  H[e] + K[e] <>> H[c] + K[e]  H[e] + K[e] <>> H[c] + K[e]  H[e] + K[e] <>> H[c] + K[e]  H[e] + LAC[e] <>> H[c] + LAC[e]  H[e] + LEU[e] <>> H[c] + LEU[c]  H[e] + LYS[e] <>> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[e]  H[e] + MALT[e] <> H[c] + MALT[e]  H[e] + MET[e] <>> H[c] + MET[e]  NaDP[c] <>> NADP[e]  NADP[e] <>> NADP[e]  Nh4[e] <>> NH4[e]  NH4[e] <>> NH4[e]  NH4[e] <>> NH4[e]  H[e] + nnn[e] <>> H[e] + nnn[e]  C2[e] <>> O2[e]  O2A[c] <>> O2A[c]  C182[e] > C182[e]  H[e] + ONN[e]  PACALD[e] <>> PACP[e]  H[e] + PACALD[e]  PAP[e] <>> PAP[e]  H[e] + PEPD[e] <>> H[e] + PEDD[e]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton S-18002 cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport constitutine reversible transport in via uniport orntunner Phenylacetaldehyde transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenethyl acetate transport (extracellular) L-phenylalanine reversible transport via proton	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[e] <> ind3eH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + kAC[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LEU[e] <> H[c] + LAC[e]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MET[e] <> H[c] + MET[c]  nac[e] <> nac[e]  NADP[c] <> NADP[e]  H[e] + nan[e] <> H[c] + nan[e]  H[e] + nan[e] <> H[c] + nan[e]  NH4[e] <> NH4[c]  H[e] + nan[e] >> H[c] + nan[e]  NH5[e] <> NH4[c]  H[e] + nan[e] >> H[e] + nan[e]  H[e] + nan[e] >> H[e] + nan[e]  NH4[e] <> NH4[e]  H[e] + nan[e] >> H[e] + nan[e]  O2[e] <> O2[e]  O2A[c] <> O4A[e]  C180[e] >> C180[e]  C181[e] >> C181[e]  H[e] + PNN[e] <>> H[e] + ONN[e]  PACALD[e] <> PACALD[e]  PAP[e] <> PAP[c]  H[e] + PEPD[e] >> H[e] + PEPD[c]  PHEAC[c] >> PHEAC[e]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14 SPAC2E1P3.02c
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton S-18002 cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport constitutine reversible transport in via uniport orntunner Phenylacetaldehyde transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenethyl acetate transport (extracellular) L-phenylalanine reversible transport via proton	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[e] <> ind3eH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + kAC[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LEU[e] <> H[c] + LAC[e]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MET[e] <> H[c] + MET[c]  nac[e] <> nac[e]  NADP[c] <> NADP[e]  H[e] + nan[e] <> H[c] + nan[e]  H[e] + nan[e] <> H[c] + nan[e]  NH4[e] <> NH4[c]  H[e] + nan[e] >> H[c] + nan[e]  NH5[e] <> NH4[c]  H[e] + nan[e] >> H[e] + nan[e]  H[e] + nan[e] >> H[e] + nan[e]  NH4[e] <> NH4[e]  H[e] + nan[e] >> H[e] + nan[e]  O2[e] <> O2[e]  O2A[c] <> O4A[e]  C180[e] >> C180[e]  C181[e] >> C181[e]  H[e] + PNN[e] <>> H[e] + ONN[e]  PACALD[e] <> PACALD[e]  PAP[e] <> PAP[c]  H[e] + PEPD[e] >> H[e] + PEPD[c]  PHEAC[c] >> PHEAC[e]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC64.14 SPAC2E1P3.02c SPAC23D3.12 SPAC23D3.12
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxanthine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport c080decynoate (n-C18:2) transport in via uniport c080decynoate (n-C18:2) transport in via uniport commond Phenylacetaldehyde transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenethyl acetate transport (extracellular) L-phenylalanine reversible transport via proton symport	Membrane	C161[e] > C161[c] $H[e] + HIS[e] <> H[c] + HIS[c]$ $H[e] + HXAN[e] <> H[c] + HXAN[c]$ $H[e] + ILE[e] <> hI[c] + ILE[c]$ $ind3eH[e] <> ind3eH[e]$ $H[e] + k[e] <> H[c] + k[c]$ $H[e] + k[e] <> H[c] + k[c]$ $H[e] + k[e] <> H[c] + k[c]$ $H[e] + LAC[e] <> H[c] + LAC[c]$ $H[e] + LEU[e] <> H[c] + LEU[c]$ $H[e] + HAL[e] <> H[c] + HAL[c]$ $H[e] + MALT[e] > H[c] + MALT[c]$ $H[e] + MALT[e] >> H[c] + MALT[c]$ $H[e] + MALT[e] >> H[c] + MALT[c]$ $H[e] + MaLT[e] >> H[c] + MaLT[c]$ $H[e] + MaT[e] >> H[c] + man[c]$ $H[e] + man[e] >> H[c] + man[c]$ $Nbfortyr[c] >> NaDP[e]$ $H[e] + nan[e] >> H[e] + nan[e]$ $Nbfortyr[c] >> Nbfortyr[e]$ $Nh4[e] <> Nh4[c]$ $H[e] + nmn[e] >> H[c] + nmn[c]$ $O2[e] <> O2(e]$ $OAA[c] <> OAA[e]$ $C180[e] >> C180[c]$ $C181[e] >> C181[c]$ $C182[e] >> C182[c]$ $H[e] + ORN[e] >> H[e] + ORN[e]$ $PACALD[e] <> PACALD[e]$ $PACALD[e] >> PAP[e]$ $H[e] + PEPD[e] >> H[e] + PEPD[e]$ $H[e] + PHE[e] <>> H[e] + PHE[e]$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14 SPAC2EIP3.02c SPAC23D3.12 SPAC23D3.12 SPAC23D3.12 SPBC1683.01
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport nypoxantinne reversible transport via proton S-18002 cine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport constitutine reversible transport in via uniport orntunner Phenylacetaldehyde transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenethyl acetate transport (extracellular) L-phenylalanine reversible transport via proton	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[e] <> ind3eH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + kAC[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LEU[e] <> H[c] + LAC[e]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MET[e] <> H[c] + MET[c]  nac[e] <> nac[e]  NADP[c] <> NADP[e]  H[e] + nan[e] <> H[c] + nan[e]  H[e] + nan[e] <> H[c] + nan[e]  NH4[e] <> NH4[c]  H[e] + nan[e] >> H[c] + nan[e]  NH5[e] <> NH4[c]  H[e] + nan[e] >> H[e] + nan[e]  H[e] + nan[e] >> H[e] + nan[e]  NH4[e] <> NH4[e]  H[e] + nan[e] >> H[e] + nan[e]  O2[e] <> O2[e]  O2A[c] <> O4A[e]  C180[e] >> C180[e]  C181[e] >> C181[e]  H[e] + PNN[e] <>> H[e] + ONN[e]  PACALD[e] <> PACALD[e]  PAP[e] <> PAP[c]  H[e] + PEPD[e] >> H[e] + PEPD[c]  PHEAC[c] >> PHEAC[e]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC64.14 SPAC2E1P3.02c SPAC23D3.12 SPAC23D3.12
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxanthine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lactate reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport c080decynoate (n-C18:2) transport in via uniport c080decynoate (n-C18:2) transport in via uniport commond Phenylacetaldehyde transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenethyl acetate transport (extracellular) L-phenylalanine reversible transport via proton symport	Membrane	C161[e] > C161[c] $H[e] + HIS[e] <> H[c] + HIS[c]$ $H[e] + HXAN[e] <> H[c] + HXAN[c]$ $H[e] + ILE[e] <> hI[c] + ILE[c]$ $ind3eH[e] <> ind3eH[e]$ $H[e] + k[e] <> H[c] + k[c]$ $H[e] + k[e] <> H[c] + k[c]$ $H[e] + k[e] <> H[c] + k[c]$ $H[e] + LAC[e] <> H[c] + LAC[c]$ $H[e] + LEU[e] <> H[c] + LEU[c]$ $H[e] + HAL[e] <> H[c] + HAL[c]$ $H[e] + MALT[e] > H[c] + MALT[c]$ $H[e] + MALT[e] >> H[c] + MALT[c]$ $H[e] + MALT[e] >> H[c] + MALT[c]$ $H[e] + MaLT[e] >> H[c] + MaLT[c]$ $H[e] + MaT[e] >> H[c] + man[c]$ $H[e] + man[e] >> H[c] + man[c]$ $Nbfortyr[c] >> NaDP[e]$ $H[e] + nan[e] >> H[e] + nan[e]$ $Nbfortyr[c] >> Nbfortyr[e]$ $Nh4[e] <> Nh4[c]$ $H[e] + nmn[e] >> H[c] + nmn[c]$ $O2[e] <> O2(e]$ $OAA[c] <> OAA[e]$ $C180[e] >> C180[c]$ $C181[e] >> C181[c]$ $C182[e] >> C182[c]$ $H[e] + ORN[e] >> H[e] + ORN[e]$ $PACALD[e] <> PACALD[e]$ $PACALD[e] >> PAP[e]$ $H[e] + PEPD[e] >> H[e] + PEPD[e]$ $H[e] + PHE[e] <>> H[e] + PHE[e]$	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14 SPAC2E1P3.02c SPAC23D3.12 SPAC23D3.12 SPAC23D3.12 SPBC1683.01 SPCC2H8.02 SPBC2B8.01 SPBC3B8.04
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantune reversibe transport via proton L-1800Edcune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-lysine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport N-mannose transport in via proton symport L-methionine reversible transport via proton symport N-mannose transport in via proton symport L-methionine reversible transport via proton symport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decenoate (n-C18:1) transport in via uniport continue reversible transport in via proton symport Phenethyl acetale transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenethyl acetate transport (extracellular) L-phenylalanine reversible transport via proton symport	Membrane	C161[c] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3etH[c] <> ind3etH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LAC[c]  H[e] + LEU[e] <> H[c] + LAC[c]  H[e] + LYS[e] <> H[e] + LYS[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAL[e] <> H[c] + MAL[c]  H[e] + MAL[e] >> H[c] + MALT[c]  H[e] + MAT[e] >> H[c] + MAT[c]  H[e] + MAT[e] <> H[c] + MAT[e]  NaDP[c] <> NADP[e]  H[e] + na1[c] <> H[c] + na1[e]  Nbfortyr[c] >> Nbfortyr[e]  Nh4[e] <> Nh4[c]  H[e] + nnn[e] >> H[c] + nnn[c]  O2[e] <> O2(c]  OAA[e] <> OAA[e]  C180[e] >> C180[c]  C181[e] >> C182[c]  H[e] + ORN[e] <>> H[e] + ORN[e]  PAP[e] <>> PAP[e]  H[e] + PEPD[e] >> H[c] + PEPD[c]  H[e] + PEPD[e] >> H[c] + PEPD[c]  H[e] + PHE[e] <>> H[c] + PHE[c]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14 SPAC2E1P3.02c SPAC23D3.12 SPAC23D3.12 SPAC23D3.12 SPEC1683.01 SPCC2H8.02 SPCSEH.01C
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantune reversibet transport via proton L-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport in via proton symport NaDP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decanoate (n-C18:1) transport in via uniport contitune reversible transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenylacetaldehyde transport (extracellular) L-phenylalanine reversible transport via proton symport Phosphate reversible transport via symport	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[c] <> ind3eH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MET[e] <> H[c] + MET[c]  nac[e] <> nac[c]  NADP[c] <> NADP[e]  H[e] + nan[e] >> H[c] + nan[e]  Nhfortyr[c] <> Nhfortyr[e]  NH4[e] <> NH4[c]  H[e] + nnn[e] >> H[c] + nnn[c]  O2[e] <> O2(e]  OAA[c] <> OAA[e]  C180[e] >> C180[e]  C181[e] >> C181[e]  H[e] + ORN[e] <> H[c] + ORN[e]  PACALD[e] <> PAPC[e]  H[e] + PEPD[e] >> H[c] + PEPD[e]  H[e] + PHE[e] <>> H[c] + PHE[e]  H[e] + PHE[e] <>> H[c] + PHE[c]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14 SPAC2E1P3.02c SPAC23D3.12 SPAC23D3.12 SPAC23D3.12 SPBC1683.01 SPCC2H8.02 SPBC2B8.01 SPBC3B8.04
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantinne reversible transport via proton c-1800@cune reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport D-mannose transport in via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport NADP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decanoate (n-C18:2) transport in via uniport C080decanoate (n-C18:2) transport in via uniport constitune reversible transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenethyl acetate transport (extracellular) L-phenylalanine reversible transport via proton symport  Phanothenate reversible transport via symport  Phenothenate reversible transport via proton symport  Prantothenate reversible transport via proton symport  Prantothenate reversible transport via proton symport  Profine reversible transport via proton symport  Profine reversible transport via proton symport  Profine reversible transport via proton symport	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[e] <>> ind3eH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LEU[e] <> H[c] + LAC[e]  H[e] + LEU[e] <> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] >> H[c] + MALT[c]  H[e] + Malte] <> H[c] + Malte]  H[e] + Malte] <> H[c] + Malte]  H[e] + Malte] <> H[e] + Malte]  H[e] + Malte] <> H[e] + Malte]  H[e] + Malte] <> H[e] + male]  Noberty (a) >> NaDP[e]  H[e] + nal[c] <>> H[c] + nal[e]  Noberty (a) >> NaDP[e]  H[e] + nal[e] <> H[e] + nal[e]  Noberty (a) >> NaDP[e]  H[e] + nal[e] <> Nhal[e]  H[e] + nal[e] <> Nhal[e]  H[e] + nal[e] <> H[e] + nal[e]  Palte] <> C180[e]  C181[e] >> C180[e]  C181[e] >> C181[e]  H[e] + PACALD[e] >> PACALD[e]  PACALD[e] <> PACALD[e]  H[e] + PEPD[e] >> H[e] + PEPD[e]  H[e] + PEPD[e] >> H[e] + PEPD[e]  H[e] + PHE[e] <>> H[e] + PHE[e]  H[e] + PHE[e] <>> H[e] + PHE[e]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14 SPAC2E1P3.02c SPAC23D3.12 SPAC23D3.12 SPAC23D3.12 SPBC1683.01 SPCC2H8.02 SPBC2B8.01 SPBC3B8.04
hexadecenoate (n-C16:1) transport in via uniport L-histidine reversible transport via proton symport hypoxantune reversibet transport via proton L-1800Eucine reversible transport via proton symport Tryptophol transport (extracellular potassium reversible transport via proton symport L-lactate reversible transport via proton symport L-leucine reversible transport via proton symport L-leucine reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-malate reversible transport via proton symport L-methionine reversible transport via proton symport Nicotinic acid transport in via proton symport NaDP transporter sodium proton antiporter (H:NA is 1:1) N,N-bisformyl-dityrosine transport (extracellular) ammonia reversible transport nmntp o2 transport (diffusion) Oxaloacetate transport C080decanoate (n-C18:0) transport in via uniport C080decanoate (n-C18:1) transport in via uniport contitune reversible transport (extracellular) PAP reversible uniport peptide transport in via proton symport Phenylacetaldehyde transport (extracellular) L-phenylalanine reversible transport via proton symport Phosphate reversible transport via symport	Membrane	C161[e] >> C161[c]  H[e] + HIS[e] <> H[c] + HIS[c]  H[e] + HXAN[e] <> H[c] + HXAN[c]  H[e] + ILE[e] <> H[c] + ILE[c]  ind3eH[c] <> ind3eH[e]  H[e] + k[e] <> H[c] + k[c]  H[e] + k[e] <> H[c] + k[c]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LAC[e] <> H[c] + LAC[e]  H[e] + LYS[e] <> H[c] + LYS[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MALT[e] <> H[c] + MALT[c]  H[e] + MET[e] <> H[c] + MET[c]  nac[e] <> nac[c]  NADP[c] <> NADP[e]  H[e] + nan[e] >> H[c] + nan[e]  Nhfortyr[c] <> Nhfortyr[e]  NH4[e] <> NH4[c]  H[e] + nnn[e] >> H[c] + nnn[c]  O2[e] <> O2(e]  OAA[c] <> OAA[e]  C180[e] >> C180[e]  C181[e] >> C181[e]  H[e] + ORN[e] <> H[c] + ORN[e]  PACALD[e] <> PAPC[e]  H[e] + PEPD[e] >> H[c] + PEPD[e]  H[e] + PHE[e] <>> H[c] + PHE[e]  H[e] + PHE[e] <>> H[c] + PHE[c]	Transport, Extracellular	SPAC977.10 SPAC15A10.06 SPAC3A11.09 SPCPB1C11.01 SPAC664.14 SPAC2E1P3.02c SPAC23D3.12 SPAC23D3.12 SPAC23D3.12 SPBC1683.01 SPCC2H8.02 SPBC2B8.01 SPBC3B8.04

	Mamhana	High DVD(a) v High DVD(a)	Transport Entracellular	
pyruvate transport in via proton symport	Membrane		Transport, Extracellular Transport, Extracellular	
riboflavin transport in via proton symport	Membrane	H[e] + ribflv[e] -> H[c] + ribflv[c]	• '	
ribose transport in via proton symporter	Membrane		Transport, Extracellular	
D-sorbitol transport via passive diffusion	Membrane	sbt-D[e] <-> sbt-D[c]	Transport, Extracellular	
L-sorbitol transport via passive diffusion	Membrane		Transport, Extracellular	
L-serine reversible transport via proton symport	Membrane		Transport, Extracellular	
sulfite transport (efflux to extracellular)	Membrane	SO3[c] -> SO3[e]	Transport, Extracellular	
sulfate uniport	Membrane	SO4[e] -> SO4[c]	Transport, Extracellular	SPAC24H6.11C SPCC320.05 SPBC3H7.02 SPAC869.05C
spermidine transport in via proton antiport	Membrane	$H[c] + spmd[e] \rightarrow H[e] + spmd[c]$	Transport, Extracellular	31 AC803.03C
spermidine excretion (cytosol to extracellular)	Membrane		Transport, Extracellular	
spermine transport via proton antiport	Membrane		Transport, Extracellular	
L-sorbose reversible transport	Membrane		Transport, Extracellular	
succinate transport via proton symport	Membrane		Transport, Extracellular	
			Transport, Extracellular	CDACOE2 00
sucrose transport in via proton symport	Membrane		•	SPAC2F3.08
taURIne transport	Membrane		Transport, Extracellular	
thymidine transport in via proton symport	Membrane		Transport, Extracellular	
Thiamine transport in via proton symport L-threonine reversible transport via proton	Membrane		Transport, Extracellular	
symnort	Membrane	H[e] + THR[e] <> H[c] + THR[c]	Transport, Extracellular	
thymine reversible transport via proton antiport	Membrane		Transport, Extracellular	
trehalose transport in via proton symporter L-tryptophan reversible transport via proton	Membrane	$H[e] + TRE[e] \rightarrow H[c] + TRE[c]$	Transport, Extracellular	
compart	Membrane		Transport, Extracellular	
fatty acid transport	Membrane	C140[e] <-> C140[c]	Transport, Extracellular	
L-tyrosine reversible transport via proton symport	Membrane	H[e] + TYR[e] <-> H[c] + TYR[c]	Transport, Extracellular	
uracil transport in via proton symport urea reversible transport via proton symport (2 H+)	Membrane	H[e] + ura[e] -> H[c] + ura[c] (2 $na[e] + urea[e] <>> 2 na[c] + urea[c]$	Transport, Extracellular Transport, Extracellular	SPAC1399.03 SPAC29B12.14C SPBC23G7.13C
urea reversible transport via proton symport (2 H+)	Memorane	(2 najej + ureajej <-> 2 najej + ureajej	Transport, Extracentuar	SPAC869.03C
URIdine transport in via proton symport	Membrane	$H[e] + URI[e] \rightarrow H[c] + URI[c]$	Transport, Extracellular	
L-valine reversible transport via proton symport	Membrane	$H[e] + VAL[e] \Leftrightarrow H[c] + VAL[c]$	Transport, Extracellular	
xanthine reversible transport	Membrane	XAN[e] <-> XAN[c]	Transport, Extracellular	
xanthosine transport in via proton symport	Membrane		Transport, Extracellular	
D-xylose reversible transport	Membrane	xyl-D[e] <-> xyl-D[c]	Transport, Extracellular	
Xylitol transport via passive diffusion	Membrane		Transport, Extracellular	
zymosterol reversible transport	Membrane	zymst[e] <-> zymst[c]	Transport, Extracellular	
			-	SPAC20G8.03
MFS myo-inositol transporter	Membrane	inost[e] <-> inost [c]	Transport, Extracellular	SPAC4F8.15
myo-inositol transporter Itr1	Membrane	inost[e] <-> inost [c]	Transport, Extracellular	SPAC4F8.15
				SPAC20G8.03
CO2 Golgi transport	Membrane		Transport, Golgi Apparatus	an. a
GDP-mannose antiport	Membrane		Transport, Golgi Apparatus	SPAC144.18
GDP Golgi transport via proton anitport	Membrane	GDP[g] + H[c] <-> GDP[c] + H[g]	Transport, Golgi Apparatus	
phosphatidylethanolamine Golgi transport	Membrane	pe [c] <-> pe [g]	Transport, Golgi Apparatus	
phosphatidylserine Golgi transport	Membrane	ps [c] <-> ps [g]	Transport, Golgi Apparatus	
UDPgalactose transport (Golgi apparatus)	Membrane	UDPgal[c] -> UDPgal[g]	Transport, Golgi Apparatus	
Diphosphate Mitochondrial transport	Membrane	$PPi[c] \Leftrightarrow PPi[m]$	Transport, Mitochondrial	
2-Dehydro-3-deoxy-D-arabino-heptonate7-	Membrane	2dda7p[c] <-> 2dda7p[m]	Transport, Mitochondrial	
phohsphate mitochondrial transport via diffusion			•	
2-Dehydropantoate mitochondrial transport	Membrane	$2DHP[c] \Leftrightarrow 2DHP[m]$	Transport, Mitochondrial	
2-Methylbutanal transport (mitochondrial)	Membrane	2mbald[c] <-> 2mbald[m]	Transport, Mitochondrial	
2-methyl-1-butanol transport (mitochondrial)	Membrane	2mbtoH[c] <-> 2mbtoH[m]	Transport, Mitochondrial	
2-methylpropanal transport (mitochondrial)	Membrane	2mppal[c] <-> 2mppal[m]	Transport, Mitochondrial	
2obut transporter (mitochondrial)	Membrane	2obut[c] <-> 2obut[m]	Transport, Mitochondrial	
2-oxoadipate transport out of mitochondria via	M		-	
diffusion	Membrane	2oxoADP[m] -> 2oxoADP[c]	Transport, Mitochondrial	
2-phenylethanol reversible transport	Membrane	2PHETOH[m] <-> 2PHETOH[c]	Transport, Mitochondrial	
3-(4-hydroxyphenyl)pyruvate mitochondrial	Membrane	34Hpp[c] + H[c] <-> 34Hpp[m] + H[m]	Transport, Mitochondrial	
transport via proton symport			Transport, Mitoenonaria	
2-Isopropylmalate transport, diffusion				
3-Carboxy-4-methyl-2-oxopentanoate transport,	Membrane	3c3Hmp[c] <-> 3c3Hmp[m]	Transport, Mitochondrial	
	Membrane	3c4MOP[c] <-> 3c5rmp[m]	Transport, Mitochondrial Transport, Mitochondrial	
diffusion	Membrane	3c4MOP[c] <>> 3c4MOP[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport	Membrane Membrane	3c4MOP[c] <-> 3c4MOP[m] 3H45DHBZ[c] <-> 3H45DHBZ[m]	Transport, Mitochondrial Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial)	Membrane Membrane	3c4MOP[c] <>> 3c4MOP[m] 3H45DHBZ[c] <>> 3H45DHBZ[m] 3mbald[c] <>> 3mbald[m]	Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion	Membrane Membrane Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m]	Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion	Membrane Membrane Membrane Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m] 3MOP[c] <>> 3MOP[m]	Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion	Membrane Membrane Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m]	Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion	Membrane Membrane Membrane Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m] 3MOP[c] <>> 3MOP[m]	Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial Transport, Mitochondrial	
diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion	Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] << 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutl[c] <> 4abut[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport	Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <<> 4abutn[m] 4abut[c] <<> 4abutn[m] PABA[c] <>> PABA[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m] 3MOP[c] <>> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <<> 4abutn[m] 4abut[c] <>> 4abut[m] PABA[c] <>> PABA[m] 4H2Oglt[c] <>> 4H2Oglt[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m] 3MOP[c] <>> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <<> 4abutn[m] 4abut[c] <<> 4abutn[m] PABA[c] <<> PABA[m] 4H2Oglt[c] <>> 4H52[m] 4H52[c] <>> 4H52[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m] 3MOP[c] <>> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <<> 4abutn[m] 4abut[c] <>> 4abut[m] PABA[c] <>> PABA[m] 4H2Oglt[c] <>> 4H2Oglt[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxybenzoate mitochondrial transport trans-4-hydroxy-L-proline mitochondrial transport	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <<> 3MOB[m] 3MOP[c] <>> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <<> 4abutn[m] 4abut[c] <<> 4abutn[m] PABA[c] <<> PABA[m] 4H2Oglt[c] <>> 4H52[m] 4H52[c] <>> 4H52[m]	Transport, Mitochondrial	
diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobutanoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-proline mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abut[c] <> 4abut[m] PABA[c] <> PABA[m] 4H2Oglt[c] <> 4H2Oglt[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxybenzoate mitochondrial transport via diffusion 4-hydroxybenzoate mitochondrial transport via diffusion	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutl[c] <> 4abutn[m] PABA[c] <> PABA[m] 4H2Oglt[c] <> 4H2Oglt[m] 4H5C[c] <> 4H5C[m] 4HPROT[c] <> 4HPROT[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-aminobenzoate mitochondrial transport via diffusion 4-Hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxy-L-proline mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport via diffusion 6-Aminolevulinate mitochondrial transport acetaldehyde mitochondrial diffusion 6-Acaptoceulinate mitochondrial diffusion	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] << 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutl[c] <> 4abutn[m] 4abutl[c] <> 4abutn[m] 4h2Oglt[c] <> 4H2Oglt[m] 4H2Oglt[c] <> 4H5z[m] 4H2Cglt[c] <> 4H5z[m] 4H2Cglt[c] <> 4H5z[m] 4HCz[c] <> 4HDZ[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-proglutarate mitochondrial transport via diffusion 4-hydroxybenzoate mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport acetaldehyde mitochondrial diffusion acetate transport adenine reversible transport	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <>> 4abutn[m] 4abut[c] <>> 4H2Oglt[m] 4H2Oglt[c] <> 4H2Oglt[m] 4HPROT[c] <> 4HDz[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[m] <> ACAL[c] ACA[c] <> ACM[m] ADE[c] <> ADE[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanal emitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-Hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxybenzoate mitochondrial transport via diffusion 4-Hydroxybenzoate mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport acetaldehyde mitochondrial diffusion acetaldehyde mitochondrial diffusion acetalte transport adenine reversible transport	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] PABA[c] <> PABA[m] 4H2Oglt[c] <> 4H2Oglt[m] 4H2Oglt[c] <> 4HPROT[m] 4HPROT[c] <> 4HPROT[m] 6ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[c] ACE[c] <> ADE[m] SAH[c] <> SAH[m]	Transport, Mitochondrial	
diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxoputanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-proline mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport acetaledhyde mitochondrial diffusion acetate transport acetaledhyde mitochondrial diffusion acetate transport S-adenosyl-L-homocysteine reversible transport	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abut[c] <> 4Abutn[m] 4hbut[c] <> 4H2Oglt[m] 4HPCOglt[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] AC[c] <> AC[m] AC[c] <> ADE[m] SAH[c] <> SAH[m] ALA[m] <> ALA[c]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-Hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxy-2-proglutarate mitochondrial transport via diffusion 4-Hydroxy-L-proline mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport acetaldehyde mitochondrial diffusion acetate transport adenine reversible transport S-adenosyl-L-homocysteine reversible transport Alanine transport from mitochondia to cytoplasm S-Adenosyl-L-methionine reversible transport	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4butl[c] <> 4H2Oglt[m] 4H2Oglt[c] <> 4H2Oglt[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] AC[c] <> AC[c] <> AC[m] ADE[c] <> ADE[m] SAH[c] <> SAH[m] ALA[m] <> ALA[c] SAM[m] <	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-Hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxy-2-proglutarate mitochondrial transport via diffusion 5-Aminobenzoate mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport via diffusion acetale transport adenine reversible transport S-adenosyl-L-homocysteine reversible transport admine reversible transport from mitochondria to cytoplasm S-Adenosyl-L-methionine reversible transport arginne mitochondrial transport via proton	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abut[c] <> 4Abutn[m] 4hbut[c] <> 4H2Oglt[m] 4HPCOglt[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] AC[c] <> AC[m] AC[c] <> ADE[m] SAH[c] <> SAH[m] ALA[m] <> ALA[c]	Transport, Mitochondrial	
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diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 5-Aminobenzoate mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport and diffusion 5-Aminolevulinate mitochondrial transport acetaldehyde mitochondrial diffusion acetate transport adenine reversible transport S-adenosyl-L-homocysteine reversible transport Alanine transport from mitochondia to cytoplasm S-Adenosyl-L-methionine reversible transport argmme mitochondrial transport via proton tran	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abut[c] <> 4Abutn[m] 4bv[c] <> 4H2Oglt[m] 4H2Oglt[c] <> 4H2Oglt[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] AC[c] <> AC[c] <> AC[m] ADE[c] <> ADE[m] SAH[c] <> SAH[m] ALA[m] >> ALA[c] SAM[c] <> SAM[m] ALA[m] >> ALA[c] SAM[c] <> SAM[m] ARG[c] + H[c] <> ARG[m] + H[m]	Transport, Mitochondrial	
diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 5-Aminobenzoate mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport addifusion 5-Aminolevulinate mitochondrial transport acetaledhyde mitochondrial diffusion acetate transport S-adenosyl-L-hemtocysteine reversible transport Alanine transport from mitochondria transport Via proton symport saparagine mitochondrial transport via proton transport Aspartate-glutamate transport via proton	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abut[c] <> 4abutn[m] 4abut[c] <> 4abut[m] 4bz[c] <> 4abut[m] 4H2Oglt[c] <> 4H2Oglt[m] 4HPCOT[c] <> 4HDZ[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] AC[c] <> ACL[c] AC[c] <> ADE[m] SAM[c] <> SAM[m] ADE[c] <> ADE[m] SAM[c] <> SAM[m] ALA[m] >> ALA[c] SAM[c] <> SAM[m] ARG[c] + H[c] <> ARG[m] + H[m] ASN[c] + H[c] <> ASN[m] + H[m] ASN[c] + H[c] <> ASN[m] + H[m] ASP[m] + GLU[c] >> ASP[c] + GLU[m]	Transport, Mitochondrial	
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-Indroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxy-L-proline mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport acetaldehyde mitochondrial diffusion acetate transport adenine reversible transport S-adenosyl-L-homocysteine reversible transport argume mitochondrial transport via proton symmost asparagine mitochondrial transport via proton transport Aspartate-glutamate transporter asparate mitochondrial transport via proton symmost	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abut[c] <> 4Abutn[m] 4abut[c] <> 4H2Oght[m] 4H2Oght[c] <> 4H2Oght[m] 4H2Oght[c] <> 4HD2[m] 4HPROT[c] <> 4HD2[m] 4HPROT[c] <> 4HD2[m] 4Abutn[c] <> 5aop[m] ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[m] ADE[c] <> SAM[m] ALA[m] > ALA[c] SAM[c] <> SAM[m] ALS[c] + H[c] <> ARS[m] + H[m] ASN[c] + H[c] <> ASP[c] + GLU[m] ASP[m] + GLU[c] > ASP[c] + GLU[m] ASP[c] + H[c] <> ASP[m] + H[m]	Transport, Mitochondrial	SPRC530.10C
diffusion 3-Hexaprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxopentanoate transport, diffusion 3-Co86prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-aminobenzoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxy-2-proglutarate mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport via diffusion acetale transport acetaledehyde mitochondrial diffusion acetate transport Alanine transport from mitochondia to cytoplasm S-Adenosyl-L-methionine reversible transport argume mitochondrial transport via proton transport asparagine mitochondrial transport via proton transport Asparate-glutamate transporter asparate mitochondrial transport via proton sumport Appriate Transporter	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4H2Oght[m] 4H2Oght[c] <> 4H2Oght[m] 4H2Oght[c] <> 4HPROT[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[c] ACAL[m] <> ACAL[m] ADE[c] <> ADE[m] SAH[c] <> SAH[m] ALA[m] > ALA[c] SAM[c] <> SAM[m] ALS[c] <> SAM[m] ALS[c] <> H[c] <> ASP[m] + H[m] ASP[c] + H[c] <> ASP[c] + GLU[m] ASP[c] + H[c] <> ASP[m] + H[m]	Transport, Mitochondrial	SPBC530.10C
diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-minobutanoate mitochondrial transport via diffusion 4-Aminobutanoate mitochondrial transport via diffusion 4-Aminobutanoate mitochondrial transport via diffusion 4-Hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-Hydroxy-2-posione mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport vian-4-hydroxy-1-proline mitochondrial transport vian-diffusion 5-Aminolevulinate mitochondrial transport acetaledhyde mitochondrial diffusion acetate transport dennine reversible transport Alanine transport from mitochondia to cytoplasm S-Adenosyl-L-methionine reversible transport Alanine transport from mitochondrial transport via proton symnort asparagiem mitochondrial transport via proton transport Aspartate-glutamate transporter cymnort ADP/ATP transporter citrate transport	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abutl[c] <> 4abutn[m] 4abutl[c] <> 4abutn[m] 4hBZ[c] <> PABA[m] 4H2Oglt[c] <> 4HDZ[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] AC[c] <> AC[m] ADE[c] <> SADE[m] SAH[c] <> SAH[m] ALA[m] <> ACAL[c] AC[c] <> AC[m] ADE[c] <> SAH[m] ALA[m] <> ACAL[c] AC[m] <> ACAN[m] ASAN[c] <> SAN[m] ALA[c] <> SAN[m] ASAN[c] <> SAN[m] ASS[c] + H[c] <> ASP[m] + H[m] ASP[m] + GLU[c] >> ASP[c] + GLU[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + ATP[m] + H[c] >> ADP[m] + ATP[c] + H[m] CIT[c] + MAL[m] <> CIT[m] + MAL[c]	Transport, Mitochondrial	SPBC530.10C
diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-Co80prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 5-Aminobenzoate mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport via diffusion 5-Aminolevulinate mitochondrial transport acetaldehyde mitochondrial diffusion acetate transport adenine reversible transport S-adenosyl-L-hemocysteine reversible transport Alanine transport from mitochondia to cytoplasm S-Adenosyl-L-methionine reversible transport argume mutochondrial transport via proton transport generate mitochondrial transport via proton transport aparagine mitochondrial transport via proton transport aparate-glutamate transporter asparate mitochondrial transport via proton transport transport via proton transport via	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abut[c] <> 4abutn[m] 4abut[c] <> 4Abutn[m] 4hBZ[c] <> 4HBZ[m] 4HPQB[t] <>> 4H2Oght[m] 4HPQG[t] <>> 4HPROT[m] 5aop[c] <>> 5aop[m] 4CAL[m] <>> ACAL[c] AC[c] <> AC[m] ADE[c] <> ADE[m] SAH[c] <> SAH[m] ALA[m] <> ACAL[c] AC[c] <> ADE[m] SAH[c] <> SAH[m] ALA[m] <> HALA[c] SAM[c] <> SAM[m] ALS[c] <> SAM[m] ALS[c] <> SAM[m] ARG[c] + H[c] <> ARG[m] + H[m] ASP[c] + H[c] <> ASP[c] + GLU[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + H[c] <> ADP[m] + ATP[c] + H[m] CIT[c] + MAL[m] <>> CIT[m] + MAL[c] CIT[c] + PEP[m] <>> CIT[m] + MAL[c] CIT[c] + PEP[m] <>> CIT[m] + PEP[c]	Transport, Mitochondrial	SPBC530.10C
diffusion 3-Hexprenyl-4,5-dihydroxybenzoate transport 3-methylbutanal transport (mitochondrial) 3-methyl-2-oxobutanoate transport, diffusion 3-Methyl-2-oxobutanoate transport, diffusion 3-C080prenyl-4-hydroxybenzoate mitochondrial transport 4-aminobutanal mitochondrial transport via diffusion 4-minobutanoate mitochondrial transport via diffusion 4-aminobutanoate mitochondrial transport via diffusion 4-Aminobenzoate mitochondrial transport via diffusion 4-hydroxy-2-oxoglutarate mitochondrial transport via diffusion 4-hydroxy-2-proline mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport trans-4-hydroxy-1-proline mitochondrial transport and diffusion 5-Aminolevulinate mitochondrial transport acetaledhyde mitochondrial diffusion acetate transport 4-adenine reversible transport 5-adenosyl-L-homocysteine reversible transport Alanine transport from mitochondia to cytoplasm 5-Adenosyl-L-methionine reversible transport agnine mitochondrial transport via proton symnoral asparagine mitochondrial transport via proton transport Aspartate-glutamate transporter caparatie mitochondrial transport via proton cymnoral ADP/ATP transporter	Membrane	3c4MOP[c] <> 3c4MOP[m] 3H45DHBZ[c] <> 3H45DHBZ[m] 3mbald[c] <> 3mbald[m] 3MOB[c] <> 3MOB[m] 3MOP[c] <> 3MOP[m] O4HBZ[c] <> O4HBZ[m] 4abutn[c] <> 4abutn[m] 4abutn[c] <> 4abutn[m] 4abutl[c] <> 4abutn[m] 4abutl[c] <> 4abutn[m] 4hBZ[c] <> PABA[m] 4H2Oglt[c] <> 4HDZ[m] 4HPROT[c] <> 4HPROT[m] 5aop[c] <> 5aop[m] ACAL[m] <> ACAL[c] AC[c] <> AC[m] ADE[c] <> SADE[m] SAH[c] <> SAH[m] ALA[m] <> ACAL[c] AC[c] <> AC[m] ADE[c] <> SAH[m] ALA[m] <> ACAL[c] AC[m] <> ACAN[m] ASAN[c] <> SAN[m] ALA[c] <> SAN[m] ASAN[c] <> SAN[m] ASS[c] + H[c] <> ASP[m] + H[m] ASP[m] + GLU[c] >> ASP[c] + GLU[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + H[c] <> ASP[m] + H[m] ASP[c] + ATP[m] + H[c] >> ADP[m] + ATP[c] + H[m] CIT[c] + MAL[m] <> CIT[m] + MAL[c]	Transport, Mitochondrial	SPBC530.10C

CO2 transport (diffusion)	Membrane	CO2[c] <-> CO2[m]	Transport, Mitochondrial	
CoA transporter (mitochondrial)	Membrane	$CoA[c] \rightarrow CoA[m]$	Transport, Mitochondrial	
CTP/CMP antiport	Membrane	$CMP[m] + CTP[c] + 2\ H[c] \rightarrow CMP[c] + CTP[m] + 2\ H[m]$	Transport, Mitochondrial	SPAC688.09
D-lactate/pyruvate antiport	Membrane	dLAC[c] + PYR[m] <-> dLAC[m] + PYR[c]	Transport, Mitochondrial	
D-lactate transport	Membrane	H[c] + dLAC[c] <-> H[m] + dLAC[m]	Transport, Mitochondrial	
dihydroxyacetone phosphate transport	Membrane	DHAP[m] -> DHAP[c]	Transport, Mitochondrial	
dihydrofolate reversible mitochondrial transport	Membrane	DHF[c] <-> DHF[m]	Transport, Mitochondrial	
dhnpt mitochondrial transport  Dihydropteroate mitochondrial transport via	Membrane	DHNPT[c] <-> DHNPT[m]	Transport, Mitochondrial	
diffusion	Membrane	DHPT[c] <-> DHPT[m]	Transport, Mitochondrial	
L-erythro-4-hydroxyglutamate mitochondrial	Membrane	e4HGLU[c] <-> e4HGLU[m]	Transport, Mitochondrial	
transport via diffusion D-erythrose 4-phosphate mtiochondrial transport				
via diffusion	Membrane	E4P[c] <-> E4P[m]	Transport, Mitochondrial	
ethanol transport to mitochondria (diffusion)	Membrane	ETOH[c] <-> ETOH[m]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C120ACP[m] -> C120ACP[c]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C140ACP[m] -> C140ACP[c]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C141ACP[m] -> C141ACP[c]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C160ACP[m] -> C160ACP[c]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C161ACP[m] -> C161ACP[c]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C180ACP[m] -> C180ACP[c]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C181ACP[m] -> C181ACP[c]	Transport, Mitochondrial	
fatty-acyl-ACP mitochondrial transport	Membrane	C182ACP[m] -> C182ACP[c]	Transport, Mitochondrial	
FAD/FMN antiport	Membrane	fad[c] + fmn[m] -> fad[m] + fmn[c]	Transport, Mitochondrial	SPBC27B12.09C
iron (II) uptake (mitochondrial)	Membrane	fe2[c] -> fe2[m]	Transport, Mitochondrial	
iron (II) transport	Membrane	fe2[m] -> fe2[c]	Transport, Mitochondrial	
formate mitochondrial transport	Membrane	for[m] -> for[c]	Transport, Mitochondrial	CDAC1742.05
fumarate reductaseic/mitochondrial farnesyl diphosphate transport (mitochondrial)	Membrane Membrane	FADH2[m] + FUM[c] -> fad[m] + SUCC[c] FRPP[c] <-> FRPP[m]	Transport, Mitochondrial Transport, Mitochondrial	SPAC17A2.05
glycoaldehyde mitochondrial transport	Membrane	gcald[c] <-> PRPP[m] gcald[c] <-> gcald[m]	Transport, Mitochondrial	
L-glutamate transport into mitochondria via				
hydroxide ion antiport	Membrane	$GLU[c] + oH1[m] \rightarrow GLU[m] + oH1[c]$	Transport, Mitochondrial	
Glutamate transport (uniporter)	Membrane	$GLU[c] \rightarrow GLU[m]$	Transport, Mitochondrial	
glycerol-3-phosphate shuttle	Membrane	$GLYC3p[c] \rightarrow GLYC3p[m]$	Transport, Mitochondrial	
glycine mitochondrial transport via proton symport	Membrane	GLY[c] + H[c] <-> GLY[m] + H[m]	Transport, Mitochondrial	
guanosine mitochondrial transport via proton symport	Membrane	GSN[c] + H[c] <-> GSN[m] + H[m]	Transport, Mitochondrial	
GTP/GDP translocase (electroneutral)	Membrane	$GDP[m] + GTP[c] + H[c] \rightarrow GDP[c] + GTP[m] + H[m]$	Transport, Mitochondrial	
guanine mitochondrial transport via diffusion	Membrane	GUA[c] <-> GUA[m]	Transport, Mitochondrial	
H2O transport	Membrane	H2O[c] <-> H2O[m]	Transport, Mitochondrial	
all-trans-hexaprenyl diphosphate transport	Membrane	$HXPP[c] \Longleftrightarrow HXPP[m]$	Transport, Mitochondrial	
histidine mitochondrial transport via proton	Membrane	H[m] + HIS[m] <> H[c] + HIS[c]	Transport, Mitochondrial	
Hydroxymethylglutaryl-CoA reversible	Membrane	HmgCoA[c] <-> HmgCoA[m]	Transport, Mitochondrial	
mitochondrial transport				
isoamyl alcohol transport (mitochondrial) isobutyl alcohol transport (mitochondrial)	Membrane Membrane	IAMOH[c] <-> IAMOH[m] IBUTOH[c] <-> IBUTOH[m]	Transport, Mitochondrial Transport, Mitochondrial	
indole-3-acetaldehyde mitochondrial transport via				
diffusion	Membrane	id3acald[c] <-> id3acald[m]	Transport, Mitochondrial	
Isoleucine transport from mitochondria to cytosol	Membrane	ILE[m] -> ILE[c]	Transport, Mitochondrial	
indole-3-acetate mitochondrial transport via diffusion	Membrane	ind3ac[c] <-> ind3ac[m]	Transport, Mitochondrial	
Tryptophol transport (mitochondrial)	Membrane	ind3etH[c] <-> ind3etH[m]	Transport, Mitochondrial	
Isopentenyl diphosphate transport	Membrane	IPPP[c] <-> IPPP[m]	Transport, Mitochondrial	
L-lactate transport	Membrane	H[c] + LAC[c] <-> H[m] + LAC[m]	Transport, Mitochondrial	
Lysine mitochondrial transport via proton symport	Membrane	H[c] + LYS[c] <-> H[m] + LYS[m]	Transport, Mitochondrial	
malate transport	Membrane	MAL[c] + Pi[m] <-> MAL[m] + Pi[c]	Transport, Mitochondrial	
methionine mitochondrial transport via proton	Membrane	$H[m] + MET[m] <\!$	Transport, Mitochondrial	
symport NH3 mitochondrial transport	Membrane	NH4[c] <-> NH4[m]	Transport, Mitochondrial	
NMN mitochondrial transport via proton symport		H[c] + nmn[c] <-> H[m] + nmn[m]	Transport, Mitochondrial	
O2 transport (diffusion)	Membrane	O2[c] <> O2[m]	Transport, Mitochondrial	
oxaloacetate transport	Membrane	H[c] + OAA[c] <-> H[m] + OAA[m]	Transport, Mitochondrial	SPAC139.02C
ornithine mitochondrial transport via proton	Membrane	H[c] +ORN[m] <-> H[m] +ORN[c]	Transport, Mitochondrial	
2-oxodicarboylate transporter	Membrane	AKG[m] + oxag[c] <-> AKG[c] + oxag[m]	Transport, Mitochondrial	
Phenylacetaldehyde transport (mitochondrial)	Membrane	PACALD[c] <-> PACALD[m]	Transport, Mitochondrial	
panthetheine 4'-phosphate reversible	Membrane	pan4p[c] <-> pan4p[m]	Transport, Mitochondrial	
mitochondrial transport pantothenate mitochondrial transport	Membrane	pant-R[c] <-> pant-R[m]	Transport, Mitochondrial	
Adenosine 3',5'-bisphosphate mitochondrial				
transport	Membrane	PAP[c] <-> PAP[m]	Transport, Mitochondrial	
phosphatidate reversible transport	Membrane	pa [c] <-> pa [m]	Transport, Mitochondrial	
all-trans-Pentaprenyl diphosphate transport	Membrane	PNPP[c] <-> PNPP[m]	Transport, Mitochondrial	
phosphatidylethanolamine mitochondrial transport	Membrane	pe [c] <-> pe [m]	Transport, Mitochondrial	
Phenylalanine mitochondrial transport via proton symport	Membrane	H[m] + PHE[m] <-> H[c] + PHE[c]	Transport, Mitochondrial	
phosphate transporter	Membrane	H[c] + Pi[c] <-> H[m] + Pi[m]	Transport, Mitochondrial	SPBC1703.13C
phosphate transport via hydroxide ion symport	Membrane	oH1[m] + Pi[c] <-> oH1[c] + Pi[m]	Transport, Mitochondrial	
protoporphyrinogen IX mitochondrial transport	Membrane	pppg9[c] <-> pppg9[m]	Transport, Mitochondrial	
L-proline transport	Membrane	PRO[c] <-> PRO[m]	Transport, Mitochondrial	
PRPP reversible transport	Membrane	$PRPP[c] \Leftrightarrow PRPP[m]$	Transport, Mitochondrial	
phosphatidylserine mitochondrial transport	Membrane	ps [c] <-> ps [m]	Transport, Mitochondrial	
pyruvate mitochondrial transport via proton	Membrane	H[c] + PYR[c] <-> H[m] + PYR[m]	Transport, Mitochondrial	
Quinolinate reversible mitochondrial transport	Membrane	$Quln[c] <\!$	Transport, Mitochondrial	
Riboflavin reversible mitochondrial transport	Membrane	$ribflv[c] <\!\!-\!\!> ribflv[m]$	Transport, Mitochondrial	
serine mitochondrial transport via proton symport	Membrane	H[c] + SER[c] <-> H[m] + SER[m]	Transport, Mitochondrial	
succinate transport	Membrane	$Pi[m] + SUCC[c] \Rightarrow Pi[c] + SUCC[m]$	Transport, Mitochondrial	
succinate-fumarate transport	Membrane	FUM[m] + SUCC[c] -> FUM[c] + SUCC[m]	Transport, Mitochondrial	
Thiamine diphosphate transport	Membrane	THMPP[c] -> THMPP[m]	Transport, Mitochondrial	
threonine mitochondrial transport via proton symport	Membrane	H[c] + THR[c] <-> H[m] + THR[m]	Transport, Mitochondrial	
tryptophan mitochondrial transport via proton	Membrane	H[c] + TRP[c] <-> H[m] + TRP[m]	Transport, Mitochondrial	
symport tyrosine mitochondrial transport via proton			-	
symnort	Membrane Membrane	$H[c] + TYR[c] \Leftrightarrow H[m] + TYR[m]$ $(2 H[c] + IJMP[m] + IJTP[c] \Rightarrow 2 H[m] + IJMP[c] + IJTP[m]$	Transport, Mitochondrial Transport, Mitochondrial	SPAC688.09
UTP/UMP antiport	wiemorane	$(2 H[c] + UMP[m] + UTP[c] \rightarrow 2 H[m] + UMP[c] + UTP[m]$	Transport, Mitochondrial	3FAC088.09

Valine reversible mitochondrial transport via	Membrane	H[c] + VAL[c] <-> H[m] + VAL[m]	Transport, Mitochondrial
proton symport			•
acetyl-CoA transport 2-oxogiutarate nuclear transport via proton	Membrane Membrane	ACCoA[c] <-> ACCoA[n] AKG[c] + H[c] <-> AKG[n] + H[n]	Transport, Nuclear Transport, Nuclear
AMP transport via diffusion (cytosol to nucleus)	Membrane	AMP[n] <>> AMP[c]	Transport, Nuclear
aspartate nuclear transport via proton symport	Membrane	ASP[c] + H[c] <-> ASP[n] + H[n]	Transport, Nuclear
L-aspartate nuclear transport via diffusion	Membrane	$ASP[n] \leftarrow ASP[c]$	Transport, Nuclear
N-carbomoyl-L-aspartate transport, diffusion carbamoyl phosphate nuclear transport via	Membrane	cbasp[n] <-> cbasp[c]	Transport, Nuclear
diffusion	Membrane	cbp[c] <-> cbp[n]	Transport, Nuclear
CDP nuclear transport	Membrane	CDP[c] <-> CDP[n]	Transport, Nuclear
CO2 nuclear transport via diffusion coenzyme A transport	Membrane Membrane	CO2[n] <-> CO2[c] CoA[c] <-> CoA[n]	Transport, Nuclear Transport, Nuclear
DADP nuclear transport	Membrane	dADP[c] <-> dADP[n]	Transport, Nuclear
dCDP nuclear transport	Membrane	dCDP[c] <-> dCDP[n]	Transport, Nuclear
dGDP nuclear transport	Membrane	dGDP[c] <-> dGDP[n]	Transport, Nuclear
dUMP nuclear transport	Membrane	dUMP[c] <-> dUMP[n]	Transport, Nuclear
GDP nuclear transport	Membrane	GDP[c] <-> GDP[n]	Transport, Nuclear
glutamine nuclear transport via proton symport	Membrane	GLN[c] + H[c] <-> GLN[n] + H[n]	Transport, Nuclear
glutamate nuclear transport via proton symport hydrogen peroxide nuclear transport	Membrane Membrane	GLU[c] + H[c] <>> GLU[n] + H[n] H2O2[c] <-> H2O2[n]	Transport, Nuclear Transport, Nuclear
H2O transport	Membrane	H2O[n] <-> H2O[c]	Transport, Nuclear
bicarbonate nuclear transport via diffusion	Membrane	HCO3[c] <>> HCO3[n]	Transport, Nuclear
4-Aminobenzoate mitochondrial transport via	Membrane	PABA[c] <-> PABA[n]	Transport, Nuclear
diffusion 1D-myo-Inositol 1,4,5-trisphosphate nuclear		TADA[6] <> TADA[6]	-
transport via diffusion	Membrane	mi145p[c] <-> mi145p[n]	Transport, Nuclear
inositol hexakisphosphate nuclear transport	Membrane	minoHp[c] <-> minoHp[n]	Transport, Nuclear
(diffusion) NAD transport through pores	Membrane	NAD[n] <-> NAD[c]	Transport, Nuclear
ammonia nuclear transport	Membrane	NH4[c] <-> NH4[n]	Transport, Nuclear
phosphate nuclear transport via proton symport	Membrane	$H[c] + Pi[c] \Longleftrightarrow H[n] + Pi[n]$	Transport, Nuclear
phosphatidyl-1D-myo-insoitol nuclear transport	Membrane	ptdlino [c] <-> ptdlino [n]	Transport, Nuclear
phosphatidyl-1D-myo-4-inositol nuclear transport	Membrane	ptd4ino [c] <-> ptd4ino [n]	Transport, Nuclear
UMP nuclear transport	Membrane	UMP[c] <-> UMP[n]	Transport, Nuclear
3-(4-hydroxyphenyl)pyruvate peroxisomal transport via proton symport	Membrane	34Hpp[c] + H[c] <> 34Hpp[x] + H[x]	Transport, Peroxisomal
4-hydroxy-2-oxoglutarate peroxisomal transport	Membrane	4H2Oglt[c] <-> 4H2Oglt[x]	Transport, Peroxisomal
via diffusion acetate transport	Membrane	ac[c] <-> ac[x]	Transport, Peroxisomal
AKG transporter, peroxisome	Membrane	AKG[c] <-> AKG[x]	Transport, Peroxisomal Transport, Peroxisomal
aspartate-glutamate peroxisomal shuttle	Membrane	ASP[c] + GLU[x] <-> ASP[x] + GLU[c]	Transport, Peroxisomal
AMP/ATP transporter	Membrane	$AMP[x] + ATP[c] + H[x] \rightarrow AMP[c] + ATP[x] + H[c]$	Transport, Peroxisomal
ADP/ATP transporter	Membrane	$ADP[x] + ATP[c] + H[x] \Rightarrow ADP[c] + ATP[x] + H[c]$	Transport, Peroxisomal
citrate/malate antiport into peroxisome	Membrane	CIT[x] + MAL[c] <-> CIT[c] + MAL[x]	Transport, Peroxisomal
citrate/isocitrate antiport into peroxisome	Membrane	CIT[c] + ICIT[x] <-> CIT[x] + ICIT[c]	Transport, Peroxisomal
CO2 peroxisomal transport	Membrane	CO2[c] <-> CO2[x]	Transport, Peroxisomal
cystathione peroxisomal transport L-erythro-4-hydroxyglutamate peroxisomal	Membrane	$\operatorname{cyst-L[c]} <-> \operatorname{cyst-L[x]}$	Transport, Peroxisomal
transport via diffusion	Membrane	e4HGLU[c] <-> e4HGLU[x]	Transport, Peroxisomal
fatty acid peroxisomal transport	Membrane	C100[c] -> C100[x]	Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport	Membrane	C120[c] -> C120[x]	Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport	Membrane Membrane	C120[c] -> C120[x] C141[c] -> C141[x]	Transport, Peroxisomal Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport	Membrane Membrane	C120[c] > C120[x] C141[c] > C141[x] C160[c] > C160[x]	Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport	Membrane Membrane Membrane	C120[c] > C120[x] C141[c] > C141[x] C160[c] > C160[x] C140[c] > C140[x]	Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport fatty acid peroxisomal transport	Membrane Membrane	C120[c] > C120[x] C141[c] > C141[x] C160[c] > C160[x]	Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport	Membrane Membrane Membrane Membrane	C120[c] > C120[x] C141[c] > C141[x] C160[c] > C160[x] C140[c] > C140[x] C161[c] > C161[x]	Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport	Membrane Membrane Membrane Membrane Membrane	C120[c] > C120[x] C141[c] > C141[x] C160[c] > C160[x] C140[c] > C140[x] C161[c] > C161[x] C080[c] > C080[x]	Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport Homocysteine peroxisomal transport via proton	Membrane Membrane Membrane Membrane Membrane Membrane	$\begin{split} & \text{C120[c]} > \text{C121[x]} \\ & \text{C141[c]} > \text{C141[x]} \\ & \text{C160[c]} > \text{C160[x]} \\ & \text{C140[c]} > \text{C140[x]} \\ & \text{C161[c]} > \text{C161[x]} \\ & \text{C080[c]} > \text{C080[x]} \\ & \text{GLX[c]} <> \text{GLX[x]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport fatty acid peroxisomal transport glyoxylate transport H2O transport	Membrane Membrane Membrane Membrane Membrane Membrane Membrane Membrane	$\begin{split} &C120[c] > C120[x] \\ &C141[c] > C141[x] \\ &C160[c] > C160[x] \\ &C140[c] > C160[x] \\ &C161[c] > C161[x] \\ &C080[c] > C080[x] \\ &GLX[c] <> GLX[x] \\ &H20[c] <> H20[x] \\ &H[c] + HCYS[c] <> H[x] + HCYS[x] \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport H0mocysteine peroxisomal transport via proton symport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C140[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} <> \text{GLX[x]} \\ &\text{H20[c]} <> \text{H20[x]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport somal transport via proton symport maltate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport NMM peroxisomal transport via proton symport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{SGLX[x]} \\ &\text{H2O[c]} < \text{SH2[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{SH[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{SMAL[c]} + \text{OAA[x]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport HOmocysteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{OSLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{Hx]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < > \text{MAL[c]} + \text{OAA[x]} \\ &\text{NH4[c]} < > \text{NH4[x]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport H2O transport will provisional transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton cymport phosphate peroxisomal transport via proton cymport pyruvate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{MAL[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{NH4[c]} < \text{NH4[x]} \\ &\text{H[c]} + \text{nmn[c]} < \text{H[x]} + \text{nmn[x]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport HOmocysteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport NMN peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} <> \text{GLX[x]} \\ &\text{H2O[c]} <> \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} <> \text{M[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} <> \text{MAL[c]} + \text{OAA[x]} \\ &\text{NH4[c]} + \text{mnn[c]} <> \text{M[x]} + \text{mnn[x]} \\ &\text{H[c]} + \text{Pi[c]} <> \text{H[x]} + \text{Pi[x]} \\ \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport bemoisted peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport private peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} <> \text{GLX[x]} \\ &\text{H2O[c]} <> \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} <> \text{M[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} <> \text{MAL[c]} + \text{OAA[x]} \\ &\text{M14[c]} + \text{mnn[c]} <> \text{M[x]} + \text{mnn[x]} \\ &\text{H[c]} + \text{Pic]} <> \text{H[x]} + \text{Pix[x]} \\ &\text{H[c]} + \text{PYR[c]} <> \text{H[x]} + \text{PYR[x]} \\ \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport HZO transport HZO transport HOmocysteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} <> \text{GLX[x]} \\ &\text{H2O[c]} <> \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} <> \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} <> \text{MAL[c]} + \text{OAA[x]} \\ &\text{NH4[c]} <> \text{NH4[x]} \\ &\text{H[c]} + \text{hmn[c]} <> \text{H[x]} + \text{hmn[x]} \\ &\text{H[c]} + \text{Pic]} <> \text{H[x]} + \text{Pix} \\ &\text{H[c]} + \text{PYR[c]} <> \text{H[x]} + \text{PYR[x]} \\ &\text{TRDx[c]} <> \text{TRDx[x]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport HZO transport HZO transport HOmocysteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport byrosine peroxisomal transport via proton symport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \Rightarrow \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \Rightarrow \text{MAL[c]} + \text{OAA[x]} \\ &\text{M14[c]} + \text{mnn[c]} < \Rightarrow \text{H[x]} + \text{mnn[x]} \\ &\text{H[c]} + \text{Pic]} < \Rightarrow \text{H[x]} + \text{Pix[x]} \\ &\text{H[c]} + \text{Pyx[c]} < \Rightarrow \text{H[x]} + \text{Pyx[x]} \\ &\text{TRDox[c]} < \Rightarrow \text{TRDox[x]} \\ &\text{TRDrd[c]} < \Rightarrow \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \Rightarrow \text{H[x]} + \text{TYR[x]} \\ &\text{H[c]} + \text{TYR[c]} < \Rightarrow \text{H[x]} + \text{TYR[x]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport HZO transport HZO transport HOmocysteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport tyrosine peroxisomal transport via proton symport Larginine transport in via proton antiport (var-rolar) Lasparagine transport in via proton antiport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{M14[c]} < \text{MH4[x]} \\ &\text{H[c]} + \text{Hmn[c]} < \text{MIx]} + \text{Hmn[x]} \\ &\text{H[c]} + \text{Pi[c]} < \text{H[x]} + \text{Pi[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{H[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{MIx} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \end{split}$	Transport, Peroxisomal
fatty acid peroxisomal transport glyoxylate transport HZO transport HZO transport HOMOCYSteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport tyrosine peroxisomal transport via proton symport tyrosine peroxisomal transport via tiffusion tyrosine peroxisomal transport via proton symport t-argunnet ransport in via proton antiport (vacuolar) L-asparagine transport in via proton antiport (vacuolar)	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{M14[c]} < \text{MH4[x]} \\ &\text{H[c]} + \text{Hmn[c]} < \text{MIx]} + \text{Hmn[x]} \\ &\text{H[c]} + \text{Pi[c]} < \text{H[x]} + \text{Pi[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{H[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{MIx} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ \end{split}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport H2O transport H3O transport H3O transport H3O transport H3O transport H3D transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport NMN peroxisomal transport NMN peroxisomal transport via proton cymmorr pyruvate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton sidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport L-arginine transport in via proton antiport (vacuolar) L-asparagine transport in via proton symport L-asparagine transport via via proton symport L-asparagine transport in via proton antiport (vacuolar)	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} <> \text{GLX[x]} \\ &\text{H20[c]} <> \text{H20[x]} \\ &\text{H20[c]} <> \text{H20[x]} \\ &\text{H[c]} + \text{HCYS[c]} <> \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} <> \text{MAL[c]} + \text{OAA[x]} \\ &\text{NH4[c]} <> \text{NH4[x]} \\ &\text{H[c]} + \text{Pmn[c]} <> \text{H[x]} + \text{Pmn[x]} \\ &\text{H[c]} + \text{Pic]} <> \text{H[x]} + \text{Pi[x]} \\ &\text{H[c]} + \text{PYR[c]} <> \text{H[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} <> \text{TRDox[x]} \\ &\text{TRDrd[c]} <> \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} <> \text{H[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vecuolar Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport H3D transport H3D transport H3D transport H3D transport via proton symport maltate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} <> \text{GLX[x]} \\ &\text{H20[c]} <> \text{H20[x]} \\ &\text{H[c]} + \text{HCYS[c]} <> \text{H[x]} + \text{HCYS[x]} \\ &\text{M4L[x]} + \text{OAA[c]} <> \text{M4L[c]} + \text{OAA[x]} \\ &\text{M4[c]} <> \text{M4[x]} \\ &\text{H[c]} + \text{mnn[c]} <> \text{H[x]} + \text{mnn[x]} \\ &\text{H[c]} + \text{PYR[c]} <> \text{H[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} <> \text{TRDox[x]} \\ &\text{TRDrd[c]} <> \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} <> \text{H[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASP[c]} + \text{H[c]} \\ \end{split}$	Transport, Peroxisomal Transport, Veroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport H3D transport H3D transport H3D transport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport L-asparagine transport in via proton antiport (vacuolar) L-asparagine transport out via proton symport CO2 vacuolar transport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{S080[x]} \\ &\text{GLX[c]} < \text{SLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{SH[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MH[c]} + \text{Pinc]} < \text{SH[x]} + \text{Pinx} \\ &\text{H[c]} + \text{Pinc]} < \text{SH[x]} + \text{Pinx} \\ &\text{H[c]} + \text{PYR[c]} < \text{SH[x]} + \text{PYR[x]} \\ &\text{TRDac[c]} < \text{TRDac[x]} \\ &\text{TRDrd[c]} < \text{TRDac[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{SH[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASP[c]} + \text{H[c]} \\ &\text{CO2[c]} < \text{CO2[v]} \\ \end{split}$	Transport, Peroxisomal Transport, Veroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport H3D transport H3D transport H3D transport H3D transport via proton symport maltate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} <> \text{GLX[x]} \\ &\text{H20[c]} <> \text{H20[x]} \\ &\text{H[c]} + \text{HCYS[c]} <> \text{H[x]} + \text{HCYS[x]} \\ &\text{M4L[x]} + \text{OAA[c]} <> \text{M4L[c]} + \text{OAA[x]} \\ &\text{M4[c]} <> \text{M4[x]} \\ &\text{H[c]} + \text{mnn[c]} <> \text{H[x]} + \text{mnn[x]} \\ &\text{H[c]} + \text{PYR[c]} <> \text{H[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} <> \text{TRDox[x]} \\ &\text{TRDrd[c]} <> \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} <> \text{H[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASP[c]} + \text{H[c]} \\ \end{split}$	Transport, Peroxisomal Transport, Veroxisomal
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport H3D peroxisomal transport via proton symport maltate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport L-asparagine transport in via proton antiport (vacuolar) L-asparagine transport out via proton symport L-asparagine transport out via proton symport CO2 vacuolar transport Glycogen vacuolar 'transport' via autophagy glucose transport L-glutamine transport in via proton antiport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{O80[x]} \\ &\text{GLX[c]} < \text{O80[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MH4[c]} < \text{MH4[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{MIx]} + \text{PYR[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{MIx]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{MIx]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASP[c]} + \text{H[c]} \\ &\text{C02[c]} < \text{C02[v]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLC[c]} < \text{GLC[v]} \\ \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Vecuolar Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HZO transport HZO transport HZO transport HOMOCYSTEINE PROVING PROVING PROVING PROVING HZO TRANSPORT HAND PROVING PROVING PROVING HAND PROVING PROVING PROVING HAND PROVING PROVING PROVING HAND PROVING PROVING HAND PROVING PROVING HAND PROVING PROVING HAND PROVING HAND PROVING PROVING HAND HAND HAND HAND HAND HAND HAND HAND	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{O80[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MH4[c]} < \text{MH4[x]} \\ &\text{H[c]} + \text{PI[c]} < \text{MIX]} + \text{PI[x]} \\ &\text{H[c]} + \text{PI[c]} < \text{MIX]} + \text{PI[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{MIX]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{MIX]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{CO2[c]} < \text{CO2[v]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLYC]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \end{aligned}$	Transport, Peroxisomal Transport, Vecuolar Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H2O transport H3D peroxisomal transport via proton symport maltate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport L-asparagine transport in via proton antiport (vacuolar) L-asparagine transport out via proton symport L-asparagine transport out via proton symport CO2 vacuolar transport Glycogen vacuolar 'transport' via autophagy glucose transport L-glutamine transport in via proton antiport	Membrane	$\begin{split} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{O80[x]} \\ &\text{GLX[c]} < \text{O80[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MH4[c]} < \text{MH4[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{MIX]} + \text{PYR[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{MIX]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{MIX]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASP[c]} + \text{H[c]} \\ &\text{C02[c]} < \text{C02[v]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLC[c]} < \text{GLC[v]} \\ \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Vecuolar Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HZO transport MNN peroxisomal transport via proton symport phosphate peroxisomal transport via proton pyruvate peroxisomal transport via proton cidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport transport in via proton antiport (vacuolar) L-asparagine transport in via proton symport L-asparate transport out via proton symport L-asparate transport Glycogen vacuolar 'transport' Glycogen vacuolar 'transport' via autophagy glucose transport L-glutamine transport in via proton antiport (vacuolar) L-glutamine transport in via proton symport	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{ML[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{M14[c]} < \text{M14[x]} \\ &\text{H[c]} + \text{Hmn[c]} < \text{MIx]} + \text{Pix[x]} \\ &\text{H[c]} + \text{Pix[c]} < \text{M[x]} + \text{Pix[x]} \\ &\text{H[c]} + \text{Pyx[c]} < \text{M[x]} + \text{Pyx[x]} \\ &\text{TRDax[c]} < \text{TRDax[x]} \\ &\text{TRDax[c]} < \text{TRDax[x]} \\ &\text{TRDax[c]} < \text{MIX} + \text{TYx[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASP[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{GLYCogen[c]} < \text{GLYCogen[v]} \\ &\text{GLC[c]} < \text{GLC[v]} \\ &\text{GLN[c]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[c]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[c]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
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fatty acid peroxisomal transport glyoxylate transport HZO transport HZO transport HOMOCYSteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symmort pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport L-argannet ransport in via proton antiport (vacuolar) L-asparagine transport out via proton symport L-asparate transport out via proton symport L-asparate transport out via proton symport CO2 vacuolar transport Glycogen vacuolar 'transport' via autophagy glucose transport L-glutamine transport in via proton antiport (vacuolar) L-glutamine transport out via proton symport L-glutamine transport out via proton symport L-glutamate transport out via proton symport	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{SML[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{SMAL[c]} + \text{OAA[x]} \\ &\text{M4L[x]} + \text{OAA[c]} < \text{SMAL[c]} + \text{OAA[x]} \\ &\text{M4[c]} + \text{nmn[c]} < \text{SH[x]} + \text{nmn[x]} \\ &\text{H[c]} + \text{PMR[c]} < \text{SH[x]} + \text{PYR[x]} \\ &\text{HC]} + \text{PYR[c]} < \text{SH[x]} + \text{PYR[x]} \\ &\text{TRDax[c]} < \text{TRDax[x]} \\ &\text{TRDrd[c]} < \text{STDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{SH[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} - \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} - \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} - \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} - \text{ASN[c]} + \text{H[c]} \\ &\text{GLN[c]} + \text{GLV[v]} \\ &\text{GLC[c]} < \text{GLC[v]} \\ &\text{GLC[c]} < \text{GLC[v]} \\ &\text{GLN[c]} + \text{H[v]} - \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{GTHrd[c]} + \text{H2O[v]} - \text{ADP[v]} + \text{GTHrd[v]} + \text{H[v]} + \text{Pi[v]} \\ \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport H2O transport H2O transport H3O transport H3NIN peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion reduced thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport t-arginine transport in via proton antiport (vacuolar) L-asparagine transport out via proton symport C3D vacuolar transport G1ycogen vacuolar 'transport' via autophagy glucose transport L-glutamite transport in via proton antiport (vacuolar) L-glutamite transport out via proton symport	Membrane	$C120[c] > C120[x] \\ C141[c] > C141[x] \\ C160[c] > C140[x] \\ C140[c] > C140[x] \\ C161[c] > C161[x] \\ C080[c] > C080[x] \\ GLX[c] <> GLX[x] \\ H20[c] <> H20[x] \\ H[c] + HCYS[c] <> H[x] + HCYS[x] \\ MAL[x] + OAA[c] <> MAL[c] + OAA[x] \\ MAL[x] + OAA[c] <> MAL[c] + OAA[x] \\ MH[c] + Hm[c] <> H[x] + Pi[x] \\ H[c] + Pi[c] <> H[x] + Pi[x] \\ H[c] + TYR[c] <> H[x] + PYR[x] \\ TRDx[c] <> TRDx[x] \\ H[c] + TYR[c] <> H[x] + TYR[x] \\ ARG[c] + H[v] > ARG[v] + H[c] \\ ASN[c] + H[v] > ASN[v] + H[c] \\ ASN[v] + H[v] > ASN[c] + H[c] \\ C02[c] <> C02[v] \\ GLYCogen[c] > GLYCogen[v] \\ GLC[c] <> GLC[v] \\ GLN[v] + H[v] > GLN[v] + H[c] \\ GLN[v] + H[v] > GLN[c] + H[c] \\ H20[c] <> H20[v] \\ H1v] + H1v] > GLN[c] + H1c] \\ H20[c] <> H20[v] \\ H[v] + H1S[c] > H[c] + H1S[v] \\ H[v] + H1S[c] > H[v] + H1S[v] \\ H[v] + H1S[c] + H1S[v] \\ H[v] + H1S[v] + H1S[v] \\ H[v] + H1S[v]$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HOMOCYSTEP TO THE TO	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \Rightarrow \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \Rightarrow \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \Rightarrow \text{MAL[x]} + \text{PMR[x]} \\ &\text{H[c]} + \text{Pmn[c]} < \Rightarrow \text{H[x]} + \text{Pmn[x]} \\ &\text{H[c]} + \text{Pic]} < \Rightarrow \text{H[x]} + \text{Pix[x]} \\ &\text{H[c]} + \text{PyR[c]} < \Rightarrow \text{H[x]} + \text{PyR[x]} \\ &\text{TRDax[c]} < \Rightarrow \text{TRDax[x]} \\ &\text{TRDat[c]} < \Rightarrow \text{TRDat[x]} \\ &\text{H[c]} + \text{TYR[c]} < \Rightarrow \text{H[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} \Rightarrow \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} \Rightarrow \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} \Rightarrow \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} \Rightarrow \text{ASN[c]} + \text{H[c]} \\ &\text{CO2[c]} < \text{CO2[v]} \\ &\text{GLYCogen[c]} \Rightarrow \text{GLYCogen[v]} \\ &\text{GLYCogen[c]} \Rightarrow \text{GLYCogen[v]} \\ &\text{GLN[c]} + \text{H[v]} \Rightarrow \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} \Rightarrow \text{GLN[c]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} \Rightarrow \text{GLN[c]} + \text{H[c]} \\ &\text{GLV[v]} + \text{H[v]} \Rightarrow \text{GLV[c]} + \text{H[c]} \\ &\text{HU} + \text{HIV} \Rightarrow \text{GLV[c]} + \text{H[c]} \\ &\text{HU} + \text{HIS[c]} \Rightarrow \text{H[c]} + \text{HIS[v]} \\ &\text{H[v]} + \text{HIS[c]} \Rightarrow \text{H[c]} + \text{ILE[c]} \\ &\text{H[v]} + \text{ILE[c]} \Rightarrow \text{H[c]} + \text{ILE[v]} \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport H2O transport H3Omocysteine peroxisomal transport via proton symport malate/oxaloacetate shuttle ammonia peroxisomal transport NMN peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport province peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport oxidized thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport L-agramine transport in via proton antiport (vacuolar) L-asparagine transport out via proton symport L-asparagine transport L-glutamine transport in via proton symport L-glutamine transport L-glutamine transport in via proton symport L-glutamine transport out via proton symport L-glutamine transport in via proton antiport (vacuolar) L-instictine transport in via proton antiport (vacuolar) L-instictine transport in via proton antiport (vacuolar) L-isoleucine transport in via proton symport L-soleucine transport in via proton symport	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{SML[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{SMAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{SMAL[c]} + \text{OAA[x]} \\ &\text{M4[c]} + \text{PM[c]} < \text{SM4[x]} + \text{PI[x]} \\ &\text{H[c]} + \text{PM[c]} < \text{SM[x]} + \text{PYR[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{SM[x]} + \text{PYR[x]} \\ &\text{TRDax[c]} < \text{TRDax[x]} \\ &\text{TRDax[c]} < \text{TRDax[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{SM[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{GLYC[c]} < \text{GLC[v]} \\ &\text{GLYCgen[c]} < \text{GLYCgen[v]} \\ &\text{GLC[c]} < \text{GLC[v]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{GLV[v]} + \text{GTHrd[c]} + \text{H2O[v]} > \text{ADP[v]} + \text{GTHrd[v]} + \text{H[v]} + \text{Pi[v]} \\ &\text{H2O[c]} < \text{H2O[v]} \\ &\text{H1V} + \text{H1S[c]} > \text{H[c]} + \text{H1S[v]} \\ &\text{H[v]} + \text{H1E[c]} > \text{H[c]} + \text{H1E[v]} \\ &\text{H[v]} + \text{H1E[c]} > \text{H[c]} + \text{H1E[v]} \\ &\text{H[v]} + \text{H1E[c]} > \text{H[c]} + \text{H1E[c]} \\ &\text{H[v]} + \text{H1E[c]} + \text{H1E[c]} \\ &\text{H[v]} + H1E[$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HOMOCYSTEP TO THE TO	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{Hc]} + \text{HCYS[c]} < \text{MLx} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{M4[c]} + \text{mm[c]} < \text{MAL[x]} + \text{mm[x]} \\ &\text{H[c]} + \text{PM[c]} < \text{M[x]} + \text{PM[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{M[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDox[x]} \\ &\text{Hc]} + \text{TYR[c]} < \text{M[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} - \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} - \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} - \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} - \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} - \text{ASN[c]} + \text{H[c]} \\ &\text{GLV[c]} < \text{GLV[ogen[c]} < \text{GLYCogen[v]} \\ &\text{GLC[c]} < \text{GLYOgen[v]} + \text{H[c]} \\ &\text{GLN[c]} + \text{H[v]} - \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} - \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} - \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} - \text{GLN[v]} + \text{H[c]} \\ &\text{HU} + \text{HSIc} - \text{Hc} + \text{HSIv} \\ &\text{HV} + \text{HSIc} - \text{Hc} + \text{HSIv} \\ &\text{HV} + \text{HIS[c]} - \text{H[c]} + \text{HLE[c]} \\ &\text{HV} + \text{HLE[v]} - \text{H[c]} + \text{HLE[c]} \\ &\text{Leystin[v]} + \text{H[v]} - \text{Leystin[c]} + \text{H[c]} \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HOD transport HOMOCYSTER PROVING TO THE PROVING	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[x]} + \text{HPX} \\ &\text{H[c]} + \text{PHX[c]} < \text{M[x]} + \text{PHX} \\ &\text{H[c]} + \text{PYR[c]} < \text{H[x]} + \text{PYR[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{M[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{M[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLN[c]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{GLV[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{H[v]} + \text{HS[c]} > \text{H[c]} + \text{HS[v]} \\ &\text{H[v]} + \text{HS[c]} > \text{H[c]} + \text{HS[v]} \\ &\text{H[v]} + \text{HS[c]} > \text{H[c]} + \text{HS[v]} \\ &\text{H[v]} + \text{HLE[c]} > \text{H[c]} + \text{HLE[v]} \\ &\text{H[v]} + \text{HLE[v]} > \text{H[c]} + \text{LLE[v]} \\ &\text{H[v]} + \text{HLE[v]} > \text{H[c]} + \text{LLE[v]} \\ &\text{H[v]} + \text{LEU[c]} > \text{H[c]} + \text{LEU[v]} \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HZO transport NMN peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport phosphate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport pyruvate peroxisomal transport via proton symport cidized thioredoxin peroxisomal transport via diffusion tyrosine peroxisomal transport via proton symport transport via proton antiport (vacuolar) L-asparagine transport in via proton symport L-asparagine transport out via proton symport L-glutamine transport out via proton symport L-glutamate transport in via proton symport L-glutamate transport out via proton antiport (vacuolar) L-soleucine transport in via proton antiport (vacuolar) L-isoleucine transport in via proton symport L-eystine transport via proton symport L-eystine transport out via proton antiport (vacuolar) L-eyetine transport out via proton antiport L-eyetine tr	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{MLX[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{M14[c]} < \text{NH4[x]} \\ &\text{H[c]} + \text{Hmn[c]} < \text{MIx]} + \text{PIX[x]} \\ &\text{H[c]} + \text{PIX[c]} < \text{M[x]} + \text{PIX[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{M[x]} + \text{PYR[x]} \\ &\text{TRDax[c]} < \text{TRDax[x]} \\ &\text{TRDax[c]} < \text{TRDax[x]} \\ &\text{TRDax[c]} < \text{MIX} + \text{TYR[x]} \\ &\text{ASR[c]} + \text{H[v]} > \text{ASR[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{GLYCogen[c]} < \text{GLYCogen[v]} \\ &\text{GLZ[c]} < \text{GLY[v]} \\ &\text{GLN[c]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{ATP[v]} + \text{GTHat[c]} + \text{H2O[v]} > \text{ADP[v]} + \text{GTHat[v]} + \text{H[v]} + \text{Pi[v]} \\ &\text{H2O[c]} < \text{H2O[v]} \\ &\text{H[v]} + \text{HIS[c]} > \text{H[c]} + \text{HIS[v]} \\ &\text{H[v]} + \text{HIS[c]} > \text{H[c]} + \text{HIE[v]} \\ &\text{H[v]} + \text{HLE[v]} > \text{H[c]} + \text{HLE[v]} \\ &\text{H[v]} + \text{HLE[v]} > \text{H[c]} + \text{LEU[v]} \\ &\text{H[v]} + \text{HLE[v]} > \text{H[c]} + \text{LEU[v]} \\ &\text{H[v]} + \text{LEU[c]} > \text{H[c]} + \text{LEU[v]} \\ &\text{H[v]} + \text{LEU[c]} > \text{H[c]} + \text{LEU[v]} \\ &\text{H[v]} + \text{LEU[v]} >$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HOD transport HOMOCYSTER PROVING TO THE PROVING	Membrane	$\begin{aligned} &\text{C120[c]} > \text{C120[x]} \\ &\text{C141[c]} > \text{C141[x]} \\ &\text{C160[c]} > \text{C160[x]} \\ &\text{C140[c]} > \text{C160[x]} \\ &\text{C161[c]} > \text{C161[x]} \\ &\text{C080[c]} > \text{C080[x]} \\ &\text{GLX[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{GLX[x]} \\ &\text{H2O[c]} < \text{H2O[x]} \\ &\text{H[c]} + \text{HCYS[c]} < \text{H[x]} + \text{HCYS[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[c]} + \text{OAA[x]} \\ &\text{MAL[x]} + \text{OAA[c]} < \text{MAL[x]} + \text{HPX} \\ &\text{H[c]} + \text{PHX[c]} < \text{M[x]} + \text{PHX} \\ &\text{H[c]} + \text{PYR[c]} < \text{H[x]} + \text{PYR[x]} \\ &\text{H[c]} + \text{PYR[c]} < \text{M[x]} + \text{PYR[x]} \\ &\text{TRDox[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDox[x]} \\ &\text{TRDrd[c]} < \text{TRDrd[x]} \\ &\text{H[c]} + \text{TYR[c]} < \text{M[x]} + \text{TYR[x]} \\ &\text{ARG[c]} + \text{H[v]} > \text{ARG[v]} + \text{H[c]} \\ &\text{ASN[c]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{ASN[v]} + \text{H[v]} > \text{ASN[c]} + \text{H[c]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLYCogen[c]} > \text{GLYCogen[v]} \\ &\text{GLN[c]} + \text{H[v]} > \text{GLN[v]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{GLN[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{GLV[v]} + \text{H[v]} > \text{GLN[c]} + \text{H[c]} \\ &\text{H[v]} + \text{HS[c]} > \text{H[c]} + \text{HS[v]} \\ &\text{H[v]} + \text{HS[c]} > \text{H[c]} + \text{HS[v]} \\ &\text{H[v]} + \text{HS[c]} > \text{H[c]} + \text{HS[v]} \\ &\text{H[v]} + \text{HLE[c]} > \text{H[c]} + \text{HLE[v]} \\ &\text{H[v]} + \text{HLE[v]} > \text{H[c]} + \text{LLE[v]} \\ &\text{H[v]} + \text{HLE[v]} > \text{H[c]} + \text{LLE[v]} \\ &\text{H[v]} + \text{LEU[c]} > \text{H[c]} + \text{LEU[v]} \end{aligned}$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar
fatty acid peroxisomal transport glyoxylate transport HOMOCYSTEP TO THE TO	Membrane	$C120[c] > C120[x] \\ C141[c] > C141[x] \\ C160[c] > C160[x] \\ C140[c] > C160[x] \\ C160[c] > C161[x] \\ C080[c] > C080[x] \\ GLX[c] <> GLX[x] \\ H20[c] <> H20[x] \\ H[c] + HCYS[c] <> H[x] + HCYS[x] \\ MAL[x] + OAA[c] <> MAL[c] + OAA[x] \\ MAL[x] + OAA[c] <> MAL[c] + OAA[x] \\ MH[c] + Hmn[c] <> H[x] + Pi[x] \\ H[c] + Pi[c] <> H[x] + Pi[x] \\ H[c] + PyR[c] <> H[x] + PyR[x] \\ TRDox[c] <> TRDox[x] \\ TRDox[c] <> TRDox[x] \\ TRDox[c] <> H[x] + TYR[x] \\ ARG[c] + H[v] > ARG[v] + H[c] \\ ASN[c] + H[v] > ASN[v] + H[c] \\ ASN[v] + H[v] > ASN[c] + H[c] \\ ASN[v] + H[v] > ASN[c] + H[c] \\ GLYCogen[c] > GLYCogen[v] \\ GLC[c] <> GLC[v] \\ GLN[c] + H[v] > GLN[v] + H[c] \\ GLV[v] + H[v] > GLN[v] + H[c] \\ GLV[v] + H[v] > GLN[c] + H[c] \\ H20[c] <> H20[v] + H[c] \\ H20[c] <> H20[v] + H[c] \\ H20[c] <> H20[v] \\ H20[c] <> H20[v] \\ H20[c] <> H20[v] \\ H[v] + H20[c] > H[c] + H20[v] > ADP[v] + GTHrd[v] + H[v] + Pi[v] \\ H20[c] <> H20[v] \\ H[v] + HLE[v] > H[c] + LLE[v] \\ H[v] + LLE[v] > H[c] + LLE[v] \\ H[v] + LLYS[c] > H[c] + LLE[v] \\ H[v] + LLYS[c] > H[c] + LLE[v] \\ H[v] + LLYS[c] > H[c] + LLYS[v] \\ H[v] + LLYS[c] > H[c] + LLYS[v] \\ H[v] + LLYS[c] > H[c] + LLYS[v] \\ H[v] + LLYS[v] + H[v] + LLYS$	Transport, Peroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Veroxisomal Transport, Vacuolar

phosphatidylserine vacuolar transport	Membrane Membrane	ps [c] <-> ps [v]	Transport, Vacuolar		
Taurcholate via ABC system (vacuolar)		ATP[v] + H2O[v] + tCHOLa[c] -> ADP[v] + H[v] + Pi[v] + tCHOLa[v]	Transport, Vacuolar		
trehalose vacuolar transport via proton symport L-tyrosine transport in via proton antiport	Membrane Membrane	$\begin{aligned} &H[c] + TRE[c] &<> H[v] + TRE[v] \\ &H[v] + TYR[c] -> H[c] + TYR[v] \end{aligned}$	Transport, Vacuolar Transport, Vacuolar		
(vacuolar) L-tyrosine transport out via proton symport	Membrane	H[v] + TYR[v] -> H[c] + TYR[c] $H[v] + TYR[v] -> H[c] + TYR[c]$	Transport, Vacuolar		
Alanyl-tRNA synthetase	Cytosol	$II_{\{V\}} + II_{\{V\}} > II_{\{V\}} + II_{\{V\}}$ trnaALA + ALA + ATP -> ALAtrna + AMP + PPi	tRNA charging	SPAC23C11.09	
Arginyl-tRNA synthetase	Cytosol	trnaARG + ARG + ATP -> ARGtrna + AMP + PPi	tRNA charging	SPBC25B2.09c	
Arginyl-tRNA synthetase	Mitochondria	trnaARG + ARG + ATP -> ARGtrna + AMP + PPi	tRNA charging	SPBC25B2.09c	
Asparaginyl-tRNA synthetase	Cytosol	trnaASN + ASN + ATP -> ASNtrna + AMP + PPi	tRNA charging	SPBC1773.10c	
asparaginyl-tRNA synthetase, miotchondrial	Mitochondria	trnaASN + ASN + ATP -> ASNtrna + AMP + PPi	tRNA charging	SPBC1198.10c	
Aspartyl-tRNA synthetase	Cytosol	trnaASP + ASP + ATP -> ASPtrna + AMP + PPi	tRNA charging	SPCC1223.07c	
Aspartyl-tRNA synthetase	Mitochondria	trnaASP + ASP + ATP -> ASPtrna + AMP + PPi	tRNA charging	SPCC736.06	
Cysteinyl-tRNA synthetase	Cytosol	trnaCYS + ATP + CYS -> CYStrna + AMP + PPi	tRNA charging	SPAC29E6.06c	
Methionyl-tRNA formyltransferase	Mitochondria	METtrna + 10FTHF -> fMETtrna + H + THF	tRNA charging	SPAC1805.09c	
Glutaminyl-tRNA synthetase	Cytosol	trnaGLN + GLN + ATP -> GLNtrna + AMP + PPi	tRNA charging	SPBC342.02	
Glutamyl-tRNA synthetase	Cytosol	trnaGLU + GLU + ATP -> GLUtrna + AMP + PPi	tRNA charging	SPAC17A5.15c	
glutamyl-tRNA synthetase	Mitochondria	trnaGLU + GLU + ATP -> GLUtrna + AMP + PPi	tRNA charging	SPAPB1A10.11c	
Glycyl-tRNA synthetase	Cytosol	trnaGLY + GLY + ATP -> GLYtrna + AMP + PPi	tRNA charging	SPAC3F10.03	
Histidyl-tRNA synthetase	Cytosol	trnaHIS + HIS + ATP -> HIStrna + AMP + PPi	tRNA charging	SPBC2G2.12	
histidyl-tRNA synthetase	Mitochondria	trnaHIS + HIS + ATP -> HIStrna + AMP + PPi	tRNA charging	SPBC2G2.12	
Isoleucyl-tRNA synthetase	Cytosol	trnaILE + ILE + ATP -> ILEtrna + AMP + PPi	tRNA charging	SPBC8D2.06	
isoleucyl-tRNA synthetase	Mitochondria	trnaILE + ILE + ATP -> ILEtrna + AMP + PPi	tRNA charging	SPCC18B5.08c	
Leucyl-tRNA synthetase	Cytosol	trnaLEU + LEU + ATP -> AMP + LEUtrna + PPi	tRNA charging	SPAC26F1.13c	
leucyl-tRNA synthetase	Mitochondria	trnaLEU + LEU + ATP -> AMP + LEUtrna + PPi	tRNA charging	SPAC4G8.09	
Lysyl-tRNA synthetase	Cytosol	trnaLYS + LYS + ATP -> AMP + LYStrna + PPi	tRNA charging	SPBC17G9.03c	
Lysyl-tRNA synthetase	Mitochondria	trnaLYS + LYS + ATP -> AMP + LYStrna + PPi	tRNA charging	SPCC18.08	
Methionyl-tRNA synthetase	Cytosol	trnaMET + MET + ATP -> METtrna + AMP + PPi	tRNA charging	SPBC17A3.04c	
methionyl-tRNA synthetase	Mitochondria	trnaMET + MET + ATP -> METtrna + AMP + PPi	tRNA charging	SPAC27E2.06c	
				SPAC23A1.12c+SPAC3G	
Phenylalanyl-tRNA synthetase	Cytosol	trnaPHE + PHE + ATP -> PHEtrna + AMP + PPi	tRNA charging	9.06	
phenylalanyl-tRNA synthetase	Mitochondria	trnaPHE + PHE + ATP -> PHEtrna + AMP + PPi	tRNA charging	SPCC736.03c	
Prolyl-tRNA synthetase	Cytosol	trnaPRO + PRO + ATP -> PROtrna + AMP + Ppi	tRNA charging	SPBC24C6.03	
	•	•		SPBC19C7.06 SPAC25B8.06c	
Seryl-tRNA synthetase	Cytosol	trnaSER + SER + ATP-> SERtrna + AMP + PPi	tRNA charging	SPAC29A4.15	
Threonyl-tRNA synthetase	Cytosol	trnaTHR + THR + ATP -> THRtrna + AMP + PPi	tRNA charging	SPBC25H2.02	
threonyl-tRNA synthetase	Mitochondria	trnaTHR + THR + ATP -> THRtrna + AMP + PPi	tRNA charging	SPAC24C9.09	
Tryptophanyl-tRNA synthetase	Cytosol	trnaTRP + TRP + ATP -> TRPtrna + AMP + PPi	tRNA charging	SPAC2F7.13c	
Tryptophanyl-tRNA synthetase	Mitochondria	trnaTRP + TRP + ATP -> TRPtrna + AMP + PPi	tRNA charging	SPAC3G9.13c	
tyrosyl-tRNA synthetase	Cytosol	trnaTYR + TYR + ATP -> TYRtrna + AMP + PPi	tRNA charging	SPCC1672.05c	
tyrosyl-tRNA synthetase	Mitochondria	$trnaTYR + TYR + ATP \Rightarrow TYRtrna + AMP + PPi$	tRNA charging	SPCC576.06c	
Valyl-tRNA synthetase	Cytosol	trnaVAL + VAL + ATP -> VALtrna + AMP + PPi	tRNA charging	SPAC4A8.08c	
,	-,			SPBC1709.02C	
valyl-tRNA synthetase	Mitochondria	trnaVAL + VAL + ATP -> VALtrna + AMP + PPi	tRNA charging	SPAC4A8.08c SPBC1709.02C	
S-Adenosyl-L-methionine:catechol O-	Vacuole	SAM + DOP -> SAH + MOTAM	Tyrosine, Tryptophan, and Phenylalanine		2.1.1.6
methyltransferase	vacuoie	SAM + DOF -> SAH + MOTAM	Tyrosine, Tryptophan, and Fhenylaranni	e3FBFB21E7.04C	2.1.1.0
4-(2-Aminoethyl)-1,2-benzenediol:o2 oxidoreductase(deaminating)(flavin-containing)	Cytosol	DOP + H2O + O2 -> DHPACAL + NH4 + H2O2	Tyrosine, Tryptophan, and Phenylalanin	e SPAC2E1P3.04	1.4.3.21
3,4-Dihydroxyphenylacetaldehyde:nADP	G	DUDIGIT VIED UNG DUDIG VIEDU U		GD 4 G022 07	
oxidoreductase	Cytosol	DHPACAL + NADP + H2O <-> DHPAC + NADPH + H	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c	1.2.1.5
S-Adenosyl-L-methionine:catechol O-	Vacuole	SAM + DHPAC -> SAH + HVAN	Tyrosine, Tryptophan, and Phenylalanine	e SPBPB21E7.04c	2.1.1.6
methyltransferase Tyramine:o2 oxidoreductase(deaminating)(flavin-					
containing)	Cytosol	TAM + H2O + O2 -> HPACAL + NH4 + H2O2	Tyrosine, Tryptophan, and Phenylalanine	e SPAC2E1P3.04	1.4.3.21
4-Hydroxyphenylacetaldehyde:nADP	Cytosol	HPACAL + NADP + H2O <-> HPAC + NADPH + H	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c	1.2.1.5
3-Methoxy-4-hydroxyphenylacetaldehyde:nADP	Cytosol	MOHPACAL + NADP + H2O -> HVAN + NADPH + H	Tyrosine, Tryptophan, and Phenylalanine	eSPAC922.07c	1.2.1.5
oxidoreductase 5-ivieuioxy-4-	Cytosor	Non-resident index in the control of	Tyroone, Trypophan, and Thenyanann		1.2.1.0
hydroxyphenylglycolaldehyde:nADP	Cytosol	$MOHPGAL + NADP + H2O \rightarrow MOHMAN + NADPH + H$	Tyrosine, Tryptophan, and Phenylalanin		
3,4-Dihydroxymandelaldehyde:nADP				e SPAC922.07c	1.2.1.5
oxidoreductase	Cutocol	DUMANAL I NADR I U2O < > DUMAN I NADRU I U	Turceina Truntonhan and Phanulalanin		
	Cytosol	DHMANAL + NADP + H2O <>> DHMAN + NADPH + H	Tyrosine, Tryptophan, and Phenylalanin		1.2.1.5 1.2.1.5
S-Adenosyl-L-methionine:catechol O-	Cytosol Vacuole	$\label{eq:dhmanal} DHMANAL + NADP + H2O <-> DHMAN + NADPH + H$ $\label{eq:dhman} DHMAN + SAM -> SAH + MOHMAN$	Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c	
	Vacuole	DHMAN + SAM -> SAH + MOHMAN	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c	1.2.1.5 2.1.1.6
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase	•			e SPAC922.07c e SPBPB21E7.04c	1.2.1.5
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O-	Vacuole	DHMAN + SAM -> SAH + MOHMAN	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c	1.2.1.5 2.1.1.6
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase	Vacuole Vacuole Vacuole	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP	Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase	Vacuole Vacuole	DHMAN + SAM -> SAH + MOHMAN NOADREN + SAM -> SAH + NOMNEP	Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c	1.2.1.5 2.1.1.6 2.1.1.6
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase Phenethyltransferase Phenethylamine:oxygen oxidoreductase	Vacuole Vacuole Vacuole	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP	Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase	Vacuole Vacuole Vacuole Vacuole Cytosol	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD)	Vacuole Vacuole Vacuole Vacuole	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG	Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase Phenethyltransferase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde,	Vacuole Vacuole Vacuole Vacuole Cytosol	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD)	Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <-> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04 e SPAC9E9.09c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase (ademinating) aldehylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde,	Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH	Tyrosine, Tryptophan, and Phenylalanin Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04 e SPAC9E9.09c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3
S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase S-Adenosyl-L-methionine:catechol O- methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD)	Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <-> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04 e SPAC9E9.09c e SPAC9E9.09c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD)	Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Golgi apparatus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04 e SPAC2E1P3.04 e SPAC9E9.09c e SPAC9E9.09c e SPAC9E9.09c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3 1.2.1.3
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catelase A	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Golgi apparatus Mitochondria	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <-> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04 e SPAC9E9.09c e SPAC9E9.09c e SPAC9E9.09c e SPAC9E9.09c e SPAC9E9.09c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3 1.2.1.3 1.1.1.1.6
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catalase A N-Formyl-L-kynurenine amidohydrolase	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Golgi apparatus Mitochondria	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3 1.2.1.3 1.1.1.6 2.6.1
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC6B12.04c eSPC757.07c eSPAC6B12.04c eSPC757.07c eSPAC10F6.13c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3 1.2.1.3 1.11.1.6 2.6.1 1.11.1.6
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus)	Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <-> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O +O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O +O2  34Hpp + GLU -> AKG + TYR	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04 e SPAC9E9.09c e SPAC9E9.09c e SPAC9E9.09c e SPAC9E9.07c e SPAC9E9.07c e SPAC9E9.07c e SPAC9E9.07c e SPAC16B12.04c e SPAC19E9.07c	1.2.1.5 2.1.1.6 2.1.1.6 2.1.1.6 2.1.1.6 1.4.3.21 1.2.1.3 1.2.1.3 1.11.1.6 2.6.1 1.11.1.6 2.6.1.1
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09e eSPAC9E9.09e eSPAC9E9.09c eSPAC6B12.04c eSPAC1066.13c eSPAC198.15 eSPAC198.15 eSPAC193.13	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,11,1,6 2,6,1,- 1,11,1,6 2,6,1,1 4,2,1,20 4,2,3,5
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate)	Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Gilgi apparatus Mitochondria Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <-> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkymr + H2O -> Lkymr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09e eSPAC9E9.09e eSPAC9E9.09c eSPAC9E9.07c eSPAC106.13c eSPAC198.15 eSPC173.13 eSPAC1523.14 SSPBC1773.13	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,2,1,3 1,1,1,1,6 2,6,1,- 1,11,1,6 2,6,1,1 4,2,1,20
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E193.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E3.04c eSPAC9	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,11,1,6 2,6,1,- 1,11,1,6 2,6,1,1 4,2,1,20 4,2,3,5
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi	Tyrosine, Tryptophan, and Phenylalanin	e SPAC922.07c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPBPB21E7.04c e SPAC2E1P3.04 e SPAC2E1P3.04 e SPAC9E9.09c e SPAC9E9.09c e SPAC9E9.09c e SPAC6B12.04c e SPAC10F6.13c e SPAC50F6.40c e SPA	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,11,1,6 2,6,1,- 1,11,1,6 2,6,1,1 4,2,1,20 4,2,3,5
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <>> GLU + pHPYR  AKG + TRP <>> GLU + indPYR	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC10F6.13c eSPAC10F6.13c eSPAC10F6.13c eSPAC9E9.09c eSPAC10F6.13c eSPAC10F6.13c eSPAC9E9.09c eSPAC9E9.00c	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,2,1,3 1,2,1,3 1,1,1,1,6 2,6,1,- 1,11,1,6 2,6,1,- 1,11,1,6 2,6,1,- 1,2,1,2,0 4,2,3,5 2,6,1,57
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan transaminase anthranilate phosphoribosyltransferase	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus Nucleus Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <>> GLU + pHPYR	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC6B12.04c eSPAC10A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC56E4.03 SPCC569.07 SPBC1773.13 eSPAC56E4.03 SPCC569.07 SPBC1773.13 eSPAC56E4.03 SPCC569.07 eSPBC16G5.08	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,2,1,3 1,1,1,1,6 2,6,1,- 1,1,1,1,6 2,6,1,1 4,2,1,20 4,2,3,5 2,6,1,57
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan transaminase anthranilate phosphoribosyltransferase 3-deoxy-D-arabino-heptulosonate 7-phosphate	Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <>> GLU + pHPYR  AKG + TRP <>> GLU + indPYR	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC6B12.04c eSPAC10A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC19A8.15 eSPAC56E4.03 SPCC569.07 SPBC1773.13 eSPAC56E4.03 SPCC569.07 SPBC1773.13 eSPAC56E4.03 SPCC569.07 eSPBC16G5.08	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,2,1,3 1,2,1,3 1,1,1,1,6 2,6,1,- 1,11,1,6 2,6,1,- 1,11,1,6 2,6,1,- 1,2,1,2,0 4,2,3,5 2,6,1,57
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan transaminase anthranilate phosphoribosyltransferase	Vacuole Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <-> GLU + pHPYR  AKG + TRP <-> GLU + indPYR  antH + PRPP -> PPi + pran  E4P + H2O + PEP -> 2dda7p + Pi	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC1066.13c eSPAC1066.13c eSPAC1073.13 eSPAC56E4.03 SPCC569.07 SPBC1773.13 eSPAC56E4.03 SPCC569.07 eSPBC1773.13 eSPAC56E4.03 SPCC569.07 eSPBC16G5.08 SPAC56E4.03 SPCC569.07 eSPBC16G5.08 SPAC24H6.10c eSPAC8E4.03	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,1,1,1,6 2,6,1,- 1,1,1,1,6 2,6,1,- 4,2,1,20 4,2,3,5 2,6,1,57 2,6,1,57 2,4,2,18 2,5,1,54
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (indoleglycerol phosphate) chorismate synthase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan transaminase anthranilate phosphoribosyltransferase 3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase aldehyde dehydrogenase (indole-3-acetaldehyde, NAD)	Vacuole Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <>> GLU + pHPYR  AKG + TRP <>> GLU + indPYR  antH + PRPP -> PPi + pran	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC1066.13c eSPAC1076.13c eSPAC1076.13c eSPAC10773.13 eSPAC56E4.03 SPCC569.07 SPBC1773.13 eSPAC56E4.03 SPCC569.07 eSPBC1773.13 eSPAC56E4.03 SPCC569.07 eSPBC16G5.08 SPAC56E4.03	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,2,1,3 1,2,1,3 1,1,1,1,6 2,6,1,- 1,11,1,6 2,6,1,- 1,11,1,6 2,6,1,- 1,2,1,2 1,2,1,3 2,6,1,5 2
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan ynthase (indoleglycerol phosphate) chorismate synthase anthranilate phosphoribosyltransferase 3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde,	Vacuole Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <-> GLU + pHPYR  AKG + TRP <-> GLU + indPYR  antH + PRPP -> PPi + pran  E4P + H2O + PEP -> 2dda7p + Pi	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC9E193.04 eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E3.04c eSPAC9E3.04c eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC9E3.04c eSPAC9E3.04c eSPAC9E3.05 eSPAC9E3.07 eSP	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,1,1,1,6 2,6,1,- 1,1,1,1,6 2,6,1,- 4,2,1,20 4,2,3,5 2,6,1,57 2,6,1,57 2,4,2,18 2,5,1,54
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan transaminase anthranilate phosphoribosyltransferase 3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP)	Vacuole Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <-> GLU + pHPYR  AKG + TRP <-> GLU + indPYR  antH + PRPP -> PPi + pran  E4P + H2O + PEP -> 2dda7p + Pi  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09e eSPAC9E9.09e eSPAC9E9.09e eSPAC9E9.09c eSPAC1076.13c eSPAC1076.00 eSPAC1	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan transaminase anthranilate phosphoribosyltransferase 3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) N-Formyl-L-kynurenine amidohydrolase	Vacuole Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Mucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkymr + H2O -> Lkymr + FORM + H  2 H2O2 -> 2 H2O + O2  3dHpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <-> GLU + pHPYR  AKG + TRP <-> GLU + indPYR  antH + PRPP -> PPi + pran  E4P + H2O + PEP -> 2dda7p + Pi  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  Lfmkynr + H2O -> Lkymr + FORM + H	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC9E19.09c eSPAC9E9.09c eSPAC9E9.09c eSPAC9E1.04c eSPAC9E1.04c eSPAC198.15 eSPAC196.10c eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC198.15 eSPAC198.10 eSPAC198.10 eSPAC198.10 eSPAC198.10 eSPAC98.00 eSPAC688.00 eSPAC688.0	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,2,1,3 1,2,1,3 1,2,1,3 1,11,1,6 2,6,1,1 4,2,1,20 4,2,3,5 2,6,1,57 2,6,1,57 2,4,2,18 2,5,1,54 1,2,1,3
S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase S-Adenosyl-L-methionine:catechol O-methyltransferase Phenethylamine:oxygen oxidoreductase (deaminating) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NAD) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) catalase A N-Formyl-L-kynurenine amidohydrolase catalase tyrosine transaminase (nucleus) tryptophan synthase (indoleglycerol phosphate) chorismate synthase phenylalanine transaminase  tryptophan transaminase anthranilate phosphoribosyltransferase 3-deoxy-D-arabino-heptulosonate 7-phosphate synthetase aldehyde dehydrogenase (indole-3-acetaldehyde, NADP) aldehyde dehydrogenase (indole-3-acetaldehyde, NADP)	Vacuole Vacuole Vacuole Vacuole Vacuole Vacuole Cytosol Cytosol Golgi apparatus Mitochondria Mitochondria Mucleus Nucleus	DHMAN + SAM -> SAH + MOHMAN  NOADREN + SAM -> SAH + NOMNEP  ADREN + SAM -> SAH + MNEP  DHPEG + SAM -> SAH + MOHPEG  PEA + O2 + H2O <> PACALD + NH4 + H2O2  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NAD -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADH  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH  2 H2O2 -> 2 H2O + O2  Lfmkynr + H2O -> Lkynr + FORM + H  2 H2O2 -> 2 H2O + O2  34Hpp + GLU -> AKG + TYR  3iG3P + SER -> G3P + H2O + TRP  3psme -> CHOR + Pi  AKG + PHE <-> GLU + pHPYR  AKG + TRP <-> GLU + indPYR  antH + PRPP -> PPi + pran  E4P + H2O + PEP -> 2dda7p + Pi  H2O + id3acald + NADP -> 2 H + ind3ac + NADPH	Tyrosine, Tryptophan, and Phenylalanin	eSPAC922.07c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPBPB21E7.04c eSPAC2E1P3.04 eSPAC9E9.09e eSPAC9E9.09e eSPAC9E9.09e eSPAC9E9.09c eSPAC10F6.13c eSPAC10F6.13c eSPAC9E9.09c	1,2,1,5 2,1,1,6 2,1,1,6 2,1,1,6 2,1,1,6 1,4,3,21 1,2,1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3

	Mitochondria	H2O + id3acald + NAD -> 2 H + ind3ac + NADH	Tyrosine, Tryptophan, and Phenylalanine SPAC9E9.09c	1.2.1.3
NAD) aldehyde dehydrogenase (indole-3-acetaldehyde,	Cytosol	H2O + id3acald + NADP -> 2 H + ind3ac + NADPH	Tyrosine, Tryptophan, and Phenylalanine SPAC9E9.09c	1.2.1.3
NADP) aldehyde dehydrogenase (indole-3-acetaldehyde,				
NADP)	Mitochondria	H2O + id3acald + NADP -> 2 H + ind3ac + NADPH	Tyrosine, Tryptophan, and Phenylalanine SPAC9E9.09c	1.2.1.3
amidase amidase	Cytosol Cytosol	H2O + pad -> NH4 + pac H2O + iad -> ind3ac + NH4	Tyrosine, Tryptophan, and Phenylalanine SPBPB8B6.03  Tyrosine, Tryptophan, and Phenylalanine SPBPB8B6.03	3.5.1.4 3.5.1.4
anthranilate phosphoribosyltransferase	Cytosol	antH + PRPP -> PPi + pran	Tyrosine, Tryptophan, and Phenylalanine SPBC16G5.08	2.4.2.18
catalase	Cytosol	2 H2O2 -> 2 H2O + O2	Tyrosine, Tryptophan, and Phenylalanine SPCC757.07c	1.11.1.6
catalase A	Peroxisome	2 H2O2 -> 2 H2O + O2	Tyrosine, Tryptophan, and Phenylalanine SPCC757.07c	1.11.1.6
chorismate mutase	Cytosol	CHOR -> PPHN	Tyrosine, Tryptophan, and Phenylalanine SPAC16E8.04c	2.6.1
chorismate mutase	Nucleus	CHOR -> PPHN	Tyrosine, Tryptophan, and Phenylalanine SPAC16E8.04c	2.6.1
chorismate synthase	Cytosol	3psme -> CHOR + Pi	Tyrosine, Tryptophan, and Phenylalanine SPCC1223.14	4.2.3.5
3-deoxy-D-arabino-heptulosonate 7-phosphate	-	E4P + H2O + PEP -> 2dda7p + Pi		2.5.1.54
synthetase 2-deoxy-D-arabino-heptulosonate 7-phosphate	Cytosol	·	Tyrosine, Tryptophan, and Phenylalanine SPAC24H6.10c SPAP8A3.07c SPAC24H6.10c	
synthetase 3-dehydroquinate synthase	Mitochondria Cytosol	E4P + H2O + PEP -> 2dda7p + Pi 2dda7p -> 3dHQ + Pi	Tyrosine, Tryptophan, and Phenylalanine SPAC24H6.10c SPAP8A3.07c  Tyrosine, Tryptophan, and Phenylalanine SPAC1834.02	2.5.1.54 4.2.3.4
3-dehydroquinate dehydratase	Cytosol	3dHQ -> 3dHsk + H2O	Tyrosine, Tryptophan, and Phenylalanine SPAC1834.02	4.2.1.10
	=			4.2.1.10
diamine transaminase	Cytosol	ACCoA + sprm -> N1sprm + CoA + H Lfmkynr + H2O -> Lkynr + FORM + H	Tyrosine, Tryptophan, and Phenylalanine Metabolism	2.6.1
N-Formyl-L-kynurenine amidohydrolase	Cytosol		Tyrosine, Tryptophan, and Phenylalanine SPAC6B12.04c	3.7.1.2
fumarylacetoacetase Homogentisate:oxygen 1,2-oxidoreductase	Cytosol	4FUMacac + H2O -> acac + FUM + H	Tyrosine, Tryptophan, and Phenylalanine Metabolism	3.7.1.2
(decyclizing)	Cytosol	Hgentis + O2 -> 4mlacac + H	Tyrosine, Tryptophan, and Phenylalanine Metabolism	
indole-3-glycerol-phosphate synthase	Cytosol	$2cpR5P + H \Rightarrow 3iG3P + CO2 + H2O$	Tyrosine, Tryptophan, and Phenylalanine SPBC1539.09c	4.1.1.48
maleylacetoacetate isomerase	Cytosol	4mlacac -> 4FUMacac	Tyrosine, Tryptophan, and Phenylalanine Metabolism SPBC1773.13	5.2.1.2
phenylalanine transaminase	Cytosol	AKG + PHE <-> GLU + pHPYR	Tyrosine, Tryptophan, and Phenylalanine SPAC56E4.03	2.6.1.57
prephenate dehydrogenase	Cytosol	NAD + PPHN -> 34Hpp + CO2 + NADH	SPCC569.07 Tyrosine, Tryptophan, and Phenylalanine SPCC1494.04c	
prephenate dehydrogenase (NADP)	Cytosol	NADP + PPHN -> 34Hpp + CO2 + NADPH	Tyrosine, Tryptophan, and Phenylalanine SPCC1494.04c	1.3.1.13
prephenate dehydratase	Cytosol	H + PPHN -> CO2 + H2O + pHPYR	Tyrosine, Tryptophan, and Phenylalanine SPBC30D10.16	4.2.1.51
prephenate dehydratase	Nucleus	H + PPHN -> CO2 + H2O + pHPYR	Tyrosine, Tryptophan, and Phenylalanine SPBC30D10.16	4.2.1.51
phosphoribosylanthranilate isomerase	Cytosol	pran -> 2cpR5P	Tyrosine, Tryptophan, and Phenylalanine SPBC1539.09c	5.3.1.24
3-phosphoshikimate 1-carboxyvinyltransferase	-	PEP + skm5p -> 3psme + Pi	Tyrosine, Tryptophan, and Phenylalanine SPAC1834.02	2.5.1.19
	Cytosol	3dHsk + H + NADPH -> NADP + skm		
shikimate dehydrogenase	Cytosol		Tyrosine, Tryptophan, and Phenylalanine SPAC1834.02	1.1.1.25
shikimate kinase	Cytosol	ATP + skm -> ADP + H + skm5p	Tyrosine, Tryptophan, and Phenylalanine SPAC1834.02	2.7.1.71
Spermidine acetyltransferase	Cytosol	ACCoA + spmd -> N1aspmd + CoA + H	Tyrosine, Tryptophan, and Phenylalanine Metabolism	
tryptophan synthase (indoleglycerol phosphate)	Cytosol	$3iG3P + SER \rightarrow G3P + H2O + TRP$	Tyrosine, Tryptophan, and Phenylalanine SPAC19A8.15	4.2.1.20
tryptophan transaminase	Cytosol	$AKG + TRP <\!$	SPBC1773.13 Tyrosine, Tryptophan, and Phenylalanine SPAC56E4.03 SPCC569.07	2.6.1.57
L-tyrosine N-formyltransferase	Cytosol	$10FTHF + TYR \rightarrow Nfortyr + H + THF$	Tyrosine, Tryptophan, and Phenylalanine Metabolism	
tyrosine transaminase	Cytosol	$34Hpp + GLU \rightarrow AKG + TYR$	Tyrosine, Tryptophan, and Phenylalanine SPAC10F6.13c	2.6.1.1
tyrosine transaminase (mitochondrial)	Mitochondria	$34Hpp + GLU \rightarrow AKG + TYR$	Tyrosine, Tryptophan, and Phenylalanine SPAC10F6.13c	2.6.1.1
2-oxo-4-methyl-3-carboxypentanoate	Nucleus	3c4MOP + H -> 4MOP + CO2	Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.6.1.42
decarboxylation				
isoleucine transaminase	Nucleus	AKG + ILE <-> 3MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.6.1.42
leucine transaminase	Nucleus	AKG + LEU <-> 4MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.6.1.42
valine transaminase				2.6.1.42
	Nucleus	AKG + VAL <-> 3MOB + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	
2-aceto-2-hydroxybutanoate synthase	Nucleus Cytosol	AKG + VAL <-> 3MOB + GLU 2obut + H + PYR -> 2aHbut + CO2		2.2.1.6
	Cytosol		Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04	
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase	Cytosol Mitochondria	$2 obut + H + PYR -> 2 a Hbut + CO2 \\ 2 obut + H + PYR -> 2 a Hbut + CO2$	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07	2.2.1.6
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase	Cytosol Mitochondria Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04  Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07  Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04	2.2.1.6 2.2.1.6
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase	Cytosol Mitochondria Cytosol Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07	2.2.1.6 2.2.1.6 2.2.1.6
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate)	Cytosol Mitochondria Cytosol Mitochondria Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c	2.2.1.6 2.2.1.6
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate)	Cytosol Mitochondria Cytosol Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Mitochondria Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <>> 3MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) isoleucine transaminase isoleucine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Mitochondria Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <>> 3MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC15C2.07 Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 1.1.1.85
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) isoleucine transaminase isoleucine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydrogenase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <>> 3MOP + GLU AKG + ILE <>> 3MOP + GLU 3c2Hmp + NAD >> 3c4MOP + H + NADH 3c2Hmp + NAD >> 3c4MOP + H + NADH 3c2Hmp -> 2ippm + H2O 2ippm + H2O <>> 3c3Hmp	Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c Valine, Leucine, and Isoleucine Metaboli SPAC9E9.03 Valine, Leucine, and Isoleucine Metaboli SPAC9E9.03	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 1.1.1.85 4.2.1.33 4.2.1.33
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydratase 2-isopropylmalate dehydratase 2-isopropylmalate hydratase acetohydroxy acid isomeroreductase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <>> 3MOP + GLU AKG + ILE <>> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp <>> 2ippm + H2O	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c Valine, Leucine, and Isoleucine Metaboli SPBC19E.03	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 1.1.1.85 4.2.1.33
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydrogenase 3-isopropylmalate dehydratase 2-isopropylmalate hydratase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <>> 3MOP + GLU AKG + ILE <>> 3MOP + GLU 3c2Hmp + NAD >> 3c4MOP + H + NADH 3c2Hmp + NAD >> 3c4MOP + H + NADH 3c2Hmp -> 2ippm + H2O 2ippm + H2O <>> 3c3Hmp	Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c Valine, Leucine, and Isoleucine Metaboli SPAC9E9.03 Valine, Leucine, and Isoleucine Metaboli SPAC9E9.03	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 1.1.1.85 4.2.1.33 4.2.1.33
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase 3-isopropylmalate dehydrogenase 3-isopropylmalate dehydratase 2-isopropylmalate dehydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2-	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp <> 2ippm + H2O 2ippm + H2O <>> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP	Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c Valine, Leucine, and Isoleucine Metaboli SPAC9E9.03	2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 1.1.1.85 4.2.1.33 4.2.1.33 1.1.1.86
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylputanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydratase 2-isopropylmalate dehydratase 2-isopropylmalate hydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2- hydroxybutanoate) leucine transaminase leucine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol Mitochondria Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU 3c2Hmp + NAD >> 3c4MOP + H + NADH 3c2Hmp + NAD >> 3c3MOP 2ippm + H2O <> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP	Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPBC3C2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c Valine, Leucine, and Isoleucine Metaboli SPBC9E9.03 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12	2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 1.1.1.85 4.2.1.33 4.2.1.33 1.1.1.86
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydrogenase 3-isopropylmalate dehydratase 2-isopropylmalate dehydratase 2-isopropylmalate dehydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2- hydroxybutanoate) leucine transaminase leucine transaminase 2-Oxo-4-methyl-3-carboxypentanoate	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Mitochondria Cytosol Cytosol Mitochondria Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp -> 2ippm + H2O 2ippm + H2O <> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP AKG + LEU <>> 4MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC32.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC1A4.02c Valine, Leucine, and Isoleucine Metaboli SPAC9E9.03 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12	2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 1.1.1.85 4.2.1.33 4.2.1.33 1.1.1.86 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylputanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydratase 2-isopropylmalate dehydratase 2-isopropylmalate hydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2- hydroxybutanoate) leucine transaminase leucine transaminase leucine transaminase 2-Oxo-4-methyl-3-carboxypentanoate decarboxylation 2-oxo-4-methyl-3-carboxypentanoate	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol Mitochondria Mitochondria Mitochondria Cytosol Mitochondria Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE -> 3MOP + GLU AKG + ILE -> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp -> 2ippm + H2O 2ippm + H2O -> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP AKG + LEU ->> 4MOP + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC32.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC9E9.03 Valine, Leucine, and Isoleucine Metaboli SPBC9E9.03 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 1.1.1.85 4.2.1.33 4.2.1.33 1.1.1.86 2.6.1.42 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydrogenase 2-isopropylmalate dehydratase 2-isopropylmalate dehydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2-hydroxybutanoate) leucine transaminase leucine transaminase 2-Oxo-4-methyl-3-carboxypentanoate decarboxylation	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp <-> 2ippm + H2O 2ippm + H2O <> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP AKG + LEU <> 4MOP + GLU AKG + LEU <> 4MOP + GLU AKG + LEU <> 4MOP + GLU 3c4MOP + H -> 4MOP + GLU 3c4MOP + H -> 4MOP + CO2	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC1428.04 Valine, Leucine, and Isoleucine Metaboli SPBC352.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 4.2.1.33 4.2.1.33 1.1.1.86 2.6.1.42 2.6.1.42 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydrogenase 3-isopropylmalate dehydratase 2-isopropylmalate dehydratase 2-isopropylmalate dehydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2- hydroxybutanoate) leucine transaminase leucine transaminase 2-Oxo-4-methyl-3-carboxypentanoate decarboxylation 2-oxo-4-methyl-3-carboxypentanoate decarboxylation	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp <-> 2ippm + H2O 2ippm + H2O <> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP AKG + LEU <> 4MOP + GLU AKG + LEU <> 4MOP + GLU 3c4MOP + H -> 4MOP + CO2 3c4MOP + H -> 4MOP + CO2	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPB735G2.07 Valine, Leucine, and Isoleucine Metaboli SPB735G2.07 Valine, Leucine, and Isoleucine Metaboli SPB735G2.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC599.03 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.43 4.2.1.33 4.2.1.33 1.1.1.86 2.6.1.42 2.6.1.42 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3-methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydrogenase 3-isopropylmalate dehydratase 2-isopropylmalate hydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2-hydroxybutanoate) leucine transaminase leucine transaminase 2-Oxo-4-methyl-3-carboxypentanoate decarboxylation 2-oxo-4-methyl-3-carboxypentanoate decarboxylation valine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol Mitochondria Cytosol Cytosol Cytosol Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol Mitochondria Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU 3c2Hmp + NAD >> 3c4MOP + H + NADH 3c2Hmp + NAD >> 3c3MOP 2ippm + H2O <> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP AKG + LEU <>> 4MOP + GLU AKG + LEU <>> 4MOP + GLU 3c4MOP + H -> 4MOP + GLU 3c4MOP + H -> 4MOP + CO2 3c4MOP + H -> 4MOP + CO2 AKG + VAL <>> 3MOB + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC352.07 Valine, Leucine, and Isoleucine Metaboli SPBC352.07 Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC99.03 Valine, Leucine, and Isoleucine Metaboli SPBC99.03 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 2.6.1.42 4.2.1.33 4.2.1.33 1.1.1.86 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylpentanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydrogenase 2-isopropylmalate dehydratase 2-isopropylmalate dehydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2- hydroxybutanoate) leucine transaminase leucine transaminase 2-Oxo-4-methyl-3-carboxypentanoate decarboxylation 2-oxo-4-methyl-3-carboxypentanoate decarboxylation valine transaminase valine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Mitochondria Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmp -> 3MOP + H2O AKG + ILE <> 3MOP + GLU AKG + ILE <> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp -> 2ippm + H2O 2ippm + H2O <>> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP AKG + LEU <>> 4MOP + GLU AKG + LEU <>> 4MOP + GLU AKG + LEU <>> 4MOP + GLU AKG + LEU <>> 4MOP + CO2 3c4MOP + H -> 4MOP + CO2 Ac4MOP + H -> 4MOP + CO2 AKG + VAL <>> 3MOB + GLU	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 SPBC14C8.04 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBC168.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC48.02c Valine, Leucine, and Isoleucine Metaboli SPBC9E9.03 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC48.02c Valine, Leucine, and Isoleucine Metaboli SPBC48.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 1.1.1.85 4.2.1.33 4.2.1.33 1.1.1.86 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42
2-aceto-2-hydroxybutanoate synthase 2-aceto-2-hydroxybutanoate synthase acetolactate synthase dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylbutanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylputanoate) dihydroxy-acid dehydratase (2,3-dihydroxy-3- methylputanoate) isoleucine transaminase isoleucine transaminase 3-isopropylmalate dehydratase 2-isopropylmalate dehydratase acetohydroxy acid isomeroreductase ketol-acid reductoisomerase (2-Aceto-2- hydroxybutanoate) leucine transaminase leucine transaminase leucine transaminase leucine transaminase valine transaminase valine transaminase valine transaminase valine transaminase valine transaminase	Cytosol Mitochondria Cytosol Mitochondria Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol Mitochondria Cytosol	2obut + H + PYR -> 2aHbut + CO2 2obut + H + PYR -> 2aHbut + CO2 H + 2 PYR -> alac-S + CO2 H + 2 PYR -> alac-S + CO2 23dHmb -> 3MOB + H2O 23dHmb -> 3MOP + H2O AKG + ILE -<> 3MOP + GLU AKG + ILE -<> 3MOP + GLU 3c2Hmp + NAD -> 3c4MOP + GH + NADH 3c2Hmp + NAD -> 3c4MOP + H + NADH 3c2Hmp -> 2ippm + H2O 2ippm + H2O -> 3c3Hmp alac-S + H + NADPH -> 23dHmb + NADP 2aHbut + H + NADPH -> 23dHmp + NADP AKG + LEU ->> 4MOP + GLU 3c4MOP + H -> 4MOP + GLU 3c4MOP + H -> 4MOP + CO2 3c4MOP + H -> 4MOP + CO2 AKG + VAL -<> 3MOB + GLU AKG + VAL -<> 3MOB + GLU AKG + VAL -<> 3MOB + GLU ATP + xylu-D -> ADP + H + xu5p-D	Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBC142.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBP35G2.07 Valine, Leucine, and Isoleucine Metaboli SPBC168.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPAC17G8.06c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c Valine, Leucine, and Isoleucine Metaboli SPBC48.02c Valine, Leucine, and Isoleucine Metaboli SPBC9B.03 Valine, Leucine, and Isoleucine Metaboli SPBC9B.03 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC56F2.12 Valine, Leucine, and Isoleucine Metaboli SPBC48.02c Valine, Leucine, and Isoleucine Metaboli SPBC428.02c	2.2.1.6 2.2.1.6 4.2.1.9 4.2.1.9 2.6.1.42 1.11.86 4.2.1.33 4.2.1.33 1.1.1.86 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42 2.6.1.42
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## Supporting Information 1B: List of metabolites used in SpoMBEL1693

	TON METABOLITE NAME	COMPARTMENT
13BDglcn	1,3-beta-D-Glucan	Extracellular
2hb	2-Hydroxybutyrate	Extracellular
2mbac	2-methylbutyl acetate	Extracellular
2mbald	2-methylbutyraldehyde	Extracellular
2mbtoh	2-methyl-1-butanol	Extracellular
2mppal	2-methylpropanal	Extracellular
2phetoh	2-phenylethanol	Extracellular
3c3hmp	3-Carboxy-3-hydroxy-4-methylpentanoate	Extracellular
3mbald	3-Methylbutanal	Extracellular
3mop	(S)-3-Methyl-2-oxopentanoate	Extracellular
4abut	4-Aminobutanoate	Extracellular
PABA	4-Aminobenzoate	Extracellular
5aop	5-Amino-4-oxopentanoate	Extracellular
8aonn	8-Amino-7-oxononanoate	Extracellular
abt	L-Arabinitol	Extracellular
ac	Acetate	Extracellular
ACAL	Acetaldehyde	Extracellular
aces	Acetic ester	Extracellular
ade	Adenine	Extracellular
adn	Adenosine	Extracellular
akg	2-Oxoglutarate	Extracellular
ALA	L-Alanine	Extracellular
alltn	Allantoin	Extracellular
alltt	Allantoate	Extracellular
SAM	S-Adenosyl-L-methionine	Extracellular
arab	D-Arabinose	Extracellular
arab	L-Arabinose	Extracellular
ARG	L-Arginine	Extracellular
ASN	L-Asparagine	Extracellular
ASP	L-Aspartate	Extracellular
btd-RR	(R,R)-2,3-Butanediol	Extracellular
btn	Biotin	Extracellular
chol	Choline	Extracellular
cit	Citrate	Extracellular
CO2	CO2	Extracellular
csn	Cytosine	Extracellular
CYS	L-Cysteine	Extracellular
cytd	Cytidine	Extracellular
dad-2	Deoxyadenosine	Extracellular
dann	7,8-Diaminononanoate	Extracellular
C100	Decanoate (n-C10:0)	Extracellular
dcyt	Deoxycytidine	Extracellular
C120	Dodecanoate (n-C12:0)	Extracellular
dgsn	Deoxyguanosine	Extracellular
din	Deoxyinosine	Extracellular
dttp	dTTP	Extracellular
duri	Deoxyuridine	Extracellular
epist	episterol	Extracellular
epistest	episterol ester	Extracellular
ergst	Ergosterol	Extracellular
ergstest	ergosterol ester	Extracellular
etha	Ethanolamine	Extracellular
etoh	Ethanol	Extracellular
2.011		Lanaconain

fe2 Fe2+ Extracellular Extracellular fecost fecosterol fecostest fecosterol ester Extracellular fmn **FMN** Extracellular **FORM** FORM ate Extracellular Extracellular fru **D-Fructose** Extracellular fum **Fumarate** g3pc Extracellular sn-Glycero-3-phosphocholine Extracellular g3pi sn-Glycero-3-phospho-1-inositol gal D-Galactose Extracellular D-Galacturonate Extracellular galur D-Glucosamine 6-phosphate Extracellular gam6p gcald Glycolaldehyde Extracellular **GLC** D-Glucose Extracellular GLN L-Glutamine Extracellular Extracellular **GLU** L-Glutamate Extracellular glx Glyoxylate Extracellular GLY Glycine glyc Glycerol Extracellular Extracellular Guanosine gsn Oxidized glutathione Extracellular gthox gthrd Reduced glutathione Extracellular gua Guanine Extracellular H+Extracellular h H<sub>2</sub>O H2O Extracellular Hexadecanoate (n-C16:0) Extracellular hdca Extracellular Hexadecenoate (n-C16:1) hdcea hexc hexacosanoate (n-C26:0) Extracellular HIS L-Histidine Extracellular hxan Hypoxanthine Extracellular Extracellular iamac isoamyl acetate iamoh Isoamyl alcohol Extracellular ibutac isobutyl acetate Extracellular ibutoh isobutyl alcohol Extracellular Extracellular id3acald Indole-3-acetaldehyde Extracellular ILE L-Isoleucine ind3eth Indole-3-ethanol Extracellular Extracellular inost myo-Inositol ins Inosine Extracellular k Extracellular potassium dLAC **D-Lactate** Extracellular LAC L-Lactate Extracellular lanost Lanosterol Extracellular Extracellular lanostest lanosterol ester Extracellular LEU L-Leucine Extracellular LYS L-Lysine L-Malate Extracellular MAL MALt Maltose Extracellular Extracellular man D-Mannose melib Melibiose Extracellular Extracellular MET L-Methionine mmet S-Methyl-L-methionine Extracellular Sodium Extracellular na1

Nicotinate

Nicotinamide adenine dinucleotide phosphate

nac NADP Extracellular

Extracellular

Nbfortyr N,N-bisFORM yl-dityrosine Extracellular Extracellular nh4 Ammonium NMN Extracellular nmn о2 O2 Extracellular Extracellular oaa Oxaloacetate Extracellular ocdca octadecanoate (n-C18:0) octadecenoate (n-C18:1) Extracellular ocdcea Extracellular ocdcya octadecadienoate (n-C18:2) Ornithine Extracellular orn pacald Phenylacetaldehyde Extracellular Extracellular Adenosine 3',5'-bisphosphate pap Phosphatidylcholine Extracellular pc pectin Pectin Extracellular PEPd **PEPtide** Extracellular pheac Phenethyl acetate Extracellular PHE L-Phenylalanine Extracellular Extracellular Pi Phosphate (R)-Pantothenate Extracellular pnto-R PRO L-Proline Extracellular Extracellular phosphatidyl-1D-myo-inositol ptd1ino ptrc Putrescine Extracellular PYR Pyruvate Extracellular rib D-Ribose Extracellular ribfly Riboflavin Extracellular sbt Dorbitol Extracellular Lorbitol Extracellular sbt Lerine Extracellular **SER** SO<sub>3</sub> Sulfite Extracellular Extracellular SO<sub>4</sub> Sulfate Spermidine Extracellular spmd Extracellular Spermine sprm srb Lorbose Extracellular Succinate Extracellular succ Sucrose Extracellular sucr Extracellular Taurine taur Extracellular Thiamin thm thmmp Thiamin monophosphate Extracellular Extracellular thmpp Thiamine diphosphate THR L-Threonine Extracellular Extracellular thym Thymine thymd Thymidine Extracellular Trehalose Extracellular tre TRP L-Tryptophan Extracellular Extracellular ttdca tetradecanoate (n-C14:0) **TYR** L-Tyrosine Extracellular Uracil Extracellular ura Urea Extracellular urea Uridine Extracellular uri Extracellular VAL L-Valine Xanthine Extracellular xan Xanthosine Extracellular xtsn xyl D-Xylose Extracellular xylt **Xylitol** Extracellular Extracellular zymosterol zymst

zymstest

zymosterol ester

Extracellular

GALI	Galactinol, 1-alpha-D-Galactosyl-myo-inositol	Extracellular
10fthf	10-FORM yltetrahydrofolate	Cytosol
10fthf	10-FORM yltetrahydrofolate	Mitochondria
12dgr	1,2-Diacylglycerol	Cytosol
13BDglcn	1,3-beta-D-Glucan	Cytosol
13dampp	1,3-Diaminopropane	Cytosol
13dpg	3-Phospho-D-glyceroyl phosphate	Cytosol
14glun	(1,4-alpha-D-Glucosyl)n	Cytosol
16BDglcn	1,6-beta-D-Glucan	Cytosol
1ag3p	1-Acyln-glycerol 3-phosphate	Cytosol
1agly3p	1-Acyl-glycerone 3-phosphate	Cytosol
1agpc	1-Acyln-glycerol-3-phosphocholine	Cytosol
GALI	Galactinol, 1-alpha-D-Galactosyl-myo-inositol	Endoplasmic Reticulum
1mncam	1-Methylnicotinamide	Cytosol
1p3h5c	L-1-Pyrroline-3-hydroxy-5-carboxylate	Cytosol
1p3h5c	L-1-Pyrroline-3-hydroxy-5-carboxylate	Mitochondria
1pyr5c	1-Pyrroline-5-carboxylate	Cytosol
1pyr5c	1-Pyrroline-5-carboxylate	Mitochondria
23camp	2',3'-Cyclic AMP	Cytosol
23dhmb	(R)-2,3-Dihydroxy-3-methylbutanoate	Mitochondria
23dhmp	(R)-2,3-Dihydroxy-3-methylpentanoate	Mitochondria
-		Cytosol
23dpg	2,3-Disphospho-D-glycerate (S) 2.15 Aming 1.(5 phospho D riboxyl) imidagala 4 carboyamidalayasinata	
saicar	(S)-2-[5-Amino-1-(5-phospho-D-ribosyl)imidazole-4-carboxamido]succinate	Cytosol
25dhpp	2,5-Diamino-6-hydroxy-4-(5'-phosphoribosylamino)-pyrimidine	Cytosol
25dthpp	2,5-diamino-6-ribitylamino-4(3H)-pyrimidinone 5'-phosphate	Cytosol
2ahbut	(S)-2-Aceto-2-hydroxybutanoate	Mitochondria
2ahhmd	2-Amino-4-hydroxy-6-hydroxymethyl-7,8-dihydropteridine diphosphate	Mitochondria
2ahhmp	2-Amino-4-hydroxy-6-hydroxymethyl-7,8-dihydropteridine	Mitochondria
2amsa	2-Aminomalonate semialdehyde	Cytosol
2aobut	L-2-Amino-3-oxobutanoate	Cytosol
2cpr5p	1-(2-Carboxyphenylamino)-1-deoxy-D-ribulose 5-phosphate	Cytosol
2dda7p	2-Dehydro-3-deoxy-D-arabino-heptonate 7-phosphate	Cytosol
2dda7p	2-Dehydro-3-deoxy-D-arabino-heptonate 7-phosphate	Mitochondria
2dglc	2-Deoxy-D-glucose	Cytosol
2dhp	2-Dehydropantoate	Cytosol
2dhp	2-Dehydropantoate	Mitochondria
2doxG6P	2-Deoxy-D-glucose 6-phosphate	Cytosol
2dr1p	2-Deoxy-D-ribose 1-phosphate	Cytosol
2dr5p	2-Deoxy-D-ribose 5-phosphate	Cytosol
2hb	2-Hydroxybutyrate	Cytosol
2hhxdal	2-Hydroxy-hexadecanal	Cytosol
2OPMB	2-Hexaprenyl-6-methoxy-1,4-benzoquinone	Mitochondria
2OPMP	2-Hexaprenyl-6-methoxyphenol	Mitochondria
2OMHMB	2-hexaprenyl-3-methyl-5-hydroxy-6-methoxy-1,4-benzoquinone	Mitochondria
2OPMMB	2-hexaprenyl-3-methyl-6-methoxy-1,4-benzoquinone	Mitochondria
2ippm	2-Isopropylmaleate	Cytosol
2kmb	2-keto-4-methylthiobutyrate	Cytosol
2mahmp	2-Methyl-4-amino-5-hydroxymethylpyrimidine diphosphate	Cytosol
2mbac	2-methylbutyl acetate	Cytosol
2mbald	2-methylbutyraldehyde	Cytosol
2mbald	2-methylbutyraldehyde	Mitochondria
2mbtoh	2-methyl-1-butanol	Cytosol Mitashandria
2mbtoh	2-methyl-1-butanol	Mitochondria
2mcit	2-Methylcitrate	Mitochondria

Cytosol

2mppal

2-methylpropanal

2mppal 2-methylpropanal Mitochondria 2obut 2-Oxobutanoate Cytosol 2obut 2-Oxobutanoate Mitochondria 2oxoadp 2-Oxoadipate Cytosol 2oxoadp 2-Oxoadipate Mitochondria D-Glycerate 2-phosphate Cytosol 2pg 2phetoh 2-phenylethanol Cytosol 2phetoh 2-phenylethanol Mitochondria 34hpl 3-(4-Hydroxyphenyl)lactate Mitochondria 3-(4-Hydroxyphenyl)pyruvate 34hpp Cytosol 34hpp 3-(4-Hydroxyphenyl)pyruvate Mitochondria 34hpp 3-(4-Hydroxyphenyl)pyruvate Peroxisome 35cCMP 3',5'-Cyclic CMP Cytosol 35cdamp 3',5'-Cyclic dAMP Cytosol 35cGMP 3',5'-Cyclic GMP Cytosol 35cIMP 3',5'-Cyclic IMP Cytosol 3c2hmp 3-Carboxy-2-hydroxy-4-methylpentanoate Cytosol 3c3hmp 3-Carboxy-3-hydroxy-4-methylpentanoate Cytosol 3c3hmp 3-Carboxy-3-hydroxy-4-methylpentanoate Mitochondria 3c4mop 3-Carboxy-4-methyl-2-oxopentanoate Cytosol 3c4mop 3-Carboxy-4-methyl-2-oxopentanoate Mitochondria 3-Hexaprenyl-4,5-dihydroxybenzoate 3H45DHBZ Cytosol 3H45DHBZ 3-Hexaprenyl-4,5-dihydroxybenzoate Mitochondria 3dhq 3-Dehydroquinate Cytosol 3dhsk 3-Dehydroshikimate Cytosol 3dsphgn 3-Dehydrosphinganine Cvtosol 3hanthrn 3-Hydroxyanthranilate Cytosol 3hdCoA (S)-3-Hydroxydecanoyl-CoA Peroxisome 3hddCoA (S)-3-Hydroxydodecanoyl-CoA Peroxisome 3hhdCoA (S)-3-Hydroxyhexadecanoyl-CoA Peroxisome 3hodCoA (S)-3-Hydroxyoctadecanoyl-CoA Peroxisome 3H4H5MOBZ 3-Hexaprenyl-4-hydroxy-5-methoxybenzoate Mitochondria 3htdCoA (S)-3-Hydroxytetradecanoyl-CoA Peroxisome 3hxcCoA (S)-3-Hydroxyhexacosyl-CoA Peroxisome 3ig3p C'-(3-Indolyl)-glycerol 3-phosphate Cytosol 3ipmmest 3-isopropylmalate-methyl-ester Cytosol 3mbald 3-Methylbutanal Cytosol 3mbald 3-Methylbutanal Mitochondria 3mob 3-Methyl-2-oxobutanoate Cytosol 3mob Mitochondria 3-Methyl-2-oxobutanoate 3mop (S)-3-Methyl-2-oxopentanoate Cytosol Mitochondria 3mop (S)-3-Methyl-2-oxopentanoate 3odCoA 3-Oxodecanoyl-CoA Peroxisome 3oddCoA 3-Oxododecanoyl-CoA Peroxisome 3ohdCoA 3-Oxohexadecanoyl-CoA Peroxisome 3ohodCoA 3-Oxooctadecanoyl-CoA Peroxisome 3ohxcCoA 3-Oxohexacosyl-CoA Peroxisome O4HBZ 3-Hexaprenyl-4-hydroxybenzoate Cytosol O4HBZ 3-Hexaprenyl-4-hydroxybenzoate Mitochondria 3otdCoA 3-Oxotetradecanoyl-CoA Peroxisome 3-Phospho-D-glycerate Cytosol 3pg 3php 3-Phosphohydroxypyruvate Cytosol 3psme 5-O-(1-Carboxyvinyl)-3-phosphoshikimate Cytosol 44mctr 4,4-dimethylcholesta-8,14,24-trienol Cytosol

Cytosol

44mzym

4,4-dimethylzymosterol

4aabutn 4-Acetamidobutanoate Cytosol 4abut 4-Aminobutanoate Cytosol 4abut 4-Aminobutanoate Mitochondria 4abutn 4-Aminobutanal Cytosol 4abutn 4-Aminobutanal Mitochondria PABA 4-Aminobenzoate Cytosol **PABA** 4-Aminobenzoate Mitochondria adcho 4-amino-4-deoxychorismate Cytosol 4ahmmp 4-Amino-5-hydroxymethyl-2-methylpyrimidine Cytosol 4ampm 4-Amino-2-methyl-5-phosphomethylpyrimidine Cytosol 4fumacac 4-Fumarylacetoacetate Cytosol 4gudbd 4-Guanidinobutanamide Cytosol 4gudbutn 4-Guanidinobutanoate Cytosol 4H2Oglt 4-Hydroxy-2-oxoglutarate Cytosol 4H2Oglt 4-Hydroxy-2-oxoglutarate Mitochondria 4H2Oglt 4-Hydroxy-2-oxoglutarate Peroxisome 4hbz 4-Hydroxybenzoate Cytosol 4hbz 4-Hydroxybenzoate Mitochondria 4hbzCoA 4-hydroxybenoyl-CoA Mitochondria 4hglusa L-4-Hydroxyglutamate semialdehyde Mitochondria 4hproT trans-4-Hydroxy-L-proline Cytosol 4hproT trans-4-Hydroxy-L-proline Mitochondria 4hthr 4-Hydroxy-L-threonine Cytosol 4-Methyl-5-(2-hydroxyethyl)-thiazole 4mhetz Cytosol 4mlacac 4-Maleylacetoacetate Cytosol 4mop 4-Methyl-2-oxopentanoate Cvtosol 4-Methyl-2-oxopentanoate Mitochondria 4mop 4mpetz 4-Methyl-5-(2-phosphoethyl)-thiazole Cytosol 4mzym 4-methylzymosterol Cytosol 44mzymc 4alpha-Methylzymosterol-4-carboxylate Cytosol 3k4mzym 4-Methylzymosterol intermediate 2 Cytosol 4pasp 4-Phospho-L-aspartate Cytosol D-4'-Phosphopantothenate Cytosol 4ppan 4ppcys N-((R)-4-Phosphopantothenoyl)-L-cysteine Cytosol 4r5au 4-(1-D-Ribitylamino)-5-aminouracil Cytosol Cytosol cair 5-amino-1-(5-phospho-D-ribosyl)imidazole-4-carboxylate 5aop 5-Amino-4-oxopentanoate Cytosol 5aop 5-Amino-4-oxopentanoate Mitochondria 5-Amino-6-(5'-phosphoribitylamino)uracil Cytosol 5aprbu 5dpmev (R)-5-Diphosphomevalonate Cytosol 5fthf 5-FORM yltetrahydrofolate Cytosol 5fthf Mitochondria 5-FORM yltetrahydrofolate 5mdr1p 5-Methylthio-5-deoxy-D-ribose 1-phosphate Cytosol 5mdru1p 5-Methylthio-5-deoxy-D-ribulose 1-phosphate Cytosol 5mta 5-Methylthioadenosine Cytosol 5mthf 5-Methyltetrahydrofolate Cytosol 5pmev (R)-5-Phosphomevalonate Cytosol 6dg D-Gal-alpha-1->6D-Glucose Cytosol **6**pgc 6-Phospho-D-gluconate Cytosol 6-phospho-D-glucono-1,5-lactone Cytosol 6pgl 6-phospho-D-glucono-1,5-lactone Endoplasmic Reticulum 6pgl

Cytosol

Cytosol Cytosol

Mitochondria

8aonn

aacald

aaCoA

aaCoA

8-Amino-7-oxononanoate

Aminoacetaldehyde

Acetoacetyl-CoA

Acetoacetyl-CoA

aact	Aminoacetone	Cytosol
abt	L-Arabinitol	Cytosol
ac	Acetate	Cytosol
ac	Acetate	Mitochondria
ac	Acetate	Peroxisome
acac	Acetoacetate	Cytosol
acACP	Acetyl-ACP	Cytosol
acACP	Acetyl-ACP	Mitochondria
ACAL	Acetaldehyde	Cytosol
ACAL	Acetaldehyde	Mitochondria
acCoA	Acetyl-CoA	Cytosol
acCoA	Acetyl-CoA	Mitochondria
acCoA	Acetyl-CoA	Nucleus
acCoA acCoA	Acetyl-CoA	Peroxisome
aces	Acetic ester	Cytosol
acg5p	N-Acetyl-L-glutamyl 5-phosphate	Mitochondria
0 1	N-Acetyl-L-glutamate 5emialdehyde	Mitochondria
acg5sa		
acgam1p	N-Acetyl-D-glucosamine 1-phosphate	Cytosol
асдатбр	N-Acetyl-D-glucosamine 6-phosphate	Cytosol
acglu	N-Acetyl-L-glutamate	Mitochondria
achms	O-Acetyl-L-homoserine	Cytosol
acon5m	E-3-carboxyl-2-pentenedioate 5-methyl ester	Cytosol
acon-T	trans-Aconitate	Cytosol
acorn	N2-Acetyl-L-ornithine	Mitochondria
ACP	acyl carrier protein	Cytosol
ACP	acyl carrier protein	Mitochondria
ACP1C	1-Aminocyclopropane-1-carboxylate	Cytosol
acser	O-Acetyl-Lerine	Cytosol
actn-R	(R)-Acetoin	Cytosol
acybut	gamma-Amino-gamma-cyanobutanoate	Cytosol
ade	Adenine	Cytosol
ade	Adenine	Mitochondria
adn	Adenosine	Cytosol
adn	Adenosine	Mitochondria
ADP	ADP	Cytosol
ADP	ADP	Golgi Apparatus
ADP	ADP	Mitochondria
ADP	ADP	Nucleus
ADP	ADP	Vacuole
ADP	ADP	Peroxisome
adprib	ADPribose	Cytosol
adprib	ADPribose	Mitochondria
adren	L-Adrenaline	???
ahcys	S-Adenosyl-L-homocysteine	Cytosol
ahcys	S-Adenosyl-L-homocysteine	Mitochondria
ahdt	2-Amino-4-hydroxy-6-(erythro-1,2,3-trihydroxypropyl)dihydropteridine triphosphate	Cytosol
aicar	5-Amino-1-(5-Phospho-D-ribosyl)imidazole-4-carboxamide	Cytosol
air	5-amino-1-(5-phospho-D-ribosyl)imidazole	Cytosol
akg	2-Oxoglutarate	Cytosol
akg	2-Oxoglutarate	Mitochondria
akg	2-Oxoglutarate	Nucleus
akg	2-Oxoglutarate	Peroxisome
ala-B	beta-Alanine	Cytosol
ala	D-Alanine	Cytosol
		•

alac (S)-2-Acetolactate Mitochondria ALA L-Alanine Cytosol ALA L-Alanine Mitochondria alatrna L-Alanyl-tRNA(Ala) Cytosol allphn Allophanate Cytosol Allantoin alltn Cytosol Allantoate alltt Cytosol S-aminomethyldihydrolipoamide Mitochondria alpam S-Aminomethyldihydrolipoylprotein Mitochondria alpro SAM S-Adenosyl-L-methionine Cytosol SAM S-Adenosyl-L-methionine Mitochondria ametam S-Adenosylmethioninamine Cytosol amob S-Adenosyl-4-methylthio-2-oxobutanoate Cytosol **AMP AMP** Cytosol AMP **AMP** Mitochondria Nucleus **AMP AMP** AMP AMP Peroxisome Adenosine 2'-phosphate Cytosol amp2p anth Anthranilate Cytosol P1,P4-Bis(5'-adenosyl) tetraphosphate Cytosol ap4a P1-(5'-adenosyl),P4-(5'-guanosyl) tetraphosphate Cytosol ap4g aPEP Nalpha-AcetylPEPtide Cytosol aproa 3-Aminopropanal Cytosol alpha-Aminopropiononitrile Cytosol aprop aprut N-Acetylputrescine Cytosol Adenosine 5'-phosphosulfate Cytosol aps **D-Arabinose** Cytosol arab Cytosol arab L-Arabinose L-Arginine Cytosol ARG ARG L-Arginine Mitochondria Vacuole ARG L-Arginine argsuc N(omega)-(L-Arginino)succinate Cytosol L-Arginyl-tRNA(Arg) Cytosol argtrna argtrna L-Arginyl-tRNA(Arg) Mitochondria ASN L-Asparagine Cvtosol **ASN** L-Asparagine Mitochondria ASN L-Asparagine Vacuole Cytosol L-Asparaginyl-tRNA(Asn) asntrna L-Asparaginyl-tRNA(Asn) Mitochondria asntrna ASP Cvtosol L-Aspartate ASP L-Aspartate Mitochondria ASP L-Aspartate Nucleus **ASP** L-Aspartate Vacuole ASP L-Aspartate Peroxisome L-Aspartate 4emialdehyde aspsa Cytosol L-Aspartyl-tRNA(Asp) Cytosol asptrna L-Aspartyl-tRNA(Asp) Mitochondria asptrna L-Allo-threonine Cytosol athr ATP ATP Cytosol ATP ATP Golgi Apparatus ATP ATP Mitochondria ATP ATP Nucleus ATP ATP Vacuole ATP ATP Peroxisome Mitochondria b124tc But-1-ene-1,2,4-tricarboxylate

htama	Distinct 5! AMD	Cytosol
btamp btd-RR	Biotinyl-5'-AMP (R,R)-2,3-Butanediol	Cytosol Cytosol
	Biotin	
btn		Cytosol
camp	cAMP	Cytosol
caphis	2-(3-Carboxy-3-aminopropyl)-L-histidine	Cytosol
cbasp	N-Carbamoyl-L-aspartate	Cytosol
cbasp	N-Carbamoyl-L-aspartate	Nucleus
cbp	Carbamoyl phosphate	Cytosol
cbp	Carbamoyl phosphate	Nucleus
CDP	CDP	Cytosol
CDP	CDP	Nucleus
CDPchol	CDPcholine	Cytosol
CDPdag	CDPdiacylglycerol	Cytosol
CDPdag	CDPdiacylglycerol	Mitochondria
CDPea	CDPethanolamine	Cytosol
cer124	Ceramide-1 (Sphinganine:n-C24:0)	Cytosol, ER, Golgi
	Columnat I (Opininguinitein C2 110)	apparatus, Mitochondria
cer126	Ceramide-1 (Sphinganine:n-C26:0)	Cytosol, ER, Golgi
		apparatus, Mitochondria
cer224	Ceramide-2 (Phytosphingosine:n-C24:0)	Cytosol
cer2'_24	Ceramide-2' (Sphinganine:n-C24:0OH)	Cytosol
cer224	Ceramide-2 (Phytosphingosine:n-C24:0)	Endoplasmic Reticulum
cer226	Ceramide-2 (Phytosphingosine:n-C26:0)	Cytosol
cer2'_26	Ceramide-2' (Sphinganine:n-C26:0OH)	Cytosol
cer226	Ceramide-2 (Phytosphingosine:n-C26:0)	Endoplasmic Reticulum
cer324	Ceramide-3 (Phytosphingosine:n-C24:0OH)	Cytosol
cer326	Ceramide-3 (Phytosphingosine:n-C26:0OH)	Cytosol
cgly	Cys-Gly	Cytosol
ch4s	Methanethiol	Cytosol
chitin	Chitin (monomer)	Cytosol
chitos	Chitosan	Cytosol
chol	Choline	Cytosol
cholp	Choline phosphate	Cytosol
CHOR	chorismate	Cytosol
cit	Citrate	Cytosol
cit	Citrate	Mitochondria
cit	Citrate	Peroxisome
citr	L-Citrulline	Cytosol
clpn	Cardiolipin	Mitochondria
cmaphis	2-[3-Carboxy-3-(methylammonio)propyl]-L-histidine	Cytosol
CMP	CMP	Cytosol
CMP	CMP	Mitochondria
cmusa	2-Amino-3-carboxymuconate semialdehyde	Cytosol
CO2	CO2	Cytosol
CO2	CO2	Golgi Apparatus
CO2	CO2	Mitochondria
CO2	CO2	Nucleus
CO2	CO2	Vacuole
CO2	CO2	Peroxisome
CoA	Coenzyme A	Cytosol
CoA	Coenzyme A Coenzyme A	Mitochondria
CoA	Coenzyme A Coenzyme A	Nucleus
CoA	•	Endoplasmic Reticulum
	Coenzyme A	Peroxisome
CoA	Coenzyme A	Mitochondria
couCoA	p-coumaroyl-CoA	
cpppg3	Coproporphyrinogen III	Cytosol

Cytosine Cytosol csn CTP **CTP** Cytosol CTP CTP Mitochondria **CYS** L-Cysteine Cytosol L-Cystathionine Cytosol cyst cyst L-Cystathionine Peroxisome L-Cysteinyl-tRNA(Cys) cystrna Cytosol cytd Cytidine Cytosol dad-2 Deoxyadenosine Cytosol dadp dADP Cytosol dADP Nucleus dadp diacylglycerol pyrophosphate Cytosol dagpy damp dAMP Cytosol dann 7,8-Diaminononanoate Cytosol Dara14lac D-Arabinono-1,4-lactone Cytosol datp dATP Cytosol db4p 3,4-dihydroxy-2-butanone 4-phosphate Cytosol dc2CoA trans-Dec-2-enoyl-CoA Peroxisome C100 Decanoate (n-C10:0) Cytosol C100 Decanoate (n-C10:0) Peroxisome C100ACP Decanoyl-ACP (n-C10:0ACP) Mitochondria C100CoA Decanoyl-CoA (n-C10:0CoA) Cytosol C100CoA Decanoyl-CoA (n-C10:0CoA) Peroxisome N6-(1,2-Dicarboxyethyl)-AMP dcamp Cytosol dCDP dCDP Cytosol dCDP dCDP Nucleus dCMP dCMP Cytosol dCTP dCTP Cytosol Deoxycytidine dcyt Cytosol dd2CoA trans-Dodec-2-enoyl-CoA Peroxisome C120 Dodecanoate (n-C12:0) Cytosol C120 Dodecanoate (n-C12:0) Peroxisome C120ACP Dodecanoyl-ACP (n-C12:0ACP) Cytosol C120ACP Dodecanoyl-ACP (n-C12:0ACP) Mitochondria C120CoA Dodecanoyl-CoA (n-C12:0CoA) Cytosol Dodecanoyl-CoA (n-C12:0CoA) Peroxisome C120CoA dext Dextrin Cytosol dGDP dGDP Cytosol dGDP dGDP Nucleus dGMP dGMP Cytosol dgsn Deoxyguanosine Cytosol dGTP dGTP Cytosol dha Dihydroxyacetone Cytosol dhap Dihydroxyacetone phosphate Cytosol Dihydroxyacetone phosphate dhap Mitochondria dhf 7,8-Dihydrofolate Cytosol dhf 7,8-Dihydrofolate Mitochondria Dihydrolipoamide Mitochondria dhlam dhlpro Dihydrolipolprotein Mitochondria ??? dhman 3,4-Dihydroxymandelate ??? dhmanal 3,4-Dihydroxymandelaldehyde dhnpt Dihydroneopterin Cytosol dhnpt Dihydroneopterin Mitochondria dhor (S)-Dihydroorotate Cytosol

???

dhpac

3,4-Dihydroxyphenylacetate

dhpacal 3,4-Dihydroxyphenylacetaldehyde ??? ??? dhpeg 3,4-Dihydroxyphenylethyleneglycol dhpmp Dihydroneopterin monophosphate Cytosol dhpt Dihydropteroate Cytosol dhpt Dihydropteroate Mitochondria din Deoxyinosine Cytosol dkmpp 2,3-diketo-5-methylthio-1-phosphopentane Cytosol dmlz 6,7-Dimethyl-8-(1-D-ribityl)lumazine Cytosol **DMPP** Dimethylallyl diphosphate Cytosol dNAD Deamino-NAD+ Cytosol dNAD Deamino-NAD+ Mitochondria dNAD Deamino-NAD+ Nucleus Cytosol dolichol Dolichol

dolmanp Dolichyl phosphate D-mannose Endoplasmic Reticulum

dolp Dolichol phosphate Cytosol

dolp Dolichol phosphate Endoplasmic Reticulum

dopDopamine???dpCoADephospho-CoACytosoldpCoADephospho-CoAMitochondriadribDeoxyriboseCytosoldscldihydrosirohydrochlorinCytosol

dtbt Dethiobiotin Cytosol dtdp dTDP Cytosol dTMP Cytosol dtmp dttp dTTP Cytosol dUDP dudp Cytosol dUDP Nucleus dudp dump dUMP Cytosol dUMP Nucleus dump duri Deoxyuridine Cytosol dUTP dutp Cytosol e3s Estrone 3ulfate Cytosol

e4hglu L-erythro-4-Hydroxyglutamate Cytosol e4hglu L-erythro-4-Hydroxyglutamate Mitochondria e4hglu L-erythro-4-Hydroxyglutamate Peroxisome D-Erythrose 4-phosphate Cytosol e4p e4p D-Erythrose 4-phosphate Mitochondria D-erythro-1-(Imidazol-4-yl)glycerol 3-phosphate eig3p Cytosol Epimelibiose Extracellular emp epist episterol Cytosol epistest episterol ester Cytosol Epimelibiose Cytosol epm

ergst Ergosterol Endoplasmic Reticulum

Cytosol

ergst3glcergosterol 3-beta-D-glucosideCytosolergstestergosterol esterCytosolergtetrolErgosta-5,7,22,24,(28)-tetraen-3beta-olCytosol

ergst

Ergosterol

ergtetrol Ergosta-5,7,22,24,(28)-tetraen-3beta-ol Endoplasmic Reticulum

ergtrol ergosta-5,7,24(28)-trienol Cytosol ertascb D-erythro-Ascorbate Cytosol Estrone Cytosol est etha Ethanolamine Cytosol Ethanolamine phosphate Cytosol ethamp Ethanol Cytosol etoh Mitochondria etoh Ethanol

f1p D-Fructose 1-phosphate Cytosol f26bp Cytosol D-Fructose 2,6-bisphosphate f6p D-Fructose 6-phosphate Cytosol FAD Flavin adenine dinucleotide oxidized Cytosol Flavin adenine dinucleotide oxidized **FAD** Mitochondria FADH2 Flavin adenine dinucleotide reduced Mitochondria fald FORM aldehyde Cytosol fdp D-Fructose 1,6-bisphosphate Cytosol fe2 Fe2+Cytosol fe2 Fe2+ Mitochondria fecosterol Cytosol fecost fecostest fecosterol ester Cytosol

ferrO Ferredoxin - Oxidized ferrR Ferredoxin - Reduced

N2-FORM yl-N1-(5-phospho-D-ribosyl)glycinamide Cytosol fgar Mitochondria ficytc Ferricytochrome c fmettrna N-FORM ylmethionyl-tRNA Mitochondria fmn **FMN** Cytosol fmn **FMN** Mitochondria Reduced FMN fmnh2 Cytosol focytc Ferrocytochrome c Mitochondria fol Folate Cytosol **FORM** Formate Cytosol **FORM** Formate Mitochondria

fgam 2-(FORM amido)-N1-(5-phospho-D-ribosyl)acetamidine Cytosol 5-FORM amido-1-(5-phospho-D-ribosyl)imidazole-4-carboxamide fprica Cvtosol **FRPP** Farnesyl diphosphate Cytosol FRPP Farnesyl diphosphate Mitochondria **D-Fructose** Cytosol fru fum Fumarate Cytosol fum Fumarate Mitochondria D-Glucose 1-phosphate Cytosol g1p Glyceraldehyde 3-phosphate Cytosol g3p sn-Glycero-3-phosphocholine Cytosol g3p

g3pi sn-Glycero-3-phospho-1-inositol Cytosol
G6P D-Glucose 6-phosphate Cytosol

G6P D-Glucose 6-phosphate Endoplasmic Reticulum
G6P-B beta-D-glucose 6-phosphate Cytosol

**D**-Galactose Cytosol gal Cytosol gal1p alpha-D-Galactose 1-phosphate gala Galactosylceramide Cytosol Galactomannan Cytosol galcman gam1p D-Glucosamine 1-phosphate Cytosol D-Glucosamine 6-phosphate Cytosol gam6p N1-(5-Phospho-D-ribosyl)glycinamide Cytosol gar gcald Glycolaldehyde Cytosol

gcald Glycolaldehyde Mitochondria
GDP GDP Cytosol
GDP GDP GOP GOIgi Appara

GDP GDP Golgi Apparatus
GDP GDP Mitochondria
GDP GDP Nucleus
GDPmann GDP-D-mannose Cytosol

GDP-mannose Golgi Apparatus

GGPP Geranylgeranyl diphosphate Cytosol ggl Galactosylglycerol Extracellular

Cytosol, ER, Golgi GLC D-Glucose apparatus, Vacuole GLN L-Glutamine Cytosol, Nucleus, Vacuole glntrna L-Glutaminyl-tRNA(Gln) Cytosol GlycylPEPtide Cytosol glp gls D-Glucoside Cytosol Cytosol glu5p L-Glutamate 5-phosphate glu5sa L-Glutamate 5emialdehyde Cytosol, Mitochondria gluala 5-L-Glutamyl-L-alanine Cytosol gamma-L-Glutamyl-L-cysteine Cytosol glucys Cytosoi, mitocnonaria, GLU L-Glutamate Nucleus, Peroxisome, L-Glutamyl-tRNA(Glu) Cytosol, Mitochondria glutrna glx Glyoxylate Cytosol, Peroxisome GLY Glycine Cytosol, Mitochondria glyald D-Glyceraldehyde Cytosol Glycerol Cytosol glyc glyc3p Glycerol 3-phosphate Cytosol, Mitochondria Cytosol, ER, Golgi glycogen glycogen apparatus, Vacuole glytrna Glycyl-tRNA(Gly) Cytosol **GMP GMP** Cytosol, Golgi apparatus P1,P4-Bis(5'-guanosyl) tetraphosphate Cytosol gp4g Geranyl diphosphate Cytosol grdp Guanosine Cytosol, Mitochondria gsn Oxidized glutathione Cytosol, Mitochondria gthox Cytosol, Mitochondria, Reduced glutathione gthrd Vacuole GTP GTP Cytosol, Mitochondria Cytosol, Mitochondria Cytosol, EK, Golgi Guanine gua apparatus, Mitochondria, h H+ Nucleus, Peroxisome, Ygfosolf, EK, Goigi apparatus, Mitochondria, H<sub>2</sub>O H<sub>2</sub>O Nucleus, Peroxisome, Vacuala Cytosol, Mitochondria, H2O2 Hydrogen peroxide Nucleus, Peroxisome H2S Hydrogen sulfide Cytosol 2-Hydroxybutane-1,2,4-tricarboxylate Mitochondria hcit 2-Hydroxybutane-1,2,4-tricarboxylate Nucleus hcit HCO3 Bicarbonate Cytosol HCO3 Bicarbonate Mitochondria HCO3 Bicarbonate Nucleus hcys L-Homocysteine Cytosol hcys L-Homocysteine Peroxisome C160 Hexadecanoate (n-C16:0) Cvtosol C160 Hexadecanoate (n-C16:0) Peroxisome C161 Hexadecenoate (n-C16:1) Cytosol C161 Hexadecenoate (n-C16:1) Peroxisome C161CoA Hexadecenoyl-CoA (n-C16:1CoA) Cytosol C161CoA Hexadecenoyl-CoA (n-C16:1CoA) Peroxisome hdd2CoA trans-Hexadec-2-enoyl-CoA Peroxisome C161ACP cis-hexadec-9-enoyl-[acyl-carrier protein] (n-C16:1) Cytosol C161ACP cis-hexadec-9-enoyl-[acyl-carrier protein] (n-C16:1) Mitochondria

hemeA

Heme A

Mitochondria

hemeO Heme O Mitochondria HXPP all-trans-Hexaprenyl diphosphate Cytosol **HXPP** all-trans-Hexaprenyl diphosphate Mitochondria hgentis Homogentisate Cytosol hicit Homoisocitrate Mitochondria HIS L-Histidine Cytosol HIS L-Histidine Mitochondria HIS Vacuole L-Histidine L-Histidinol phosphate hisp Cytosol histd L-Histidinol Cytosol L-Histidyl-tRNA(His) Cytosol histrna histrna L-Histidyl-tRNA(His) Mitochondria hLkynr 3-Hydroxy-L-kynurenine Cytosol hmbil Hydroxymethylbilane Cytosol hmgCoA Hydroxymethylglutaryl-CoA Cytosol Hydroxymethylglutaryl-CoA Mitochondria hmgCoA hom L-Homoserine Cytosol ??? hpac 4-Hydroxyphenylacetate hpacal 4-Hydroxyphenylacetaldehyde ??? Tetrahydropteroyltri-L-glutamate hpglu Cytosol hvan Homovanillate ??? hxan Hypoxanthine Cytosol trans-Hexacos-2-enoyl-CoA hxc2CoA Peroxisome hxdcal Hexadecanal Cytosol iad Indole-3-acetamide Cytosol iamac isoamvl acetate Cytosol iamoh Isoamyl alcohol Cytosol iamoh Isoamyl alcohol Mitochondria **IMASP** Iminoaspartate Cytosol ibutac isobutyl acetate Cytosol ibutoh isobutyl alcohol Cytosol ibutoh isobutyl alcohol Mitochondria icit Isocitrate Cytosol icit Isocitrate Mitochondria icit Isocitrate Peroxisome id3acald Indole-3-acetaldehyde Cytosol id3acald Indole-3-acetaldehyde Mitochondria IDP **IDP** Cytosol IDP IDP Mitochondria ILE L-Isoleucine Cvtosol ILE L-Isoleucine Mitochondria ILE L-Isoleucine Vacuole iletrna L-Isoleucyl-tRNA(Ile) Cytosol iletrna L-Isoleucyl-tRNA(Ile) Mitochondria 3-(Imidazol-4-yl)-2-oxopropyl phosphate Cytosol imacp IMP Cytosol Indole-3-acetate ind3ac Cytosol ind3ac Indole-3-acetate Mitochondria ind3acnl Indole-3-acetonitrile Cytosol ind3eth Indole-3-ethanol Cytosol Indole-3-ethanol ind3eth Mitochondria indpyr Indolepyruvate Cytosol inost myo-Inositol Cytosol ins Inosine Cytosol

Inositol phosphorylceramide, ceramide-1 (24C)

Cytosol

ipc124

ipc126	Inositol phosphorylceramide, ceramide-1 (26C)	Cytosol
ipc224	Inositol phosphorylceramide, ceramide-2 (24C)	Cytosol
ipc226	Inositol phosphorylceramide, ceramide-2 (26C)	Cytosol
ipc324	Inositol phosphorylceramide, ceramide-3 (24C)	Cytosol
ipc326	Inositol phosphorylceramide, ceramide-3 (26C)	Cytosol
IPPP	Isopentenyl diphosphate	Cytosol
IPPP	Isopentenyl diphosphate	Mitochondria
itacCoA	Itaconyl-CoA	Mitochondria
itacon	Itaconate	Mitochondria
ITP	ITP	Cytosol, Mitochondria
K	potassium	Cytosol
L2aadp	L-2-Aminoadipate	Cytosol
L2aadp6sa	L-2-Aminoadipate 6emialdehyde	Cytosol
dLAC	D-Lactate	Cytosol, Mitochondria
LAC	L-Lactate	Cytosol, Mitochondria
lald	L-Lactaldehyde	Cytosol
lanost	Lanosterol	Cytosol
lanostest	lanosterol ester	Cytosol
Lcystin	L-Cystine	Cytosol
Lcystin	L-Cystine	Vacuole
LEU	L-Leucine	Cytosol
LEU	L-Leucine	Mitochondria
LEU	L-Leucine	Vacuole
leutrna	L-Leucyl-tRNA(Leu)	Cytosol
leutrna	L-Leucyl-tRNA(Leu)	Mitochondria
Lfmkynr	L-FORM ylkynurenine	Cytosol
lgt	(R)-Lactoylglutathione	Cytosol
lgt	(R)-Lactoylglutathione	Mitochondria
Lkynr	L-Kynurenine	Cytosol
lpam	Lipoamide	Mitochondria
lpro	Lipoylprotein	Mitochondria
LYS	L-Lysine	Cytosol
LYS	L-Lysine	Mitochondria
LYS	L-Lysine	Vacuole
	·	
lystrna	L-Lysine-tRNA (Lys)	Cytosol Mitochondria
lystrna	L-Lysine-tRNA (Lys)	
m1macchitppdol	alpha-D-mannosyl-beta-D-mannosyl-diacylchitobiosyldiphosphodolichol	Golgi Apparatus
m2macchitppdol	(alpha-D-mannosyl)2-beta-D-mannosyl-diacetylchitobiosyldiphosphodolichol	Golgi Apparatus
m3macchitppdol	(alpha-D-mannosyl)3-beta-D-mannosyl-diacetylchitodiphosphodolichol	Golgi Apparatus
m4macchitppdol	(alpha-D-Mannosyl)4-beta-D-mannosyl-diacetylchitobiosyldiphosphodolichol	Golgi Apparatus
macchitppdol	beta-D-Mannosyldiacetylchitobiosyldiphosphodolichol	Golgi Apparatus
MALACP	Malonyl-[acyl-carrier protein]	Cytosol
MALACP	Malonyl-[acyl-carrier protein]	Mitochondria
MALCoA	Malonyl-CoA	Cytosol
MALCoA	Malonyl-CoA	Mitochondria
MAL	L-Malate	Cytosol
MAL	L-Malate	Mitochondria
MAL	L-Malate	Peroxisome
MALt	Maltose	Cytosol
man	D-Mannose	Cytosol
man1p	D-Mannose 1-phosphate	Cytosol
man2mi1p	Mannose-(inositol-P)2	Cytosol
man6p	D-Mannose 6-phosphate	Cytosol
manmi1p	mannose-1D-myo-Inositol 1-phosphate	Cytosol
	M	C + 1

Cytosol

mannan

Mannan

Mannan Endoplasmic Reticulum mannan mant Manninotriose Extracellular Melibiose Cytosol melib melt melibiitol Extracellular methf 5,10-Methenyltetrahydrofolate Cytosol methf 5,10-Methenyltetrahydrofolate Mitochondria MET L-Methionine Cytosol **MET** L-Methionine Mitochondria mettrna L-Methionyl-tRNA (Met) Cytosol mettrna L-Methionyl-tRNA (Met) Mitochondria mev-R (R)-Mevalonate Cytosol mohman 3-Methoxy-4-hydroxymandelate ??? 3-Methoxy-4-hydroxyphenylacetal de hydemohpacal ??? ??? mohpeg 3-Methoxy-4-hydroxyphenylethyleneglycol mohpgal 3-Methoxy-4-hydroxyphenylglycolaldehyde ??? mhpglu 5-Methyltetrahydropteroyltri-L-glutamate Cytosol mi13456p 1D-myo-Inositol 1,3,4,5,6-pentakisphosphate Cytosol 1D-myo-Inositol 1,3,4,5,6-pentakisphosphate Nucleus mi13456p mi1345p 1D-myo-Inositol 1,3,4,5-tetrakisphosphate Nucleus mi1456p 1D-myo-Inositol 1,4,5,6-tetrakisphosphate Nucleus mi145p 1D-myo-Inositol 1,4,5-trisphosphate Cytosol mi145p 1D-myo-Inositol 1,4,5-trisphosphate Nucleus mi1p 1D-myo-Inositol 1-phosphate Cytosol Mitochondria micit methylisocitrate minohp myo-Inositol hexakisphosphate Cytosol minohp myo-Inositol hexakisphosphate Nucleus mip2c124 mannose-(inositol-P)2-ceramide, ceramide-1 (24C) Cytosol mip2c126 mannose-(inositol-P)2-ceramide, ceramide-1 (26C) Cytosol mip2c224 mannose-(inositol-P)2-ceramide, ceramide-2 (24C) Cytosol mip2c226 mannose-(inositol-P)2-ceramide, ceramide-2 (26C) Cytosol mip2c324 mannose-(inositol-P)2-ceramide, ceramide-3 (24C) Cytosol mip2c326 mannose-(inositol-P)2-ceramide, ceramide-3 (26C) Cytosol mipc124 mannose-inositol phosphorylceramide, ceramide-1 (24C) Cytosol mipc126 mannose-inositol phosphorylceramide, ceramide-1 (26C) Cytosol mipc224 mannose-inositol phosphorylceramide, ceramide-2 (24C) Cytosol mipc226 mannose-inositol phosphorylceramide, ceramide-2 (26C) Cytosol mipc324 mannose-inositol phosphorylceramide, ceramide-3 (24C) Cytosol mipc326 mannose-inositol phosphorylceramide, ceramide-3 (26C) Cytosol mlthf 5,10-Methylenetetrahydrofolate Cytosol mlthf 5,10-Methylenetetrahydrofolate Mitochondria S-Methyl-L-methionine Cytosol mmet ??? L-Metanephrine mnep motam 3-Methoxytyramine ???? mthgxl Methylglyoxal Cytosol Myristoyl-ACP (n-C14:0ACP) C140ACP Cytosol Myristoyl-ACP (n-C14:0ACP) C140ACP Mitochondria N1aspmd N1-Acetylspermidine Cytosol N1sprm N1-Acetylspermine Cytosol n4abutn N4-Acetylaminobutanal Cytosol Sodium Cytosol na1 Nicotinate Cytosol nac nac Nicotinate Mitochondria Cytosol, ER, Mitochondria, NAD Nicotinamide adenine dinucleotide Nucleus, Peroxisome

NADH

Nicotinamide adenine dinucleotide - reduced

Cytosol, ER, Mitochondria,

Peroxisome

NADP Nicotinamide adenine dinucleotide phosphate Cytosol, ER, Mitochondria,

Peroxisome

NADPH Nicotinamide adenine dinucleotide phosphate - reduced Cytosol, ER, Mitochondria,

Nhapper Nicothiannde adennie dindeleotide phosphate - reduced Peroxisome

Nbfortyr N,N-bisFORM yl-dityrosine Cytosol

ncamNicotinamideCytosolncamNicotinamideMitochondriaNfortyrN-FORM yl-L-tyrosineCytosol

NH4 Ammonium Cytosol, Mitochondria,
Nucleus, Peroxisome

 nicrnt
 Nicotinate D-ribonucleotide
 Cytosol

 nicrnt
 Nicotinate D-ribonucleotide
 Mitochondria

 nmn
 NMN
 Cytosol

 nmn
 NMN
 Mitochondria

nmnNMNMitochondrinmnNMNPeroxisomenoadrenL-Noradrenaline???nomnepL-Normetanephrine???

N(pai)-Methyl-L-histidine

**NPmehis** 

O2 Cytosol, ER, Mitochondria,

Cytosol

O2 Peroxisome
Oaa Oxaloacetate Cytosol

Oxaloacetate Mitochondria oaa Oxaloacetate Peroxisome oaa Octanoyl-ACP (n-C8:0ACP) C080ACP Mitochondria C080CoA Octanoyl-CoA (n-C8:0CoA) Cytosol C080CoA Octanoyl-CoA (n-C8:0CoA) Peroxisome C180 octadecanoate (n-C18:0) Cytosol C180 octadecanoate (n-C18:0) Peroxisome

C180ACP Octadecanoyl-ACP (n-C18:0ACP) Cytosol C180ACP Octadecanoyl-ACP (n-C18:0ACP) Mitochondria octadecenoate (n-C18:1) C181 Cytosol C182 octadecadienoate (n-C18:2) Cytosol Octadecynoyl-ACP (n-C18:2ACP) C182ACP Cytosol Octadecynoyl-ACP (n-C18:2ACP) Mitochondria C182ACP C182CoA Octadecynoyl-CoA (n-C18:2CoA) Cytosol

C182CoA Octadecynoyl-CoA (n-C18:2CoA) Peroxisome
C080 octanoate (n-C8:0) Cytosol
C080 octanoate (n-C8:0) Peroxisome
C181ACP cis-octadec-11-enoyl-[acyl-carrier protein] (n-C18:1) Cytosol

C181ACP cis-octadec-11-enoyl-[acyl-carrier protein] (n-C18:1) Mitochondria od2CoA trans-Octadec-2-enoyl-CoA Peroxisome
C181CoA Octadecenoyl-CoA (n-C18:1CoA) Cytosol
C181CoA Octadecenoyl-CoA (n-C18:1CoA) Peroxisome oh1 hydroxide ion Cytosol

oh1hydroxide ionMitochondriaohpb2-Oxo-3-hydroxy-4-phosphobutanoateCytosol

orn Ornithine Cytosol
orn Ornithine Mitochondria
orot Orotate Cytosol

orot5p Orotidine 5'-phosphate Cytosol Oxaloglutarate Cytosol oxag Oxaloglutarate Mitochondria oxag Phosphatidate Cytosol pa pa Phosphatidate Mitochondria Phenylacetic acid Cytosol pac pacald Phenylacetaldehyde Cytosol

Phenylacetaldehyde pacald pad 2-Phenylacetamide C160ACP Palmitoyl-ACP (n-C16:0ACP)

C160ACP Palmitoyl-ACP (n-C16:0ACP) Pantetheine 4'-phosphate pan4p Pantetheine 4'-phosphate pan4p pan4p Pantetheine 4'-phosphate

pant-R (R)-Pantoate pant-R (R)-Pantoate

Adenosine 3',5'-bisphosphate pap Adenosine 3',5'-bisphosphate pap Adenosine 3',5'-bisphosphate pap 3'-Phosphoadenylyl sulfate paps Phosphatidylcholine pc Pyridoxine 5'-phosphate pdx5p pe phosphatidylethanolamine

phosphatidylethanolamine pe phosphatidylethanolamine pe pe phosphatidylethanolamine Phenylethylamine pea

**PNPP** all-trans-Pentaprenyl diphosphate **PNPP** all-trans-Pentaprenyl diphosphate

PEP Phosphoenolpyruvate PEP Phosphoenolpyruvate

PEPd **PEPtide** Phosphatidylglycerol pg

Phosphatidylglycerophosphate pgp

pheac Phenethyl acetate PHE L-Phenylalanine PHE L-Phenylalanine pheme Protoheme

phetrna L-Phenylalanyl-tRNA(Phe) L-Phenylalanyl-tRNA(Phe) phetrna phom O-Phospho-L-homoserine Phenylpyruvate phpyr

O-Phospho-4-hydroxy-L-threonine phthr

Ρi Phosphate Pi Phosphate

Pi Phosphate Ρi Phosphate Pi Phosphate

Pi Phosphate Pi Phosphate

C160CoA Palmitoyl-CoA (n-C16:0CoA) Palmitoyl-CoA (n-C16:0CoA) C160CoA

pnto-R (R)-Pantothenate ppbng Porphobilinogen ppCoA Propanovl-CoA pphn Prephenate PPi Diphosphate PPi Diphosphate PPi Diphosphate PPi Diphosphate

ppmi12346p 5-Diphosphoinositol pentakisphosphate ppmi1346p Diphosphoinositol tetrakisphosphate

Cytosol Cytosol Mitochondria

Mitochondria

Cytosol Mitochondria Peroxisome Cytosol Mitochondria

Cytosol Mitochondria Peroxisome Cytosol Cytosol Cytosol Cytosol

> Golgi Apparatus Mitochondria Vacuole Cytosol Cytosol

Mitochondria Cytosol Mitochondria Cytosol Mitochondria Mitochondria Cytosol

Cytosol Mitochondria Mitochondria Cytosol Mitochondria Cytosol Cytosol Cytosol

Cytosol Golgi Apparatus Mitochondria Nucleus Endoplasmic Reticulum

Vacuole Peroxisome

Cytosol

Peroxisome Cytosol Cytosol Mitochondria Cytosol Cytosol

Nucleus Peroxisome Cytosol Cytosol

Mitochondria

ppp9	Protoporphyrin	Mitochondria
pppg9	Protoporphyrinogen IX	Cytosol
pppg9	Protoporphyrinogen IX	Mitochondria
pram	5-Phospho-beta-D-ribosylamine	Cytosol
pran	N-(5-Phospho-D-ribosyl)anthranilate	Cytosol
prbamp	1-(5-Phosphoribosyl)-AMP	Cytosol
		Cytosol
prbatp	1-(5-Phosphoribosyl)-ATP 1-(5-Phosphoribosyl)-5-[(5-phosphoribosylamino)methylideneamino]imidazole-	Cytosoi
prfp	4-carboxamide	Cytosol
prlp	5-[(5-phospho-1-deoxyribulos-1-ylamino)methylideneamino]-1-(5-phosphoribosyl)imidazole-4-carboxamide	Cytosol
PRO	L-Proline	Cytosol
PRO	L-Proline	Mitochondria
protrna	L-Prolyl-tRNA(Pro)	Cytosol
prpp	5-Phospho-alpha-D-ribose 1-diphosphate	Cytosol
prpp	5-Phospho-alpha-D-ribose 1-diphosphate	Mitochondria
ps	phosphatidylserine	Cytosol
ps	phosphatidylserine	Golgi Apparatus
ps	phosphatidylserine	Mitochondria Mitochondria
ps	phosphatidylserine	Vacuole
psd5p	Pseudouridine 5'-phosphate	Cytosol
	O-Phospho-Lerine	Cytosol
pser	Phytosphingosine 1-phosphate	
psph1p		Cytosol
psph1p	Phytosphingosine 1-phosphate	Endoplasmic Reticulum
psphings	Phytosphingosine	Cytosol
psphings	Phytosphingosine	Endoplasmic Reticulum
ptd134bp	phosphatidyl-1D-myo-inositol 3,4-bisphosphate	Cytosol
ptd135bp	1-Phosphatidyl-D-myo-inositol 3,5-bisphosphate	Cytosol
ptd145bp	1-Phosphatidyl-D-myo-inositol 4,5-bisphosphate	Cytosol
ptd345tp	1-Phosphatidyl-1D-myo-inositol 3,4,5-trisphosphate	Cytosol
ptd1ino	phosphatidyl-1D-myo-inositol	Cytosol
ptd1ino	phosphatidyl-1D-myo-inositol	Nucleus
ptd2meeta	Phosphatidyl-N-dimethylethanolamine	Cytosol
ptd3ino	phosphatidyl-1D-myo-3-inositol	Cytosol
ptd4ino	phosphatidyl-1D-myo-4-inositol, yeast specific	Cytosol
ptd4ino	phosphatidyl-1D-myo-4-inositol, yeast specific	Nucleus
ptdmeeta	Phosphatidyl-N-methylethanolamine	Cytosol
ptrc	Putrescine	Cytosol
pyam5p	Pyridoxamine 5'-phosphate	Cytosol
pydam	Pyridoxamine	Cytosol
pydx	Pyridoxal	Cytosol
pydx5p	Pyridoxal 5'-phosphate	Cytosol
pydxn	Pyridoxine	Cytosol
PYR	Pyruvate	Cytosol
PYR	Pyruvate	Mitochondria
PYR	Pyruvate	Peroxisome
q6	Ubiquinone-6	Mitochondria
q6h2	Ubiquinol-6	Mitochondria
quln	Quinolinate	Cytosol
quln	Quinolinate	Mitochondria
rlp	alpha-D-Ribose 1-phosphate	Cytosol
	alpha-D-Ribose 1-phosphate	Mitochondria
rlp		
r5p	alpha-D-Ribose 5-phosphate	Cytosol
raffin	Raffinose  D. Ribere	Cytosol
rib	D-Ribose Bihoflavin	Cytosol
PINTIN	LIDOTIONIO	LATOSOL

ribflv

Riboflavin

Cytosol

ribfly Riboflavin Mitochondria rnam N-Ribosylnicotinamide Cytosol D-Ribulose 5-phosphate Cytosol ru5p Sulfur Cytosol S Sedoheptulose 1,7-bisphosphate s17bp Cytosol Sedoheptulose 7-phosphate s7p Cytosol Cytosol saccrp Laccharopine Dorbitol sbt Cytosol Lorbitol sbt Cytosol scl sirohydrochlorin Cytosol Succinyldihydrolipoamide Mitochondria sdhlam selt Selenite Cytosol seld Selenide Cytosol SER Lerine Cytosol **SER** Lerine Mitochondria Leryl-tRNA(Ser) sertrna Cytosol Sfglutth S-FORM ylglutathione Cytosol sft Sulfatide Cytosol dgala Digalactosylceramide Cytosol Siroheme sheme Cytosol skm Shikimate Cytosol skm5p Shikimate 5-phosphate Cytosol SO3 Sulfite Cytosol SO<sub>4</sub> Sulfate Cytosol sph1p Sphinganine 1-phosphate Cytosol Endoplasmic Reticulum sph1p Sphinganine 1-phosphate Sphinganine Cytosol sphgn sphgn Sphinganine Endoplasmic Reticulum Spermidine Cytosol spmd Spermine Cytosol sprm Squalene SQL Cytosol Endoplasmic Reticulum SQL Squalene srb Lorbose Cytosol **ESQL** (S)qualene-2,3-epoxide Cytosol Endoplasmic Reticulum **ESQL** (S)qualene-2,3-epoxide Stachyose Cytosol sta C180CoA Stearoyl-CoA (n-C18:0CoA) Cytosol Stearoyl-CoA (n-C18:0CoA) Peroxisome C180CoA Succinate Cytosol succ Succinate Mitochondria succ sucCoA Succinyl-CoA Mitochondria Ouccinyl-L-homoserine Cytosol suchms sucr Sucrose Cytosol Sucrose-6-phosphate Cytosol sucr6p Succinic semialdehyde Cytosol sucsal T4hcinnm trans-4-Hydroxycinnamate Mitochondria TAG Triacylglycerol, triglyceride Cytosol TAG Triacylglycerol, triglyceride Endoplasmic Reticulum taG6P D-Tagatose 6-phosphate Cytosol

taGDP D-Tagatose 1,6-biphosphate Cytosol Tyramine Cytosol tam Taurine taur Cytosol tchola taurocholic acid Cytosol taurocholic acid Vacuole tchola td2CoA trans-Tetradec-2-enoyl-CoA Peroxisome

C140CoA Tetradecanoyl-CoA (n-C14:0CoA) Cytosol C140CoA Peroxisome Tetradecanoyl-CoA (n-C14:0CoA) C141ACP cis-tetradec-7-enoyl-[acyl-carrier protein] (n-C14:1) Cytosol C141ACP cis-tetradec-7-enoyl-[acyl-carrier protein] (n-C14:1) Mitochondria C141CoA Tetradecenoyl-CoA (n-C14:1CoA) Cytosol C141CoA Tetradecenoyl-CoA (n-C14:1CoA) Peroxisome tglp N-TetradecanoylglycylPEPtide Cytosol thf 5,6,7,8-Tetrahydrofolate Cytosol Mitochondria thf 5,6,7,8-Tetrahydrofolate thfglu Tetrahydrofolyl-[Glu](2) Cytosol Thiamin Cytosol thm thmmp Thiamin monophosphate Cytosol thmpp Thiamine diphosphate Cytosol thmpp Thiamine diphosphate Mitochondria thmtp Thiamin triphosphate Cytosol THR L-Threonine Cytosol THR L-Threonine Mitochondria thrtrna L-Threonyl-tRNA(Thr) Cytosol thrtrna L-Threonyl-tRNA(Thr) Mitochondria Thymine thym Cytosol thymd Thymidine Cytosol trdox Oxidized thioredoxin Cytosol trdox Oxidized thioredoxin Mitochondria Oxidized thioredoxin Nucleus trdox trdox Oxidized thioredoxin Peroxisome Reduced thioredoxin trdrd Cvtosol Reduced thioredoxin Mitochondria trdrd trdrd Reduced thioredoxin Nucleus Reduced thioredoxin Peroxisome trdrd Trehalose Cytosol tre Trehalose Vacuole tre tre6p alpha, alpha'-Trehalose 6-phosphate Cytosol Cytosol trnaala tRNA(Ala) trnaarg tRNA(Arg) Cytosol tRNA(Arg) Mitochondria trnaarg Cytosol trnaasn tRNA(Asn) trnaasn tRNA(Asn) Mitochondria tRNA(Asp) Cytosol trnaasp Mitochondria trnaasp tRNA(Asp) trnacys tRNA(Cys) Cytosol trnagln tRNA(Gln) Cytosol Cytosol trnaglu tRNA (Glu) trnaglu tRNA (Glu) Mitochondria trnagly tRNA(Gly) Cytosol Cytosol trnahis tRNA(His) Mitochondria trnahis tRNA(His) trnaile tRNA(Ile) Cytosol tRNA(Ile) Mitochondria trnaile trnaleu tRNA(Leu) Cytosol trnaleu tRNA(Leu) Mitochondria trnalys tRNA(Lys) Cytosol trnalys tRNA(Lys) Mitochondria trnamet tRNA(Met) Cytosol Mitochondria

Cytosol

trnamet

trnaphe

tRNA(Met)

tRNA(Phe)

trnaphe tRNA(Phe) Mitochondria trnapro tRNA(Pro) Cytosol trnaser tRNA(Ser) Cytosol trnathr tRNA(Thr) Cytosol trnathr tRNA(Thr) Mitochondria trnatrp tRNA(Trp) Cytosol trnatrp tRNA(Trp) Mitochondria tRNA(Tyr) Cytosol trnatyr Mitochondria trnatyr tRNA(Tyr) trnaval tRNA(Val) Cytosol Mitochondria trnaval tRNA(Val) TRP L-Tryptophan Cytosol TRP L-Tryptophan Mitochondria trptrna L-Tryptophanyl-tRNA(Trp) Cytosol trptrna L-Tryptophanyl-tRNA(Trp)Mitochondria C140 tetradecanoate (n-C14:0) Cytosol C140 tetradecanoate (n-C14:0) Peroxisome C141 tetradecenoate (n-C14:1) Cytosol C141 tetradecenoate (n-C14:1) Peroxisome L-Tyrosine TYR Cytosol **TYR** L-Tyrosine Mitochondria **TYR** L-Tyrosine Vacuole **TYR** L-Tyrosine Peroxisome L-Tyrosyl-tRNA(Tyr) Cytosol tyrtrna tyrtrna L-Tyrosyl-tRNA(Tyr) Mitochondria UDP UDP Cytosol UDP UDP Nucleus udpacgal UDP-N-acetyl-D-galactosamine Cytosol UDPglucose udpg Cytosol **UDP**galactose Cytosol udpgal udpgal UDPgalactose Golgi Apparatus **UMP** UMP Cytosol **UMP UMP** Mitochondria **UMP UMP** Nucleus up4u P1,P4-Bis(5'-uridyl) tetraphosphate Cytosol Uroporphyrinogen III Cytosol uppg3 ura Uracil Cytosol (-)-Ureidoglycolate Cytosol urdglyc Urea Cytosol urea Uridine Cytosol uri UTP UTP Cytosol UTP UTP Mitochondria VAL L-Valine Cytosol VAL L-Valine Mitochondria L-Valyl-tRNA(Val) Cytosol valtrna L-Valyl-tRNA(Val) Mitochondria valtrna Xanthine Cytosol xan XMP Xanthosine 5'-phosphate Cytosol Xanthosine Cytosol xtsn xp4x P1,P4-Bis(5'-xanthosyl) tetraphosphate Cytosol D-Xylulose 5-phosphate Cytosol xu5p xyl D-Xylose Cytosol xylt **Xylitol** Cytosol D-Xylulose Cytosol xylu zym\_int1 zymosterol intermediate 1 Cytosol

zym\_int2zymosterol intermediate 2CytosolzymstzymosterolCytosolzymstestzymosterol esterCytosol