Appendix A. Supplementary material

Table S1: The gold standard

Enzyme Commission No.	Reaction	Reference
None	histone deacetylase	[71], [72]
1.1.1.205	IMP dehydrogenase	[73]
1.1.1.267	1-deoxy-D-xylulose 5-phosphate reductoisomerase	[74]–[76]
1.1.1.27	lactate dehydrogenase	[77], [78]
1.10.2.2	mitochondrial ubiquinol-cytochrome C reductase	[79]
1.15.1.1	superoxide dismutase	[80]
1.17.1.2	4-hydroxy-3-methylbut-2-enyl diphosphate reductase	[81]
1.17.4.1	Ribonucleoside-diphosphate reductase	[82], [83]
1.2.4.4	3-Methyl-2-oxobutanoate dehydrogenase (lipoamide)	[84]
1.3.1.9	enoyl-ACP-reductase	[85], [86]
1.3.3.1	Dihydroorotate oxidase	[87]–[93]
1.3.3.4	Protoporphyrinogen oxidase	[94], [95]
1.3.99.1	Succinate dehydrogenase	[96]
1.5.1.3	Dihydrofolate reductase	[97]–[99]
1.5.1.5, 3.5.4.9	Methylenetetrahydrofolate dehydrogenase (NADP+), methenyltetrahydrofolate cyclohydrolase	[99]
1.6.5.3	NADH dehydrogenase (ubiquinone)	[100]
1.6.99.3	NADH dehydrogenase	[101], [102]
1.8.1.7	glutathione reductase	[103]–[106]
1.8.1.9	thioredoxin reductase	[107]
2.1.1.100	Protein-S-isoprenylcysteine-O-methyltransferase	[108], [109]
2.1.1.103	phosphoethanolamine N-methyltransferase	[110]
2.1.1.45	Thymidylate synthase	[98], [111]
2.1.1.64	3-Demethylubiquinone-9,3-O-methyltransferase	[99]
2.1.3.2	aspartate carbamoyltransferase	[112]
2.2.1.7	1-deoxy-D-xylulose-5-phosphate synthase	[74], [113]
2.3.1.15	Glycerol-3-phosphate-O-acyltransferase	[114]–[116]
2.3.1.24	sphingosine N-acyltransferase	[117]
2.3.1.37	5-aminolevulinate synthase	[118], [119]
2.3.1.41	3-Oxoacyl-[acyl-carrier protein] synthase	[85], [120]–[122]
2.3.1.50	serine C-palmitoyltransferase	[117]
2.4.2.1	Purine-nucleoside phosphorylase	[123], [124]
2.4.2.10	orotate phosphoribosyltransferase	[125], [126]

2.4.2.8	Hypoxanthine phosphoribosyltransferase	[127], [128]
2.5.1.10, 2.5.1.1	Geranyltranstransferase, dimethylallyltranstransferase	[129]
2.5.1.15	Dihydropteroate synthase	[130]
2.5.1.16	Spermidine synthase	[131]
2.5.1.18	Glutathione transferase	[132]–[135]
2.5.1.19	3-Phosphoshikimate 1-carboxyvinyltransferase	[136]
2.5.1.21	Farnesyl-diphosphate farnesyltransferase	[137]
2.5.1.46	deoxyhypusine synthase	[138]
2.5.1.58	protein farnesyltransferase	[139]
2.7.1.32	Choline kinase	[140], [141]
2.7.8.3	sphingomyelin synthase/phosphatidic acid phosphatase	[117]
3.1.1.31, 1.1.1.49	6-phosphogluconolactonase, glucose-6-phosphate dehydrogenase	[142], [143]
3.1.1.5	Lysophospholipase	[144]
3.1.3.56	Inositol-1,4,5-trisphosphate 5-phosphatase	[145]
3.1.4.12	Sphingomyelin phosphodiesterase	[146]
3.1.4.17	3′,5′-Cyclic-nucleotide phosphodiesterase	[147], [148]
3.3.1.1	S-adenosyl-l-homocysteine hydrolase	[149]–[151]
3.5.2.3	Dihydroorotase	[152], [153]
3.5.4.4	Adenosine deaminase	[154], [155]
3.6.1.17	Bis(5′-nucleosyl)-tetraphosphatase (asymmetrical)	[156]
4.1.1.17	Ornithine decarboxylase	[157]–[159]
4.1.1.23	Orotidine-5′-phosphate decarboxylase	[126], [160]–[162]
4.1.1.50	Adenosylmethionine decarboxylase	[158], [159], [163], [164]
4.1.2.13	Fructose-bisphosphate aldolase	[165]
4.2.1.1	carbonate dehydratase	[166]
4.2.1.11	Phosphopyruvate hydratase / enolase	[167]
4.2.1.24	Delta-aminolevulinic acid dehydratase	[95], [168]
4.2.1.58 – 61	3-hydroxyacyl-ACP dehydratase	[85], [169]
4.2.3.5	Chorismate synthase	[90]
4.3.2.2	adenylosuccinate lyase	[170]
4.4.1.5	Lactoylglutathione lyase	[171], [172]
4.6.1.12	2C-methyl-D-erythritol 2,4-cyclodiphosphate synthase	[173]
5.3.1.1	triosephosphate isomerase	[174]
5.99.1.2	topoisomerase I	[175]
5.99.1.3	topoisomerase II	[176]–[178]
6.1.1.3	Threonine-tRNA ligase	[179]

6.1.1.7	Alanine-tRNA ligase	[180]
6.3.2.12	dihydrofolate synthase	[181]
6.3.2.17	folylpolyglutamate synthase	[181]
6.3.2.2	Gamma-glutamylcysteine synthetase	[105], [182], [183]
6.3.5.5	Carbamoyl-phosphate synthase (glutamine-hydrolysing)	[184]
6.3.4.4	adenylosuccinate synthase	[185]
6.3.5.2	GMP synthase	[186]
6.3.5.5	carbamoyl phosphate synthetase	[184]
6.4.1.2	Acetyl-CoA carboxylase	[120]

Table S2: Knocked out reactions for reactions a-g

	Reaction	**Knocked Out Reaction**
a.	SUPEROX-DISMUT-RXN	'RXN-10696', 'RXN-11026', 'PROTOPORGENOXI-RXN', 'RXN-3761', 'THIOL-OXIDASE-RXN', 'L-ASPARTATE-OXID-RXN', 'RXN66-2', 'GLUTATHIONE-PEROXIDASE-RXN', 'RXN-7650', 'DIHYDROOROTOX-RXN', 'RXN-10707', 'RXN-10706', 'RXN-744', 'PNPOXI-RXN', 'RXN3O-1380', 'RXN0-1461', 'CYSTEINE-DIOXYGENASE-RXN', 'SARCOX-RXN', 'RXN-7141', 'PMPOXI-RXN', 'RXN-7686', 'ACYL-COA-OXIDASE-RXN-BUTYRYL-COA/OXYGEN-MOLECULE', 'RXN-1541', 'RXN66-1', 'CATAL-RXN', 'RXN0-3921', 'RXN-1321', 'RXN-10697', 'RXN-10695', 'RXN-3645', 'RXN-5502', 'QUINOLINATE-SYNTHA-RXN', 'RXN-10705', 'RXN-10700', 'RXN-10704', 'RXN-10699', 'PNKIN-RXN', 'PROTOPORGENOXI-RXN', 'UROGENDECARBOX-RXN', '3-SULFINOALANINE-AMINOTRANSFERASE-RXN', 'N-CARBAMOYLSARCOSINE-AMIDASE-RXN', 'R10-RXN', 'RXN-2881', 'CREATINASE-RXN', 'RXN-7224', 'RXN-7226', 'RXN-7779', 'RXN-7142', 'PYRAMKIN-RXN', 'RXN-3303', 'RXN-5501', 'RXN0-3922-GAMMA-GLUTAMYL-GAMMA-AMINOBUTYRALDEH/NAD/WATER', 'RXN0-3922-GAMMA-GLUTAMYL-GAMMA-AMINOBUTYRALDEH/NADP/WATER', 'RXN0-3901', 'RXN1F-19', 'L-ASPARTATE-OXID-RXN', 'QUINOPRIBOTRANS-RXN', 'RXN-10707', 'RXN-10703', 'RXN-10702', 'RXN-10707', 'RXN-10706', 'RXN-10698', 'RXN0-1461', 'UROGENIIISYN-RXN', 'CYSTEINE-DIOXYGENASE-RXN', '3-SULFINYL-PYRUVATE-SPON-RXN', '3.5.2.14-RXN', 'R12-RXN', 'CREATININASE-RXN', 'RXN-7225', 'RXN-7227', 'RXN-7141', 'RXN-3645', 'RXN-7781', 'RXN-7143', 'RXN-7780', 'RXN-3642', 'RXN-1321', 'ALLENE-OXIDE-CYCLASE-RXN', 'RXN-10705', 'RXN-10701', 'OHMETHYLBILANESYN-RXN', 'UROGENDECARBOX-RXN', 'N-CARBAMOYLSARCOSINE-AMIDASE-RXN', 'CREATININE-DEAMINASE-RXN', 'RXN1F-19', '12-OXOPHYTODIENOATE-REDUCTASE-RXN', 'PORPHOBILSYNTH-RXN', 'UROGENIIISYN-RXN', '5-AMINOLEVULINIC-ACID-SYNTHASE-RXN', 'GSAAMINOTRANS-RXN', 'OHMETHYLBILANESYN-RXN', 'GLUTRNAREDUCT-RXN'
b.	CATAL-RXN	'CYSTEINE-DIOXYGENASE-RXN', 'RXN-7650', 'RXN66-2', 'RXN-3761', 'RXN-7141', 'RXN-1321', 'RXN-1541', 'RXN-744', 'RXN3O-1380', 'THIOL-OXIDASE-RXN', 'RXN-7686', 'RXN0-1461', '3-SULFINOALANINE-AMINOTRANSFERASE-RXN', 'RXN-3645', 'RXN-5502', 'RXN-7142', 'RXN-7226', 'RXN-7779', 'RXN-7224', 'RXN1F-19', 'RXN-3303', 'RXN-5501', 'UROGENDECARBOX-RXN', 'PROTOPORGENOXI-RXN', 'CYSTEINE-DIOXYGENASE-RXN', '3-SULFINYL-PYRUVATE-SPON-RXN', 'RXN-7227', 'RXN-7225', 'ALLENE-OXIDE-CYCLASE-RXN', 'RXN-1321', 'RXN-7780', 'RXN-3645', 'RXN-7143', 'RXN-3642', 'RXN-7781', 'RXN-7141', 'UROGENIIISYN-RXN', 'RXN0-1461', 'RXN1F-19', '12-OXOPHYTODIENOATE-REDUCTASE-RXN', 'UROGENDECARBOX-RXN', 'OHMETHYLBILANESYN-RXN', 'ALLENE-OXIDE-CYCLASE-RXN', 'RXN-10695', 'RXN-744', 'UROGENIIISYN-RXN', 'PORPHOBILSYNTH-RXN', 'RXN-10696', '5-AMINOLEVULINIC-ACID-SYNTHASE-RXN', 'GSAAMINOTRANS-RXN', 'OHMETHYLBILANESYN-RXN', 'RXN-10697', 'RXN-10695', 'GLUTRNAREDUCT-RXN', 'RXN-10696', 'RXN-10698', 'RXN-10699', 'RXN-10697', 'RXN-10698', 'RXN-10706', 'RXN-10699', 'RXN-10704', 'RXN-10706', 'RXN-10702', 'RXN-10704', 'RXN-10700', 'RXN-10702', 'RXN-10707', 'RXN-10705', 'RXN-10700', 'RXN-10703', 'RXN-10707', 'RXN-10705', 'RXN-10701'
c.	S-ADENMETSYN-RXN	'RXN-5501', 'RXN-5762', 'ADOMET-DMK-METHYLTRANSFER-RXN', 'DIPHTHINE-SYNTHASE-RXN', 'SAMDECARB-RXN', 'RXN-5763', 'RXN1F-28', 'RXN-3645', '2.1.1.71-RXN', '2-OCTAPRENYL-6-OHPHENOL-METHY-RXN', '2.1.1.5-RXN', '2.1.1.62-RXN', '2.1.1.137-RXN', 'RXN-5643', 'HOMOCYSMET-RXN', '2.1.1.77-RXN', 'RXN-5642', 'FORMYLMETHIONINE-DEFORMYLASE-RXN', 'RXN-5761', '2.1.1.138-RXN', 'RXN-3642', '2.1.1.103-RXN', '2-OCTAPRENYL-METHOXY-BENZOQ-METH-RXN', 'PYRIMSYN1-RXN', 'HOMOCYSMETB12-RXN', 'RXN-5502', 'DMK-RXN',

		'MALATE-DEHYDROGENASE-ACCEPTOR-RXN-MAL/DEMETHYLMENAQUINONE', 'DLACTDEHYDROGFAD-RXN-D-LACTATE/DEMETHYLMENAQUINONE', 'RXN0-5260-DEMETHYLMENAQUINONE/GLYCEROL-3P', 'SPERMINE-SYNTHASE-RXN', 'RXN0-5217', 'SPERMIDINESYN-RXN', 'RXN-745', 'RXN4FS-3', 'RXN-5643', '2.7.7.57-RXN', 'RXN-5642', 'RXN-9311', 'LYSDECARBOX-RXN', 'RXN-744', 'RXN-10708', 'RXN1F-28', 'NAPHTHOATE-SYN-RXN', 'DMK-RXN', 'RXN-9311', 'O-SUCCINYLBENZOATE-COA-LIG-RXN', 'NAPHTHOATE-SYN-RXN', 'O-SUCCINYLBENZOATE-COA-SYN-RXN'
d.	2.5.1.19-RXN	'CHORISMATE-SYNTHASE-RXN', 'SHIKIMATE-KINASE-RXN', 'CHORPYRLY-RXN', 'CHORISMATEMUT-RXN', 'ISOCHORSYN-RXN', 'PABASYN-RXN', 'ANTHRANSYN-RXN', '2.5.1.19-RXN', 'SHIKIMATE-5-DEHYDROGENASE-RXN', '2.5.1.19-RXN', 'RXN-7968-SHIKIMATE/NAD', '4OHBENZOATE-OCTAPRENYLTRANSFER-RXN', '2.5.1.39-RXN', 'PREPHENATEDEHYDRAT-RXN', 'PREPHENATEDEHYDROG-RXN', 'ISOCHORMAT-RXN', 'ADCLY-RXN', 'PRTRANS-RXN', '3-OCTAPRENYL-4-OHBENZOATE-DECARBOX-RXN', 'TYRAMINOTRANS-RXN', 'ORNITHINE--OXO-ACID-AMINOTRANSFERASE-RXN-L-ORNITHINE/P-HYDROXY-PHENYLPYRUVATE', 'DHBDEHYD-RXN', 'ISOCHORSYN-RXN', 'PABASYN-RXN', 'RXN-6142', 'H2PTEROATESYNTH-RXN', 'PRAISOM-RXN', 'ANTHRANSYN-RXN', 'ISOCHORMAT-RXN', 'ENTMULTI-RXN', 'DIHYDROFOLATESYNTH-RXN', 'H2PTERIDINEPYROPHOSPHOKIN-RXN', 'IGPSYN-RXN', 'PRTRANS-RXN', 'H2NEOPTERINALDOL-RXN', 'H2PTEROATESYNTH-RXN', 'PRAISOM-RXN', 'RXN0-2381', 'DIHYDRONEOPTERIN-MONO-P-DEPHOS-RXN', 'H2PTERIDINEPYROPHOSPHOKIN-RXN', 'IGPSYN-RXN', 'RXN0-2382', 'H2NEOPTERINALDOL-RXN', 'H2NEOPTERINP3PYROPHOSPHOHYDRO-RXN', 'TRYPTOPHAN--TRNA-LIGASE-RXN', 'RXN0-2381', 'DIHYDRONEOPTERIN-MONO-P-DEPHOS-RXN', 'GTP-CYCLOHYDRO-I-RXN'
e.	CHORISMATE-SYNTHASE-RXN	'CHORPYRLY-RXN', '2.5.1.19-RXN', 'CHORISMATEMUT-RXN', 'ISOCHORSYN-RXN', 'PABASYN-RXN', 'ANTHRANSYN-RXN', '4OHBENZOATE-OCTAPRENYLTRANSFER-RXN', '2.5.1.39-RXN', 'SHIKIMATE-KINASE-RXN', 'CHORISMATE-SYNTHASE-RXN', 'PREPHENATEDEHYDRAT-RXN', 'PREPHENATEDEHYDROG-RXN', 'ISOCHORMAT-RXN', 'ADCLY-RXN', 'PRTRANS-RXN', 'TYRAMINOTRANS-RXN', 'ORNITHINE--OXO-ACID-AMINOTRANSFERASE-RXN-L-ORNITHINE/P-HYDROXY-PHENYLPYRUVATE', 'ISOCHORSYN-RXN', 'DHBDEHYD-RXN', 'PABASYN-RXN', 'RXN-6142', 'H2PTEROATESYNTH-RXN', 'PRAISOM-RXN', 'ANTHRANSYN-RXN', 'ISOCHORMAT-RXN', 'ENTMULTI-RXN', 'DIHYDROFOLATESYNTH-RXN', 'H2PTERIDINEPYROPHOSPHOKIN-RXN', 'IGPSYN-RXN', 'PRTRANS-RXN', '3-OCTAPRENYL-4-OHBENZOATE-DECARBOX-RXN', '2.5.1.19-RXN', 'SHIKIMATE-5-DEHYDROGENASE-RXN', 'RXN-7968-SHIKIMATE/NAD', 'H2NEOPTERINALDOL-RXN', 'H2PTEROATESYNTH-RXN', 'PRAISOM-RXN', 'RXN0-2381', 'H2PTERIDINEPYROPHOSPHOKIN-RXN', 'DIHYDRONEOPTERIN-MONO-P-DEPHOS-RXN', 'IGPSYN-RXN', 'RXN0-2382', 'H2NEOPTERINALDOL-RXN', 'H2NEOPTERINP3PYROPHOSPHOHYDRO-RXN', 'TRYPTOPHAN--TRNA-LIGASE-RXN', 'RXN0-2381', 'GTP-CYCLOHYDRO-I-RXN', 'DIHYDRONEOPTERIN-MONO-P-DEPHOS-RXN'
f.	SHIKIMATE-KINASE-RXN	'RXN-7968-SHIKIMATE/NAD', 'SHIKIMATE-5-DEHYDROGENASE-RXN', '2.5.1.19-RXN', 'SHIKIMATE-KINASE-RXN', 'CHORISMATE-SYNTHASE-RXN', 'ANTHRANSYN-RXN', 'CHORISMATEMUT-RXN', '2.5.1.19-RXN', 'PABASYN-RXN', 'CHORPYRLY-RXN', 'ISOCHORSYN-RXN', 'PREPHENATEDEHYDROG-RXN', 'PREPHENATEDEHYDRAT-RXN', 'ADCLY-RXN', '4OHBENZOATE-OCTAPRENYLTRANSFER-RXN', '2.5.1.39-RXN', 'ISOCHORMAT-RXN', 'ORNITHINE--OXO-ACID-AMINOTRANSFERASE-RXN-L-ORNITHINE/P-HYDROXY-PHENYLPYRUVATE', 'TYRAMINOTRANS-RXN', 'PABASYN-RXN', 'RXN-6142', 'H2PTEROATESYNTH-RXN', '3-OCTAPRENYL-4-OHBENZOATE-DECARBOX-RXN', 'DHBDEHYD-RXN', 'ISOCHORSYN-RXN', 'DIHYDROFOLATESYNTH-RXN', 'H2PTERIDINEPYROPHOSPHOKIN-RXN', 'ENTMULTI-RXN', 'ISOCHORMAT-RXN', 'PRTRANS-RXN', 'H2NEOPTERINALDOL-RXN', 'H2PTEROATESYNTH-RXN', 'ANTHRANSYN-RXN', 'PRAISOM-RXN', 'H2PTERIDINEPYROPHOSPHOKIN-RXN', 'DIHYDRONEOPTERIN-MONO-P-DEPHOS-RXN', 'PRTRANS-RXN', 'IGPSYN-RXN', 'H2NEOPTERINALDOL-RXN', 'H2NEOPTERINP3PYROPHOSPHOHYDRO-RXN', 'PRAISOM-RXN', 'RXN0-2381', 'GTP-CYCLOHYDRO-I-RXN', 'DIHYDRONEOPTERIN-MONO-P-DEPHOS-RXN', 'IGPSYN-RXN', 'RXN0-2382', 'RXN0-2381', 'TRYPTOPHAN--TRNA-LIGASE-RXN'
g.	ADENOSYLHOMOCYSTEINASE-RXN	'RXN-5761', 'RXN-5501', 'ADOMET-DMK-METHYLTRANSFER-RXN', '2.1.1.62-RXN', '2.1.1.103-RXN', 'RXN-5762', '2.1.1.71-RXN', '2-OCTAPRENYL-METHOXY-BENZOQ-METH-RXN', '2.1.1.77-RXN', 'RXN-3642', 'RXN-5642', 'RXN-5643', 'RXN1F-28', '2.1.1.137-RXN', 'RXN-5763', 'DIPHTHINE-SYNTHASE-RXN', 'RXN-3645', '2-OCTAPRENYL-6-OHPHENOL-METHY-RXN', '2.1.1.138-RXN', 'RXN-5502', 'MALATE-DEHYDROGENASE-ACCEPTOR-RXN-MAL/DEMETHYLMENAQUINONE', 'RXN0-5260-DEMETHYLMENAQUINONE/GLYCEROL-3P', 'DMK-RXN', 'DLACTDEHYDROGFAD-RXN-D-LACTATE/DEMETHYLMENAQUINONE', 'RXN-

		5642', '2.7.7.57-RXN', 'RXN-5643', 'RXN4FS-3', 'RXN-745', 'RXN-9311', 'RXN1F-28', 'RXN-10708', 'RXN-744', 'NAPHTHOATE-SYN-RXN', 'DMK-RXN', 'RXN-9311', 'O-SUCCINYLBENZOATE-COA-LIG-RXN', 'NAPHTHOATE-SYN-RXN', 'O-SUCCINYLBENZOATE-COA-SYN-RXN'

Appendix B Supplementary material

The predicted essential reaction based on our analysis in the network are presented in table S3, of which most of this reactions were identified to be found in the gold standards or have been predicted to be essential to the network in previous study.

Predicted essential reactions

Table S3: All predicted essential reactions in the network used in this study.

REACTION	No. of knocked Reaction	Essentiality
SUPEROX-DISMUT-RXN	94	1.27027027
CATAL-RXN	74	1
S-ADENMETSYN-RXN	49	0.662162162
2.5.1.19-RXN	48	0.648648649
CHORISMATE-SYNTHASE-RXN	48	0.648648649
SHIKIMATE-KINASE-RXN	48	0.648648649
ADENOSYLHOMOCYSTEINASE-RXN	39	0.527027027
RXN-1321	31	0.418918919
12-OXOPHYTODIENOATE-REDUCTASE-RXN	30	0.405405405
ALLENE-OXIDE-CYCLASE-RXN	30	0.405405405
RXN1F-19	30	0.405405405
IMPCYCLOHYDROLASE-RXN	27	0.364864865
UDPKIN-RXN	27	0.364864865
2.6.1.18-RXN	26	0.351351351
AICARTRANSFORM-RXN	26	0.351351351
3-HYDROXYPROPIONATE-DEHYDROGENASE-RXN	25	0.337837838
PROPCOASYN-RXN	25	0.337837838
RXN-6383	25	0.337837838
RXN-6384	25	0.337837838
DIAMINOPIMDECARB-RXN	24	0.324324324
DIAMINOPIMEPIM-RXN	24	0.324324324
SUCCDIAMINOPIMDESUCC-RXN	24	0.324324324
SUCCINYLDIAMINOPIMTRANS-RXN	24	0.324324324
TETHYDPICSUCC-RXN	24	0.324324324
RXN-10695	23	0.310810811
RXN-10701	23	0.310810811
RXN-5472	23	0.310810811
RXN-10696	22	0.297297297
RXN-10697	22	0.297297297
RXN-10698	22	0.297297297

RXN-10699	22	0.297297297
RXN-10700	22	0.297297297
RXN-10702	22	0.297297297
RXN-10703	22	0.297297297
RXN-10704	22	0.297297297
RXN-10705	22	0.297297297
RXN-10706	22	0.297297297
RXN-10707	22	0.297297297
RXN-5466	22	0.297297297
RXN-5467	22	0.297297297
RXN-5468	22	0.297297297
RXN-5469	22	0.297297297
RXN-5470	22	0.297297297
RXN-5471	22	0.297297297
R601-RXN-FUM/REDUCED-MENAQUINONE	21	0.283783784
ATPPHOSPHORIBOSYLTRANS-RXN	19	0.256756757
HISTIDINE--TRNA-LIGASE-RXN	19	0.256756757
2.7.4.22-RXN	18	0.243243243
DIHYDROFOLATEREDUCT-RXN	18	0.243243243
GLUTAMIDOTRANS-RXN	18	0.243243243
HISTALDEHYD-RXN	18	0.243243243
HISTAMINOTRANS-RXN	18	0.243243243
HISTCYCLOHYD-RXN	18	0.243243243
HISTIDPHOS-RXN	18	0.243243243
HISTOLDEHYD-RXN	18	0.243243243
HISTPRATPHYD-RXN	18	0.243243243
IMIDPHOSDEHYD-RXN	18	0.243243243
PRIBFAICARPISOM-RXN	18	0.243243243
URIDINEKIN-RXN	17	0.22972973
3-HYDROXYISOBUTYRATE-DEHYDROGENASE-RXN	16	0.216216216
3-HYDROXYISOBUTYRYL-COA-HYDROLASE-RXN	16	0.216216216
MEPROPCOA-FAD-RXN	16	0.216216216
METHYLACYLYLCOA-HYDROXY-RXN	16	0.216216216
RXN-1541	15	0.202702703
PABASYN-RXN	14	0.189189189
ADCLY-RXN	13	0.175675676
NAG1P-URIDYLTRANS-RXN	13	0.175675676
PROTOPORGENOXI-RXN	13	0.175675676
DIOHBUTANONEPSYN-RXN	12	0.162162162
NICONUCADENYLYLTRAN-RXN	12	0.162162162
OHMETHYLBILANESYN-RXN	12	0.162162162
PORPHOBILSYNTH-RXN	12	0.162162162

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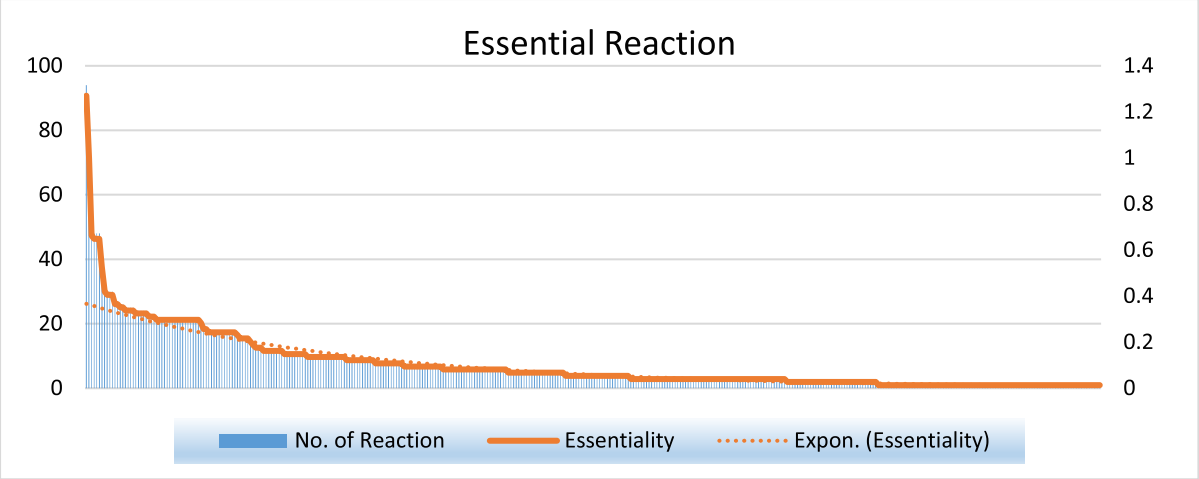

Figure S1: Graph to show No. of reactions considered and essentiality of reactions

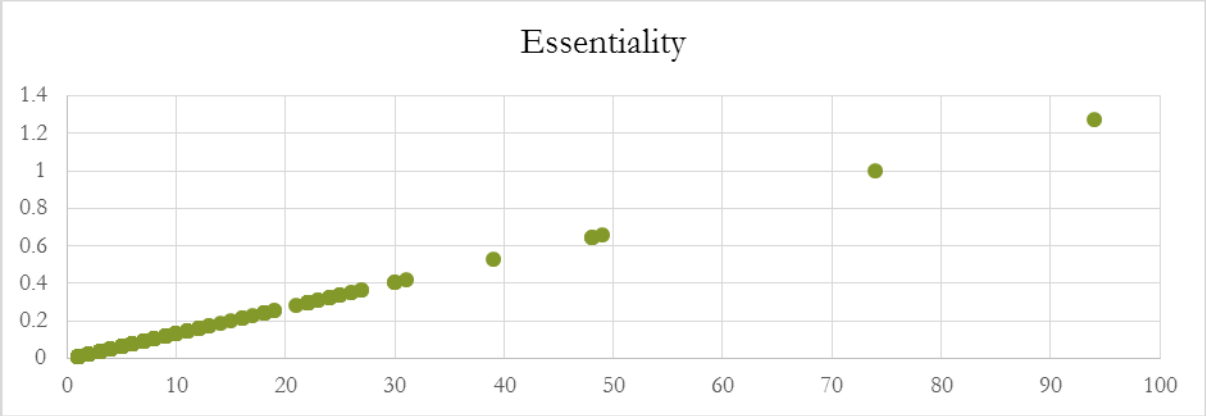

Figure S2: Graph to represent essentiality of reaction

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