2-HG - 2-Hydroxyglutarate
2-HPAA - 2-Hydroxyphenylacetic Acid
3-AP - 3-Aminopropionaldehyde
3-MG - 3-Methylglutaric Acid
3-MGA - 3-Methylglutaconic Acid
3-PHP - 3-Phosphate Hydroxypyruvate
3-Pser - 3-Phosphoserine
4AB - 4-Aminobutyrate
4ABT - 4-Aminobutyrate Transaminase
4Fe-4S - Tetrakis(*X*-oxo(+1)-oxo) Tetrasulfane Tetrasulfanide
4-HB - 4-Hydroxybenzoic Acid
4-HBA - 4-Hydroxybenzaldehyde
4-HBS - 4-Hydroxybenzoate Synthase
4-HCA - 4-Hydroxycinnamic Acid
4-Mel - 4-Methylimidazole
4-MeIA - Methylimidazole Acetaldehyde
4-MeIAA - 4-Methylimidazole Acetate Hydrolase
5-HIA - 5-Hydroxyindoleacetaldehyde
5-HIAA - 5-Hydroxyindoleacetic Acid
5-MTHF - 5-Methyltetrahydrofolate
5,10-MTHF - 5,10-MethyleneTetraHydroFolate
6PGL - 6-Phosphogluconolactone
6PG - 6-Phosphogluconate
6PGD - 6-Phosphogluconate Dehydrogenase
AA - Amino Acids
AAA - Acetoacetic Acid
AAC - Acetoacetyl-CoA
AADC - Aromatic L-Amino Acid Decarboxylase
AAO - L-Amino-Acid Oxidase
ABCD4 - ATP-Binding Cassette 4
AC - Aconitase
ACAD8 - Isobutyryl-CoA Dehydrogenase
ACADL - Long-Chain Specific Acyl-CoA Dehydrogenase
ACADM - Medium-Chain Specific Acyl-CoA Dehydrogenase
ACADS - Short-Chain Specific Acyl-CoA Dehydrogenase
ACADSB - Short/Branched Chain Acyl-CoA Dehydrogenase
ACADV - Very Long-Chain Specific Acyl-CoA Dehydrogenase
ACC - Acetyl-CoA Carboxylase
ACMS - 2-Amino-3-Carboxymuconic-6-Semialdehyde Acid
ACSM1/2B - Mitochondrial Medium-chain Acyl-CoA Synthetases
A-CoA - Acetyl-CoA
AChE - Acetylcholinesterase
ACOD - cis-Aconitate Decarboxylase
ACOT - Acyl-CoA Thioesterase
ACOX - Peroxisomal Acyl-Coenzyme A Oxidase
ACLY - ATP Citrate Lyase
ACSL - Acyl-CoA Synthetase (Long-Chain)
ACSM - Acyl-CoA Synthetase (Medium-Chain)
ACSS - Acyl-CoA Synthetase (Short-Chain)
ACSVL - Acyl-CoA Synthetase (Very Long-Chain)
ACTH - Adrenocorticotropic Hormone
ADC - Arginine Decarboxylase
ADK - Adenylate Kinase (Myokinase)
ADH - Alcohol Dehydrogenase
ADHFE - Hydroxyacid-Oxoacid Transhydrogenase
ADO - 2-Aminoethanethioldioxygenase
AdoCbl(III) - Adenosyl-Cobalamin ATP-Pump
ADP - Adenosine Diphosphate
ADS - Adenylsuccinate
ADSL - Adenylsuccinate Lyase
ADSS - Adenylsuccinate Synthetase
AFMID - Kynurenine Formamidase
AGAT - Arginine:Glycine Amidinotransferase
AGS - Agmatinase
AGXT - Alanine-Glyoxylate Aminotransferase
AHCY - S-Adenosylhomocysteine Hydrolase
AICAR - 5-Aminoimidazole-4-Carboxamide Ribonucleotide
AIR - 5-Aminoimidazole Ribonucleotide
AIRS - AIR Synthetase
α-KB - α-Ketobutyrate
α-KG - α-Ketoglutarate
α-KGDH - alpha-Ketoglutarate Dehydrogenase (Complex)
Al - Aluminium
Ala - Alanine
ALD - Aldolase
ALDH - Aldehyde Dehydrogenase
ALP - Alkaline Phosphatase
ALT - Alanine Aminotransferase
AMP - Adenosine Monophosphate
AMPD - AMP Deaminase
AMPK - AMP-activated Protein Kinase
Arg - Arginine
ARG1 - Arginase
AR - Aldose Reductase
AO - Aldehyde Oxidase
APS - Adenosine-5'-Phosphosulfate
APSK - APS Kinase
AQP9 - Aquaporin-9
ASA - Argininosuccinate
ASDC - Aspartate Decarboxylase
ASL - Argininosuccinase
Asp - Aspartate
ASPT - Aspartate Transcarbamoylase
ASS - Argininosuccinate Synthetase
AST - Aspartate Aminotransferase
ASMT - Acetylserotonin O-Methyltransferase
ATP - Adenosine Triphosphate
AUH - Methylglutaconyl-CoA Hydratase
BCKDH - Branched-Chain Alpha-Keto Acid Dehydrogenase (Complex)
BCAT - Branched-Chain-Amino-Acid Aminotransferase
BH₂ - Dihydrobiopterin
BH₄ - Tetrahydrobiopterin
BHB - β-hydroxybutyric Acid
BHMT - Betaine-Homocysteine S-methyltransferase
BPG - Biphosphoglycerate
BPGM - BPG Mutase
BPGP - 2,3 BPG Phosphatase
Br - Bromine
Ca - Calcium
CAIR - 5-Aminoimidazole-4-Carboxylate Ribonucleotide
cAMP - Cyclic Adenosine Monophosphate
Car - Carnosine
Car-AcAl-IA - Carnosine-Acetaldehyde-Imidazolidinone Adduct
CAT - Catalase
CBS - Cystathionine B-Synthase
CSAD - Cysteine Sulfinic Acid Decarboxylase
CDP - Cytidine 5'-Diphosphate
CK - Creatine Kinase
CGL - Cystathionine gamma-Lyase
CHAC1 - Glutathione-Specific gamma-Glutamylcyclotransferase 1
ChaT - Choline Acetyltransferase
CHDH - Choline Dehydrogenase
CHK - Choline Kinase
CHPT - Cholinephosphotransferase
Cl - Chloride
CMP - Cytidine Monophosphate
CMPK - UMP-CMP Kinase
CNMT - Carnosine N-Methyl Transferase
CNDP - Cytosolic Non-Specific Dipeptidase
CO - Carbon Monoxide
CO₂ - Carbon Dioxide
Co - Cobalt
CoA - Coenzyme A
CN - Hydrogen Cyanide
CNCbl(III) - Cyanocobalamin
Cob(III)alamin [any] - AdoCbl(III), MeCbl(III), OH-Cob(III)alamin
COMT - Catechol O-methyltransferase
CP - Carbamoyl Phosphate
CPS1 - Carbamoyl Phosphate Synthase1
CR - Carbonyl Reductase
Cr - Chromium
Cre - Creatine
CRH - Corticotrophin-Releasing Hormone
CRNS - Carnosine Synthase
CPT - Carnitine O-Palmitoyltransferase
CS - Citrate Synthase
CTP - Cytidine Triphosphate
Cu - Copper
CYP - Cytochrome P450 monooxygenase
Cys - Cysteine
DAG - Diacylglycerol
DAT - Dopamine Transporter
DAO - Diamine Oxidase
DBH - Dopamine Beta Hydroxylase
DHBA - 3,4-Dihydroxybenzeneacetic Acid
DHF - Dihydrofolate
DHFR - Dihydrofolate Reductase
DHAP - Dihydroxyacetone Phosphate
DHI - 5,6-Dihydroxyindole

I - Iodine
IAA - Imidazole Acetaldehyde
IAcA - Imidazole Acetic Acid
IAL - Imidazoleacetate-Lyase
ICL - Isocitrate Lyase
IDH - Isocitrate Dehydrogenase
IDO - Indoleamine 2,3-Dioxygenase
IFN - Interferon
IMP - Inosine Monophosphate
IMPCH - IMP Cyclohydrolase
IP3 - Inositol Trisphosphate
IQ - Indole-5,6-Quinone
IVD - Isovaleryl-CoA Dehydrogenase
K - Potassium
KADC - Ketoacid Decarboxylase (Microbial)
KAT - Kynurenine Aminotransferase
KHK - Ketohexokinase
KIC - alpha-Ketoisocaproate
KIV - alpha-Ketoisovalerate
KMBA - 2-Oxo-4-Methiobutyric Acid
KMO - Kynurenine 3-Monooxygenase
KYNU - Kynureninase
LDH - Lactate Dehydrogenase
LMBD1 - Lysosomal Cobalamin Transport Escort Protein
LPA - Lipoamide
LPH4 - Lactoyl-PH4
M6P - Mannose 6-Phosphate
MAA - Maleylacetoacetic Acid
MAAI - Maleylacetoacetate Isomerase
MAS - Malate Synthase
MAO - Monoamine Oxidase
MCCC - Methylcrotonoyl-CoA Carboxylase
MDH - Malate Dehydrogenase
ME1 - NADP-dependent Malic Enzyme
MeCbl(III) - Methylcobalamin
MetHb - Methemoglobinemia
Mg - Magnesium
MHPG - 3-Methoxy-4-Hydroxyphenylglycoladehyde
MIF - Macrophage Migration Inhibitory Factor
MMAA - (Cbl) MA Type A protein, GTPase
MMAB - (Cbl B) ATPCob(I)alamin Adenosyltransferase
MMACHC - (CblC) MA and Homocystinuria Type C protein
MMADHC - (CblD) MA and Homocystinuria Type D protein
MMC-M - Methylmalonyl-CoA Mutase
MMC-R - MethylMalonyl-CoA Racemase
MMP - Matrix Metalloproteinase
MMSA - Methylmalonic Semialdehyde
Mn - Manganese
Mo - Molybdenum
Mo-MPT - Mo-Molybdopterin
MPI - Mannose-6-Phosphate Isomerase
MS - Methionine Synthase
MT - Methionine Transaminase
MTA - 5'-Methylthioadenosine
MTHFR - MethyleneTetraHydroFolate Reductase
MTR - 3-Methoxytyramine
MTRR - Methionine Synthase Reductase**Na** - Sodium
Na+/K+-ATPase - Sodium-Potassium ATP Pump
N-Ac-Put - *N*-Acetyl-Putrescine
N-Ac-ABAL - N-Acetyl-Gamma-Aminobutyraldehyde
N-Ac-GABA - N-Acetyl-Gamma-Aminobutyric
NAD - Nicotinamide Adenine Dinucleotide
NADK - NAD Kinase
NADPT - NADP(+) Transhydrogenase
NADSYN - NAD Synthetase
NAGK - N-Acetylglucosamine Kinase
NAM - Nicotinamide
NAMPT - Nicotinamide Phosphoribosyltransferase
NAPRT - Nicotinate Phosphoribosyltransferase
N-ASS - N-Acetylspermine
N-ASD - N-Acetylspermidine
NCS - Norcoclaurine Synthase
NDPK - Nucleoside Diphosphokinase
NET - Norepinephrine Transporter
NF-κB - Nuclear Factor kappa Beta
NH₃ - Ammonia
NMNAT - Nicotinamide Mononucleotide Adenylyltransferase
NO - Nitric Oxide
NOS - Endothelial Nitric Oxide Synthase
NRF - Nuclear Regulatory Factor
NTSC2 - Cytosolic 5'-nucleotidase II
O₂ - Oxygen
OAA - Oxaloacetate
OAADPR - 2'-O-Acetyl-ADP-Ribose
OAT - Ornithine Aminotransferase
ODC - Ornithine Decarboxylase
OH-Cob(III)alamin - Hydroxocobalamin
OH-ENPP - 4-Hydroxy-Enol-Phenylpyruvate
OH-Glut - 4-Hydroxyglutamate
OH-GlutSA - 4-Hydroxyglutamate Semialdehyde
OH-KG - 4-Hydroxy-2-Ketoglutarate
OH-PSC - Pyroline Hydroxycarboxylate
OH-PA - 4-Hydroxyphenylacetaldehyde
OH-PAA - 4-Hydroxyphenylacetic Acid
OH-PD - 4-Hydroxyphenylpyruvate Dioxygenase
OH-PH4 - 1-Hydroxy-2-Oxopropyl Tetrahydropterin
OH-PLA - Hydroxyphenyllactic Acid
OH-PPA - 4-Hydroxyphenylpyruvic Acid
OH-PPD - 4-Hydroxyphenylpyruvate Dioxygenase
OH-Pyr - Hydroxypyruvate
OMP - Orotidine-5'-Monophosphate
OMPDC - OMP Decarboxylase
OPRT - Orotate Phosphoribosyltransferase
OTC - Ornithine Transcarbamoylase
Ox - Oxalate
OXH - Oxaloacetate (Microbial)
PSC - Pyroline-5-Carboxylate
PSCR - PSC Reductase
PSP - Pyridoxal 5'-Phosphate
PAA - Phenylacetic Acid
PAAL - Phenylacetaldehyde
PAGM - Phosphoacetylglucosamine Mutase
PAGN - Phenylacetylglutamine
PAGS - Phenylacetylglutamine Synthetase
PAH - Phenylalanine Hydroxylase
PAIS/S.C - AIR carboxylase
PAIS/S.N - SAICAR synthetase
PAL - Pyruvaldehyde
PAMOAT - Propionamide:Oxaloacetate Aminotransferase
PANK - Pantetheine Kinase
PAO - Polyamine Oxidase
PAP - Adenosine 3',5'-Diphosphate
PAPS - 3'-Phosphoadenosine-5'-Phosphosulfate
PAT - Phenylalanine Aminotransferase
PATK - Panthenate Kinase
PCB - Pyruvate Carboxylase
PC - Phosphatidylcholine
PCC - Propionyl-CoA Carboxylase
PCr⊕ - Phosphocreatine
PCY71A - Choline-Phosphate Cytidylyltransferase
PDH - Pyruvate Dehydrogenase (Complex)
PDH-OP - O-Phospho-L-Seryl-PDH E1 alpha Subunit
PDK - Pyruvate Dehydrogenase Kinase
PDP - Pyruvate Dehydrogenase Phosphatase
PE - Phosphatidylethanolamine
PEPC - Phosphoenolpyruvate Carboxylase
PEPCK - Phosphoenolpyruvate Carboxykinase
PFAS - Phosphoribosylformylglycinamidine Synthase
PFK-1 - Phosphofructokinase
PFK-2 - 6-Phosphofructo-2-Kinase
PGAM - Phosphoglycerate Mutase
PGC1α - PPAR-gamma Coactivator 1-Alpha
PGI - Phosphoglucose Isomerase
PGK - Phosphoglycerate Kinase
PGLS - 6-Phosphogluconolactonase
PGM - Phosphoglucomutase
PHACA - Phenylacetate 2-Hydroxylase
PHCDH - Pyrroline-3-Hydroxy-5-Carboxylate Dehydrogenase
PHD - Prolyl Hydroxylase
PHGDH - Phosphoglycerate Dehydrogenase
PHT - Phenylpyruvate Tautomerase
Pi - Phosphate
PK - Pyridoxal Kinase
PKM - Pyruvate Kinase
PKA - Protein Kinase A
PKC - Protein Kinase C
PLA - Phenylacetic Acid
PLD - Prolidase
PMP - Pyridoxamine 5'-Phosphate
PNMT - Phenylethanolamine N-Methyltransferase
PNP - Purine Nucleoside Phosphorylase
PNPO - Pyridoxine 5'-Phosphate Oxidase
PPA - Phenylpyruvic Acid
PPAR - Peroxisome Proliferator-Activated Receptor
PPAT - Amidophosphoribosyltransferase
PPP - Pyridoxal Phosphate Phosphatase
PP - Pyrophosphate
PPCDC - Phosphopantothenoylcysteine Decarboxylase
PPCS - Phosphopantothenoylcysteine Synthetase
PPDC - Phenylpyruvate Decarboxylase
PPM - Phosphomannomutase
PPO - Pyridoxine 5'-Phosphate Oxidase
PPT - Phosphopantetheine
PRA - Phosphoribosylamine
PRAT - Histone-Arginine Methyltransferase
PRODH - Proline Dehydrogenase
PRPP - 5-Phosphoribosyl-1-Pyrophosphate
PRPS - Phosphoribosyl Pyrophosphate Synthetase
PSP - Protein Synthesis Pathway
PS - Phosphatidylserine
PSAT - Phosphoserine Aminotransferase
PSPH - Phosphoserine Phosphatase
PSS - Phosphatidylserine Synthase
PTP - 6-Pyruvoyl-Tetrahydropterin
PTPS - 6-Pyruvoyl-Tetrahydropterin Synthase
Pyr - Pyruvate
Q - Ubiquinone (Coenzyme Q10)
Q_0 - Ubiquinol (Reduced Coenzyme Q10)
Qu - Queuine
Qua - Quinolinate
QRPT - Quinolinate Phosphoribosyltransferase
R1P - Ribose-1-Phosphate
R5P - Ribose-5-Phosphate
RBKS - Ribokinase
RET - Reverse Electron Transfer (Inner Mitochondrial Membrane)
RK - Ribokinase
ROS - Reactive Oxygen Species
RPE - Ribulose-5-Phosphate 3-Epimerase
RPIA - Ribose-5-Phosphate Isomerase A
Ru5P - Ribulose-5-Phosphate
S7P - Sedoheptulose-7-Phosphate
SAH - S-Adenosyl-L-Homocysteine
SAICAR - 5-Aminoimidazole-4-(N-succinylcarboxamide) Ribonucleotide
SAMe - S-Adenosylmethionine
SAMeA - S-Adenosylmethioninamine
SAMeDC - S-Adenosylmethionine Decarboxylase
SAMeS - S-Adenosylmethionine Synthase
SARDH - Sarcosine Dehydrogenase
SAT - Serotonin N-Acetyltransferase
SCOT - Succinyl-CoA:3-ketoacid CoA Transferase
SCS - Succinyl-CoA Synthetase
SDH - Succinate Dehydrogenase
Se - Selenium
Ser - Serine
SGLT - Serine-Glyoxylate Transaminase
SHMT - Serine Hydroxymethyltransferase
Si - Silicon
SIRT - Sirtuin
SLC - Solute Carrier
SORD - Sorbitol Dehydrogenase
SPDS - Spermidine Synthase
SPOX - Spermine Oxidase
SPS - Spermine Synthase
SQOR - Sulfide Quinone Oxidoreductase
SR - Sepiapterin Reductase
SSAL - Succinic Semialdehyde
SSAT1 - Spermidine/Spermine-N1-Acetyltransferase
Succ - Succinate
SULTs - Sulfotransferases
SUOX - Sulfite Oxidase
T3 - Triiodothyronine
TA - Tyrosinase
TALDO1 - Transaldolase 1
TAT - Tyrosine Aminotransferase
TDC - Tyrosine Decarboxylase
TGF - Transforming Growth Factor
TGT - tRNA Guanine Transglycosylase
TH - Tyrosine Hydroxylase
THDP - Thiamine Diphosphate
THF - Tetrahydrofolate
THL - Thiolase
THP - Tetrahydropapaveroline
TKT - Transketolase
TMLH - Trimethyllysine Hydroxylase
TNF - Tumor Necrosis Factor
TPH - Tryptophan Hydroxylase
TPI - Triose Phosphate Isomerase
TPP - Thiamine Pyrophosphate
TPQ - Topaquinone
TRP - Thioredoxin-related Protein
TS - Thymidylate Synthase
TST - Thiosulfate Sulfurtransferase
UCK - Uridine-Cytidine Kinase
UDP - Uridine Diphosphate
UGPase - UDP-Glucose Pyrophosphorylase
UGAPase - UDP-GlcNAc Pyrophosphorylase
UMP - Uridine Monophosphate
UPB1 - β-Ureidopropionase
UPP - Uridine Phosphorylase
UPRT - Uracil Phosphoribosyltransferase
UROC - Urocanase
UTP - Uridine Triphosphate
V - Vanadium
V-ATPase - Vesicular H+-ATP Pump
Vit C - Ascorbic Acid
Vit E - Tocopherols, Tocotrienols
VMA - Vanillymandelic Acid
VMAT - Vesicular Monoamine Transporter
VNN - Vanin-1 (Pantetheinase)
XO - Xanthine Oxidase
XuSP - Xylulose-5-Phosphate
Zn - Zinc

COLOUR KEY (Labels)

ATP, ADP, AMP, GTP, GDP, GMP, CTP, CDP, CMP, UTP, UDP, UMP
TPP
FAD, FMN
NAD+, NADH, NADP, NADPH
P5P
Q_0, TAHG

REACTION
TRANSAMINATION
TRANSPORTERS
MICROBIAL / PATHOGENIC
PROMOTER
INHIBITOR
*MDX OAT MARKER#
(Others - Illustrative)

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Figure 1.Pathway Diagram: The role of mitochondrial dysfunction in chronic disease and aging.

ME/CFS: Correcting Chronic Mitochondrial Dysfunction

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