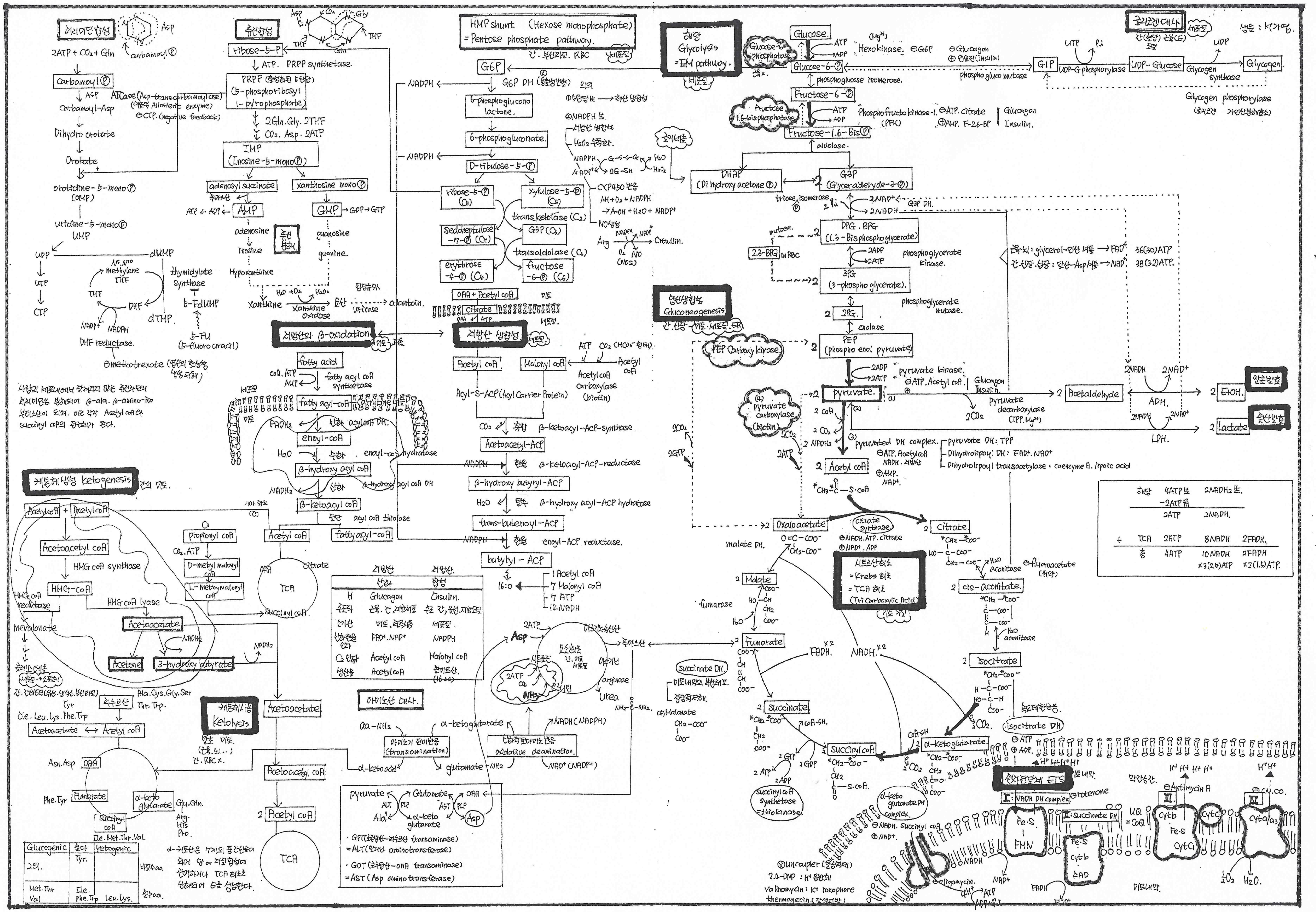

HMP shunt (Hexose monophosphate) = Pentose phosphate pathway.
해당 Glycolysis = EM pathway.
Glucose
Hexokinase. ⊖G6P
Glucose-6-Ⓟ
phosphoglucose isomerase.
Fructose-6-Ⓟ
Phosphofructokinase-1. (PFK) ⊖ATP. citrate ⊕AMP. F-2,6-BP
Glucagon Insulin.
Fructose-1,6-BisⓅ
aldolase.
DHAP (Dihydroxy acetone Ⓟ)
triose isomerase
G3P (Glyceraldehyde-3-Ⓟ)
G3P DH.
DPG. BPG (1,3-Bisphosphoglycerate)
phosphoglycerate kinase.
2,3-BPG in RBC
3PG (3-phospho glycerate).
phosphoglycerate mutase.
2PG.
enolase
PEP (phospho enol pyruvate)
pyruvate kinase. ⊖ATP. Acetyl coA. Glucagon Insulin.
pyruvate.
pyruvate carboxylase (biotin)
PEP Carboxy kinase
Gluconeogenesis
Acetaldehyde
pyruvate decarboxylase (TPP, Mg2+)
ADH.
EtOH.
Lactate
LDH.
Pyruvate DH complex. ⊖ATP. Acetyl coA NADH ⊕AMP. NAD+.
pyruvate DH : TPP
Dihydrolipoyl DH : FAD+. NAD+
Dihydrolipoyl transacetylase : coenzyme A. lipoic acid
36(30)ATP
38(32)ATP.
Acetyl coA
Glucose-6-phosphatase
Fructose 1,6-bisphosphatase
G1P
UDP-G phosphorylase
UDP-Glucose
Glycogen synthase
Glycogen.
Glycogen phosphorylase
phospho gluco mutase
⊖Glucagon ⊕Insulin
G6P
G6P DH
6-phosphoglucono lactone.
6-phosphogluconate.
D-ribulose-5-Ⓟ
ribose-5-Ⓟ (C5)
xylulose-5-Ⓟ (C5)
trans ketolase (C2)
Sedoheptulose-7-Ⓟ (C7)
G3P (C3)
transaldolase (C3)
erythrose-4-Ⓟ (C4)
fructose-6-Ⓟ (C6)
NADPH
NADPH. G-S-S-G H2O H2O2 2G-SH
CYP450
AH + O2 + NADPH → A-OH + H2O + NADP+
Arg NO (NOS) Citrullin.
Oxaloacetate
Citrate synthase ⊖NADH. ATP. citrate ⊕NAD+. ADP
Citrate
aconitase ⊖fluoroacetate
cis-Aconitate.
aconitase
Isocitrate
Isocitrate DH ⊖ATP ⊕ADP.
α-ketoglutarate.
α-keto glutarate DH complex. ⊖NADH. Succinyl coA ⊕NAD+.
Succinyl coA
Succinyl coA Synthetase = thiokinase
Succinate
Succinate DH. ⊖Malonate
Fumarate
fumarase
Malate
malate DH.
Krebs 회로 = TCA 회로 (Tri Carboxylic Acid)
FADH. x2
NADH. x2
ETS
I : NADH DH complex ⊖rotenone
II : succinate DH
III. ⊖Antimycin A
IV. ⊖CN.CO.
Fe-S FMN
Fe-S Cyt b FAD
UQ = CoQ
Cyt b Fe-S Cyt c1
Cyt c
Cyt a/a3
1/2 O2 H2O.
⊖oligomycin.
ADP + Pi ATP
⊗Uncoupler
2,4-DNP : H+ ionophore
Valinomycin : K+ ionophore
thermogenin
해당 4ATP 2ATP 2NADH.
+ TCA 2ATP 8NADH 2FADH.
총 4ATP 10NADH x3(2.5)ATP 2FADH x2(1.5)ATP.
β-oxidation
fatty acid
fatty acyl coA synthetase
fatty acyl-coA
Carnitine
acyl coA DH.
enoyl-coA
enoyl-coA hydratase
β-hydroxy acyl coA
β-hydroxy acyl coA DH
β-ketoacyl coA
acyl coA thiolase
Acetyl coA
fatty acyl-coA
지방산 생합성
OAA + Acetyl coA
Citrate
Acetyl coA
Malonyl coA
Acetyl coA carboxylase (biotin)
Acyl-S-ACP (Acyl Carrier Protein)
β-ketoacyl-ACP-synthase
Acetoacetyl-ACP
β-ketoacyl-ACP-reductase
β-hydroxy butyryl-ACP
β-hydroxy acyl-ACP hydratase
trans-butenoyl-ACP
enoyl-ACP reductase.
butyryl-ACP
16:0
1 Acetyl coA
7 Malonyl coA
7 ATP
14 NADH
H Glucagon Insulin.
Acetyl coA Malonyl coA
FAD+. NAD+ NADPH
Propionyl coA
D-methyl malonyl coA
L-methymalonyl coA
Succinyl coA.
TCA
케톤체생성 Ketogenesis
Acetyl coA + Acetyl coA
Acetoacetyl coA
HMG coA synthase
HMG-coA
HMG coA reductase
HMG coA lyase
mevalonate
Acetoacetate
Acetone
3-hydroxy butyrate
케톤체이용 Ketolysis
Acetoacetate
Acetoacetyl coA
2 Acetyl coA
TCA
아미노산 대사.
aa-NH2
α-ketoglutarate
(transamination)
oxidative deamination.
NADH (NADPH)
NAD+ (NADP+)
glutamate-NH2
α-ketoacid
pyruvate Glutamate OAA
ALT PLP AST PLP
Ala α-keto glutarate Asp
GPT = ALT (alanine aminotransferase)
GOT = AST (Asp amino transferase)
요소회로
2ATP
Asp
NH3
arginase
Urea
Ala. Cys. Gly. Ser
Thr. Trp.
Tyr
Ile. Leu. Lys. Phe. Trp
Acetoacetate ↔ Acetyl coA
Asn. Asp OAA
Phe. Tyr Fumarate
α-keto glutarate Glu. Gln.
Arg. His Pro.
Succinyl coA
Ile. Met. Thr. Val.
Glucogenic Ketogenic
Tyr.
Met. Thr Val
Ile. Phe. Trp
Leu. Lys.
피리미딘합성
Asp
2ATP + CO2 + Gln
carbamoyl Ⓟ
Carbamoyl Ⓟ
ATCase (Asp-transcarbamoylase) Allosteric enzyme ⊖CTP. (negative feedback)
Carbamoyl-Asp
Dihydro orotate
Orotate
orotidine-5-mono Ⓟ (OMP)
uridine-5-mono Ⓟ
UMP
UDP
UTP
CTP
dUMP
N5,N10 methylene THF
THF
DHF
thymidylate synthase
5-FdUMP
5-FU (5-fluoro uracil)
dTMP.
NADP+ NADPH
DHF reductase.
⊖methotrexate
퓨린합성
ribose-5-P
ATP. PRPP synthetase.
PRPP (5-phosphoribosyl 1-pyrophosphate)
2Gln. Gly. 2THF
CO2. Asp. 2ATP
IMP (Inosine-5-mono Ⓟ)
adenosyl succinate
xanthosine mono Ⓟ
AMP
GMP → GDP → GTP
adenosine
inosine
Hypoxanthine
guanosine
guanine.
Xanthine
Xanthine oxidase
Uricase
allantoin.
Gly
THF
Gln
CO2