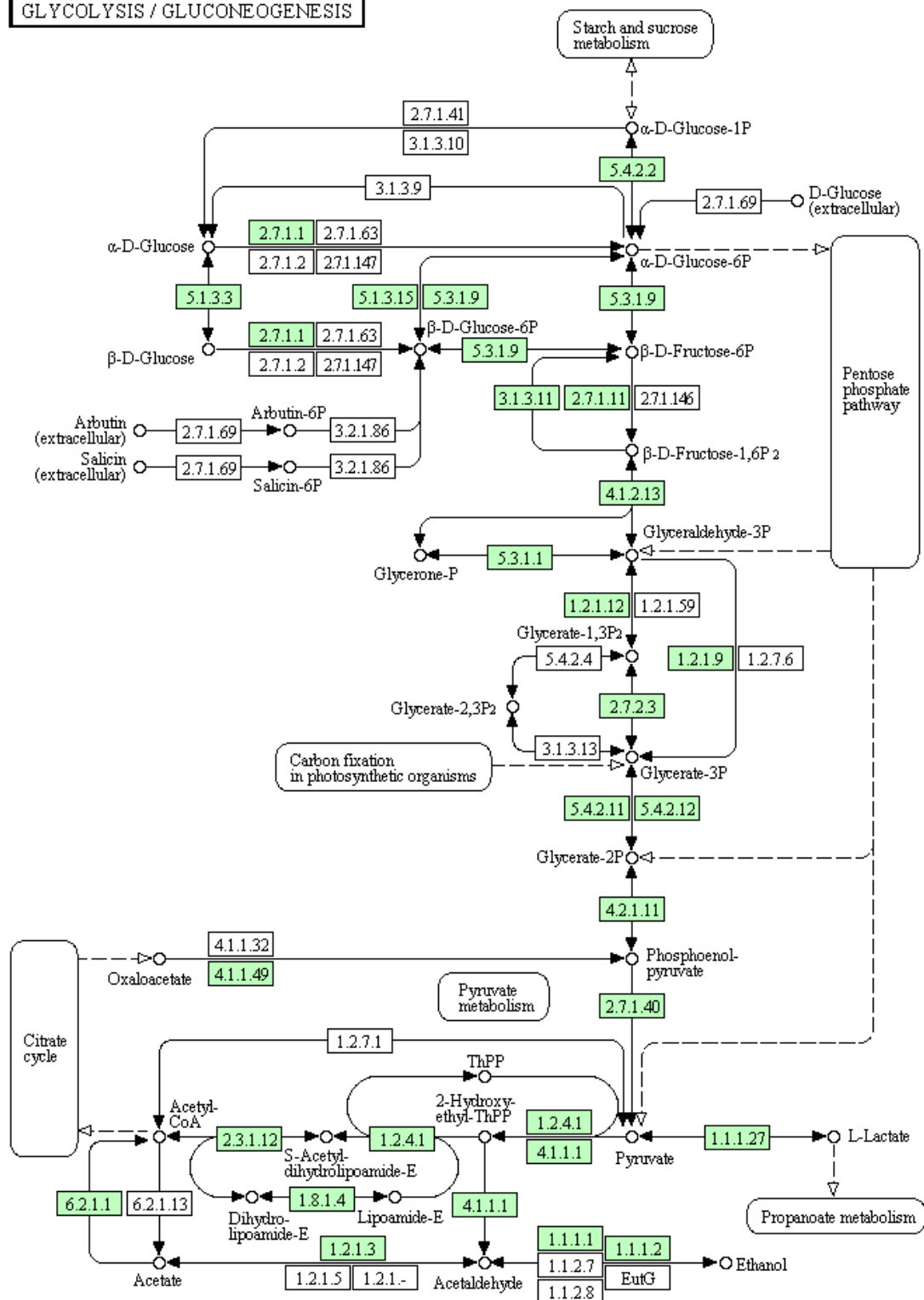
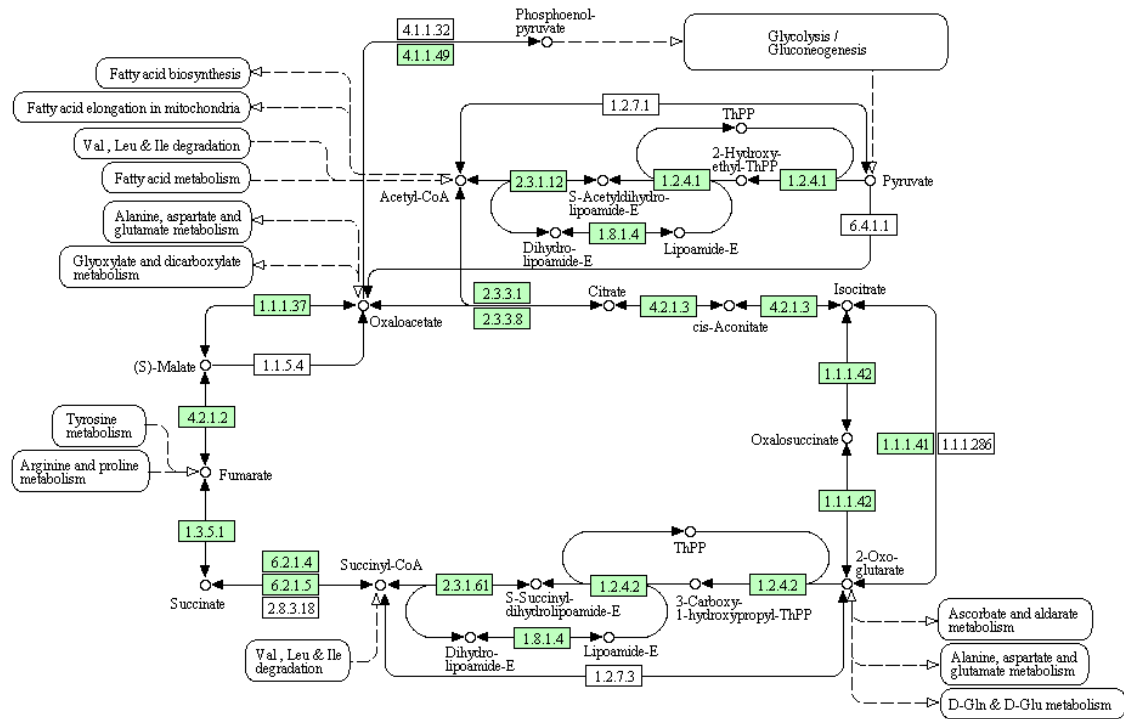


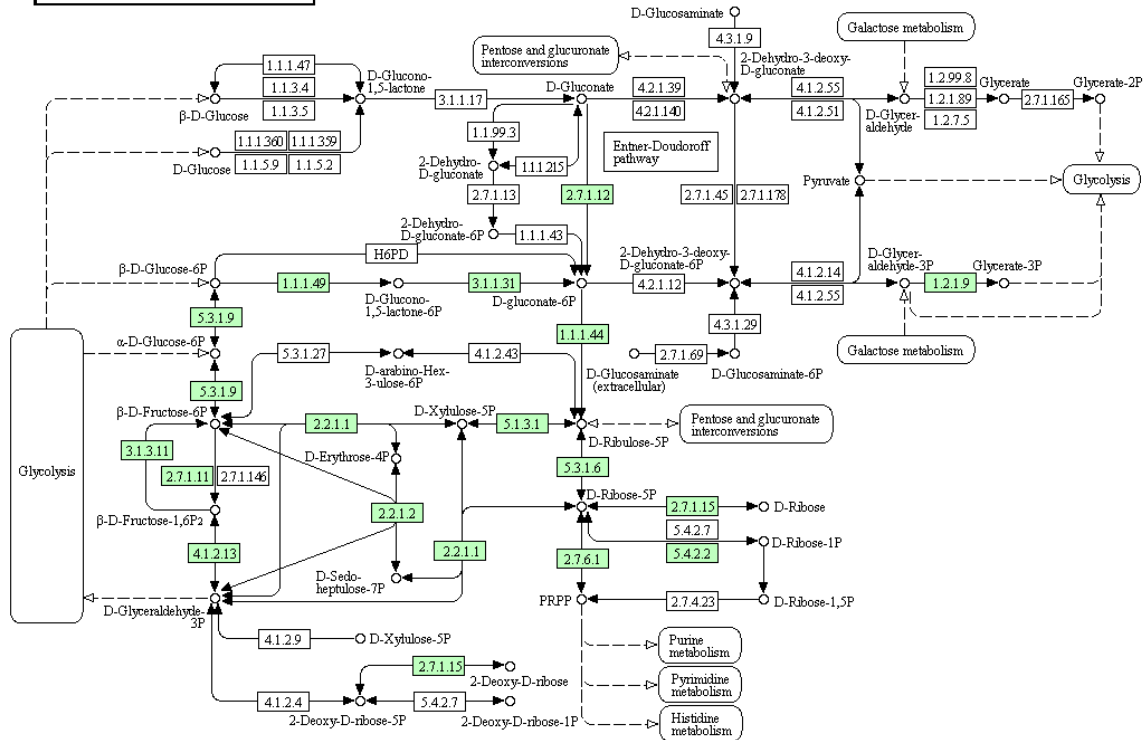
GLYCOLYSIS / GLUCONEOGENESIS



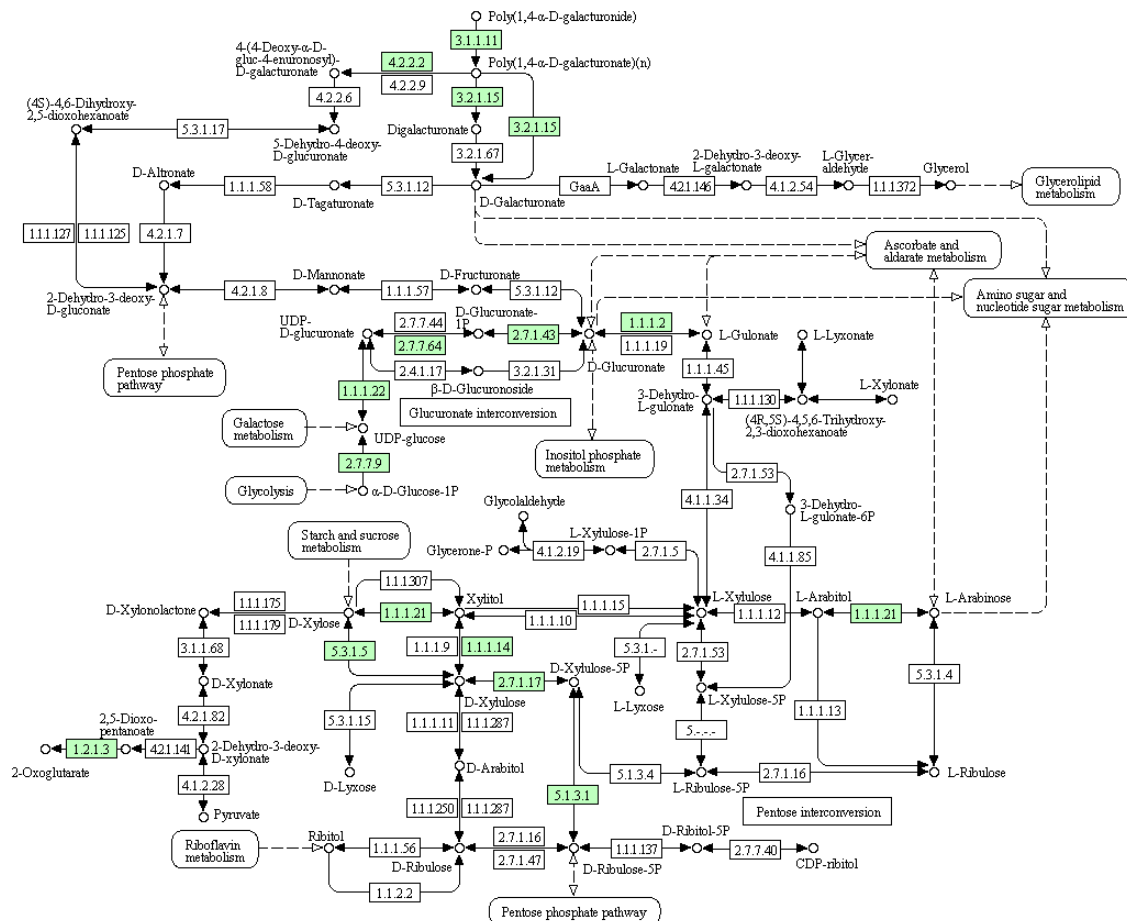
CITRATE CYCLE (TCA CYCLE)



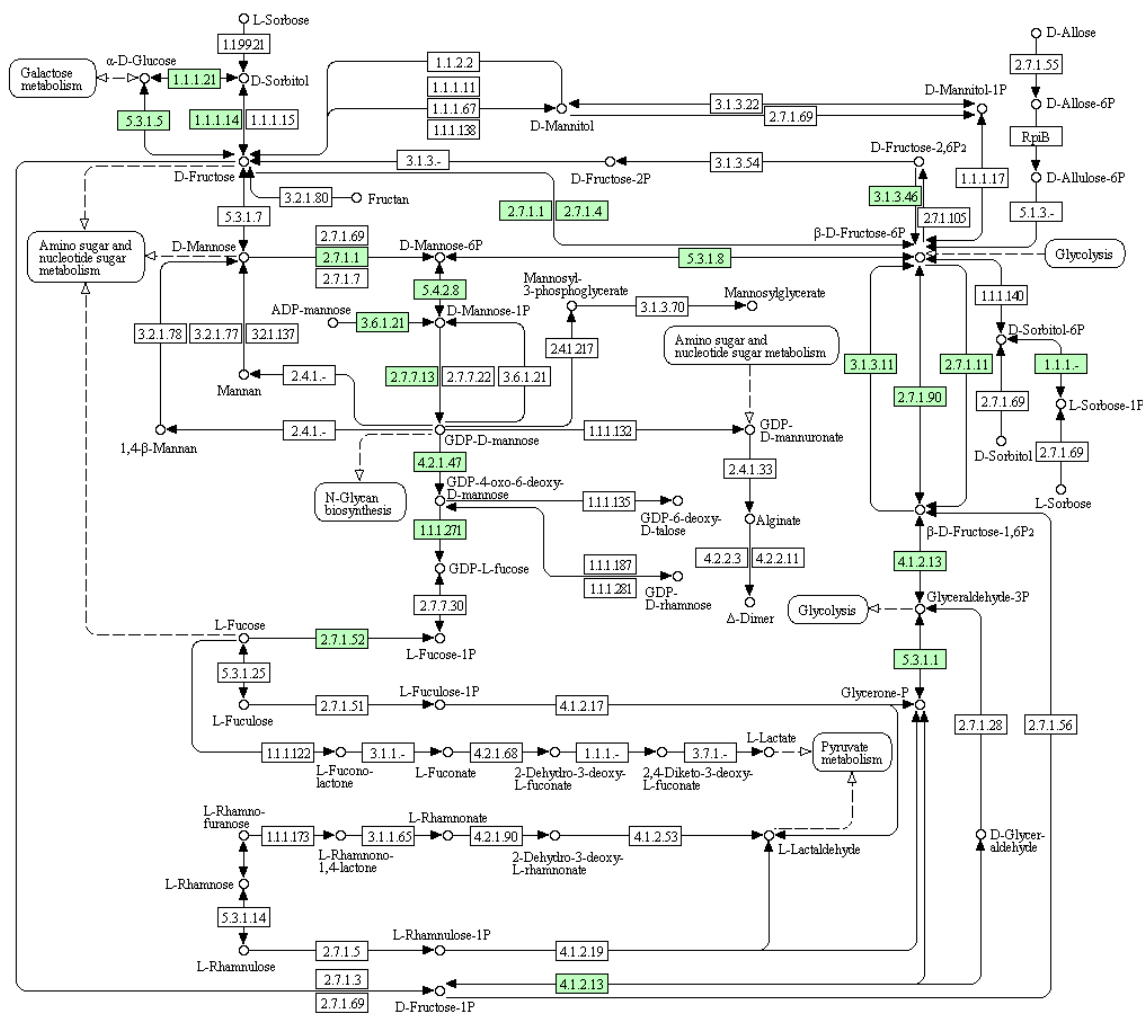
PENTOSE PHOSPHATE PATHWAY

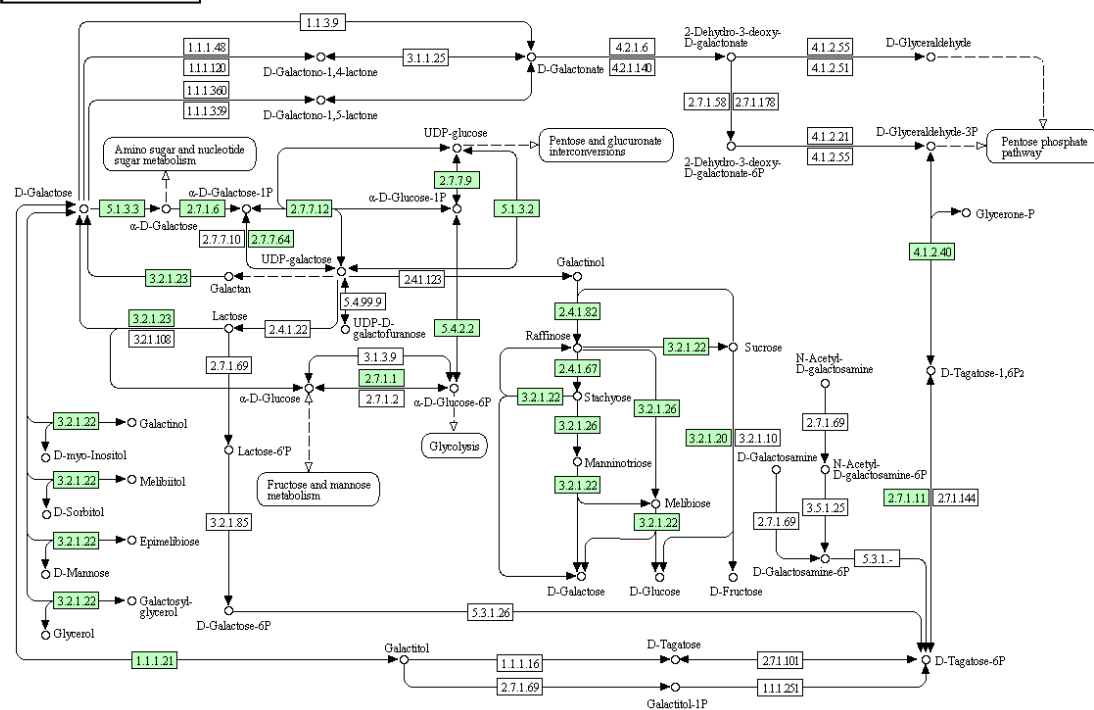


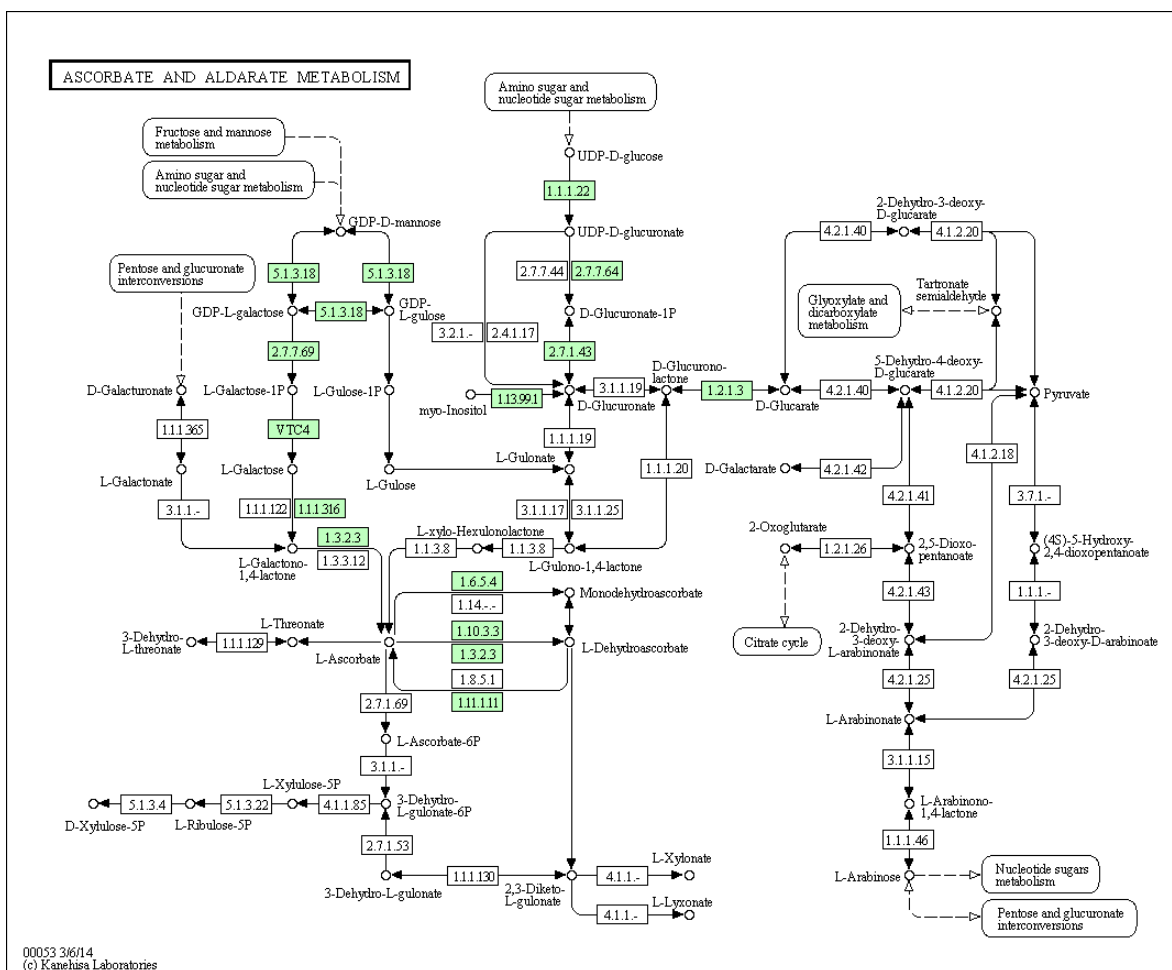
PENTOSE AND GLUCURONATE INTERCONVERSIONS

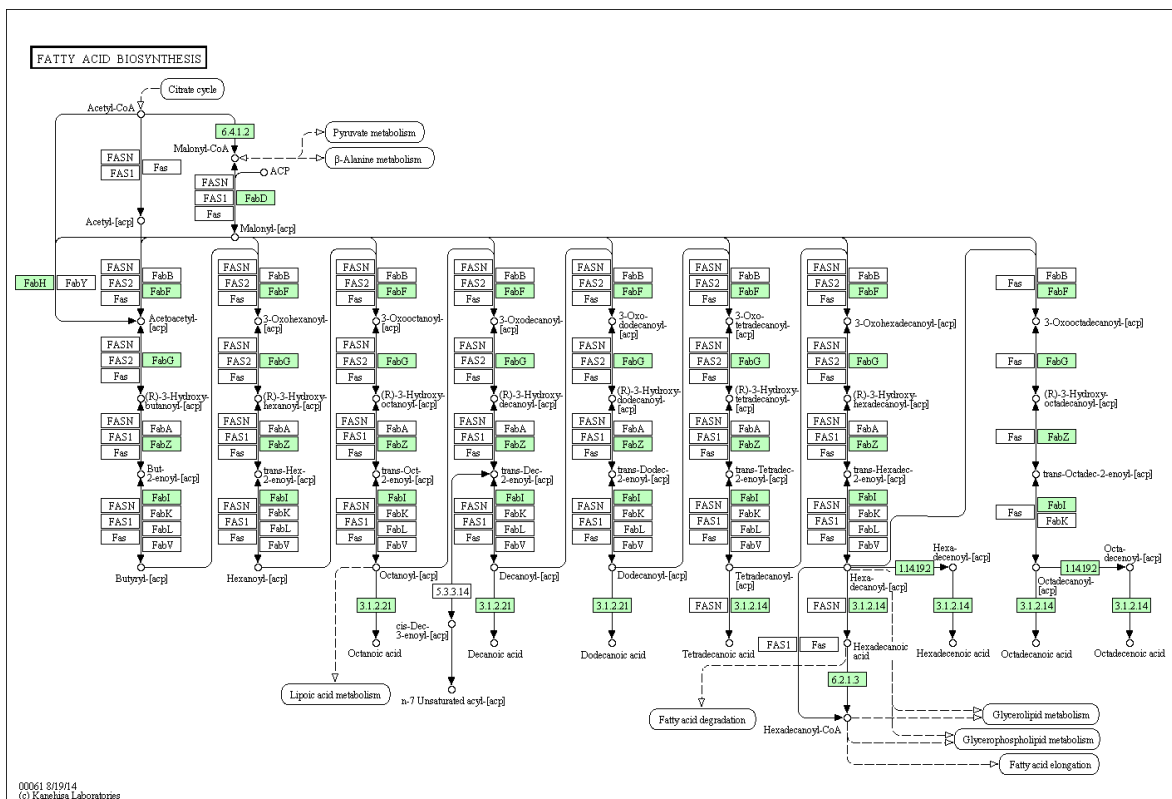


FRUCTOSE AND MANNOSE METABOLISM

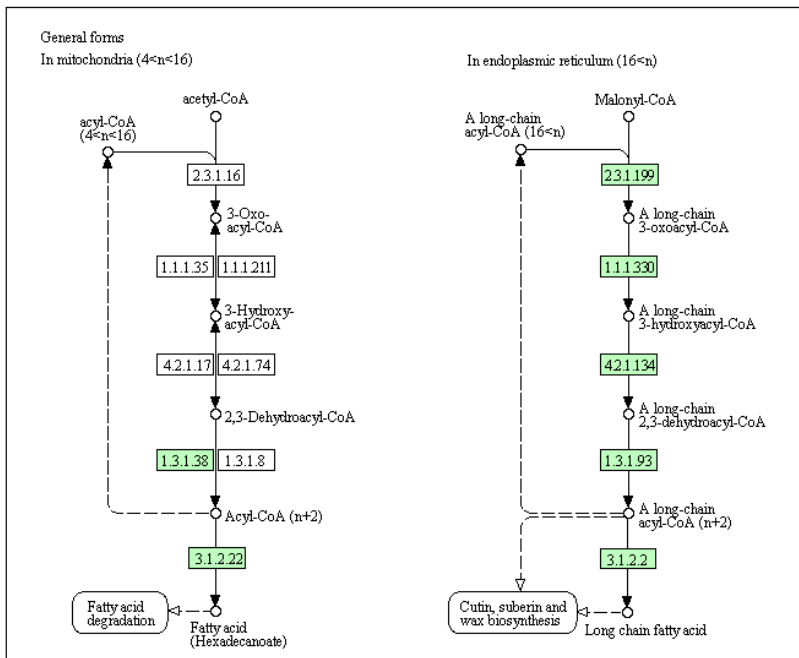
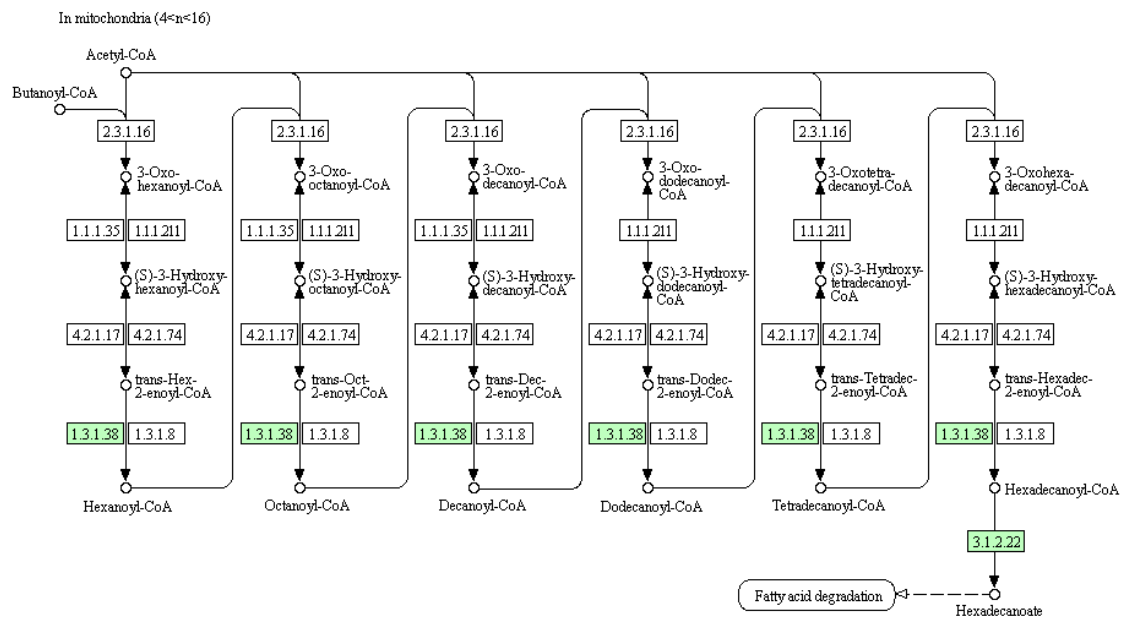




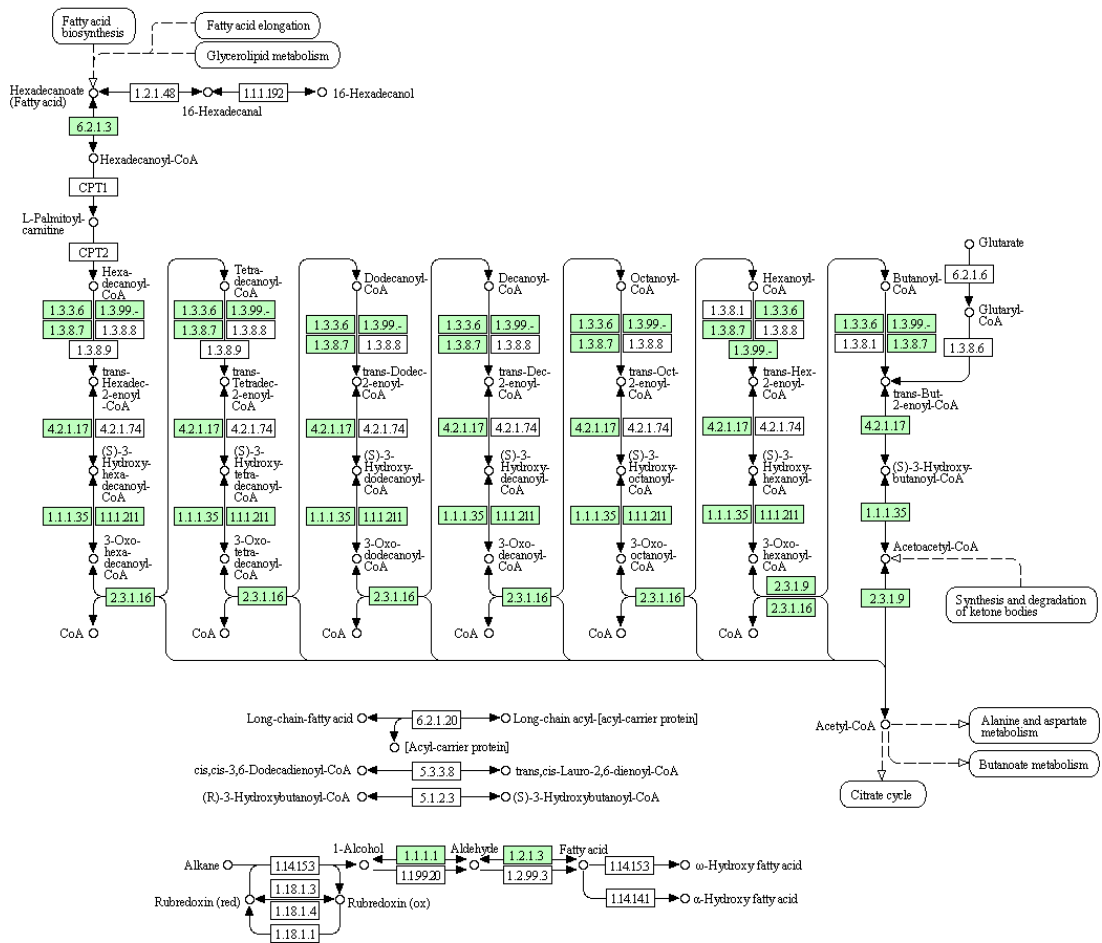




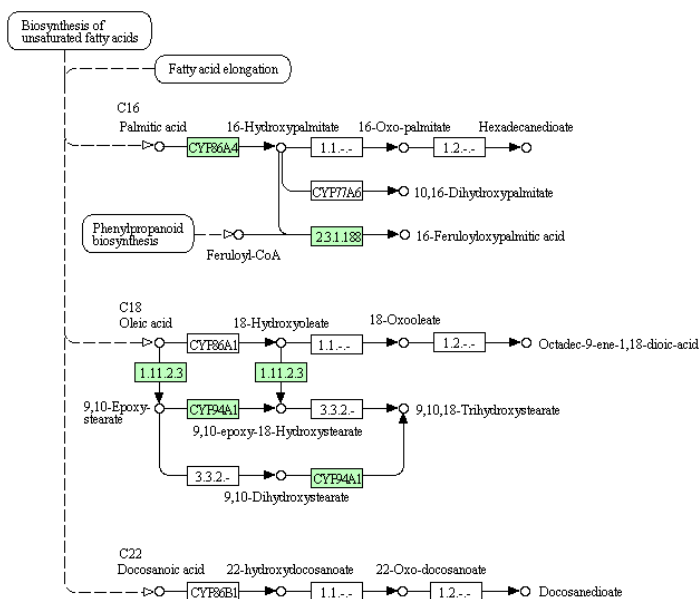
FATTY ACID ELONGATION



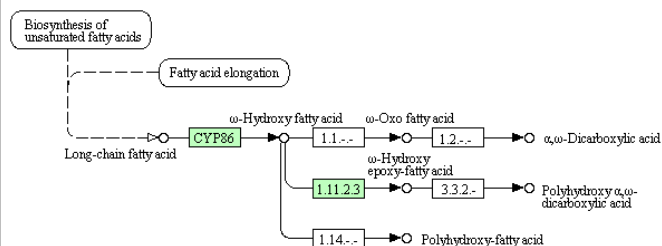
FATTY ACID DEGRADATION



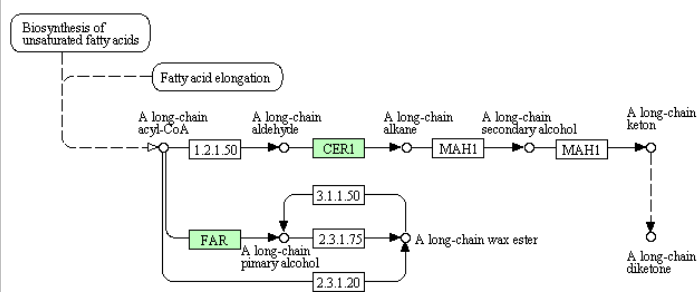
CUTIN, SUBERINE AND WAX BIOSYNTHESIS



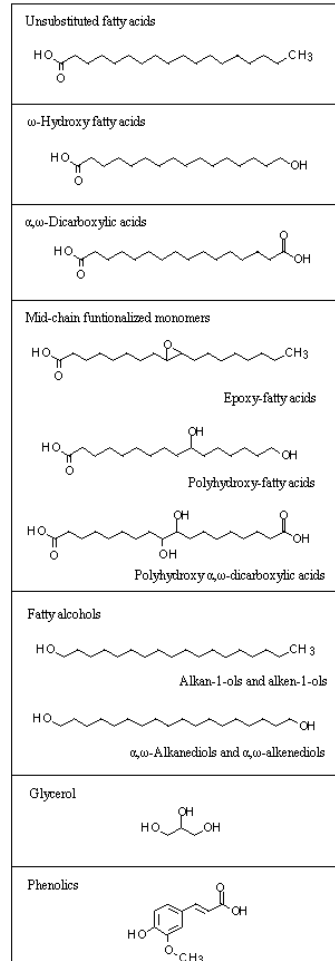
Cutin and suberin biosynthesis (general form)



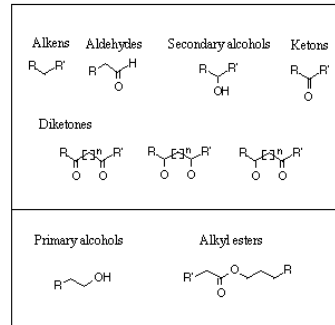
Wax biosynthesis (general form)

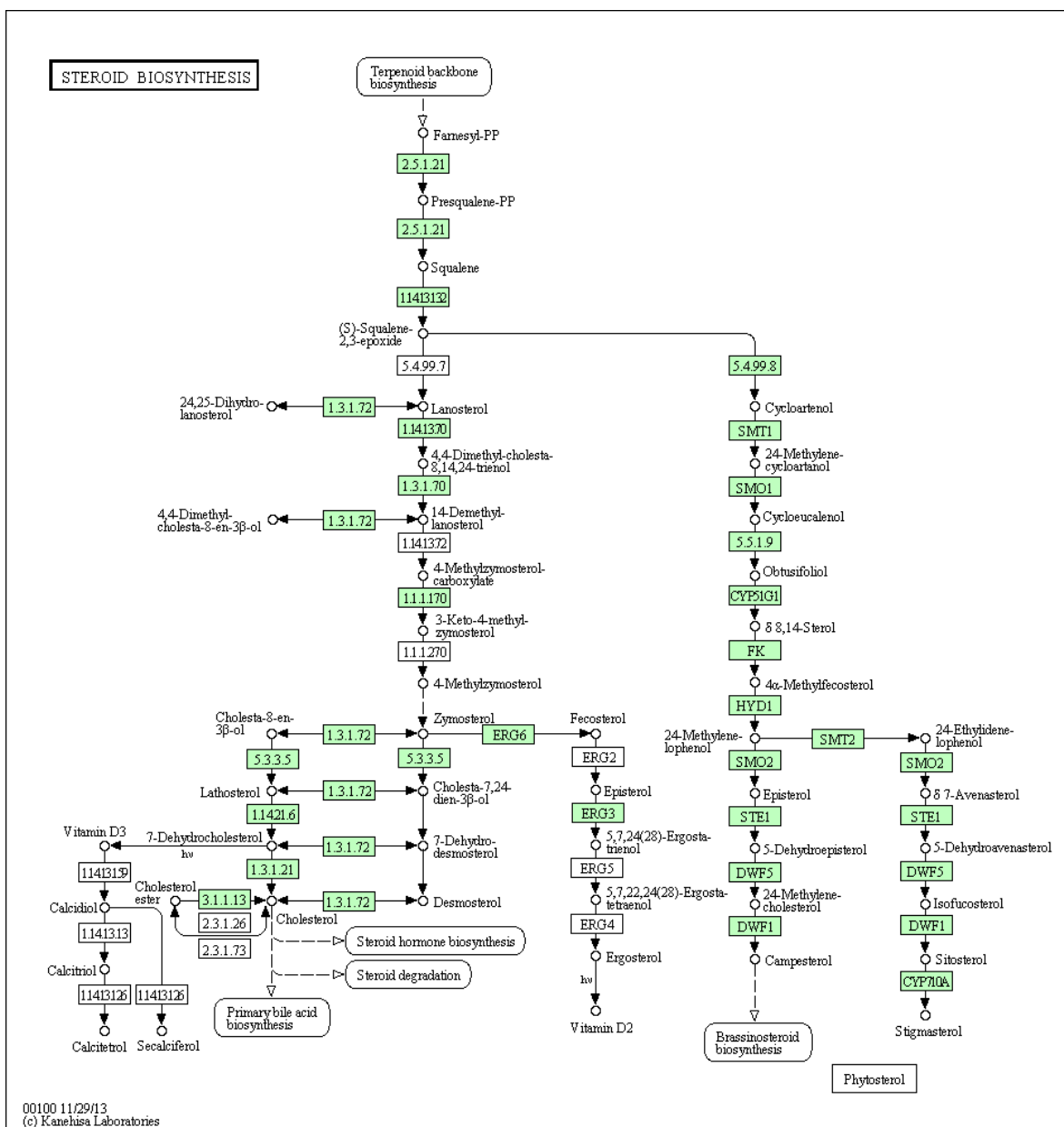


Structure of common cutin and suberin monomers

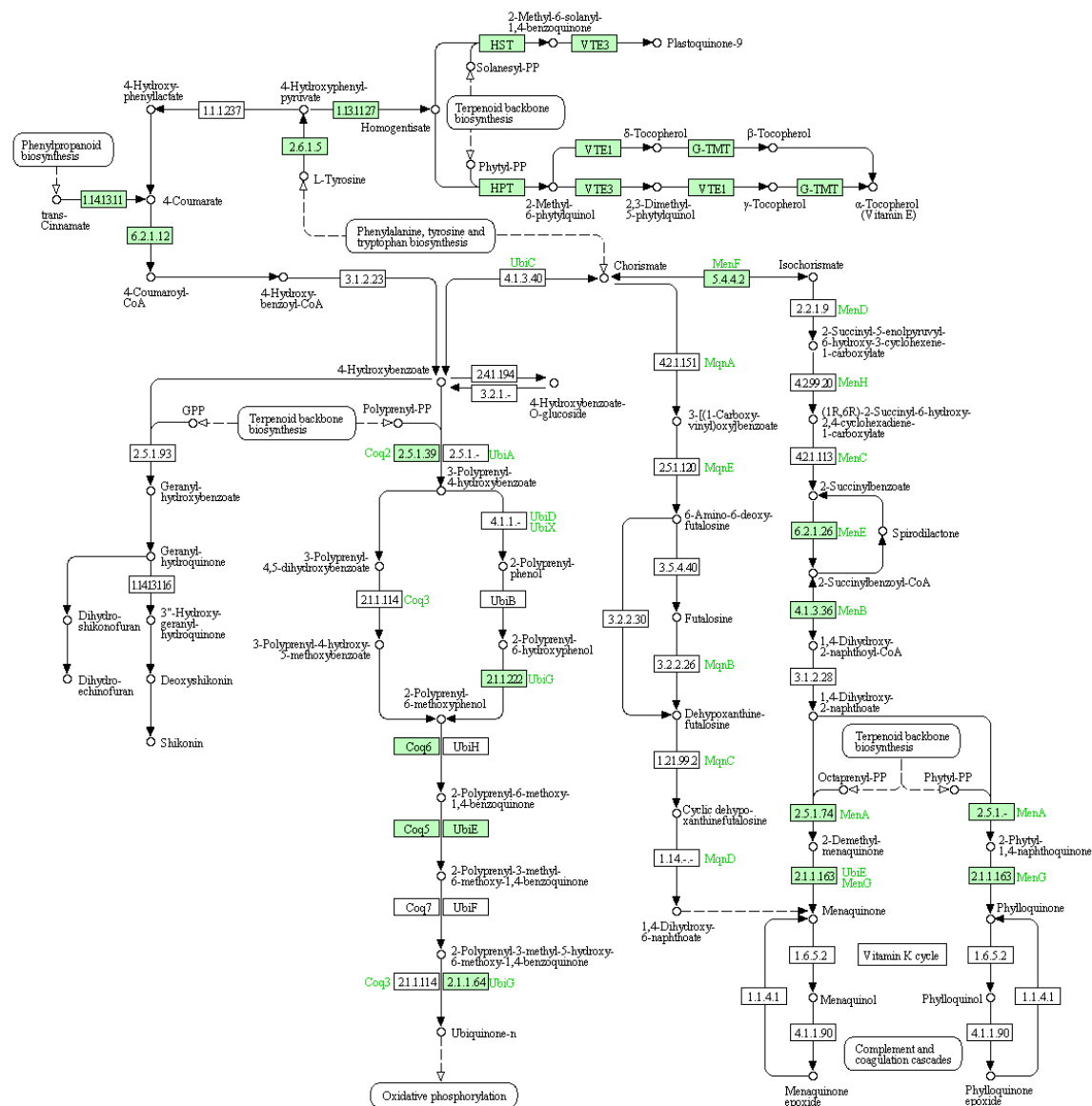


Structure of common wax

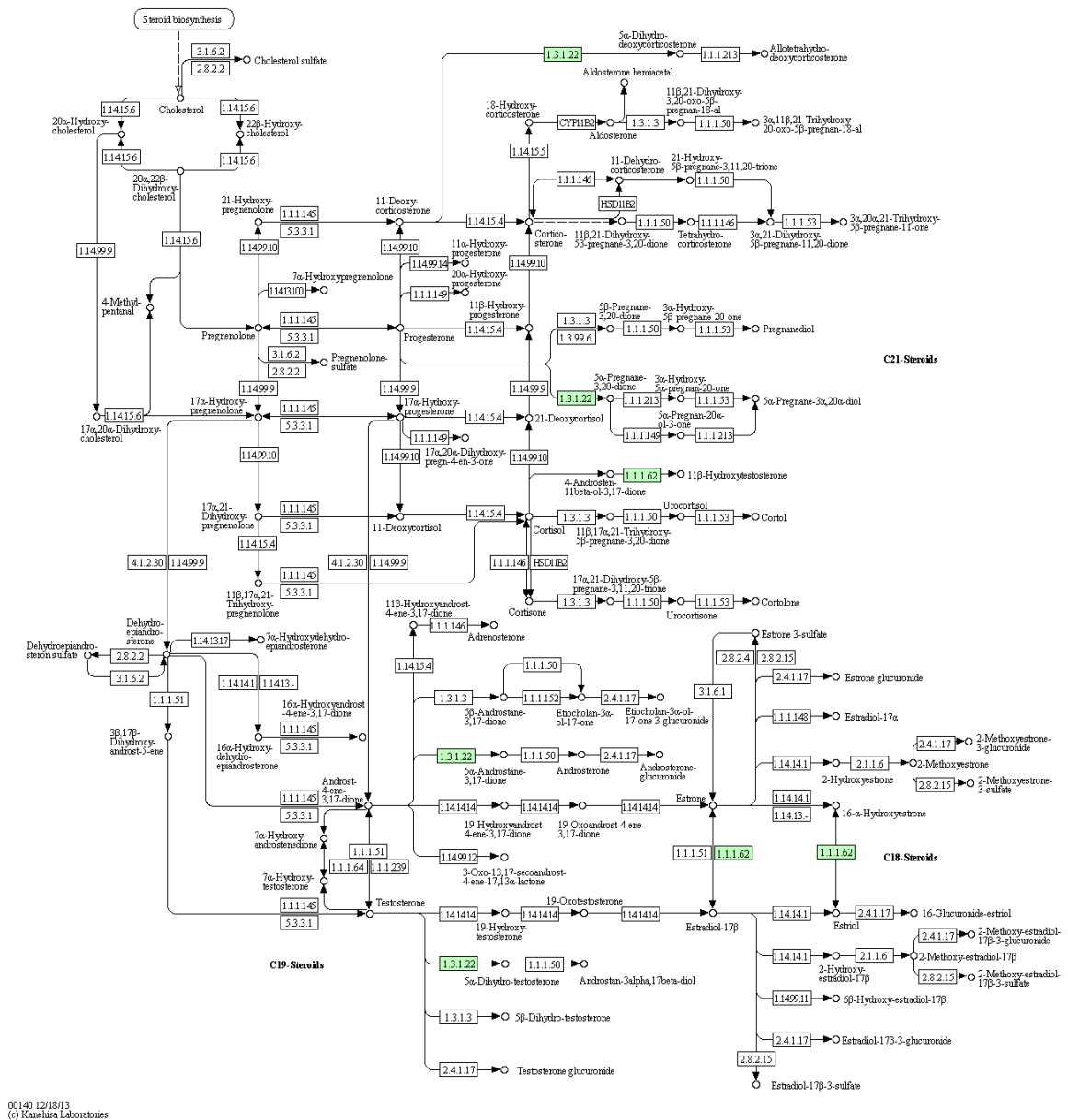




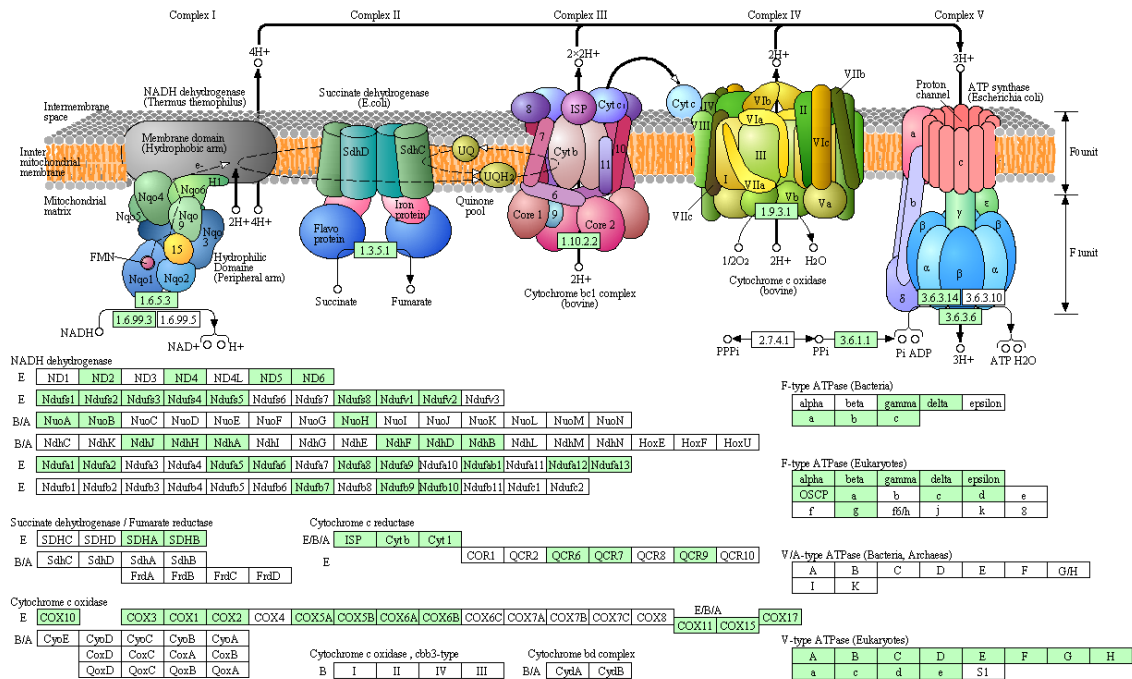
UBIQUINONE AND OTHER TERPENOID-QUINONE BIOSYNTHESIS



STEROID HORMONE BIOSYNTHESIS

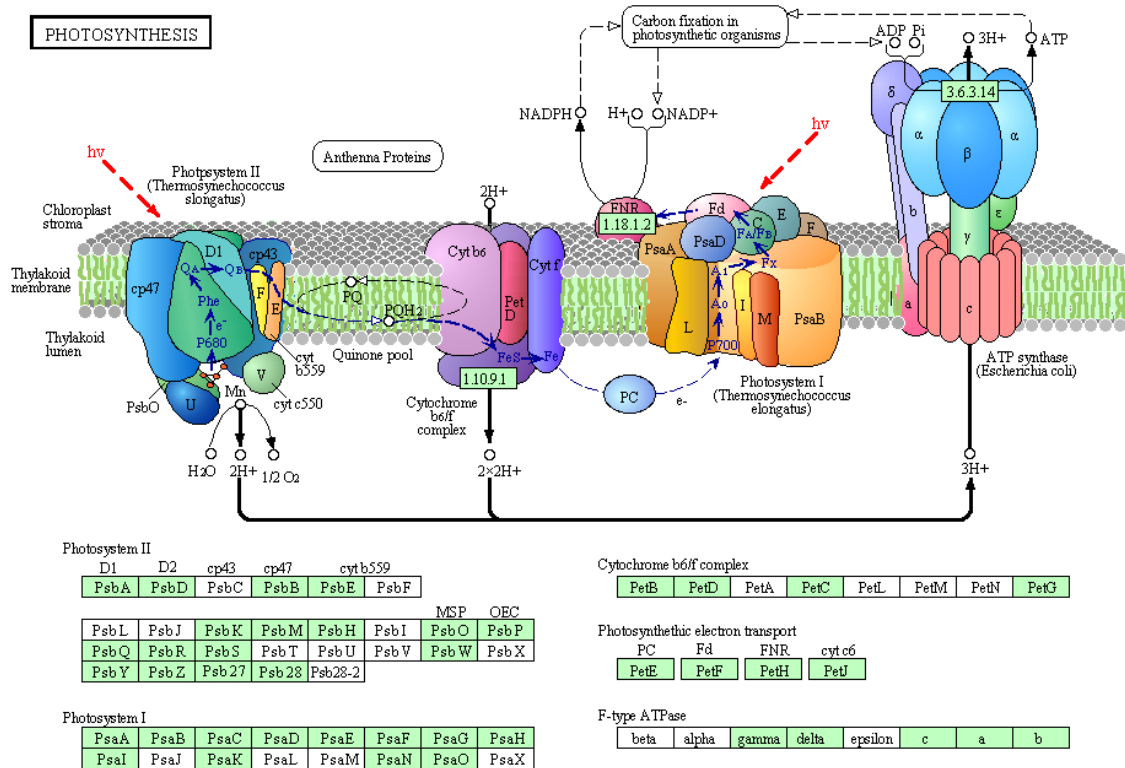


OXIDATIVE PHOSPHORYLATION



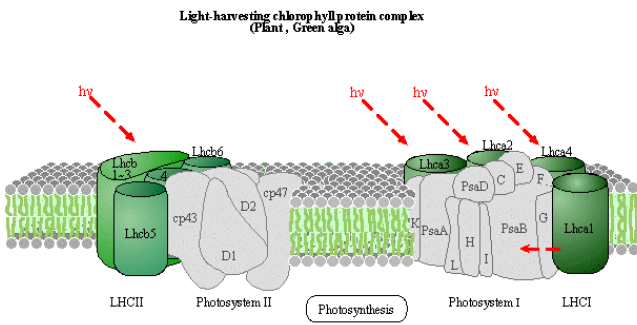
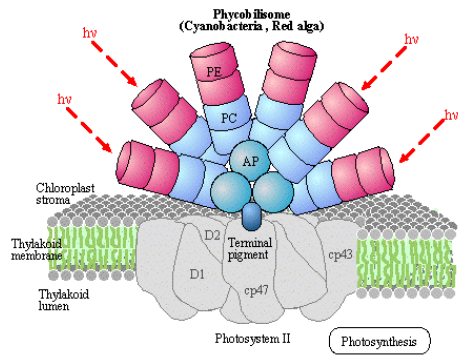
00190 5/7/14
(c) Kanehisa Laboratories

PHOTOSYNTHESIS



00195 1/15/14
(c) Kanehisa Laboratories

PHOTOSYNTHESIS - ANTENNA PROTEINS



Allophycocyanin (AP)

ApcA ApcB ApcC ApcD ApcE ApcF

Phycocyanin (PC) / Phycoerythrocyanin (PEC)

CpcA CpcB CpcC CpcD CpcE CpcF CpcG

Phycoerythrin (PE)

CpeA CpeB CpeC CpeD CpeE CpeR CpeS CpeT CpeU CpeY CpeZ

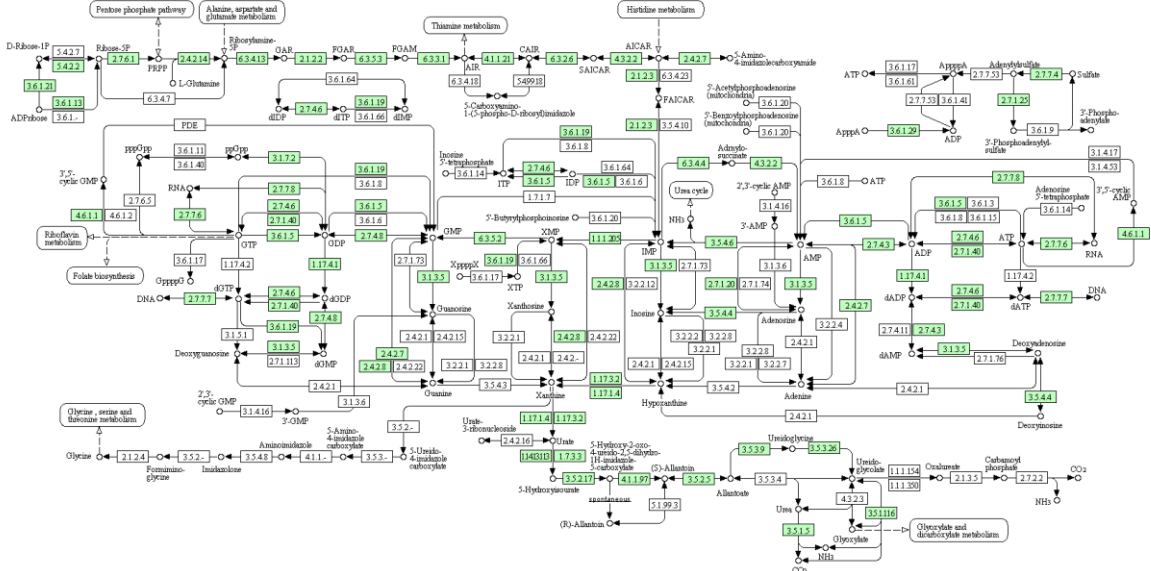
Light-harvesting chlorophyll protein complex (LHC)

Lhca1 Lhca2 Lhca3 Lhca4 Lhca5

Lhcb1 Lhcb2 Lhcb3 Lhcb4 Lhcb5 Lhcb6 Lhcb7

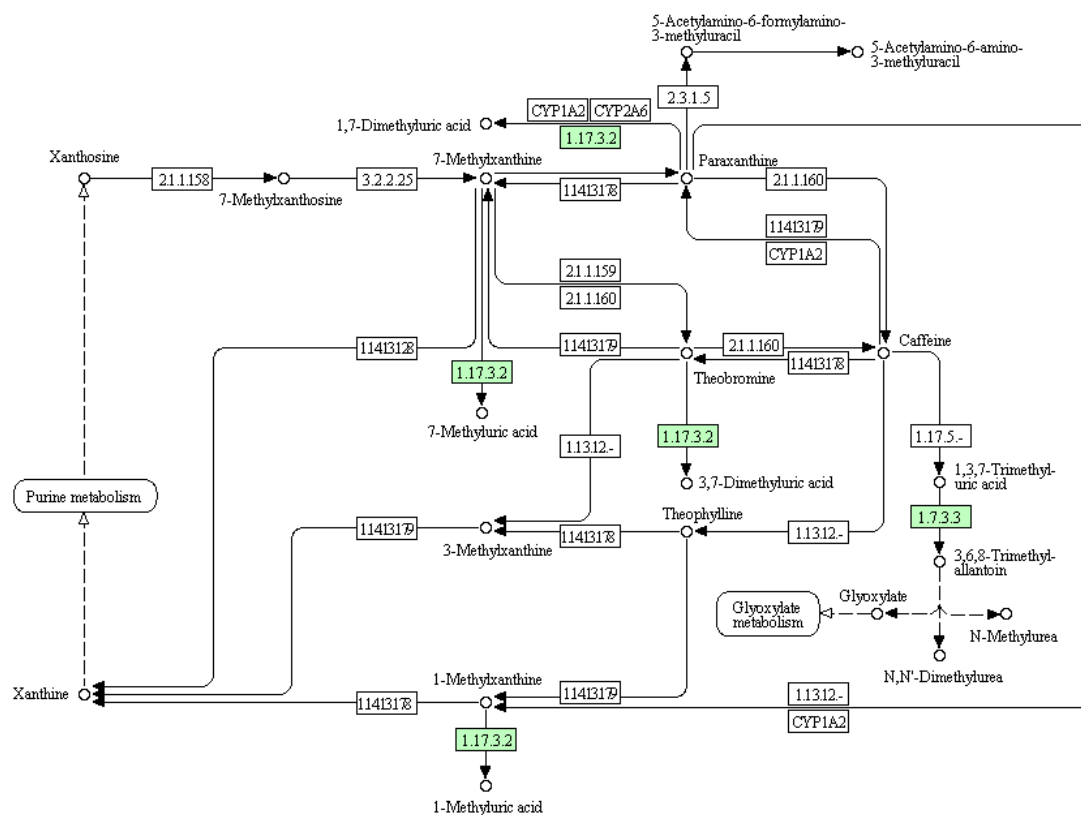
00196 11/16/10
(c) Kanehisa Laboratories

PURINE METABOLISM



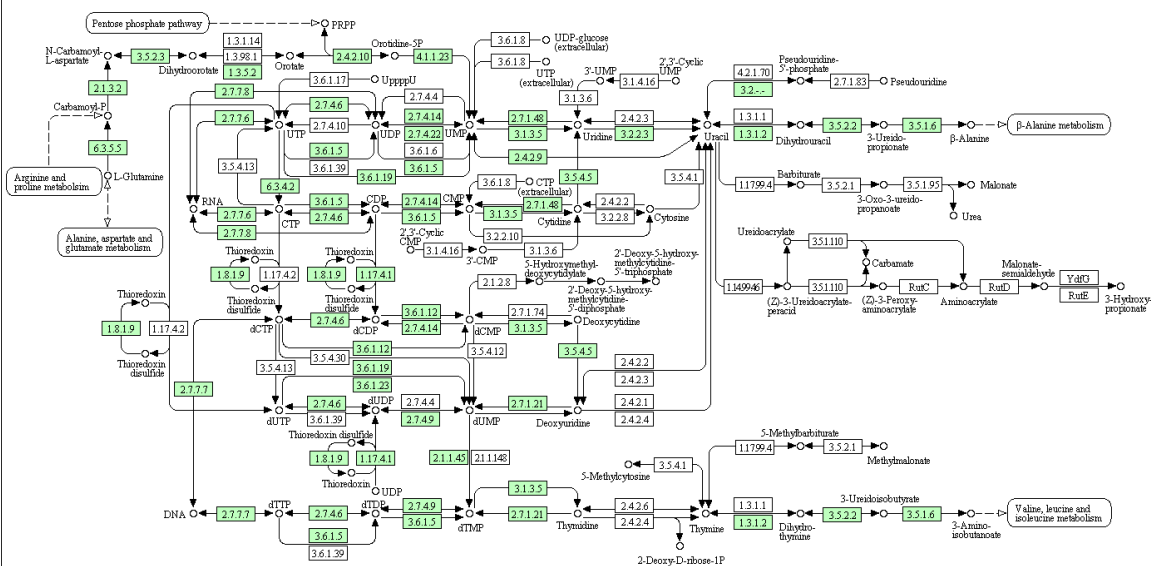
00220 12/01/4
(c) Kanehisa Laboratories

CAFFEINE METABOLISM



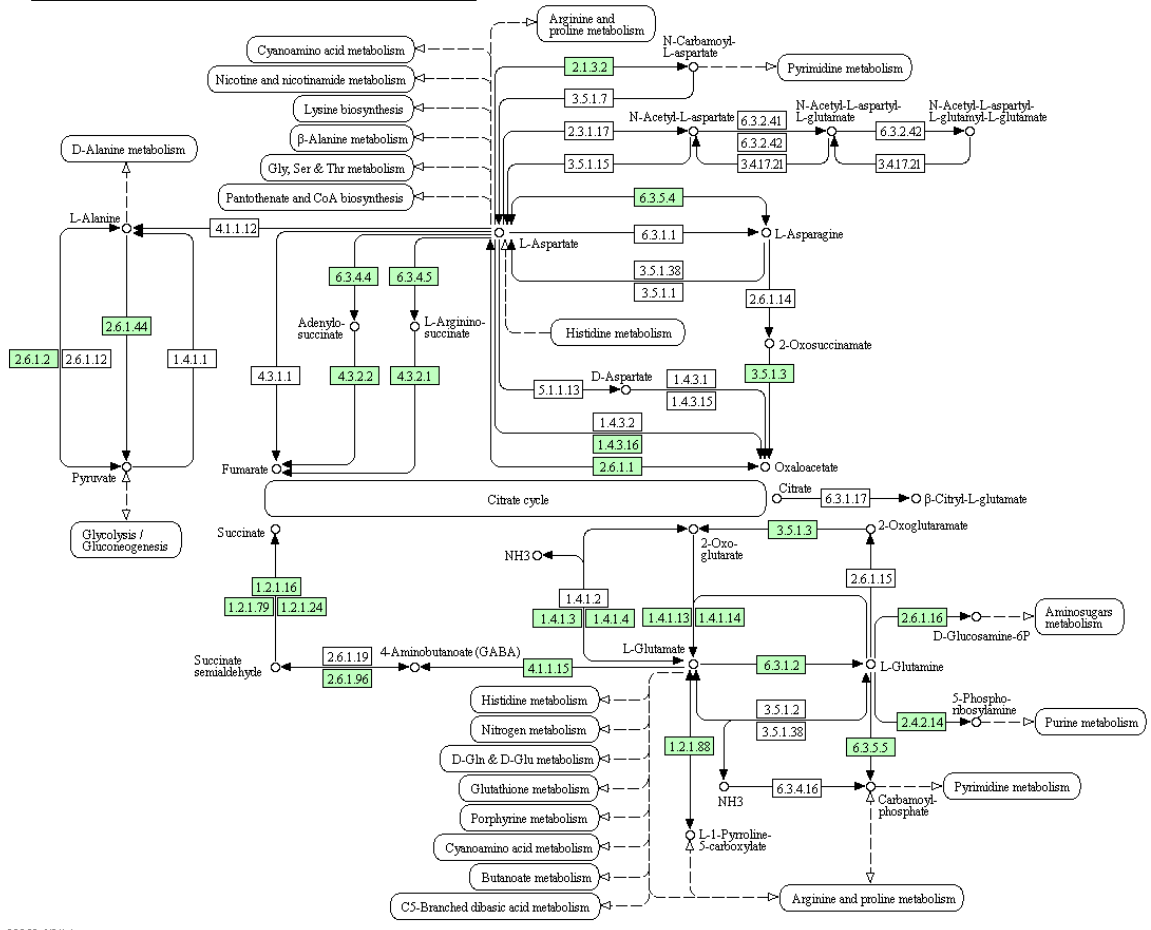
00232 10/22/13
(c) Kanehisa Laboratories

PYRIMIDINE METABOLISM

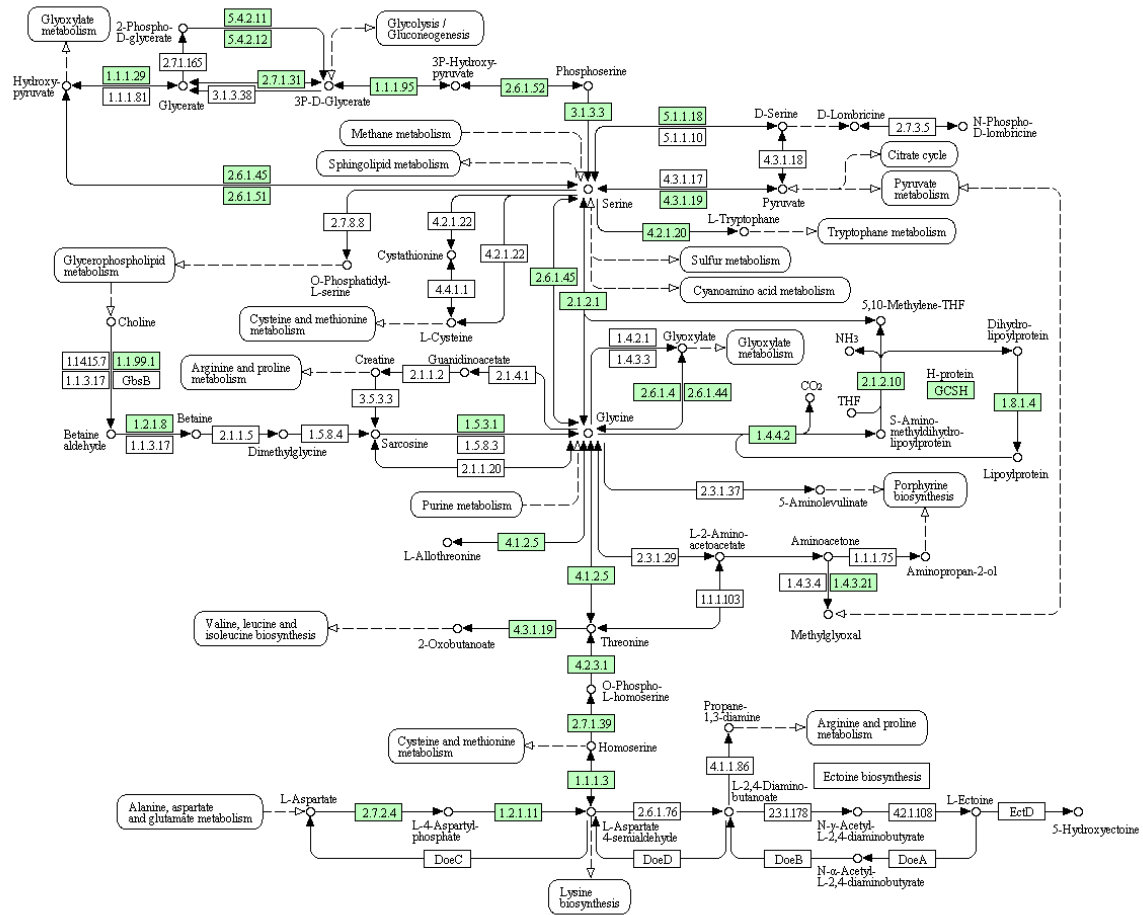


00240 5/21/14
(c) Kanehisa Laboratories

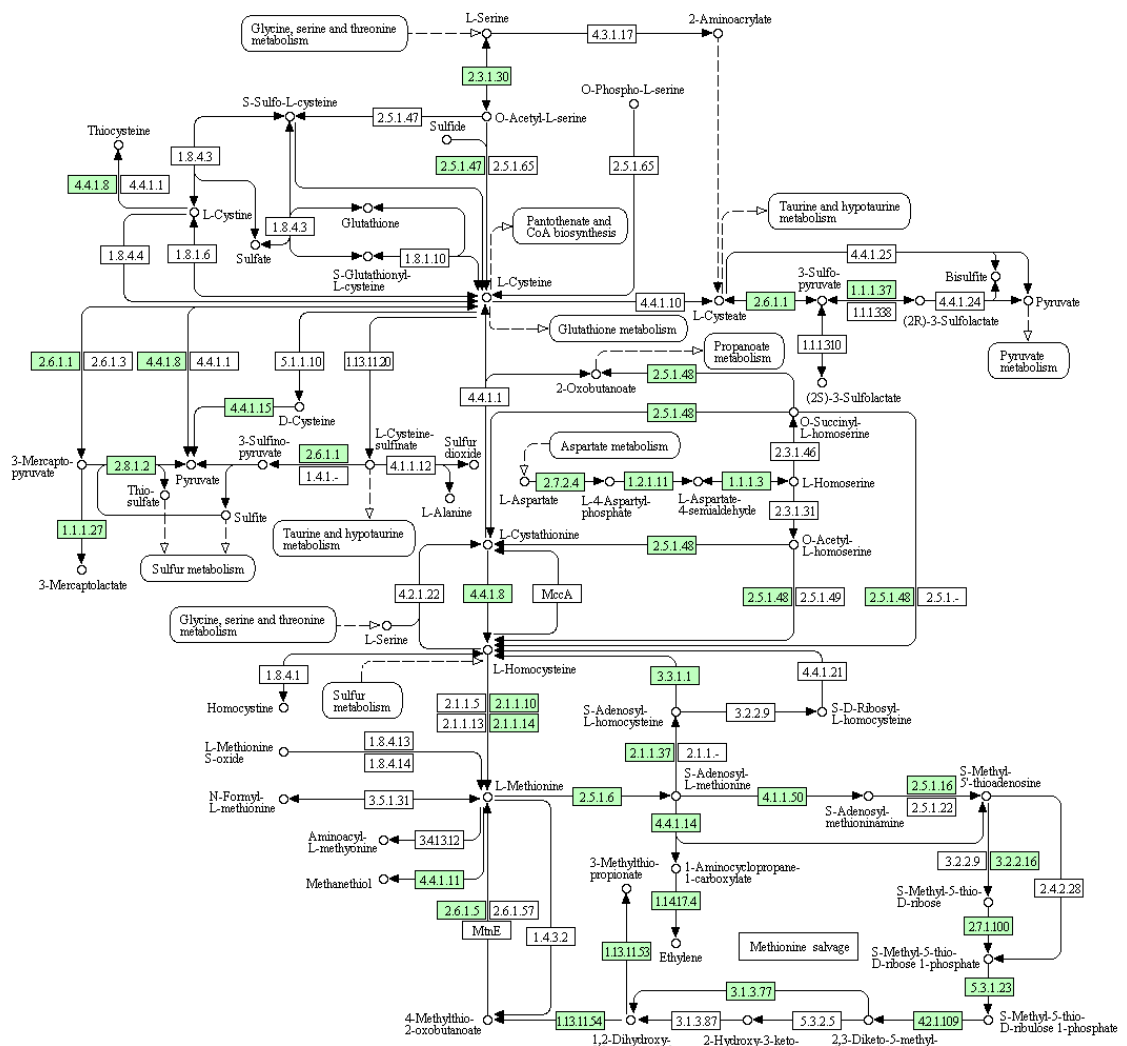
ALANINE, ASPARTATE AND GLUTAMATE METABOLISM



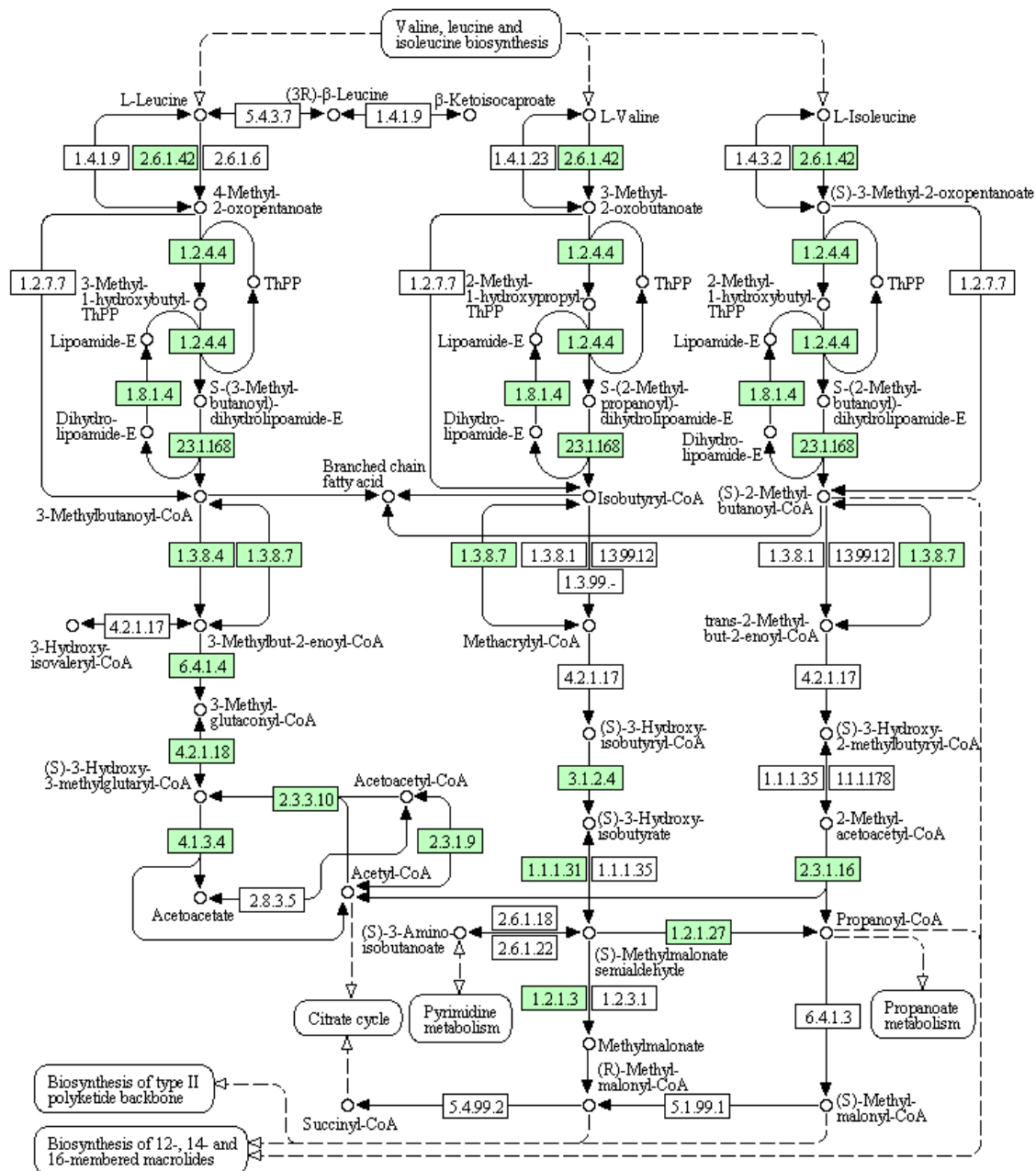
GLYCINE, SERINE AND THREONINE METABOLISM



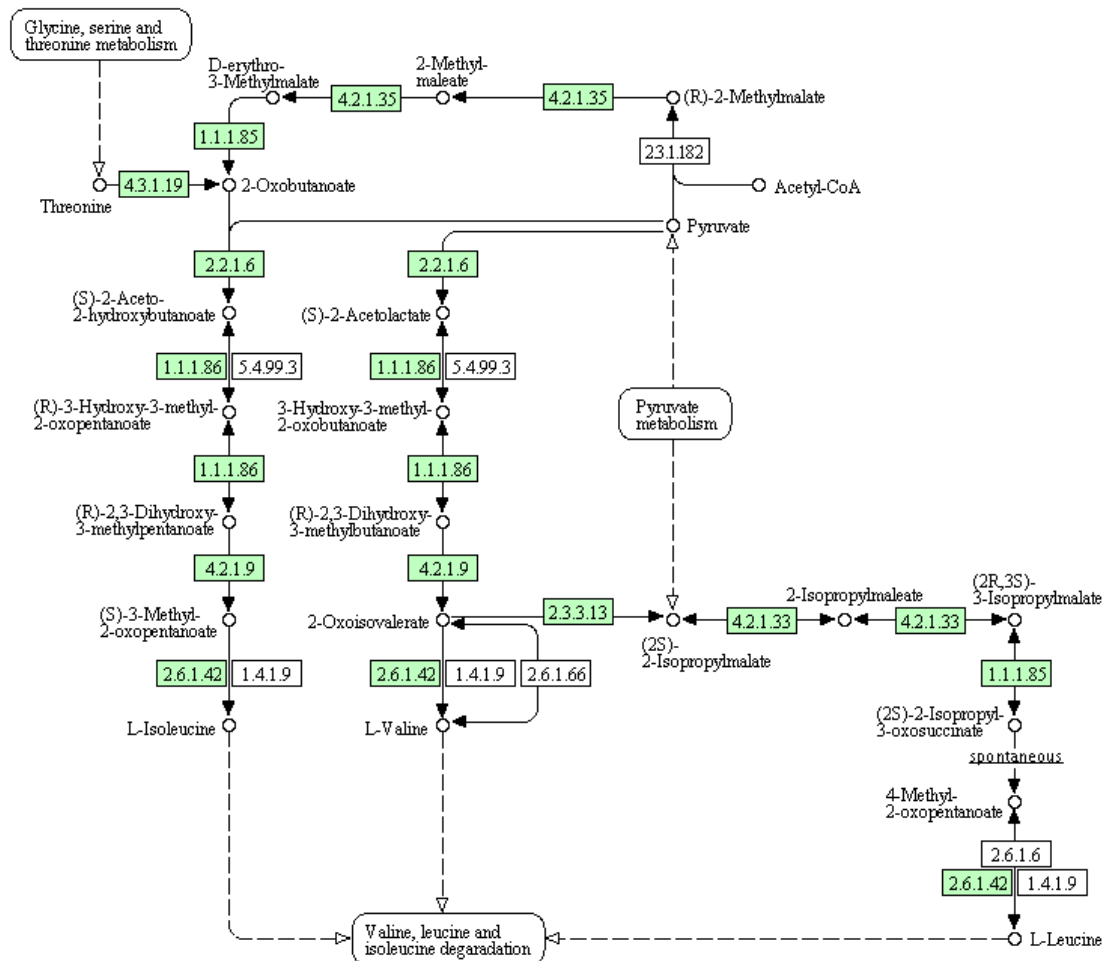
CYSTEINE AND METHIONINE METABOLISM



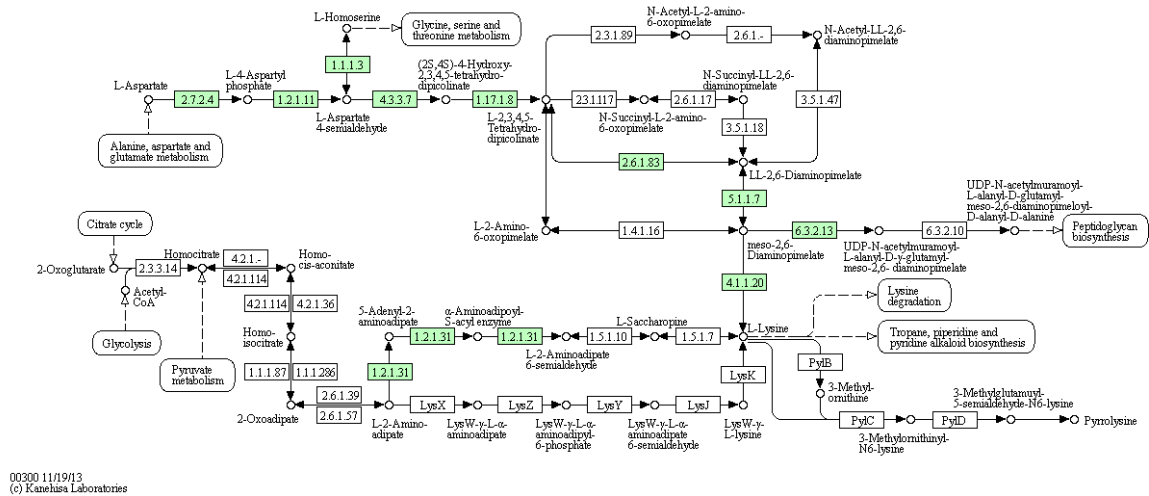
VALINE, LEUCINE AND ISOLEUCINE DEGRADATION



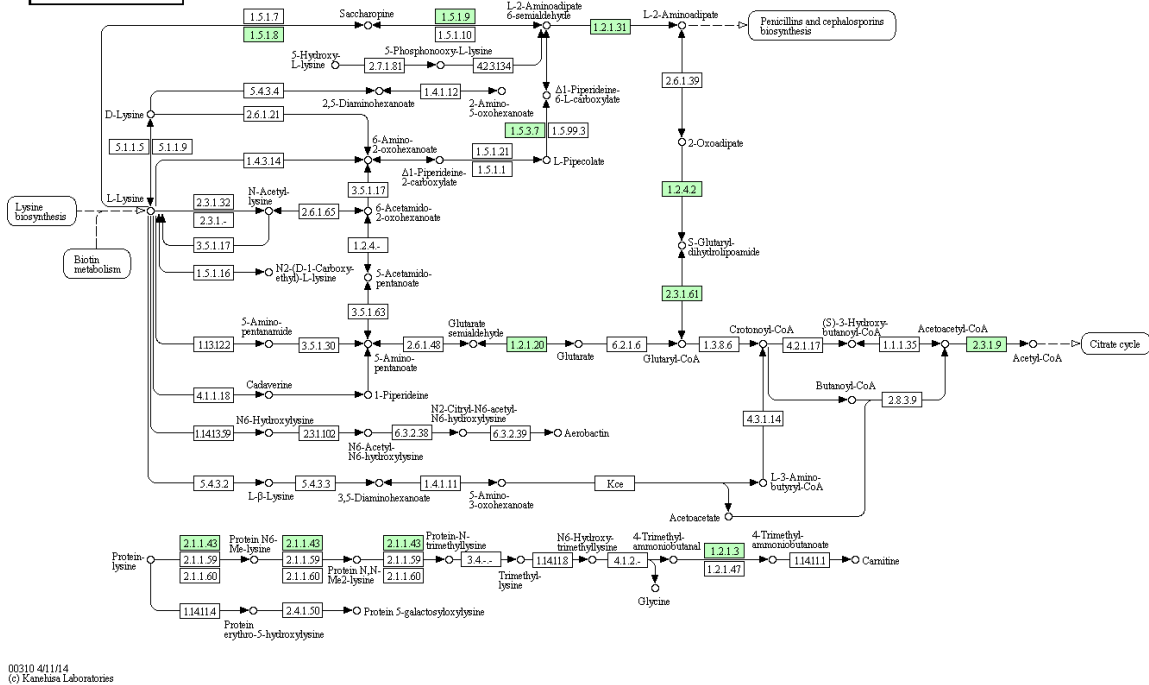
VALINE, LEUCINE AND ISOLEUCINE BIOSYNTHESIS

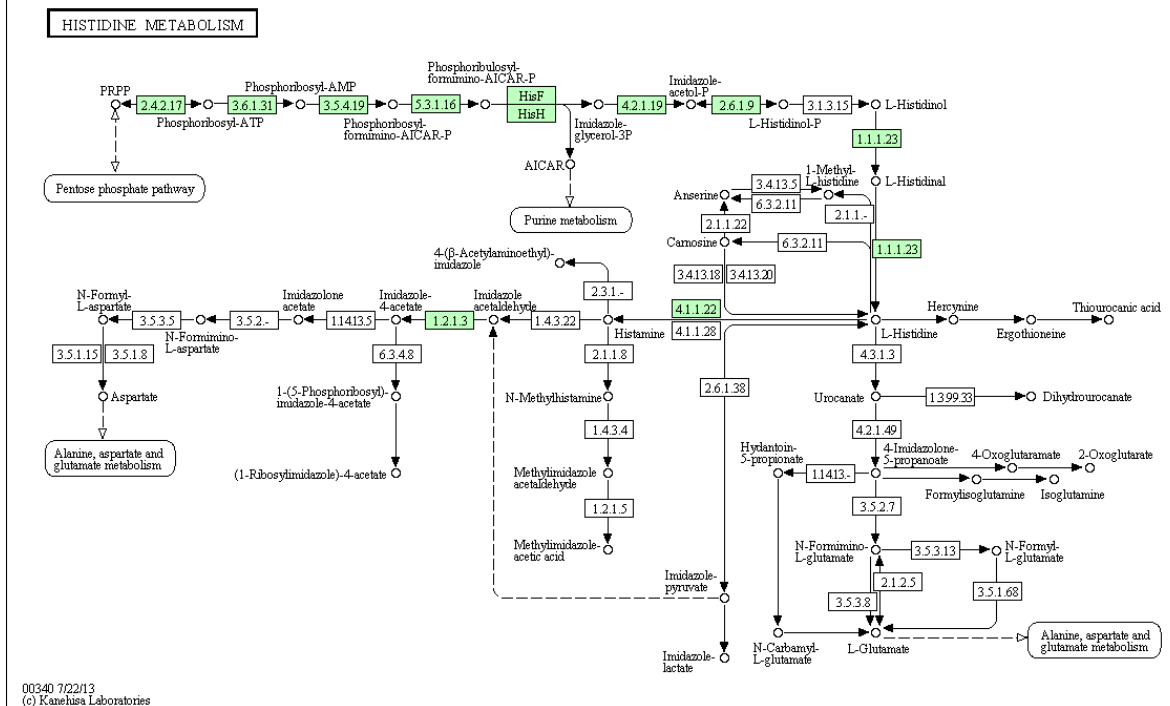
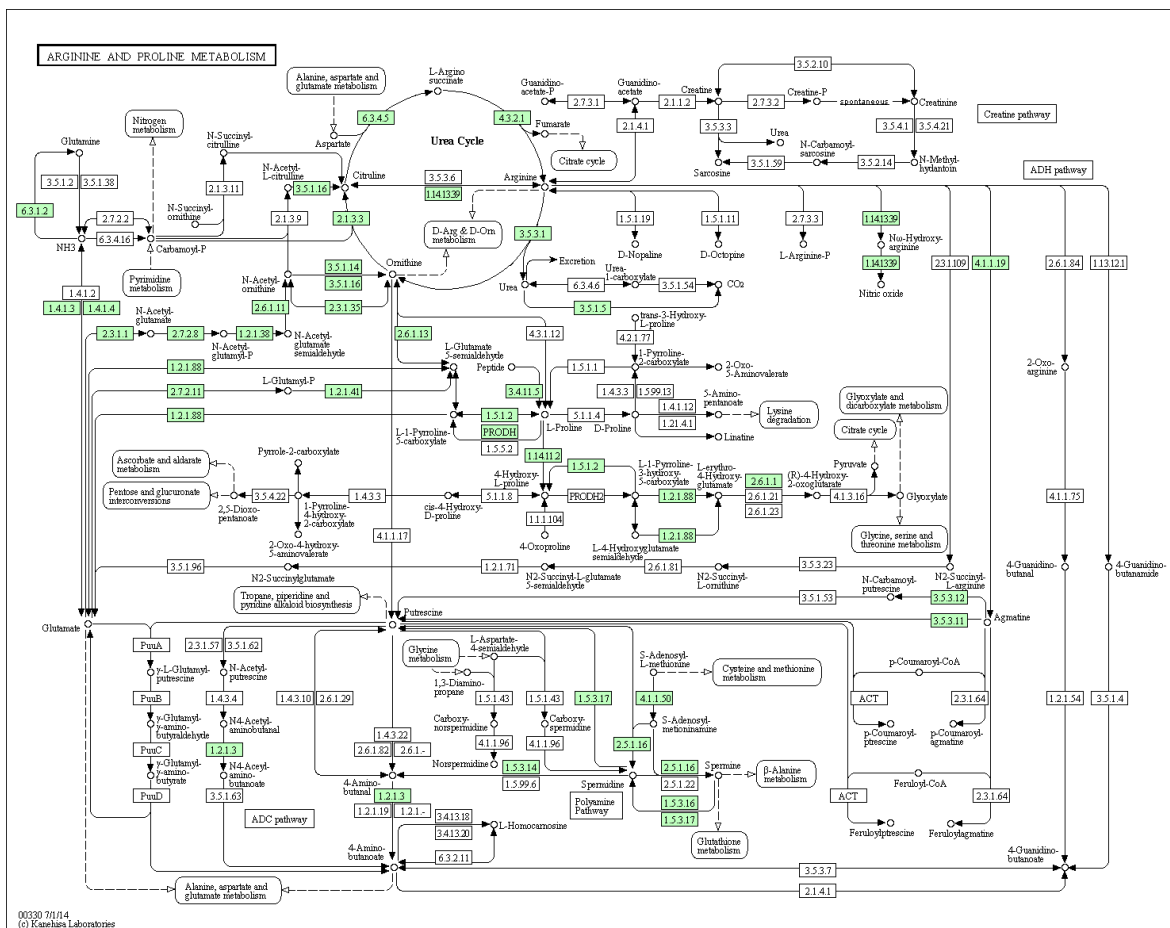


LYSINE BIOSYNTHESIS

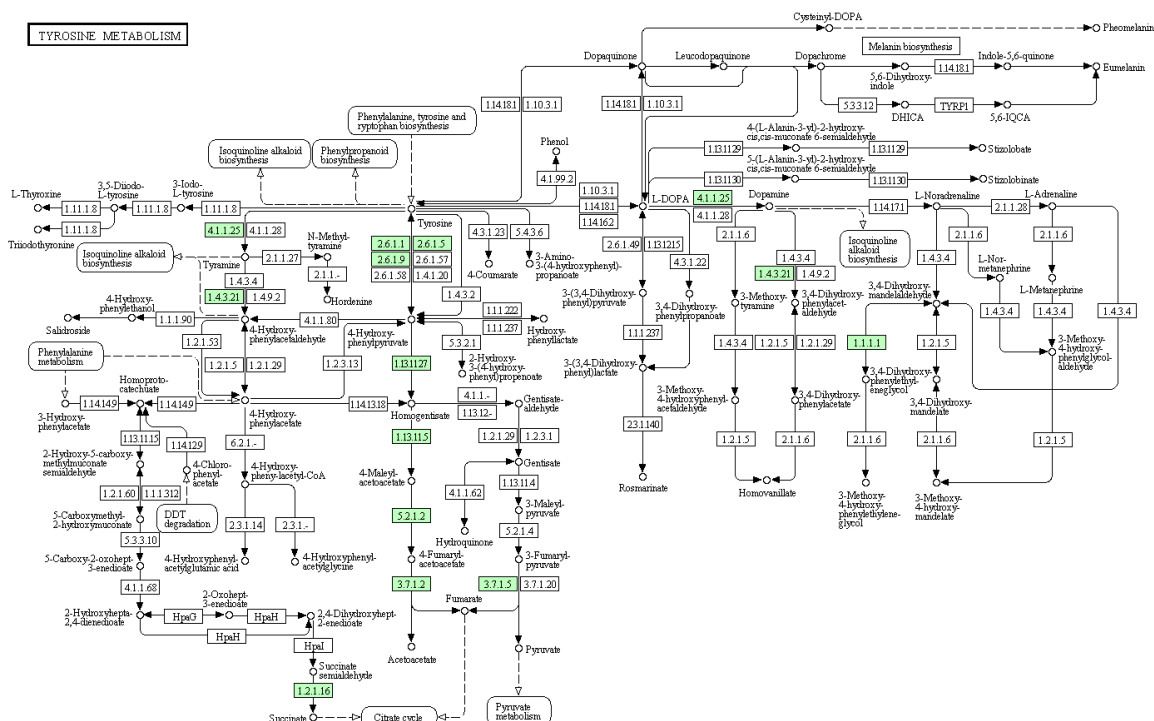


LYSINE DEGRADATION



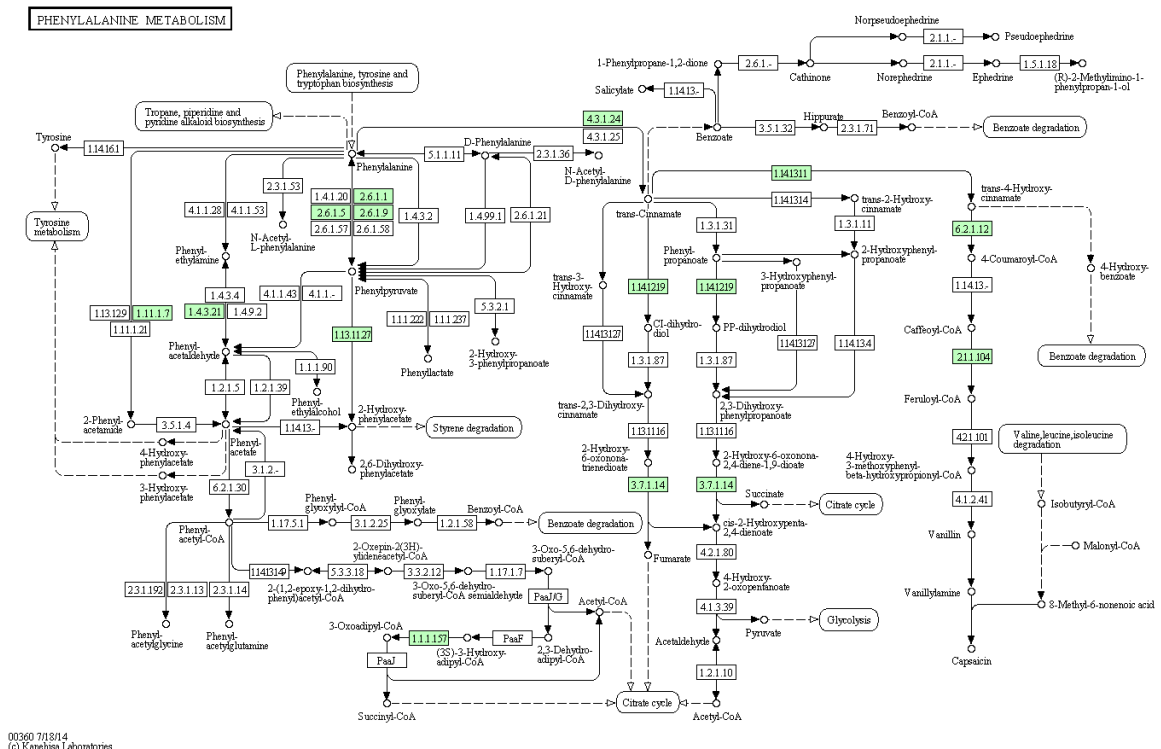


TYROSINE METABOLISM



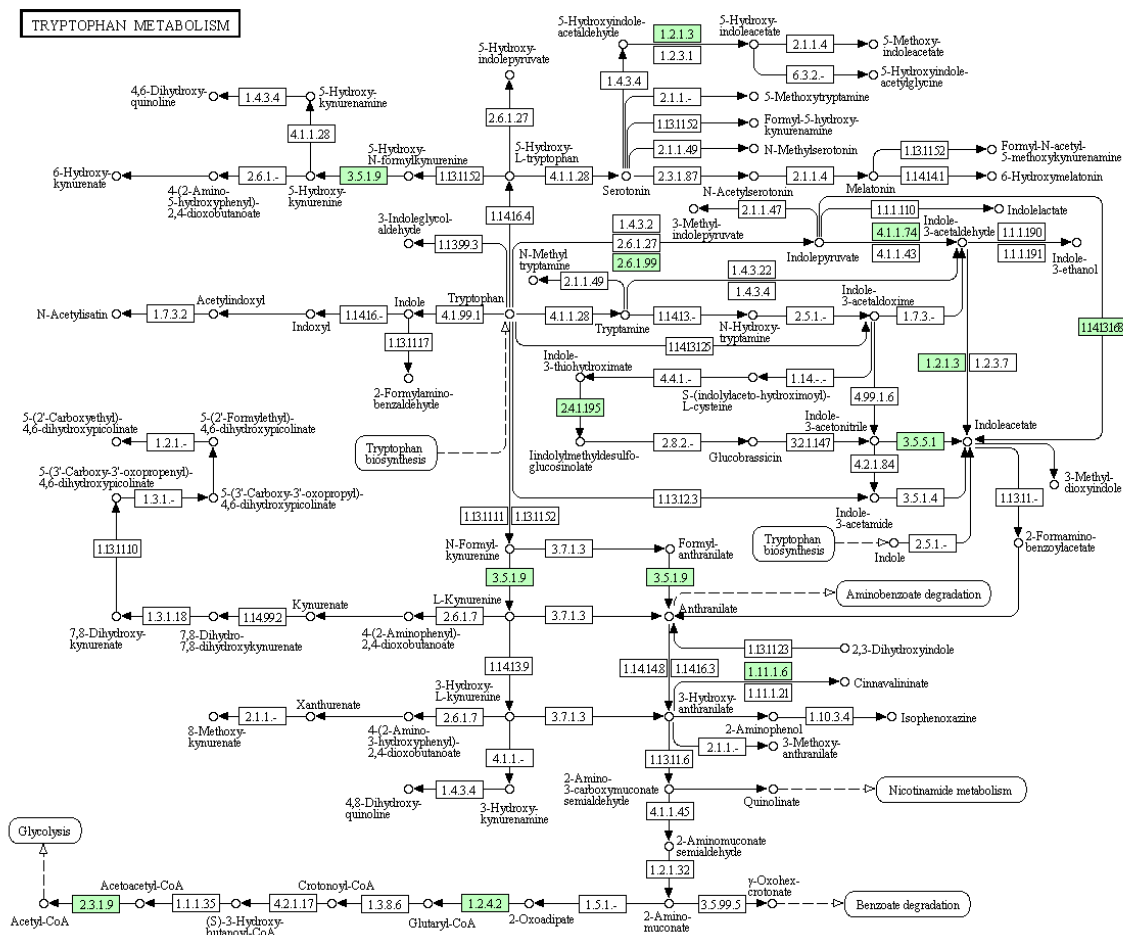
00330 7/22/14
(c) Kanehisa Laboratories

PHENYLALANINE METABOLISM

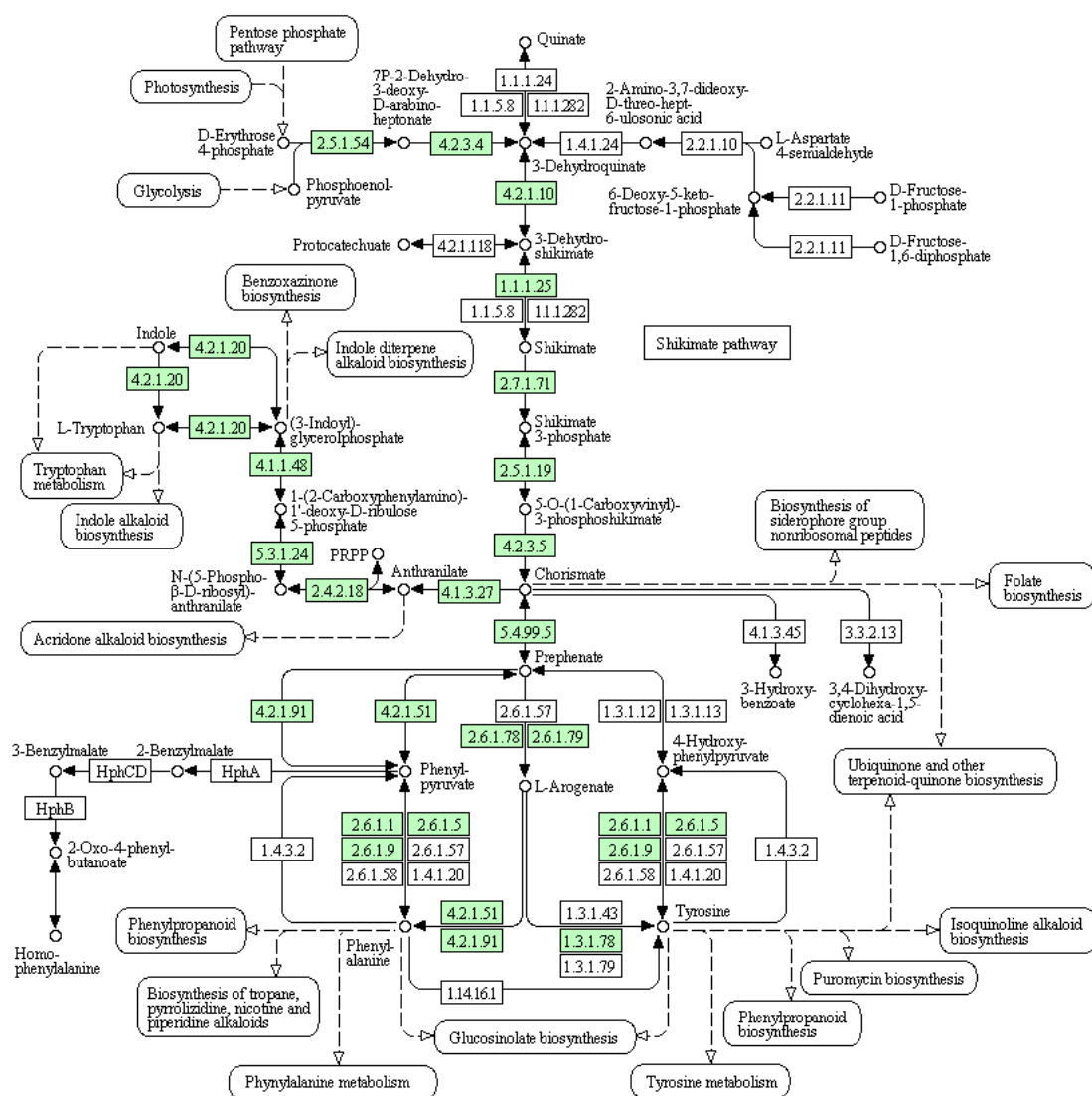


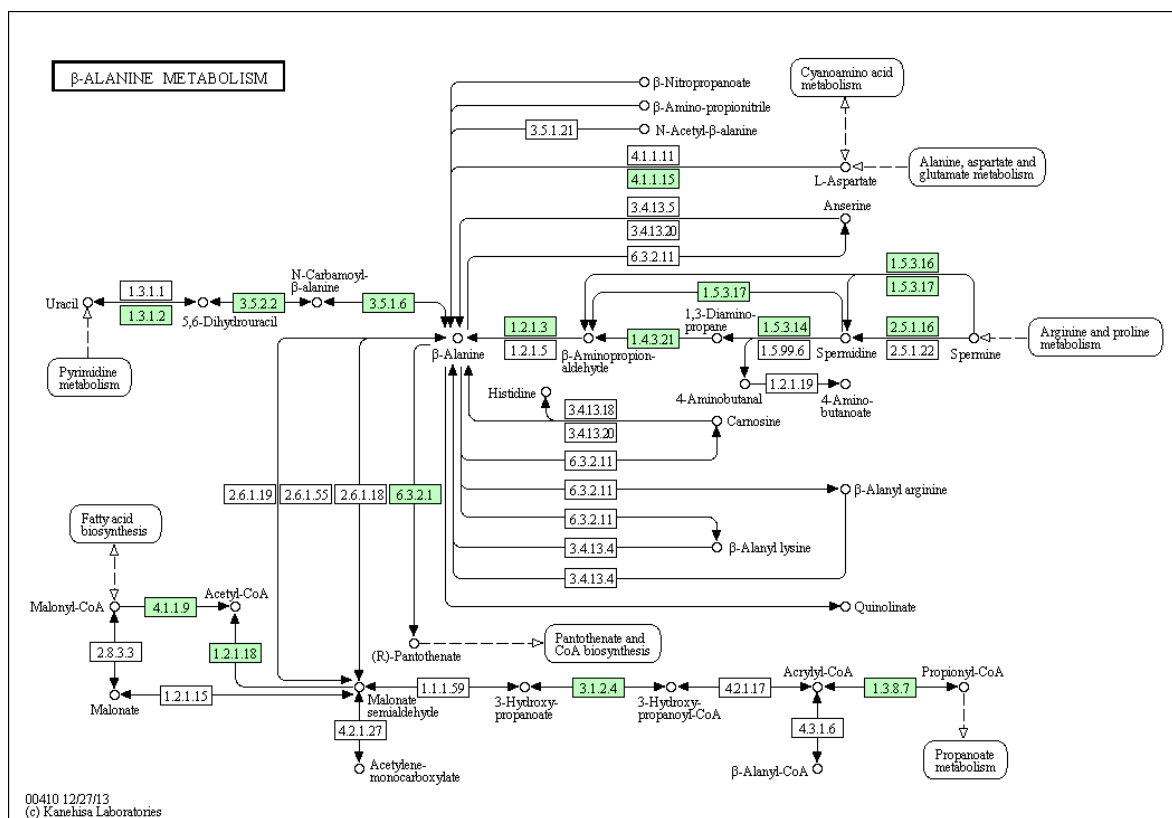
00360 7/18/14
(c) Kanehisa Laboratories

TRYPTOPHAN METABOLISM

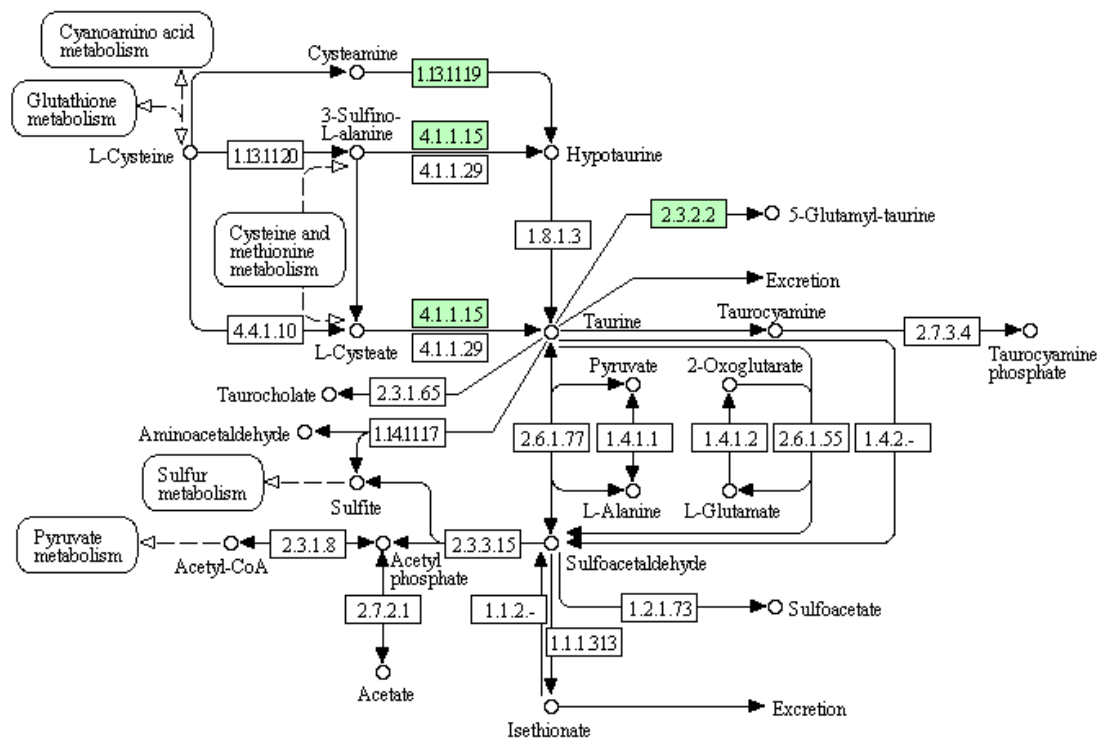


PHENYLALANINE, TYROSINE AND TRYPTOPHAN BIOSYNTHESIS



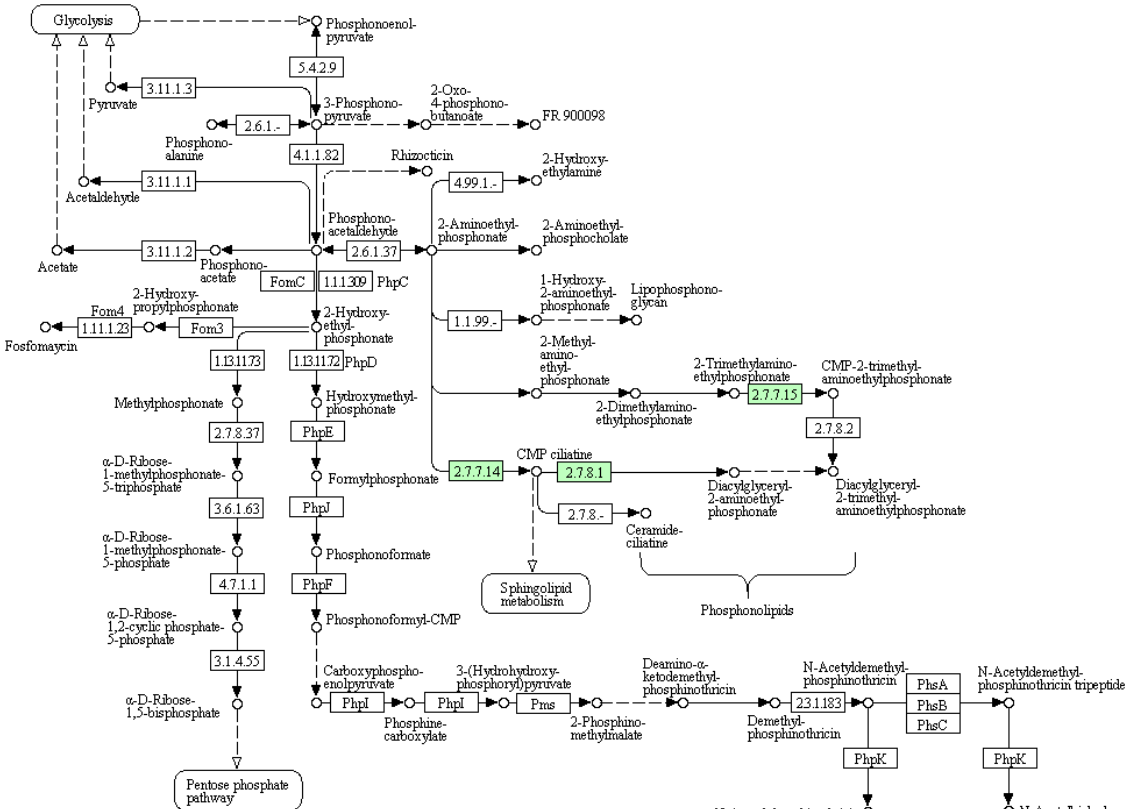


TAURINE AND HYPOTAURINE METABOLISM



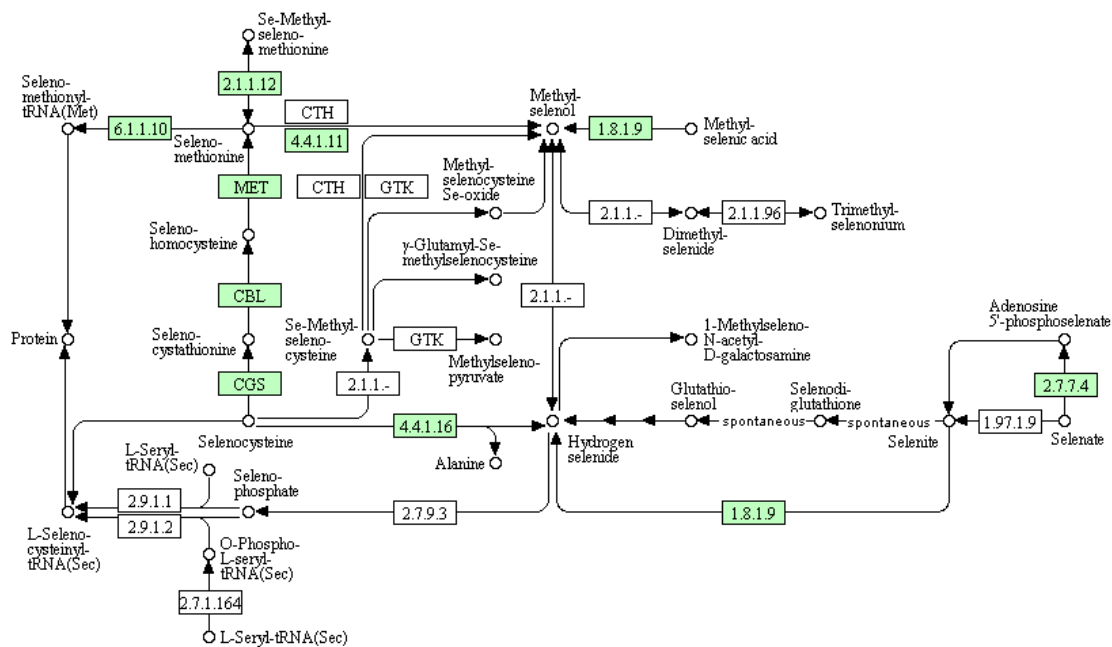
00430 7/29/11
(c) Kanehisa Laboratories

PHOSPHONATE AND PHOSPHINATE METABOLISM

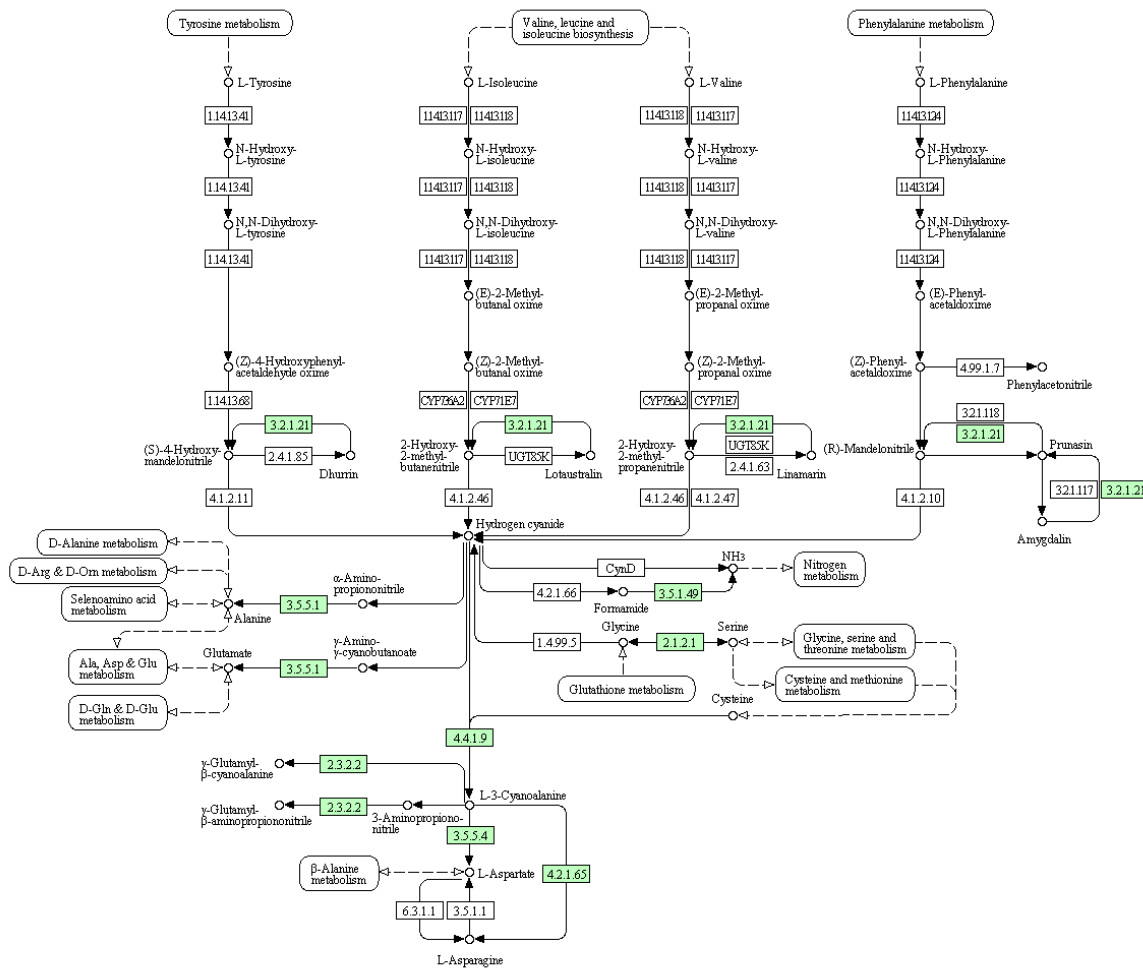


00440 8/4/14
(c) Kanehisa Laboratories

SELENOCOMPOUND METABOLISM

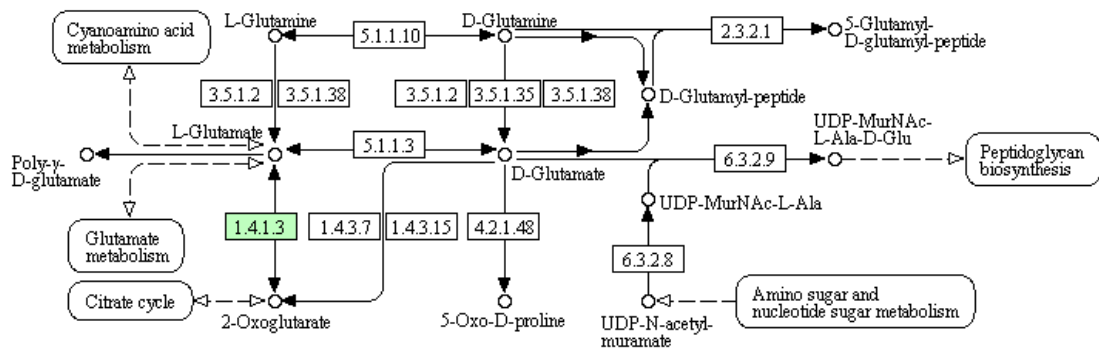


CYANOAMINO ACID METABOLISM



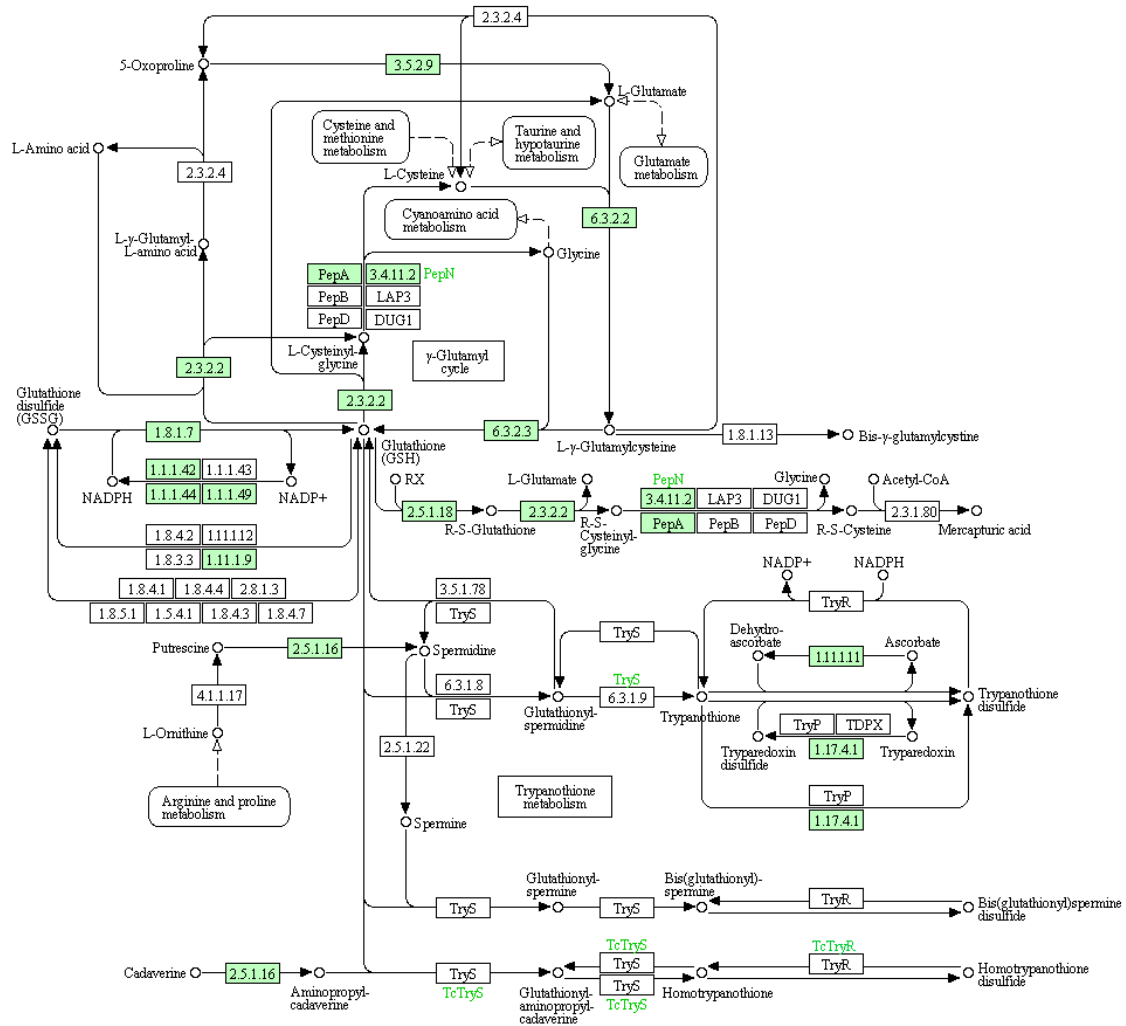
00460 5/23/14
(c) Kanehisa Laboratories

D-GLUTAMINE AND D-GLUTAMATE METABOLISM

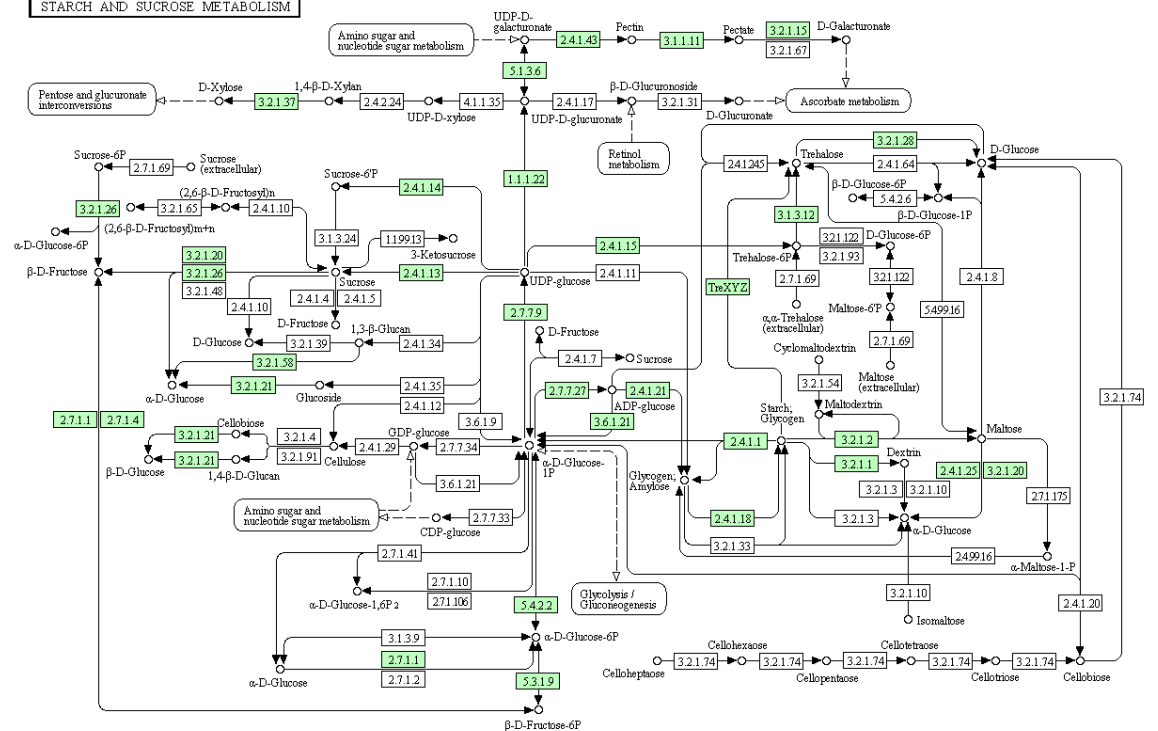


00471 3/14/11
(c) Kanehisa Laboratories

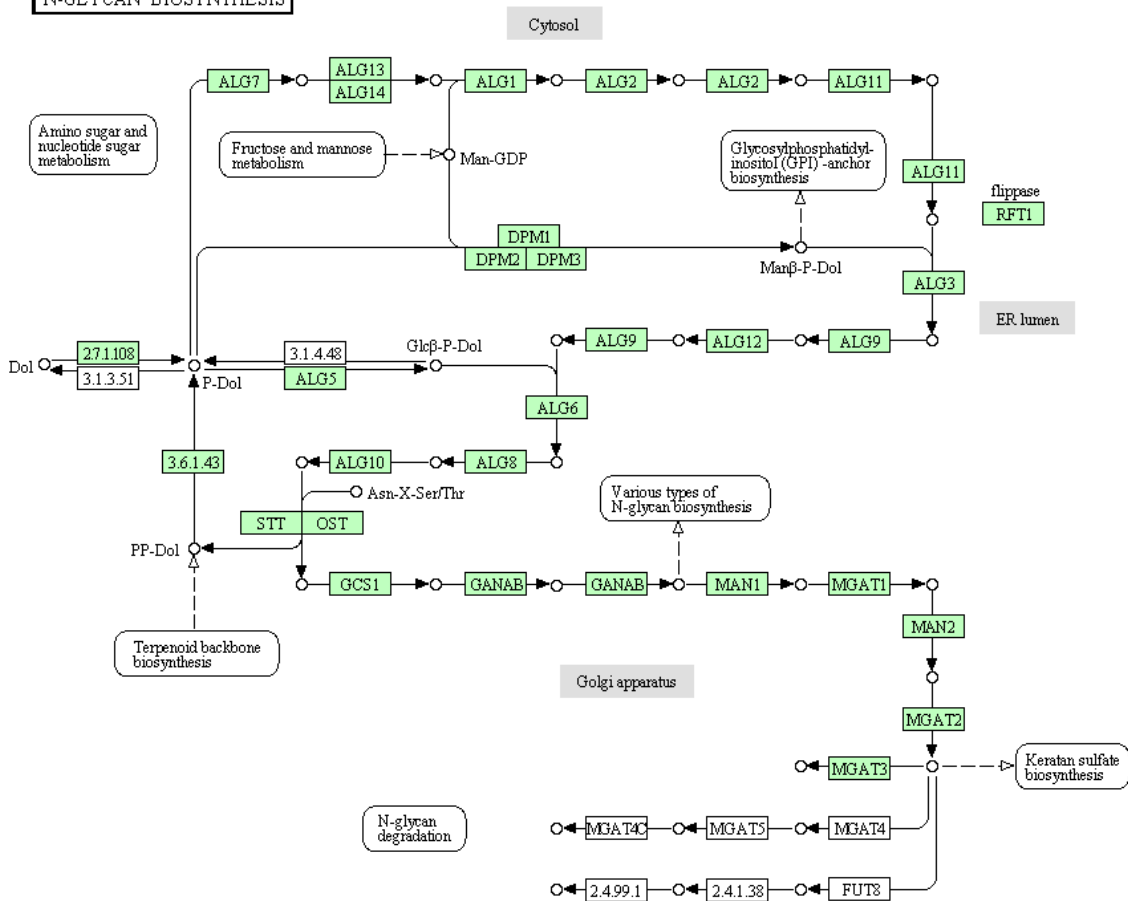
GLUTATHIONE METABOLISM



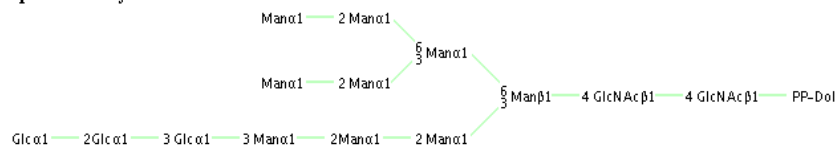
STARCH AND SUCROSE METABOLISM



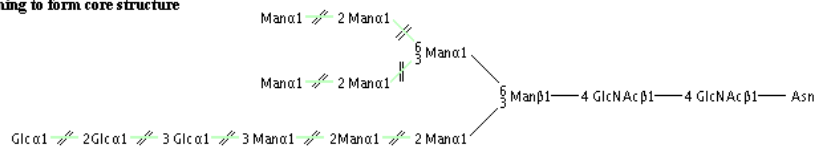
N-GLYCAN BIOSYNTHESIS



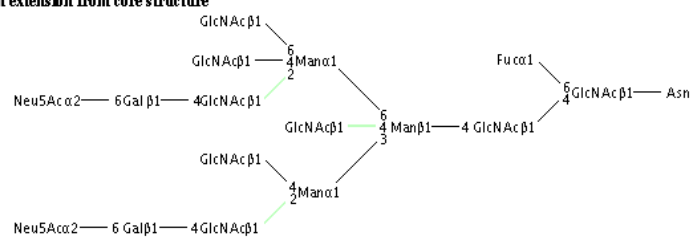
N-glycan precursor biosynthesis



Trimming to form core structure



Glycan extension from core structure



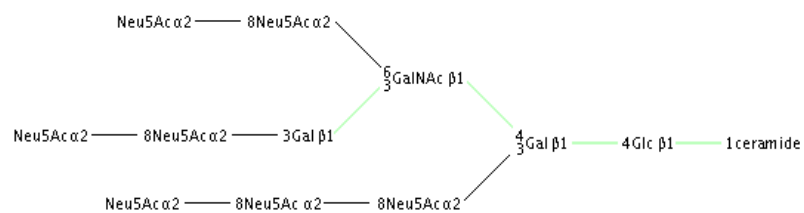
OTHER GLYCAN DEGRADATION

N-glycan



N-Glycan biosynthesis

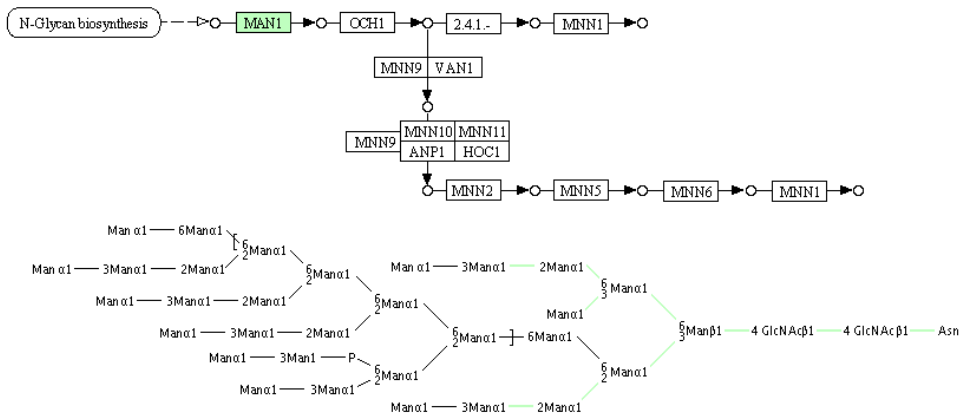
Ganglioside



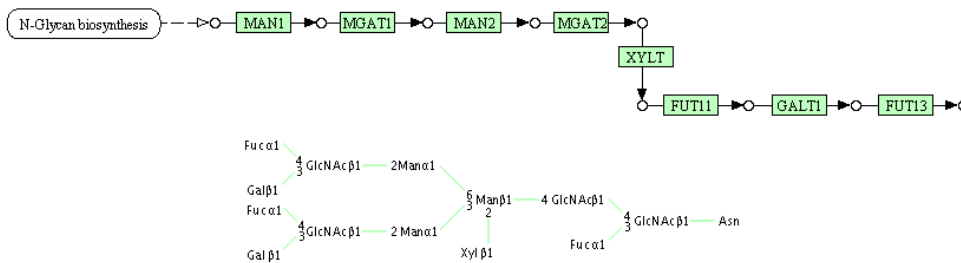
Glycosphingolipid biosynthesis
- ganglio series

VARIOUS TYPES OF N-GLYCAN BIOSYNTHESIS

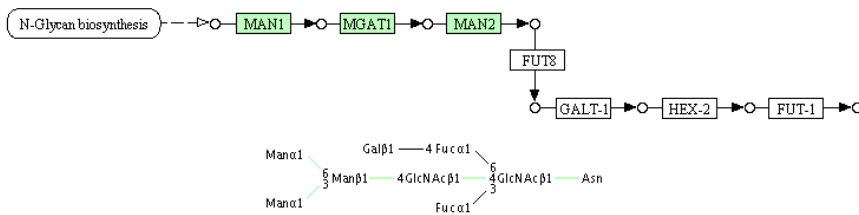
High-mannose type (Yeast)



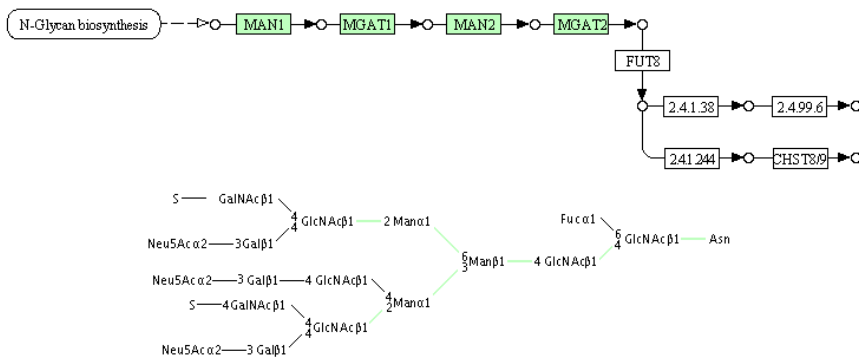
Complex type (Plant)



Paucimannose type (Nematode)

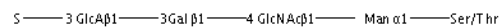
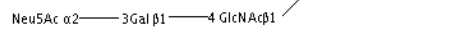
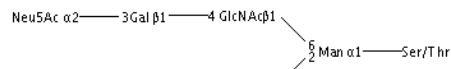
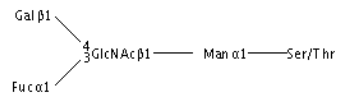
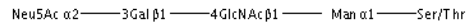


Glycophorin

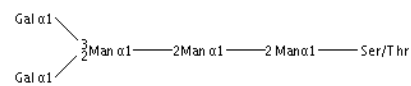
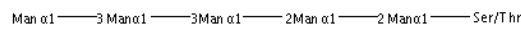


OTHER TYPES OF O-GLYCAN BIOSYNTHESIS

O-linked Man type (Mammal)



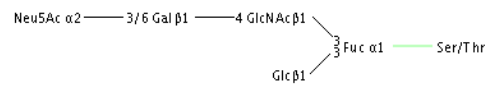
O-linked Man type (Yeast)



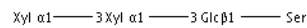
O-linked GlcNAc type



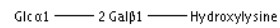
O-linked Fuc type



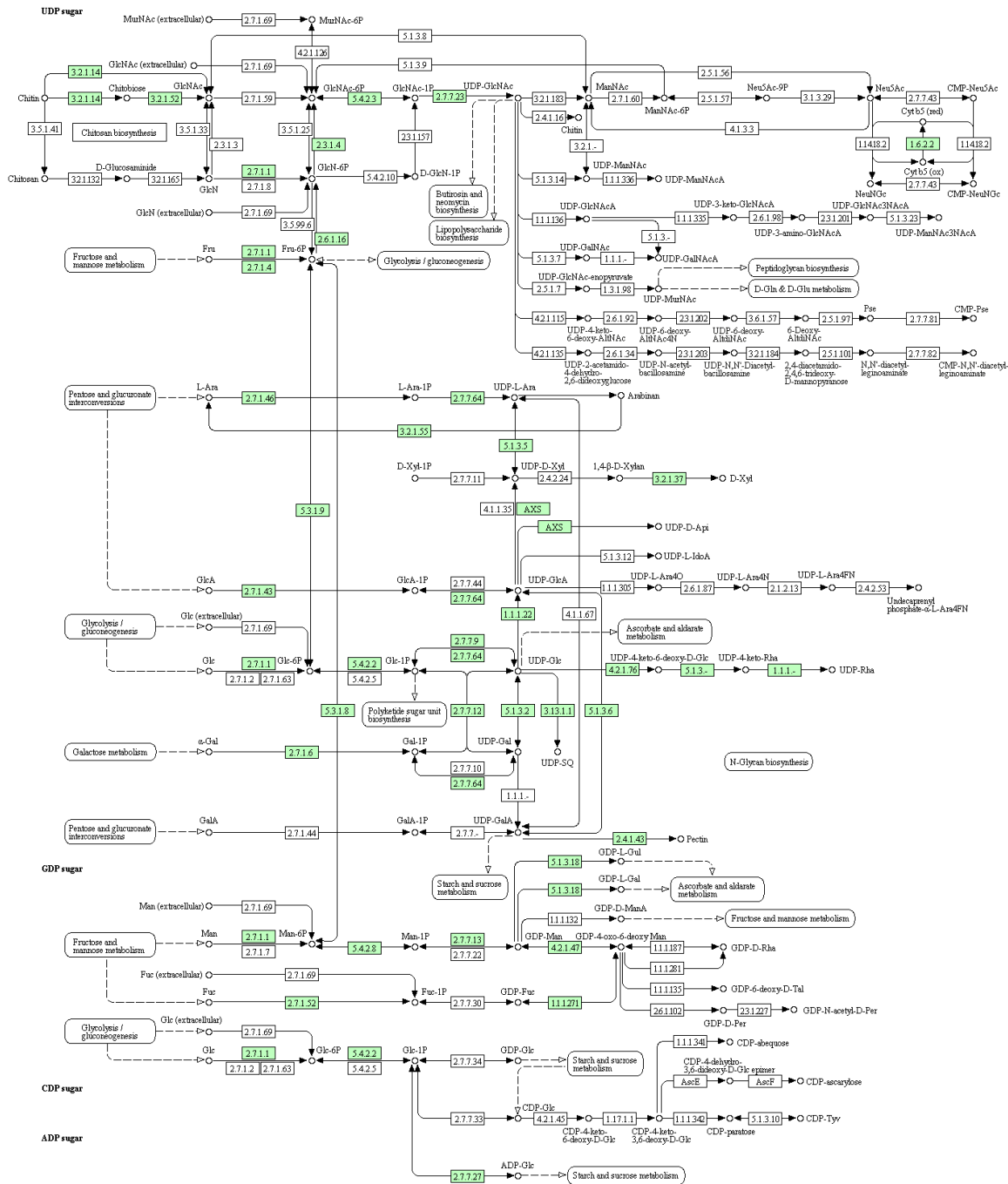
O-linked Glc type



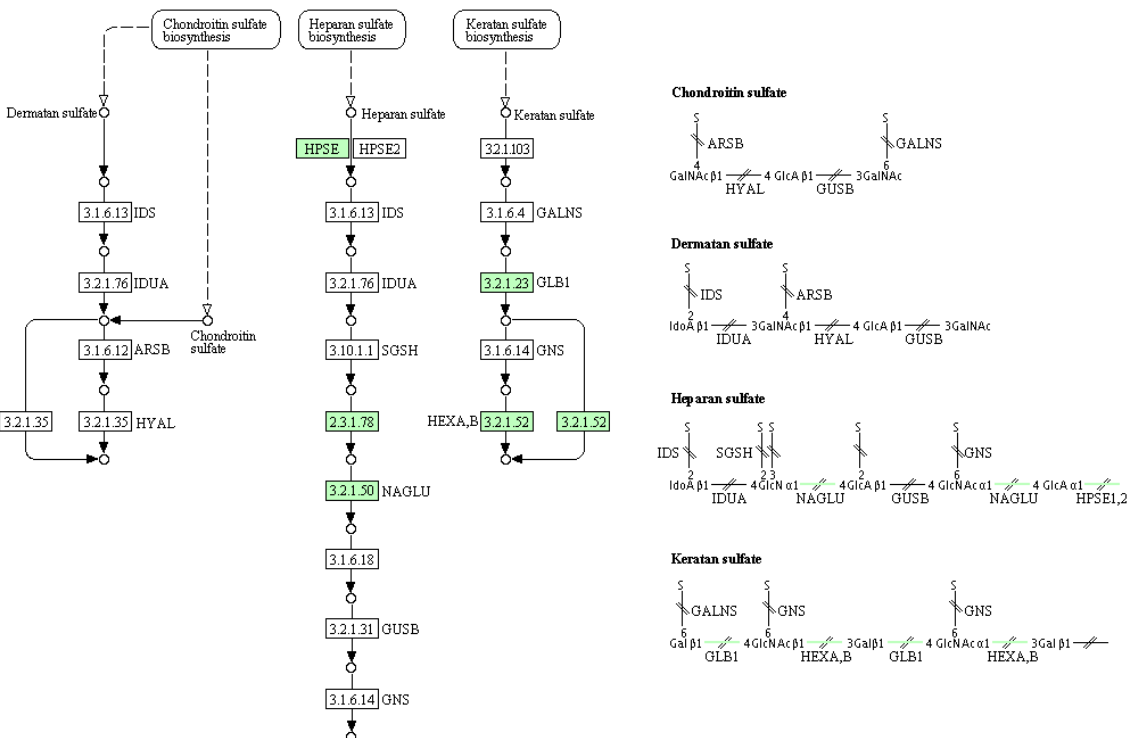
O-linked Gal type



AMINO SUGAR AND NUCLEOTIDE SUGAR METABOLISM

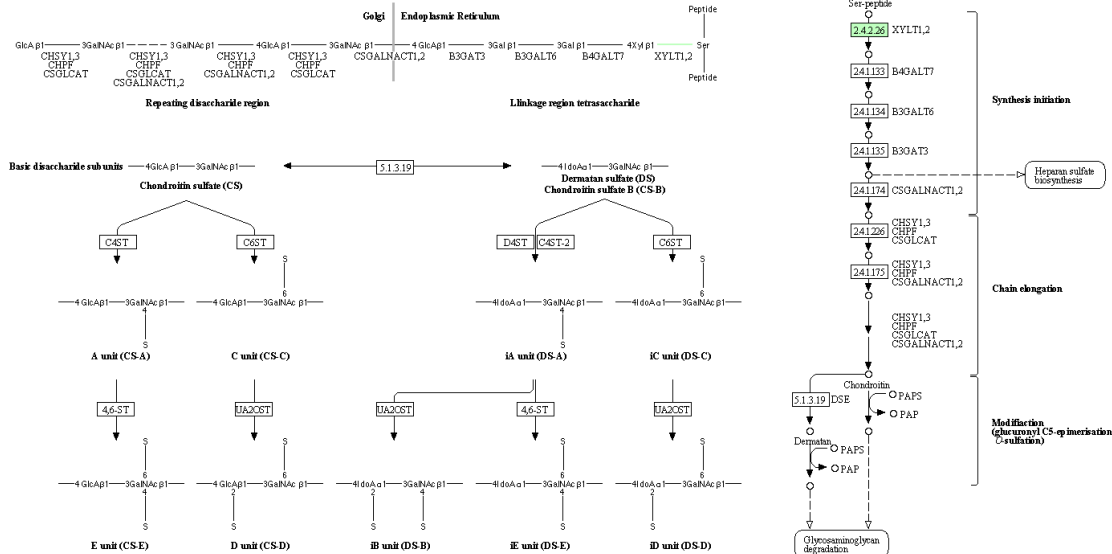


GLYCOSAMINOGLYCAN DEGRADATION



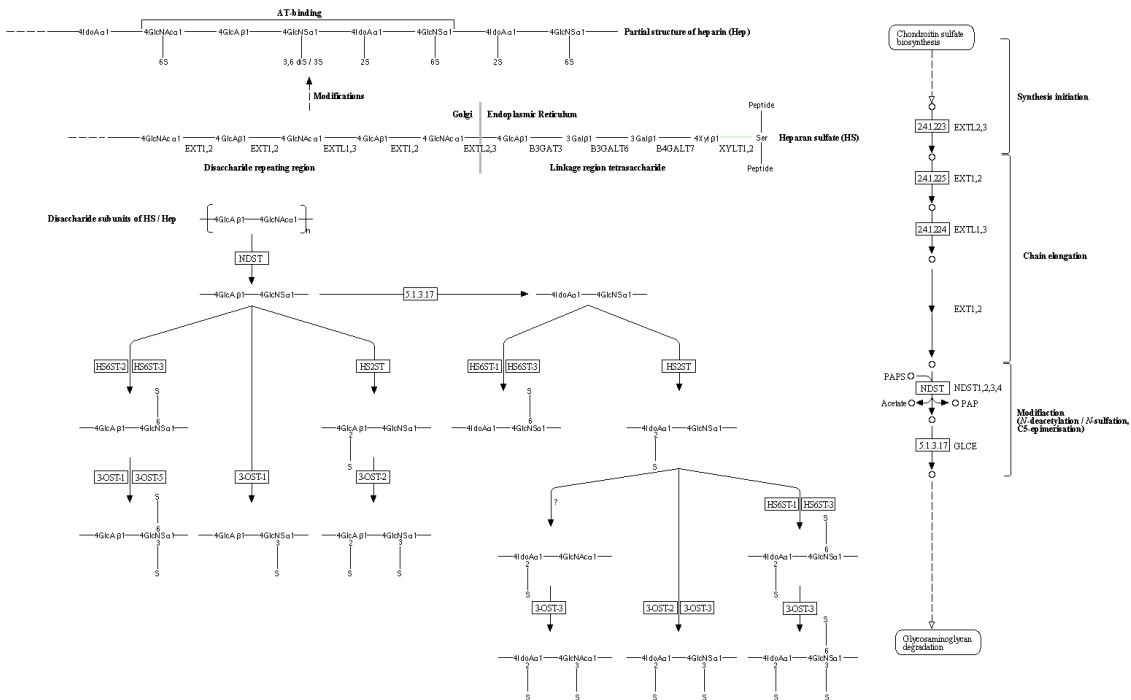
00531 6/6/12
(c) Kanehisa Laboratories

GLYCOSAMINOGLYCAN BIOSYNTHESIS - CHONDROITIN SULFATE / DERMATAN SULFATE

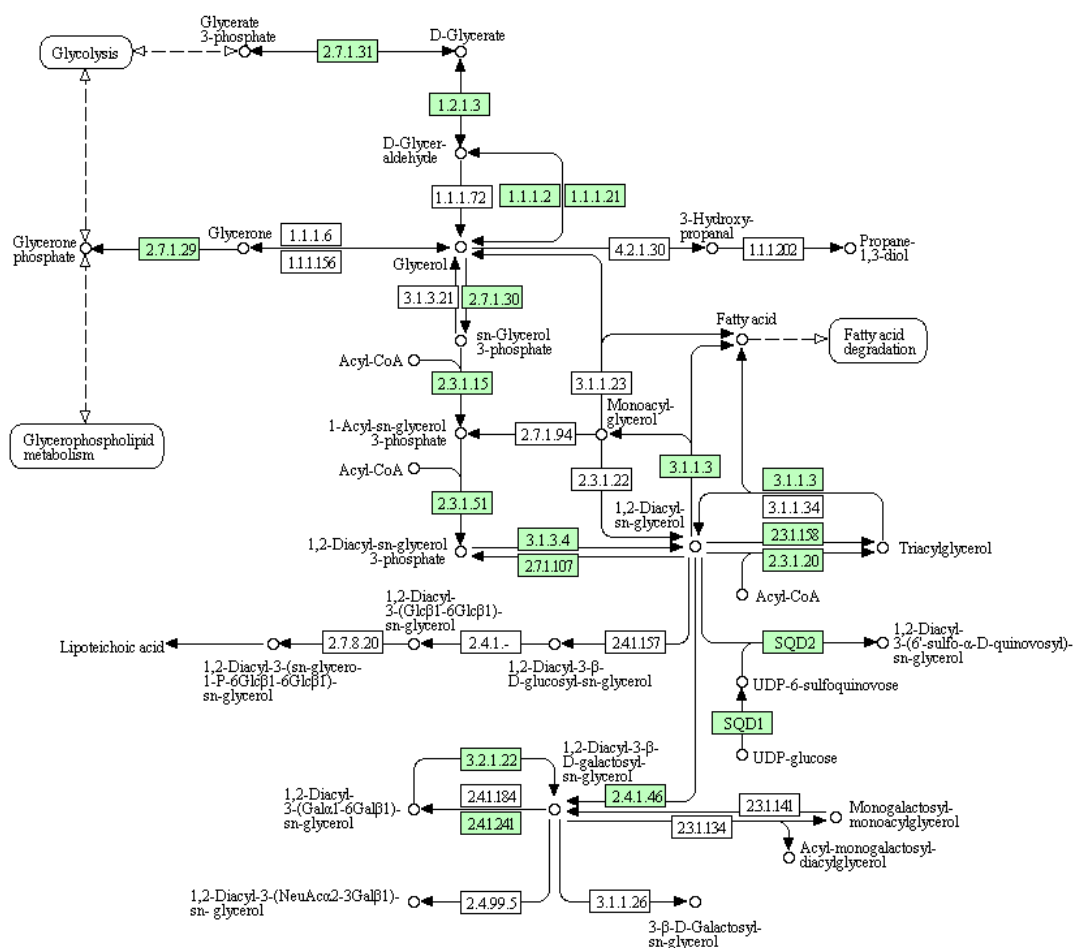


00532 1/8/13
(c) Kanehisa Laboratories

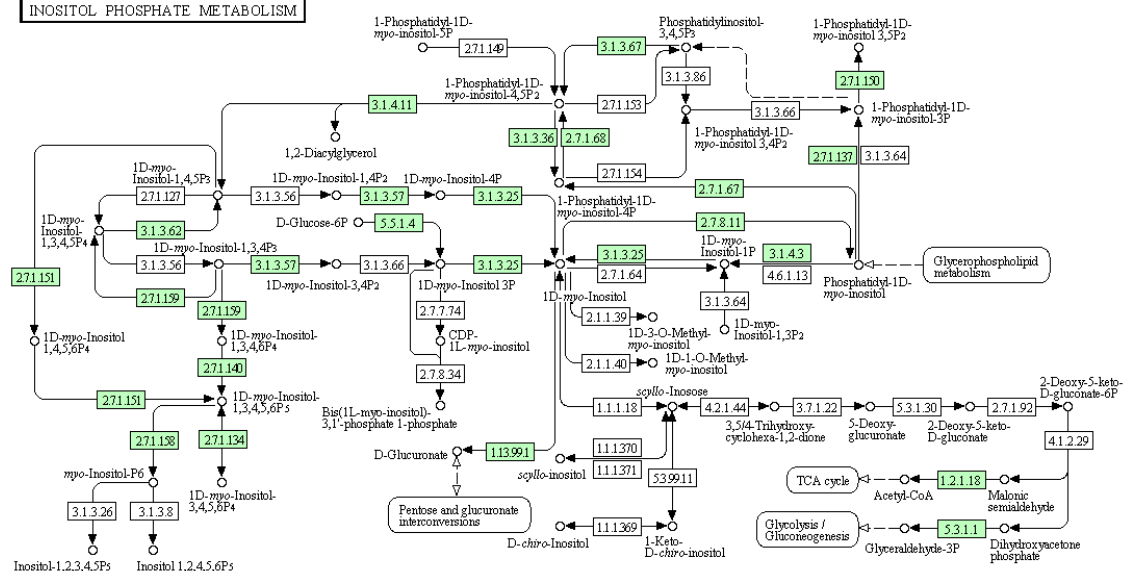
-----4IdoAα1-----4GlcNAcα1-----4Glcβ1-----4GlcNSα1-----4IdoAα1-----4GlcNSα1-----4IdoAα1-----4GlcNSα1----- Partial structure of heparin (Hep)



GLYCEROLIPID METABOLISM

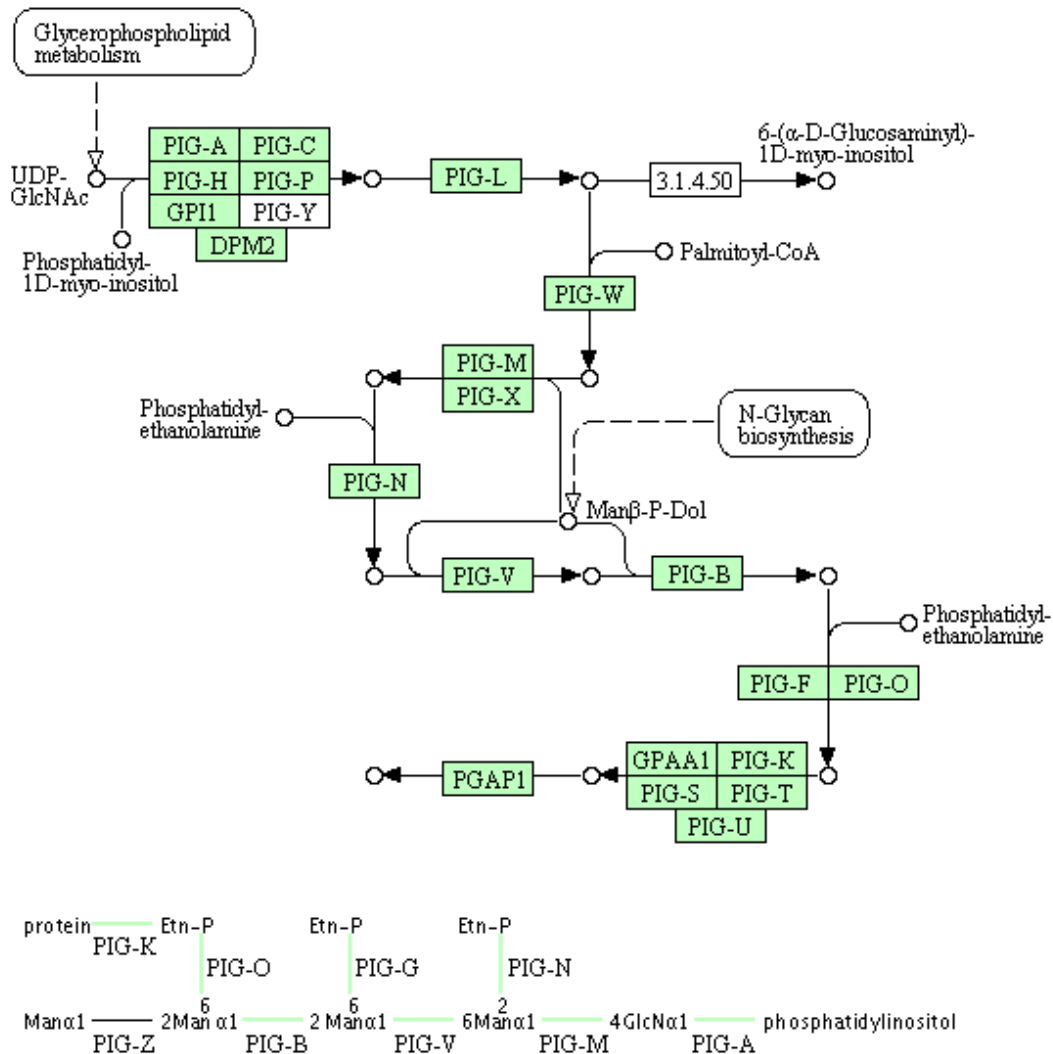


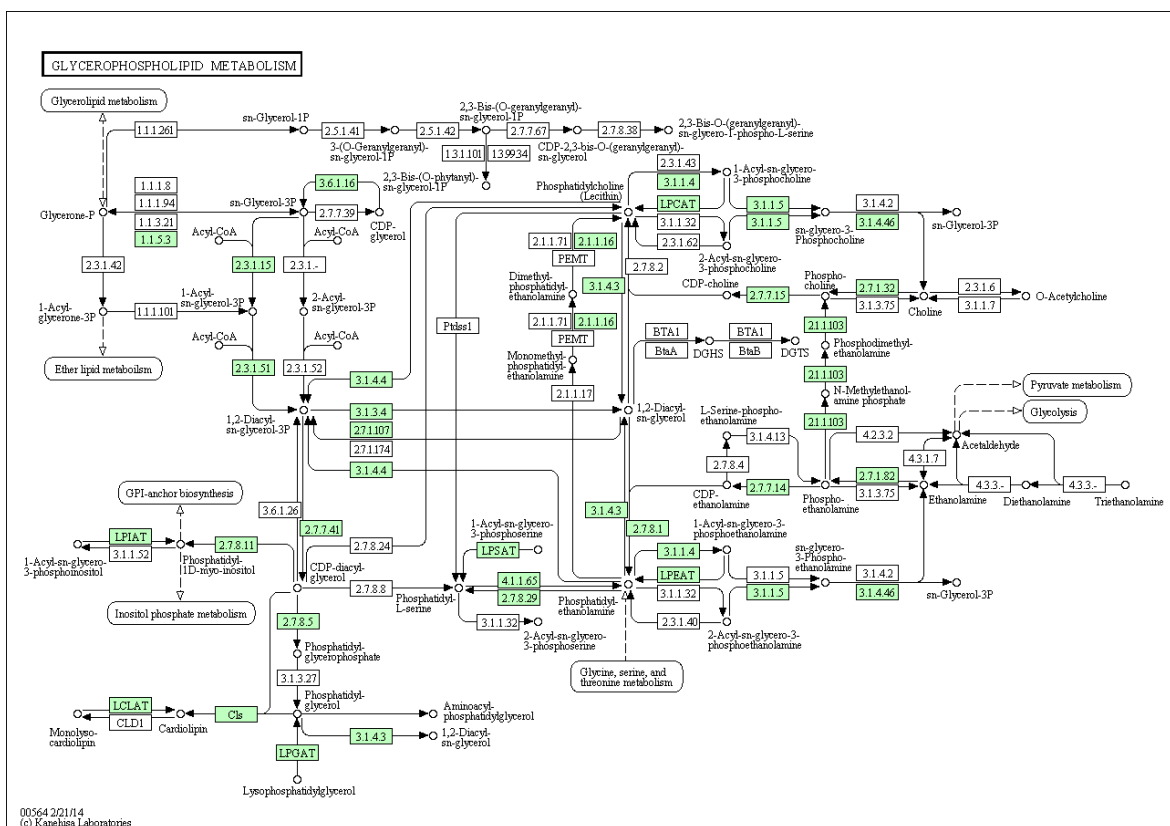
INOSITOL PHOSPHATE METABOLISM



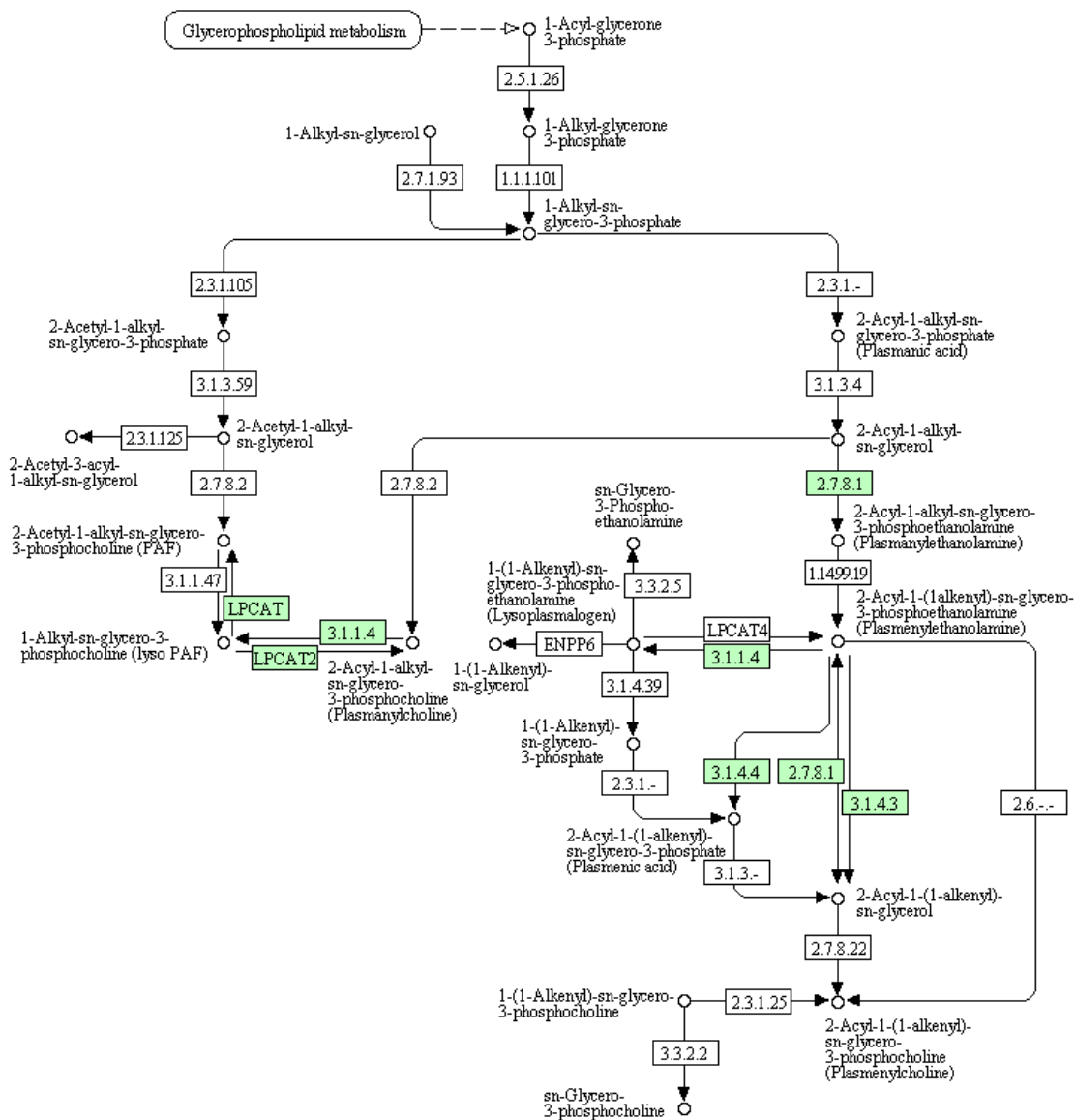
00562 4/10/14
(c) Kanehisa Laboratories

GLYCOSYLPHOSPHATIDYLINOSITOL (GPI) - ANCHOR BIOSYNTHESIS





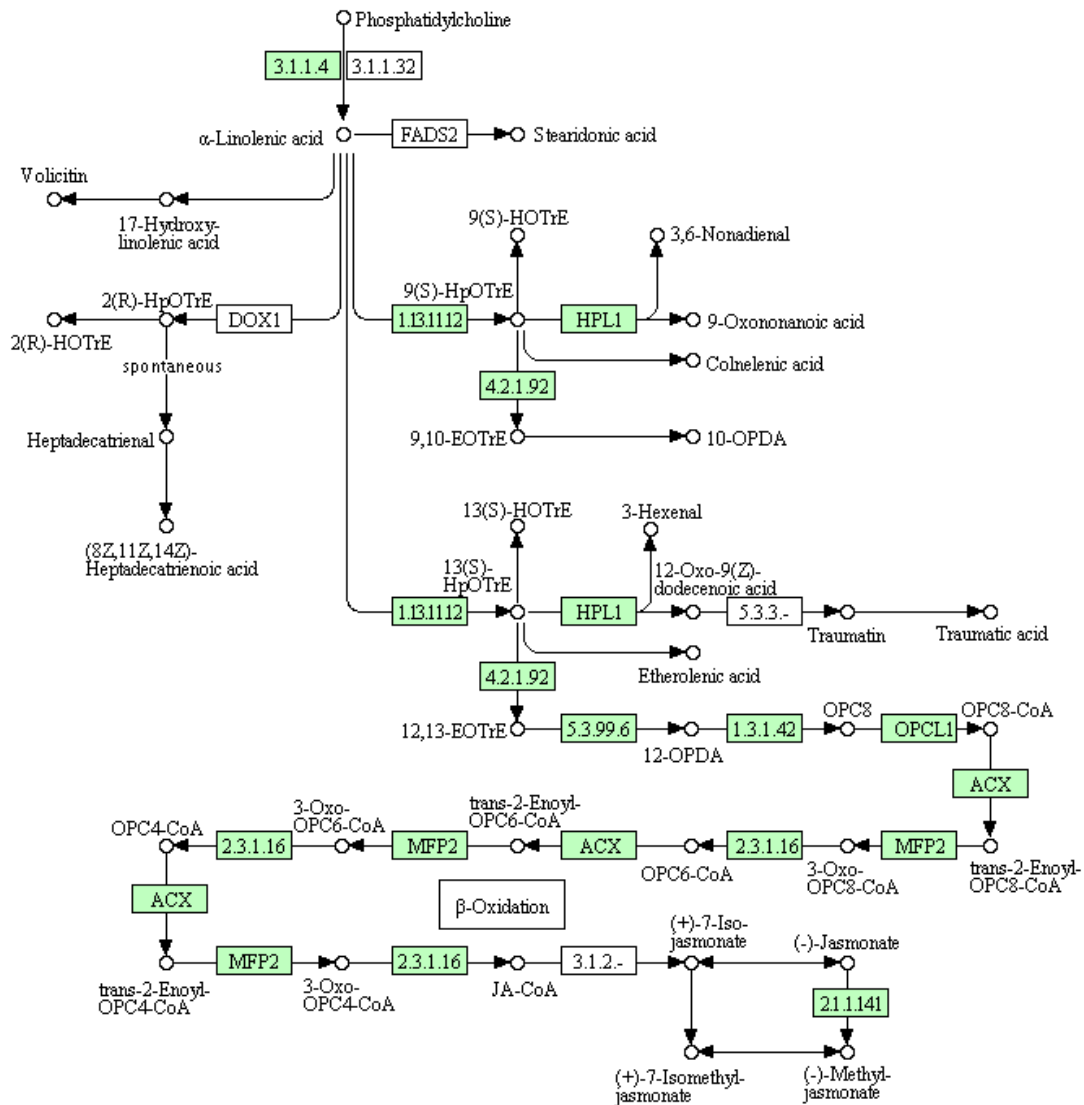
ETHER LIPID METABOLISM



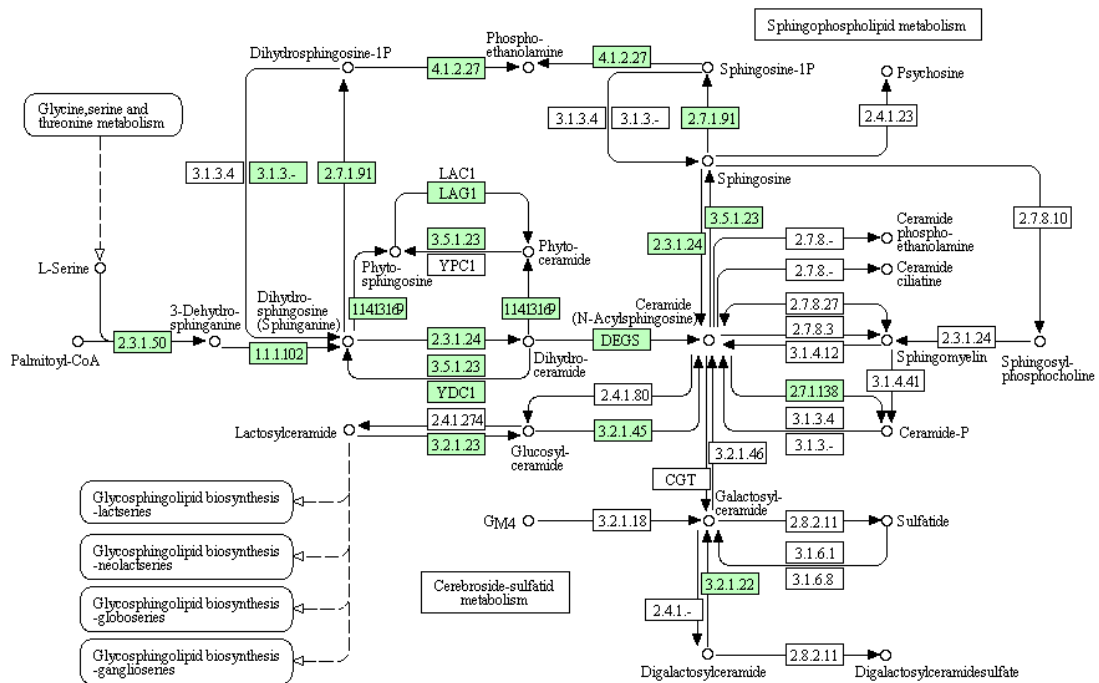
[illegible][illegible]

00591 12/25/13
(c) Kanehisa Laboratories

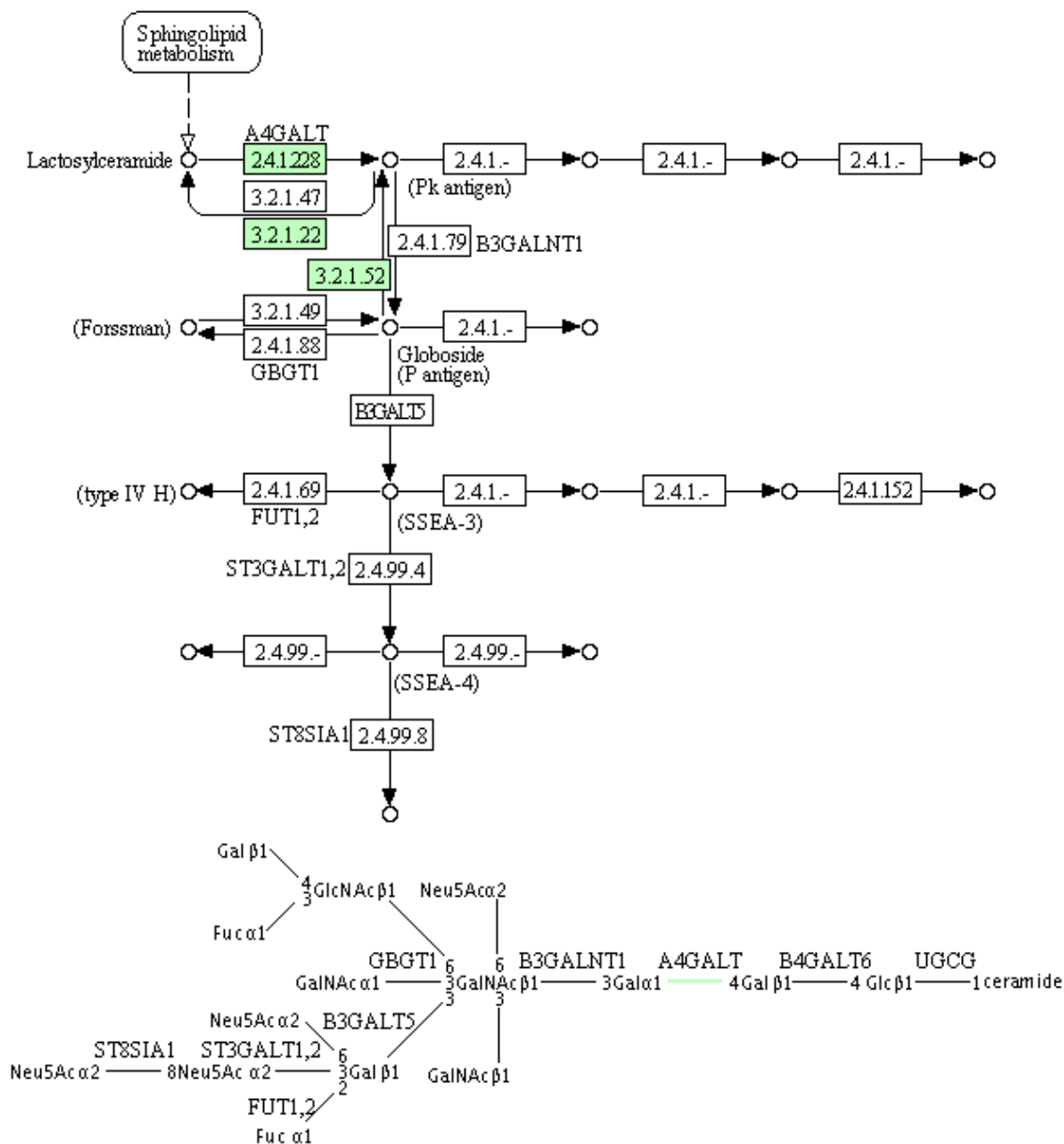
α-LINOLENIC ACID METABOLISM



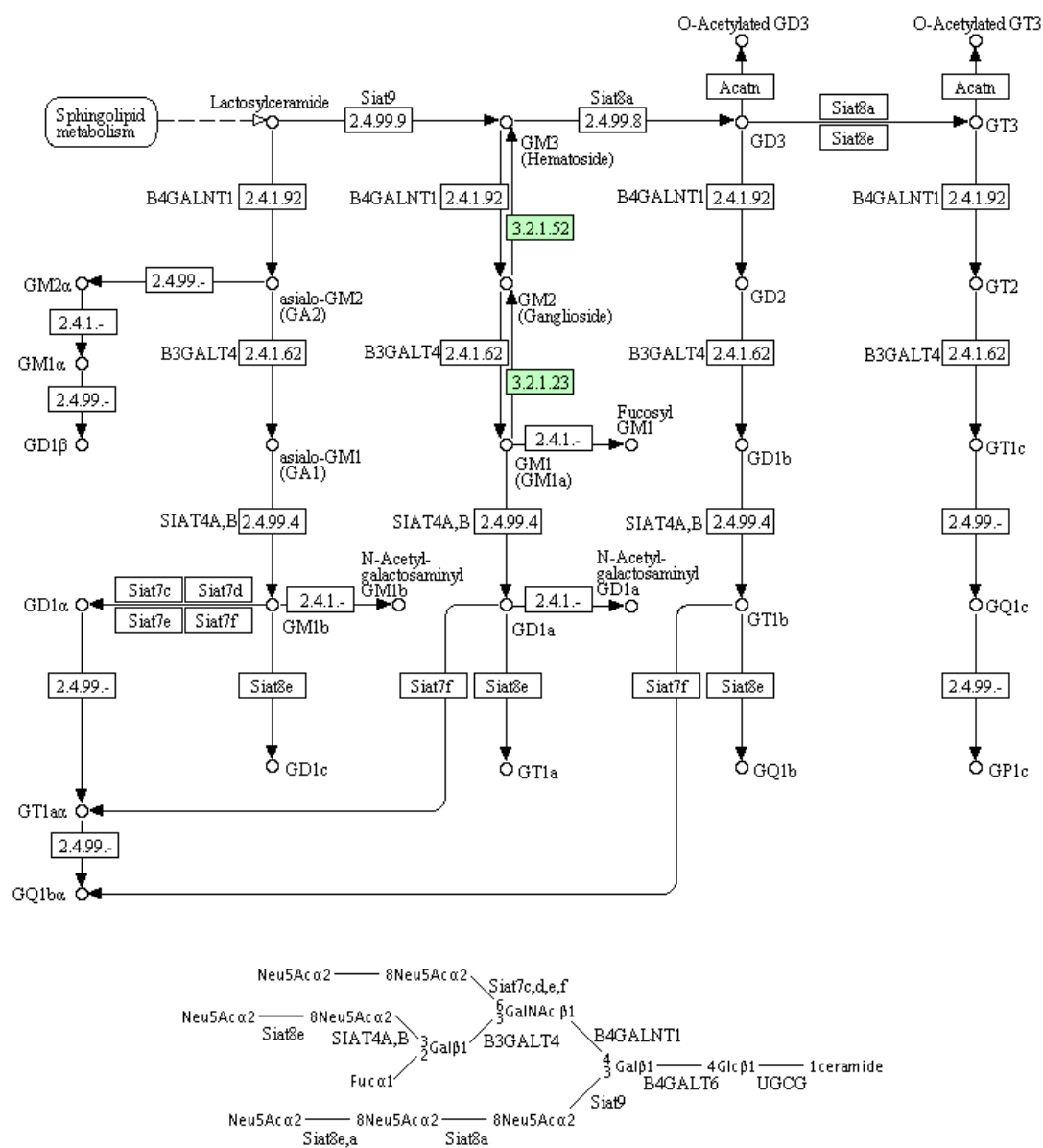
SPHINGOLIPID METABOLISM

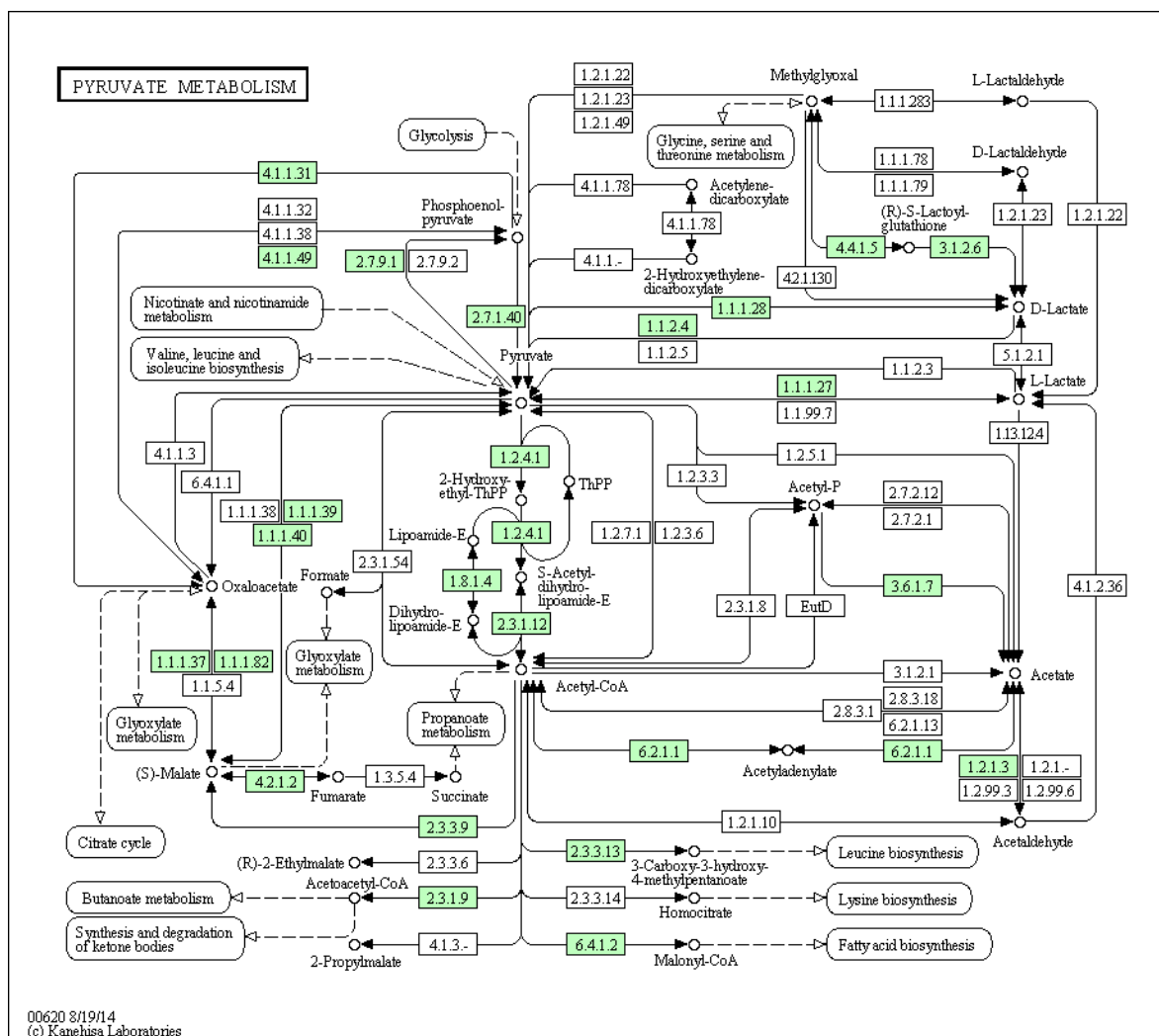


GLYCOSPHINGOLIPID BIOSYNTHESIS - GLOBOSERIES

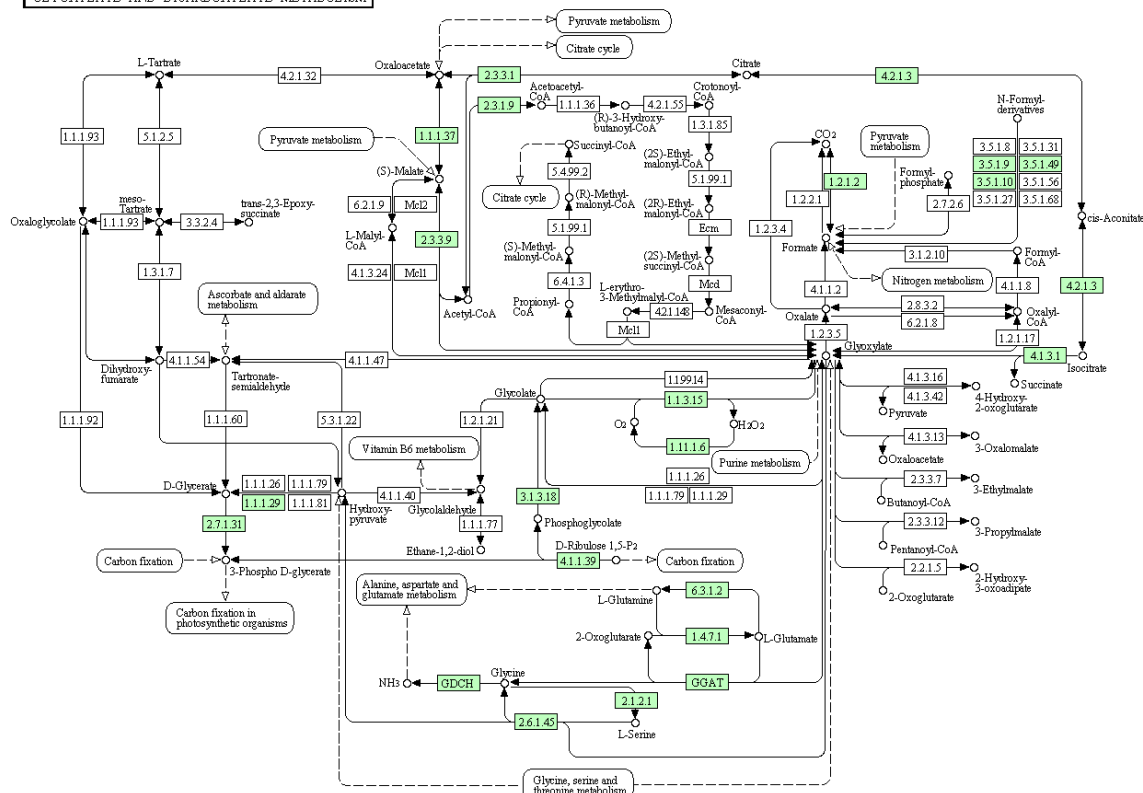


GLYCOSPHINGOLIPID BIOSYNTHESIS - GANGLIO SERIES



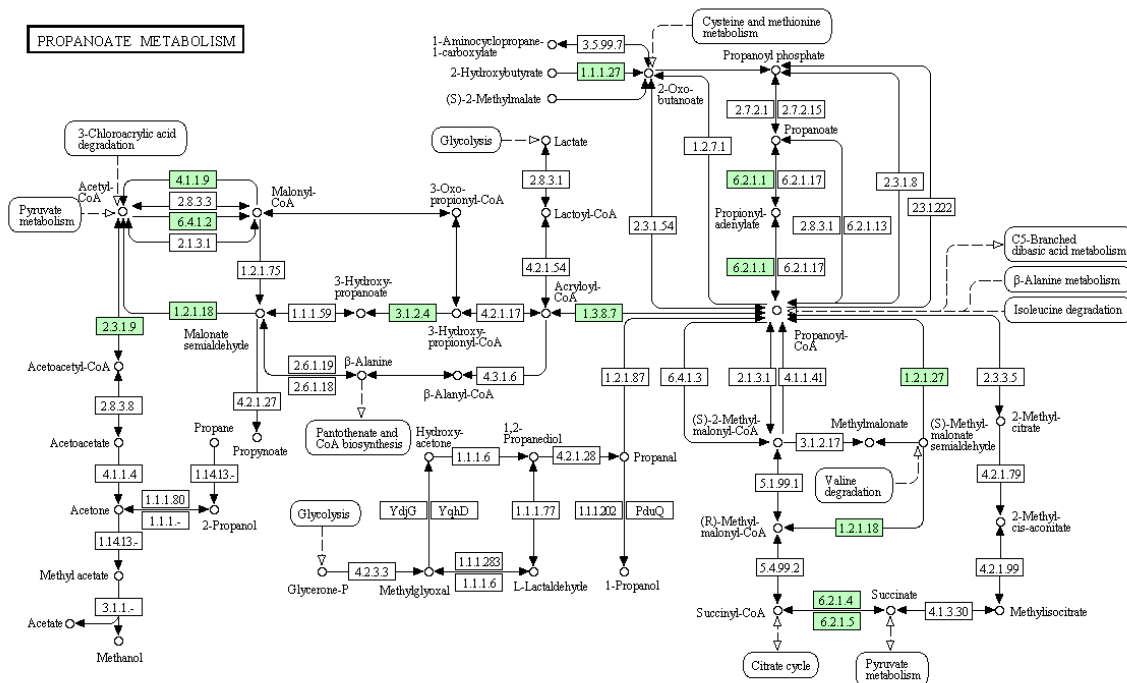


GLYOXYLATE AND DICARBOXYLATE METABOLISM



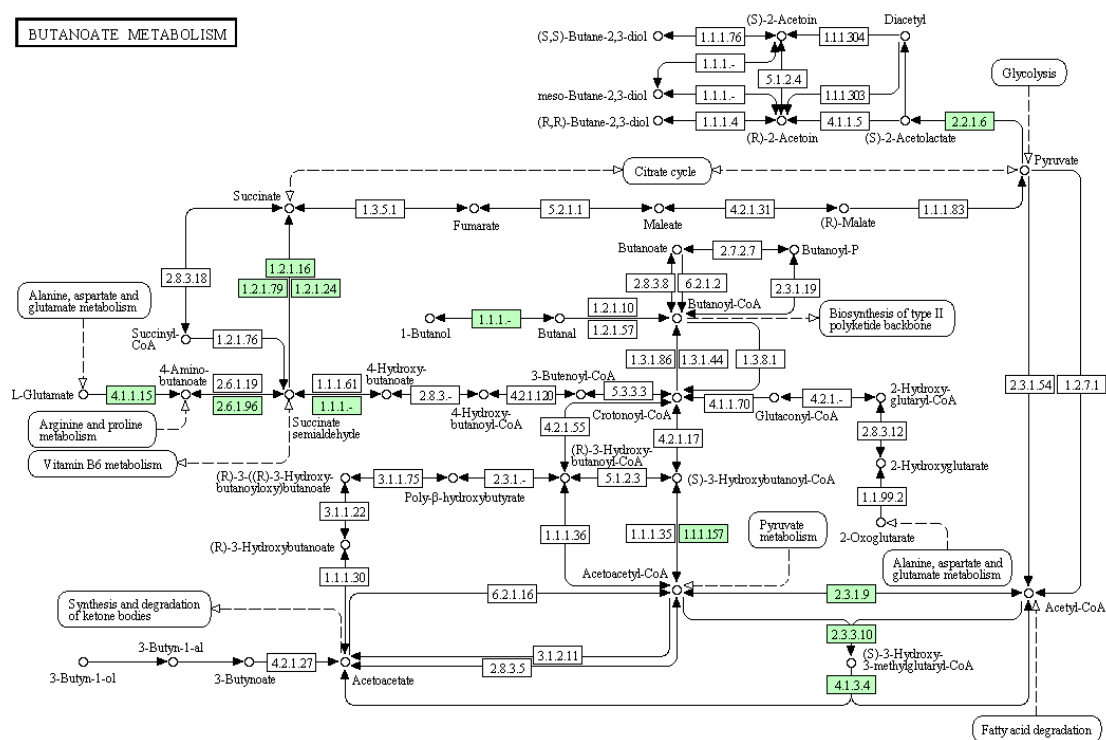
00630 6/3/14
(c) Kanehisa Laboratories

PROPANOATE METABOLISM

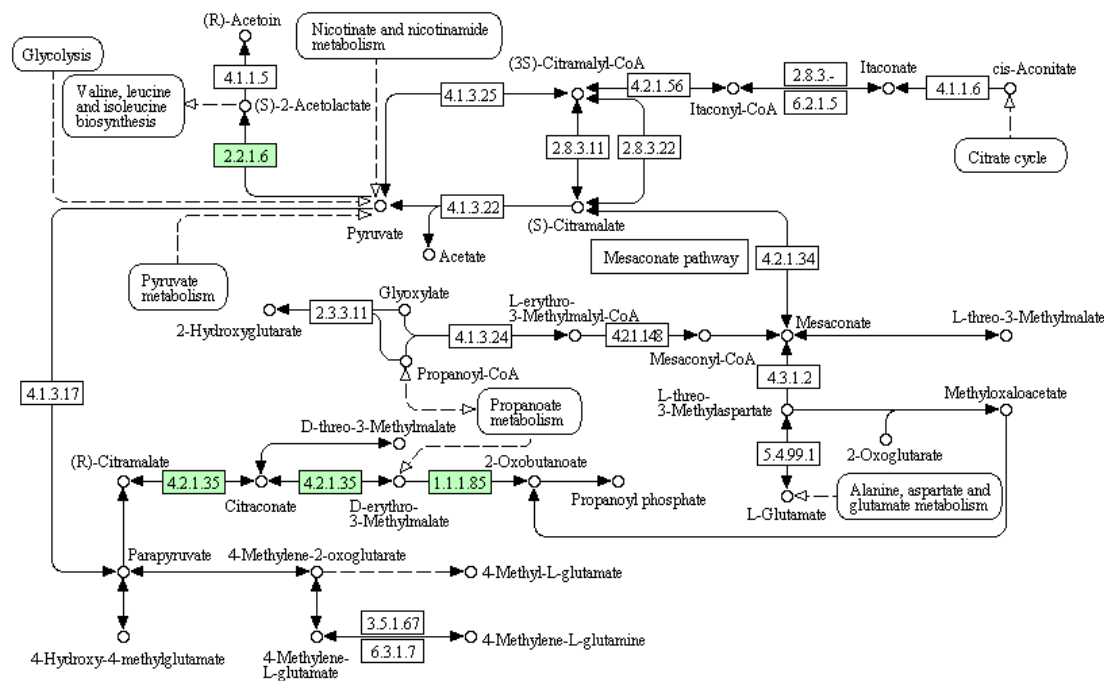


00640 8/21/14
(c) Kanehisa Laboratories

BUTANOATE METABOLISM

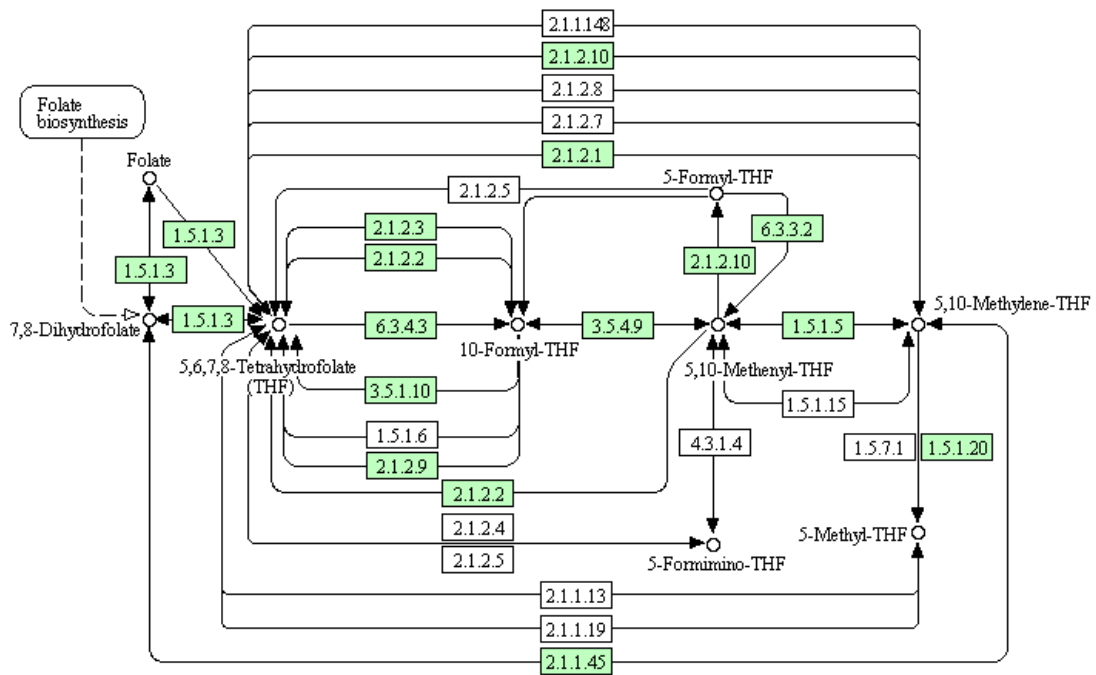


00650 6/24/14
(c) Kanehisa Laboratories

C₅-BRANCHED DIBASIC ACID METABOLISM

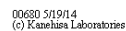
00660 6/2/14
(c) Kanehisa Laboratories

ONE CARBON POOL BY FOLATE

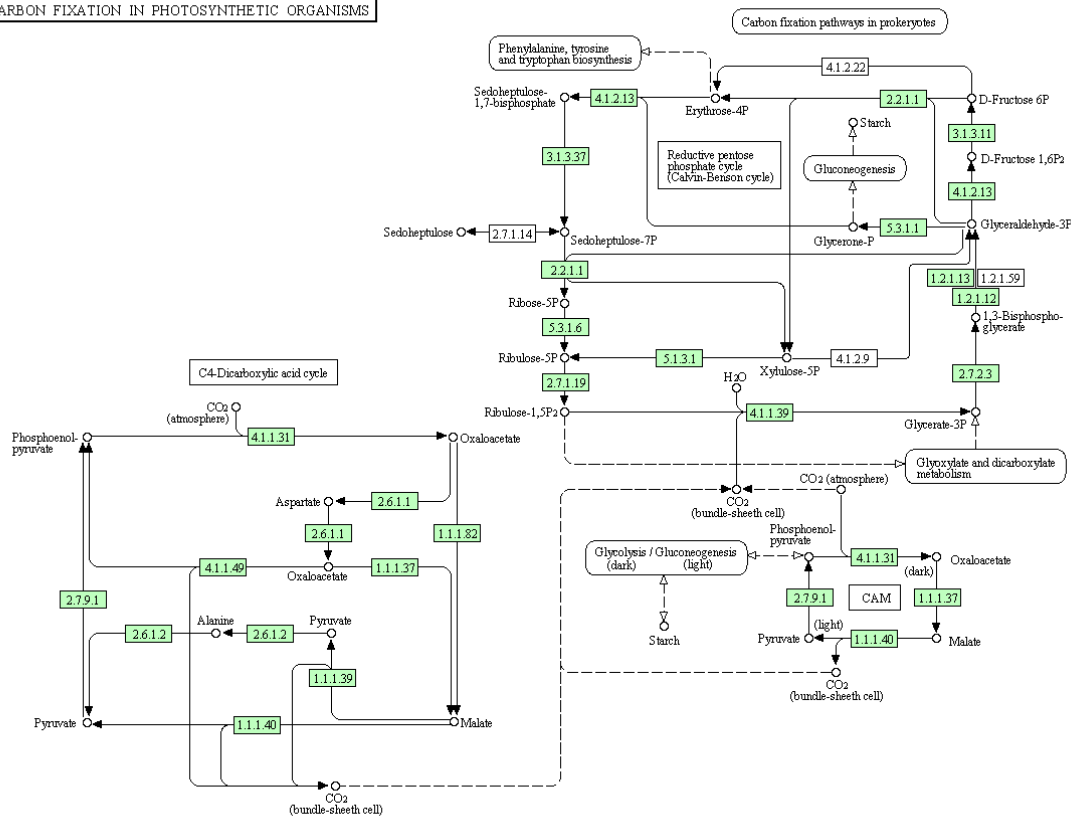


00670 9/13/11
(c) Kanehisa Laboratories

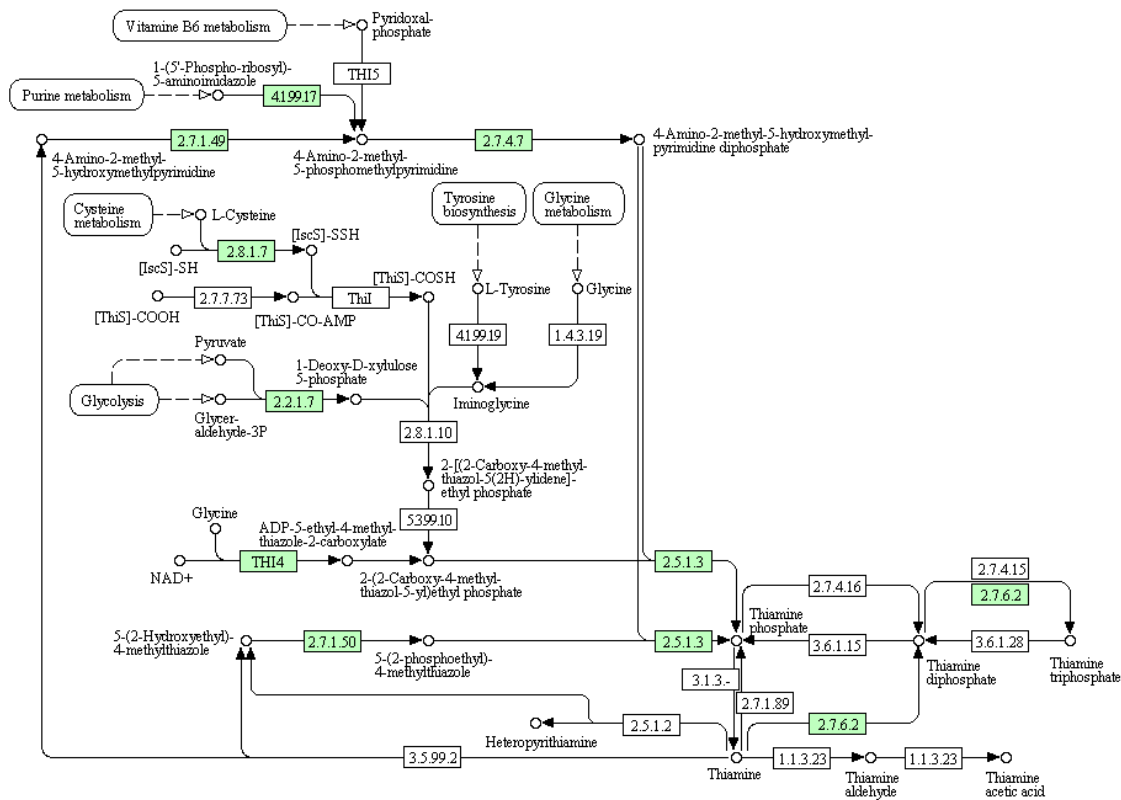
METHANE METABOLISM



CARBON FIXATION IN PHOTOSYNTHETIC ORGANISMS

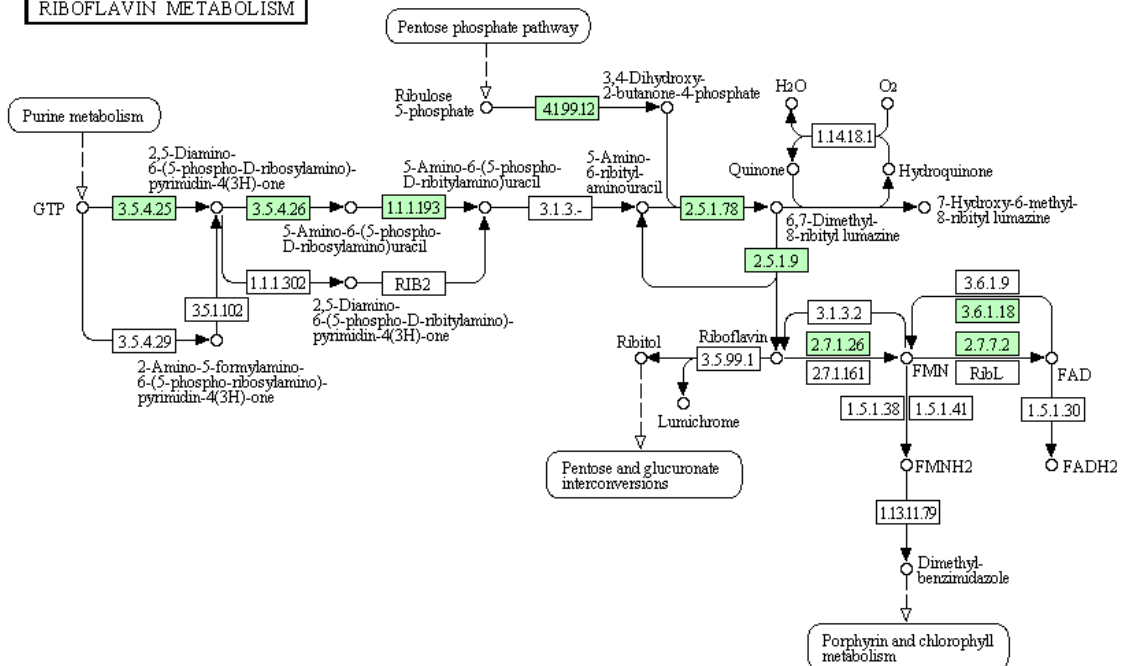


THIAMINE METABOLISM



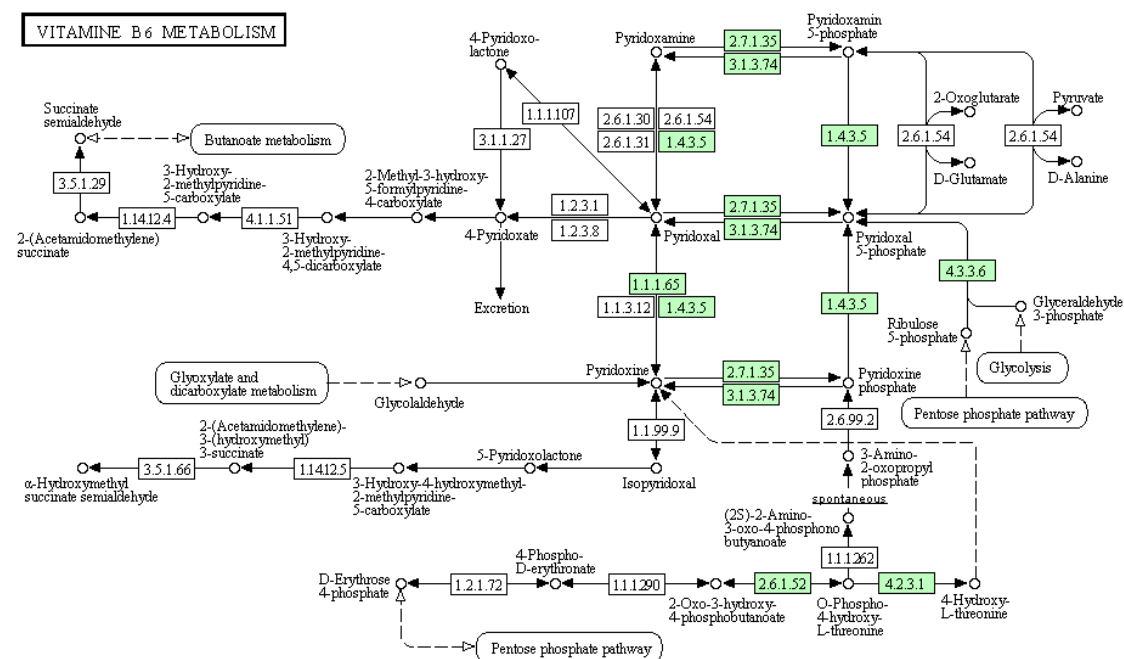
00730 6/26/14
(c) Kanehisa Laboratories

RIBOFLAVIN METABOLISM



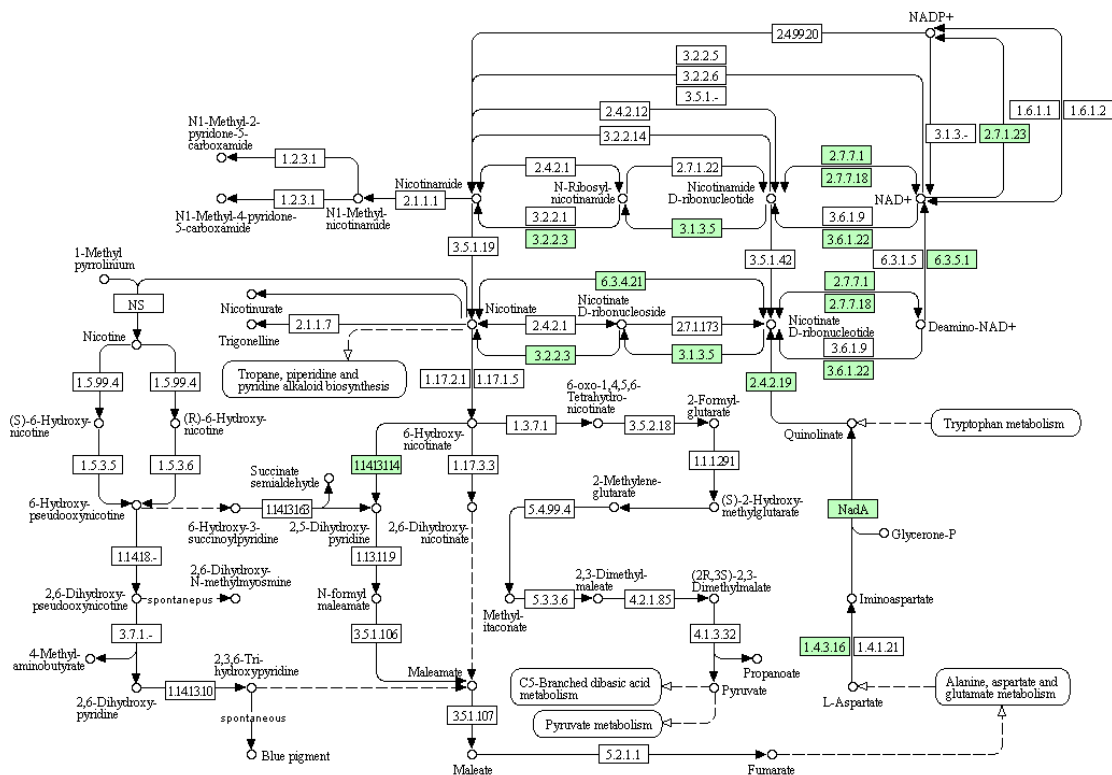
00740 8/4/14
(c) Kanehisa Laboratories

VITAMINE B6 METABOLISM

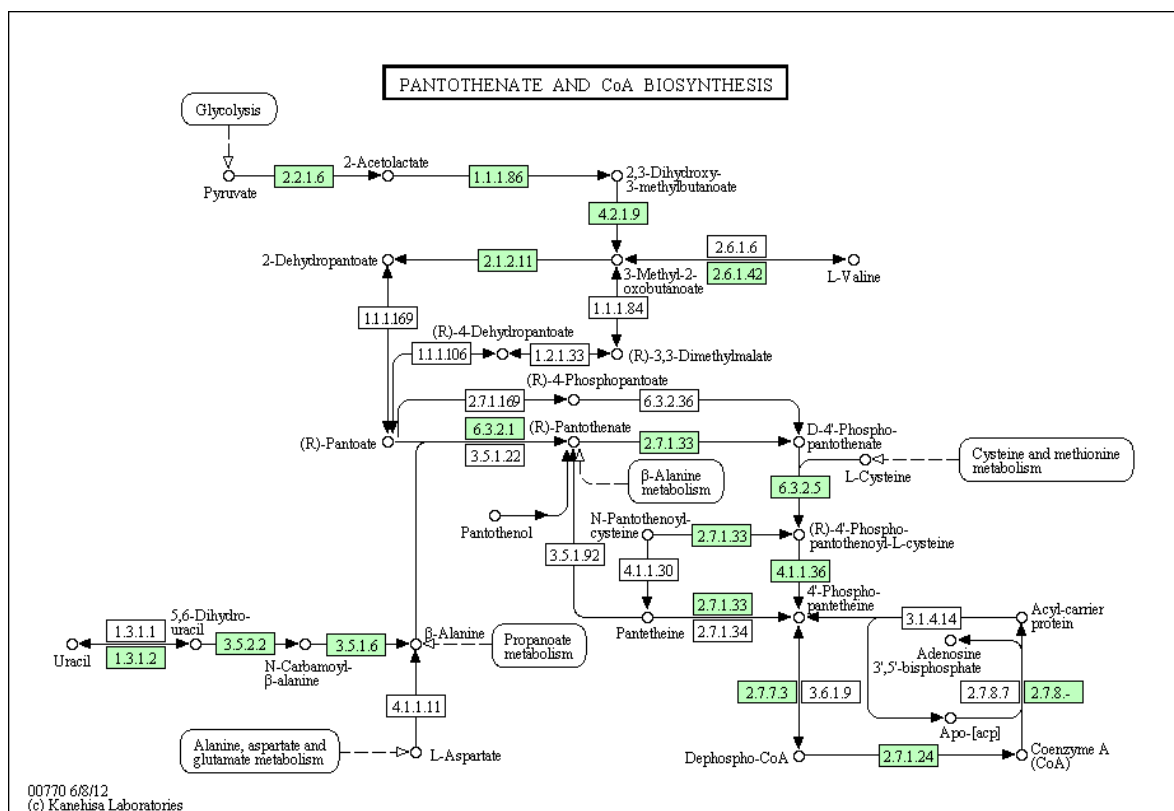


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(c) Kanehisa Laboratories

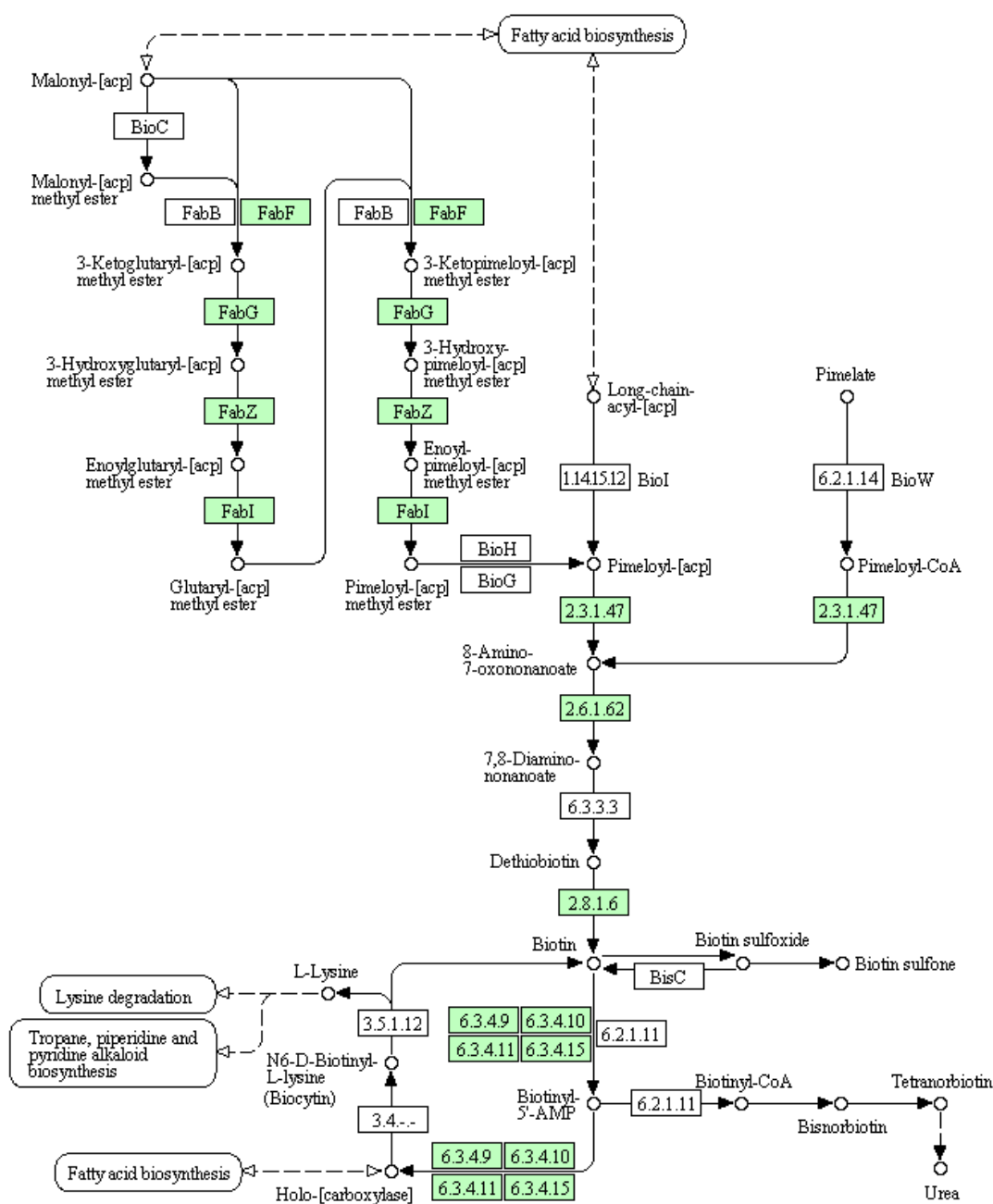
NICOTINATE AND NICOTINAMIDE METABOLISM



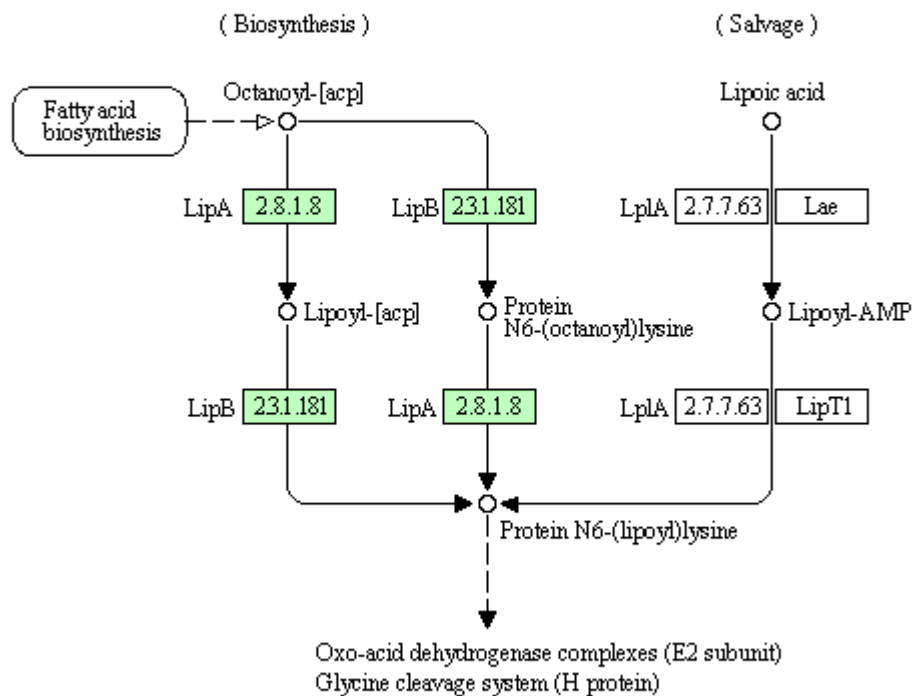
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(c) Kanehisa Laboratories



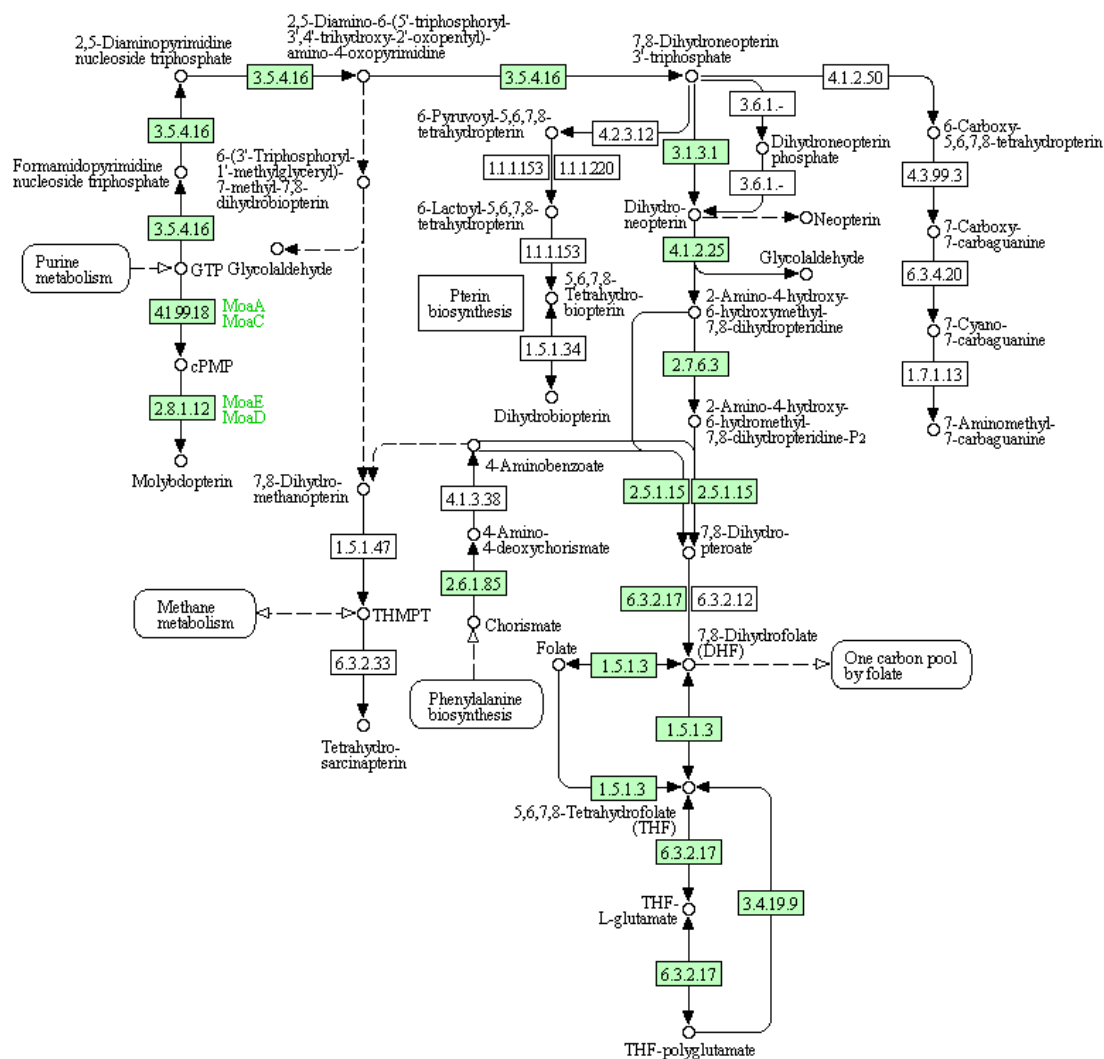
BIOTIN METABOLISM



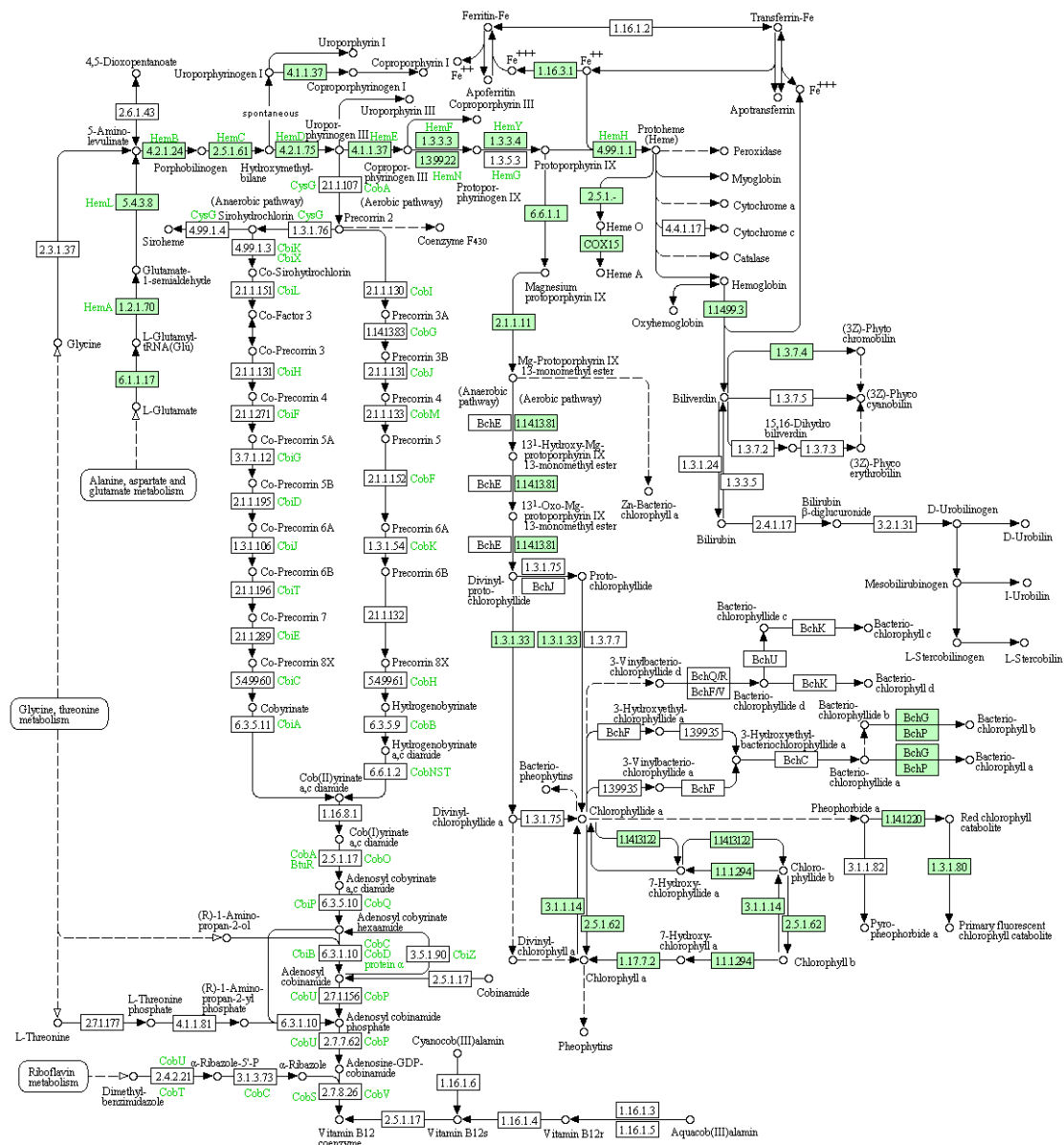
LIPOIC ACID METABOLISM



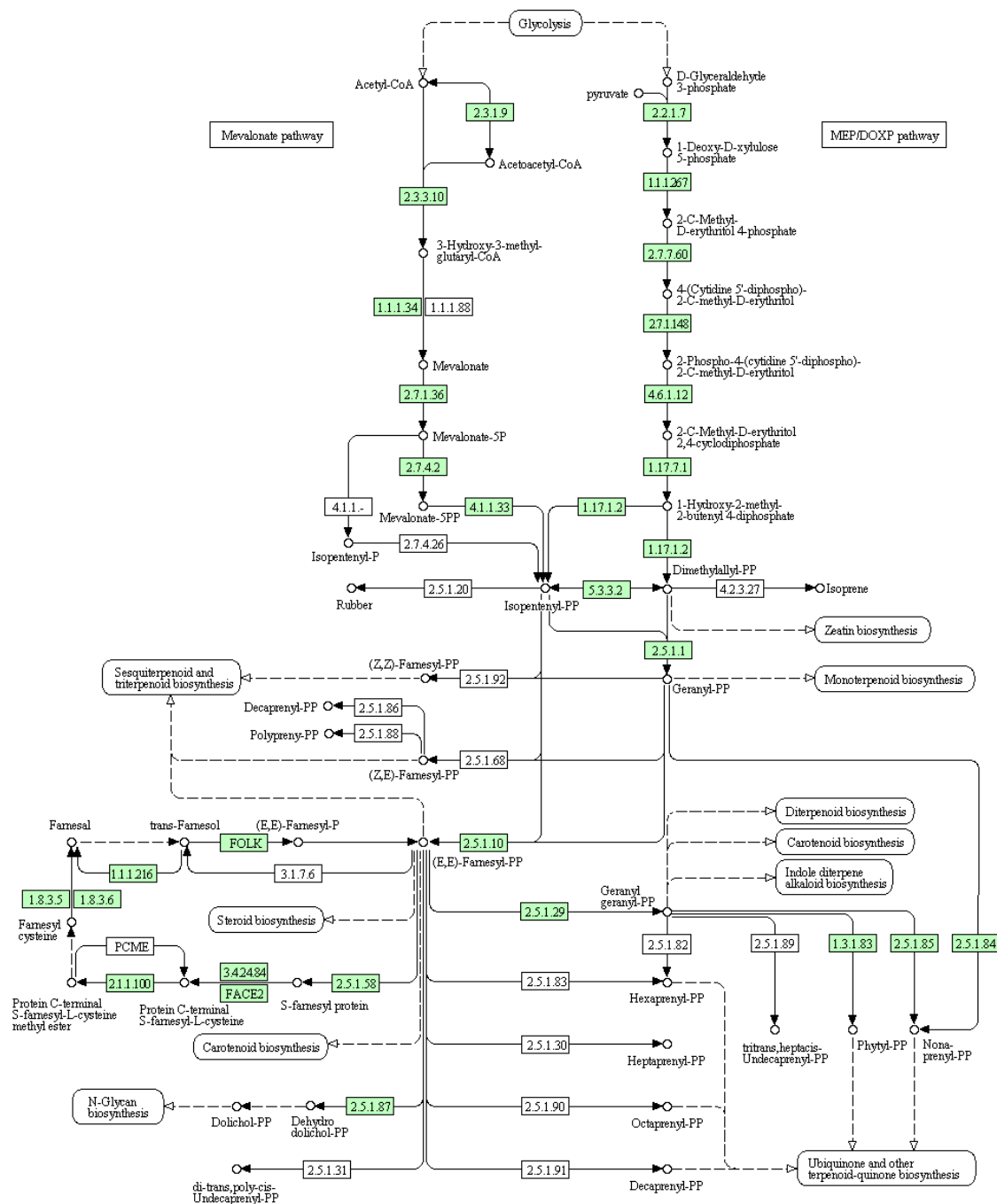
FOLATE BIOSYNTHESIS



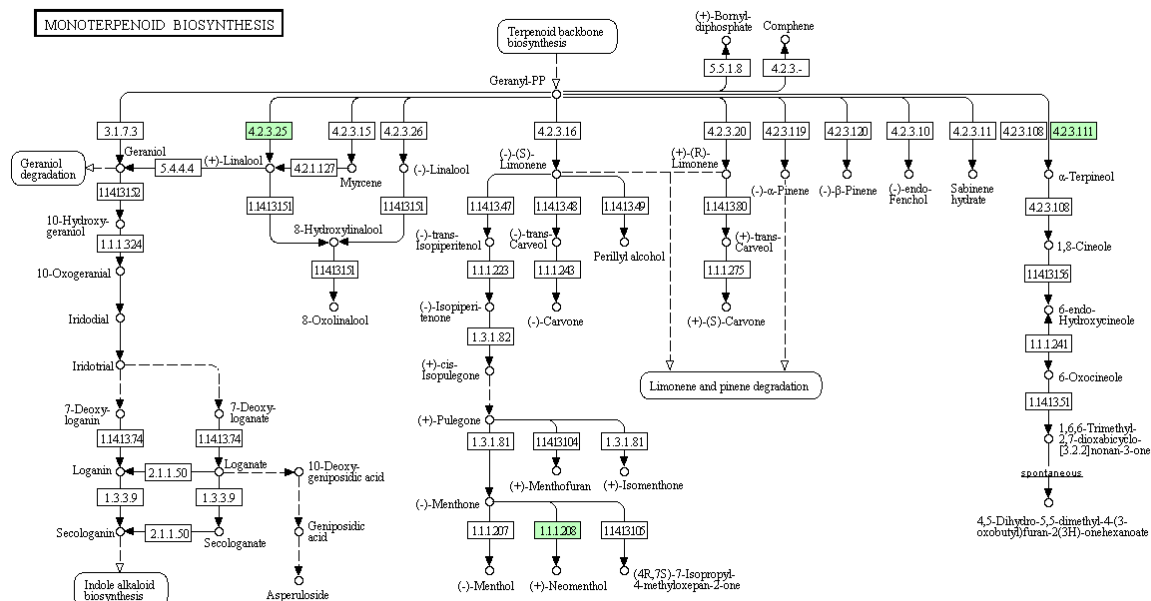
PORPHYRIN AND CHLOROPHYLL METABOLISM



TERPENOID BACKBONE BIOSYNTHESIS

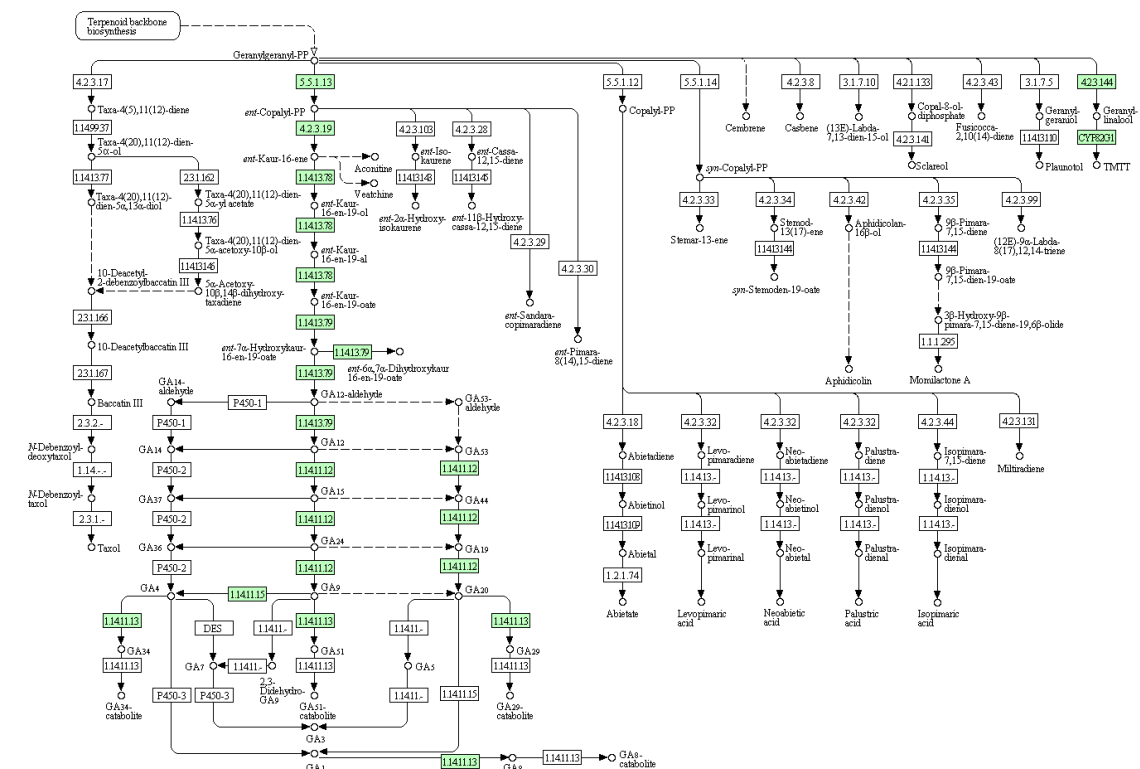


MONOTERPENOID BIOSYNTHESIS



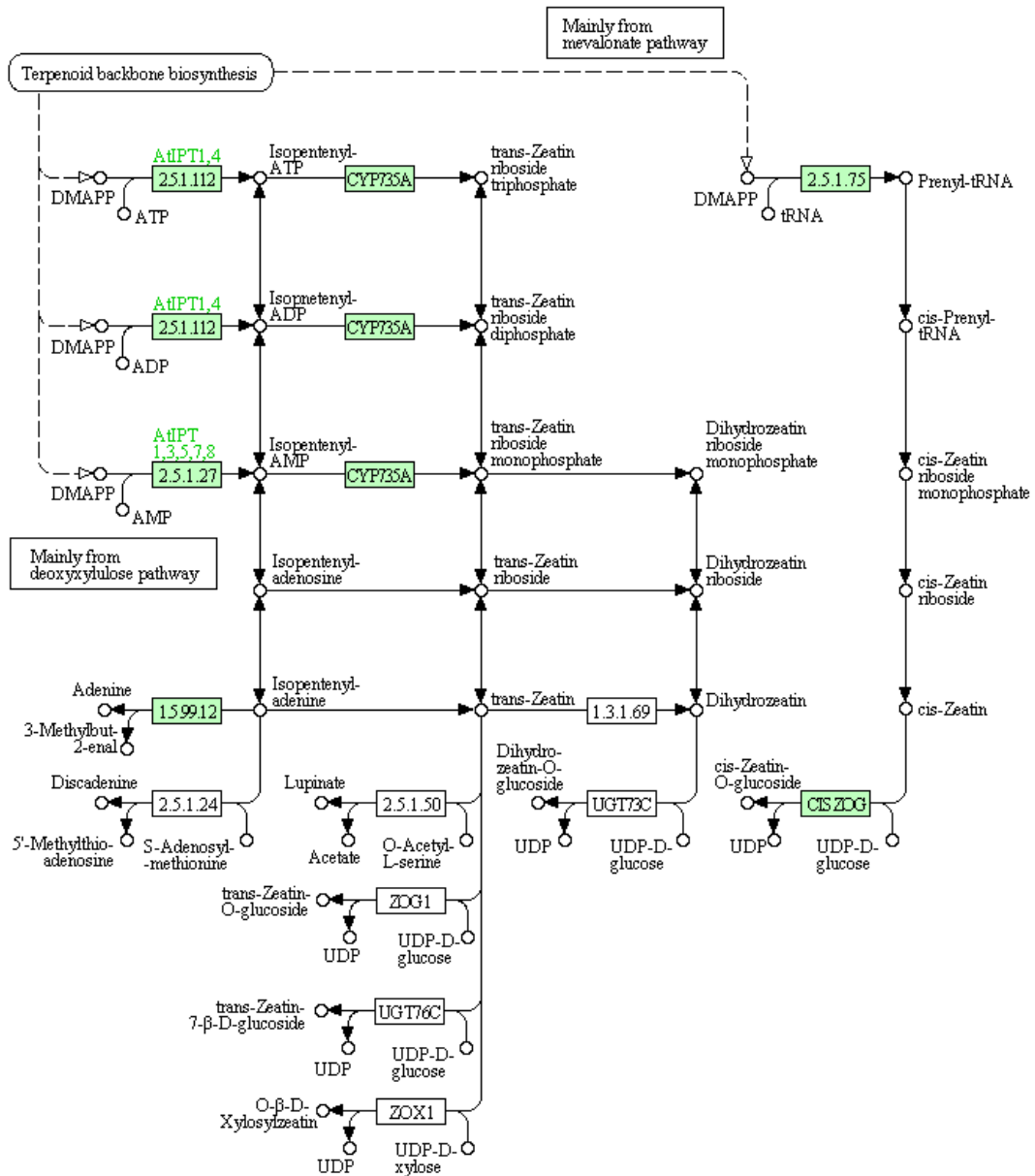
00902 3/13/14
(c) Kanehisa Laboratories

DITERPENOID BIOSYNTHESIS

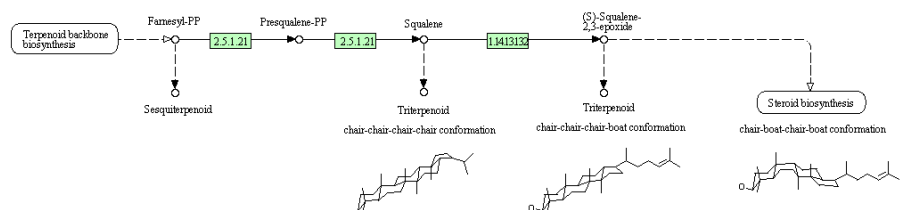


00904 5/26/14
(c) Kanehisa Laboratories

ZEATIN BIOSYNTHESIS

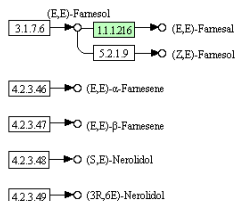


SESQUITERPENOID AND TRITERPENOID BIOSYNTHESIS

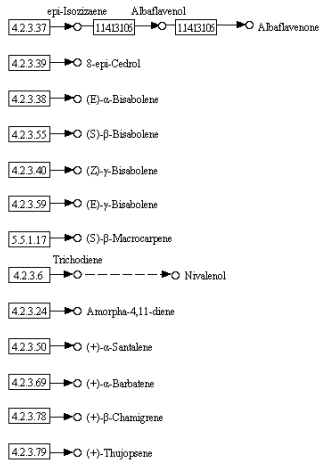


Sesquiterpenoid

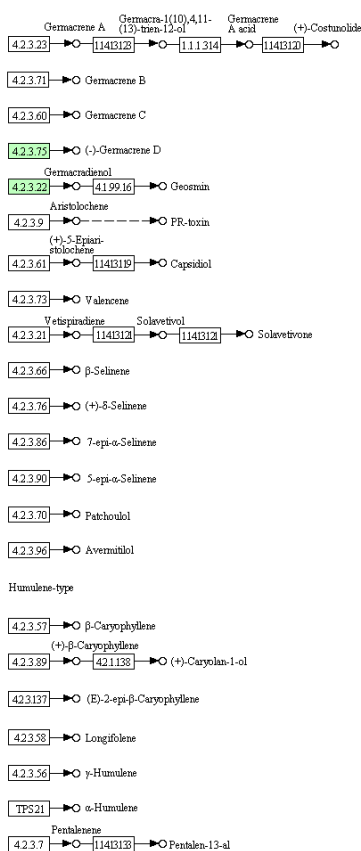
Acyclic sesquiterpenoid



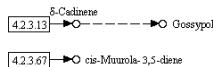
Bisabolene-type



Germacrene-type

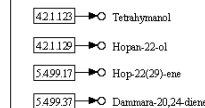


Cadinyl-type



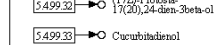
Triterpenoid chain-chair-chair-chair conformation

Hopene and Tetrahymanol

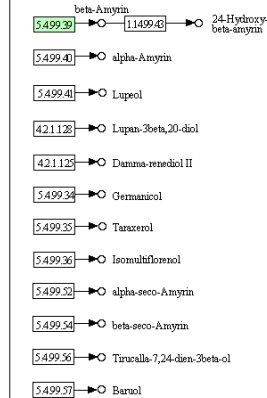


Triterpenoid chain-chair-chair-boat conformation

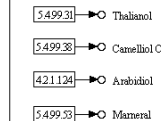
Protosteryl-type



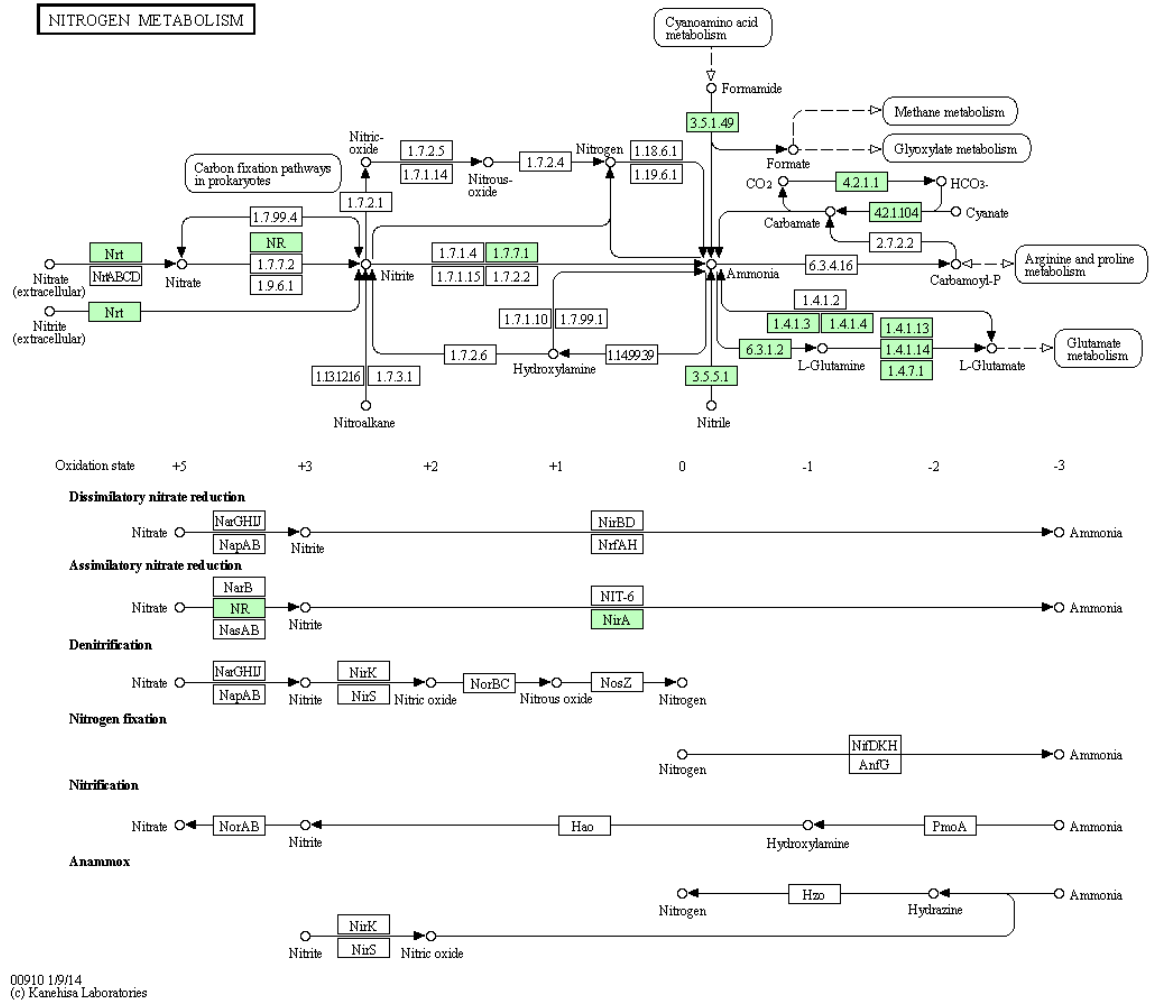
Dammaranyl-type



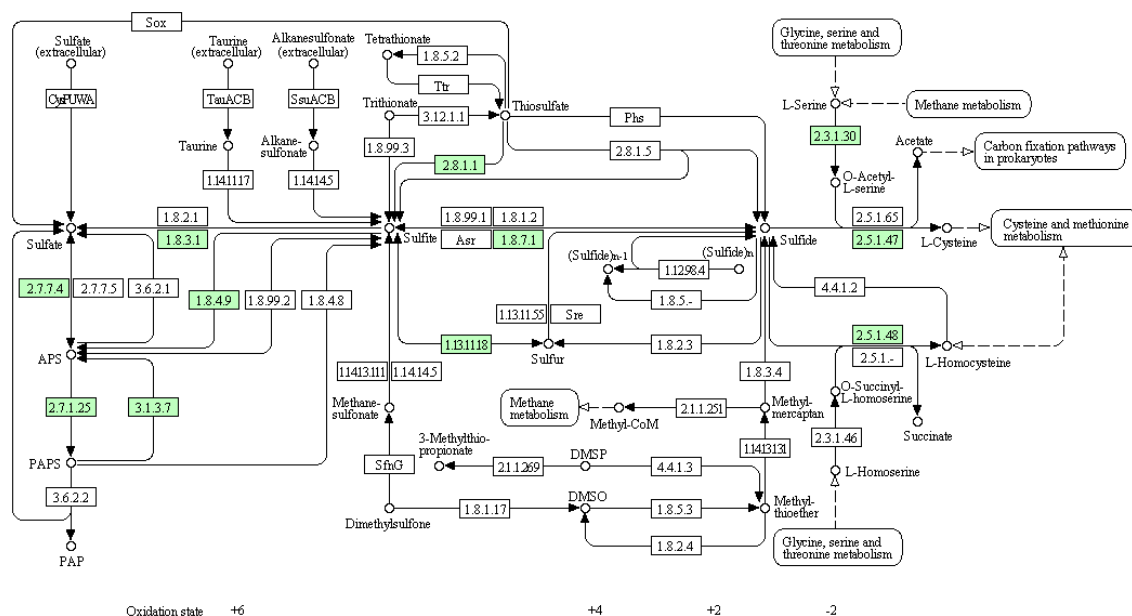
Other-type



NITROGEN METABOLISM



SULFUR METABOLISM



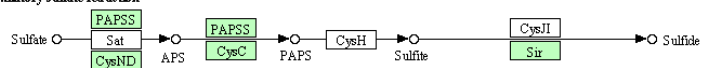
Oxidation state +6

+4

+2

-2

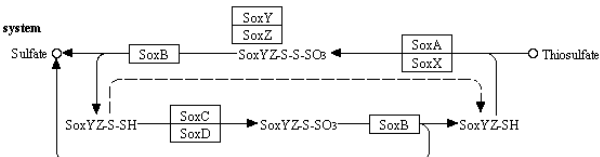
Assimilatory sulfate reduction



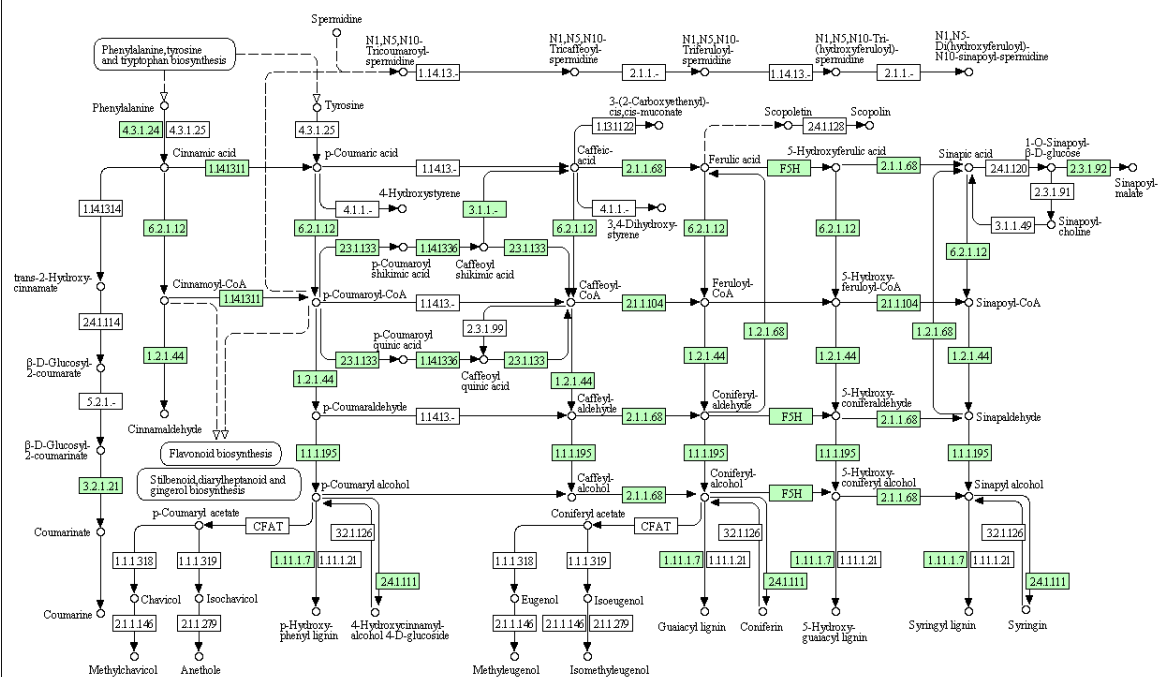
Dissimilatory sulfate reduction and oxidation



SOX system

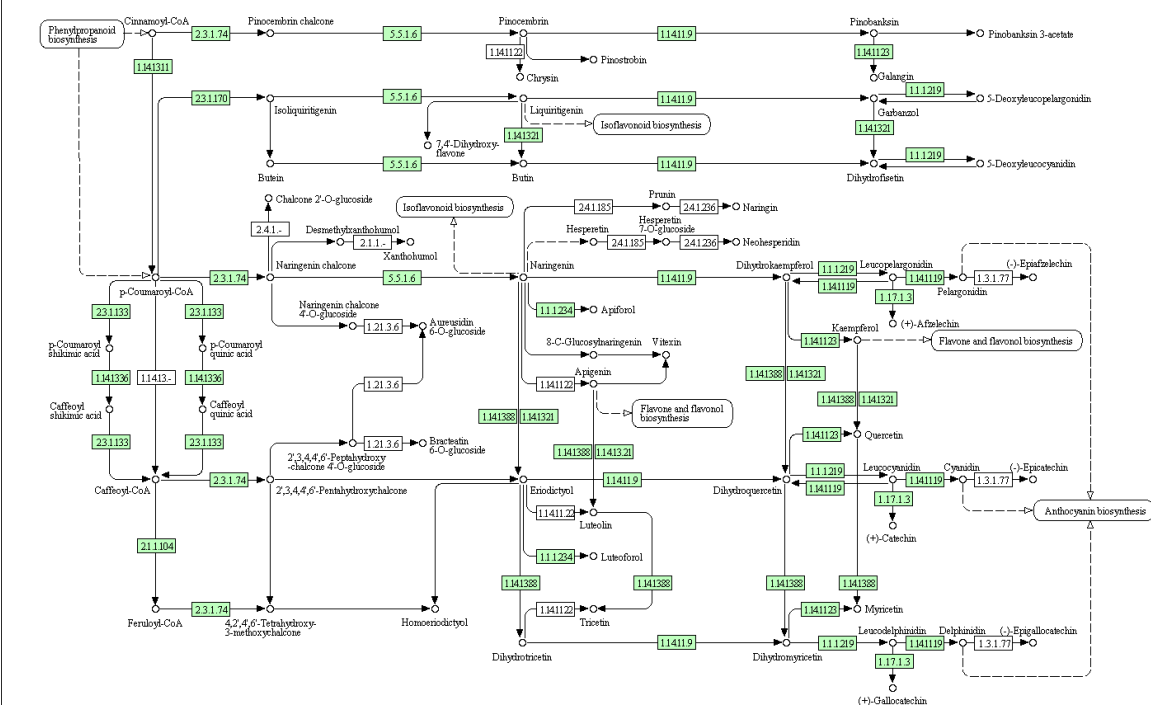


PHENYLPROPANOID BIOSYNTHESIS



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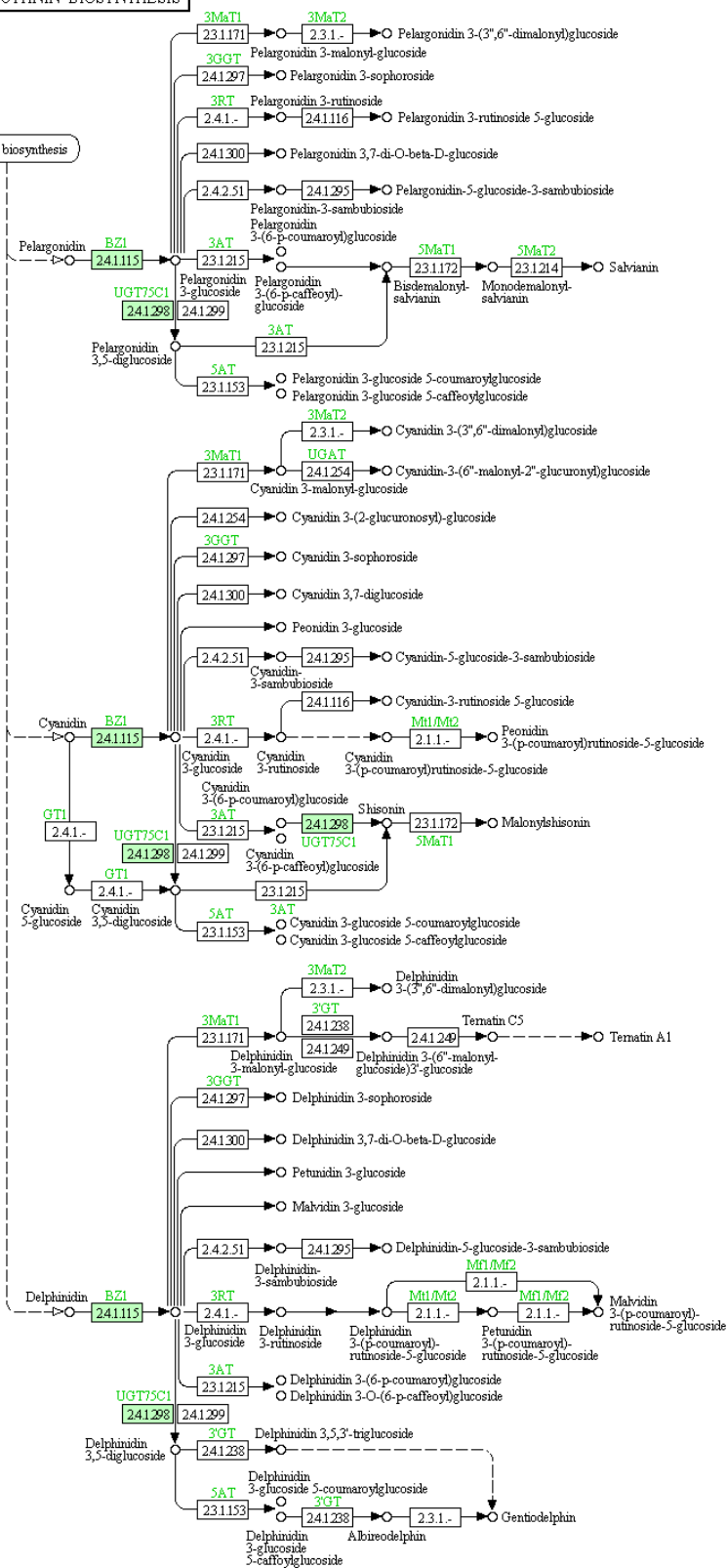
FLAVONOID BIOSYNTHESIS



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ANTHOCYANIN BIOSYNTHESIS

Flavonoid biosynthesis



4-O-Methylapigenin

2.1.1.75

Apigenin

2.4.1.81

Cosmosin

2.4.2.25

Apin

2.3.1.15

Apigenin 7-O- β -D-glucosyl-(1 $\rightarrow$ 2)-[6-malonyl- β -D-Glc]

2.4.1.236

Rhoifolin

2.4.1.105

Isovitexin

2.4.1.105

Isovitexin 2"-O-beta-D-glucoside

2.4.1.105

Vitexin

2.4.1.105

Vitexin 2"-O-beta-D-glucoside

2.1.1.153

Isovertsinin 2"-rhamnoside

2.1.1.153

Vitexin 2"-O-beta-L-rhamnoside

2.4.1.81

Lutcoloside

2.4.1.236

Scolymoside

2.4.1.189

Lutolin 7-O- β -D-GlcA

2.4.1.190

Lutolin 7-O- β -D-GlcA-(1 $\rightarrow$ 2)- β -D-GlcA

2.4.1.191

Lutolin 7-O- β -D-GlcA-(1 $\rightarrow$ 2)- β -D-GlcA

3.2.1.31

Lutolin 7-O- β -D-GlcA-(1 $\rightarrow$ 2)- β -D-GlcA-4-O- β -D-GlcA

2.1.1.42

3"-O-Methylrutolin

Flavonoid biosynthesis

Kaempferide

2.1.1.55

Kaempferol

2.4.1.-

Kaempferin

2.4.1.91

Astragaln

2.4.1.239

Sophoraflavonoloid

2.4.1.240

Kaempferol 3-O- β -D-glucosyl-(1 $\rightarrow$ 2)- β -D-glucoside

2.3.1.173

Trifolin

2.4.1.-

Kaempferol 3-O-beta-D-glucosylgalactoside

3-O-Methylquercetin

3.7-O-Dimethylquercetin

2.1.1.76

2.1.1.83

Ayanin

2.4.1.91

Isoquercitrin

2.3.1.116

Quercetin 3-O-(6-O-malonyl- β -D-Glc)

2.4.2.35

Quercetin 3-O-[beta-D-xylosyl-(1 $\rightarrow$ 2)-beta-D-glucoside]

2.4.1.159

Rutin

2.4.2.35

Quercetin 3-(2-O-xylosylrutinoside)

2.4.1.239

Baimaside

2.4.1.240

Quercetin 3-sophorotrioside

2.4.1.-

Quercitrin

2.4.1.-

Quercetin 3-O-rhamnoside-7-O-glucoside

2.8.2.25

Quercetin 3-O-sulfate

2.8.2.26

Quercetin 3,3'-disulfate

2.8.2.28

Quercetin 3,3',7'-trisulfate

2.8.2.27

Quercetin 3,4'-disulfate

2.8.2.28

Quercetin 3,4,7'-trisulfate

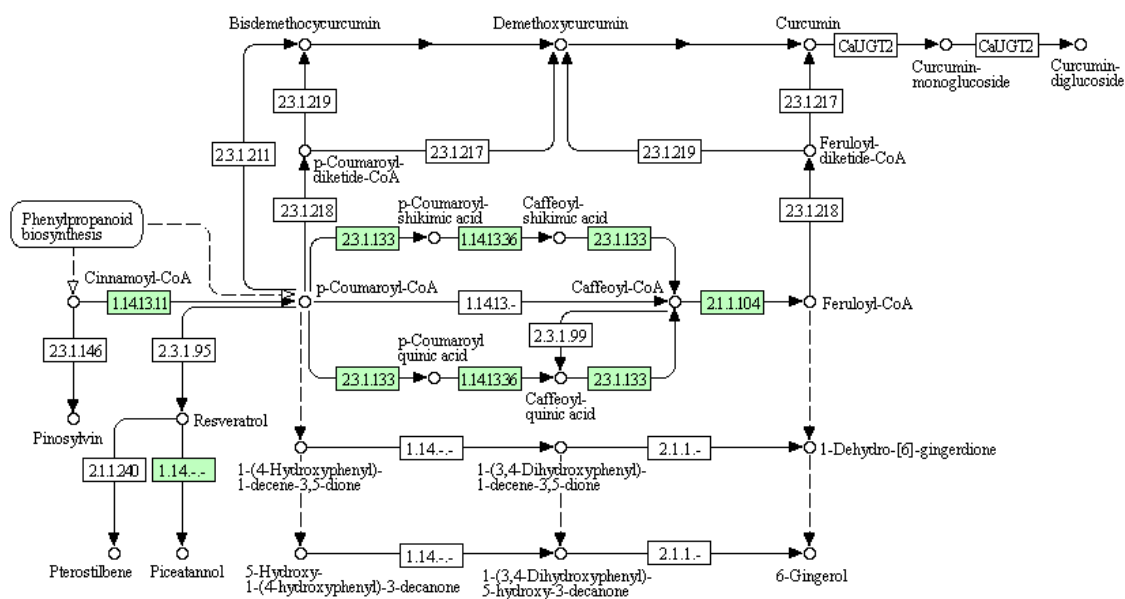
Myricetin

2.1.1.267

2.1.1.267

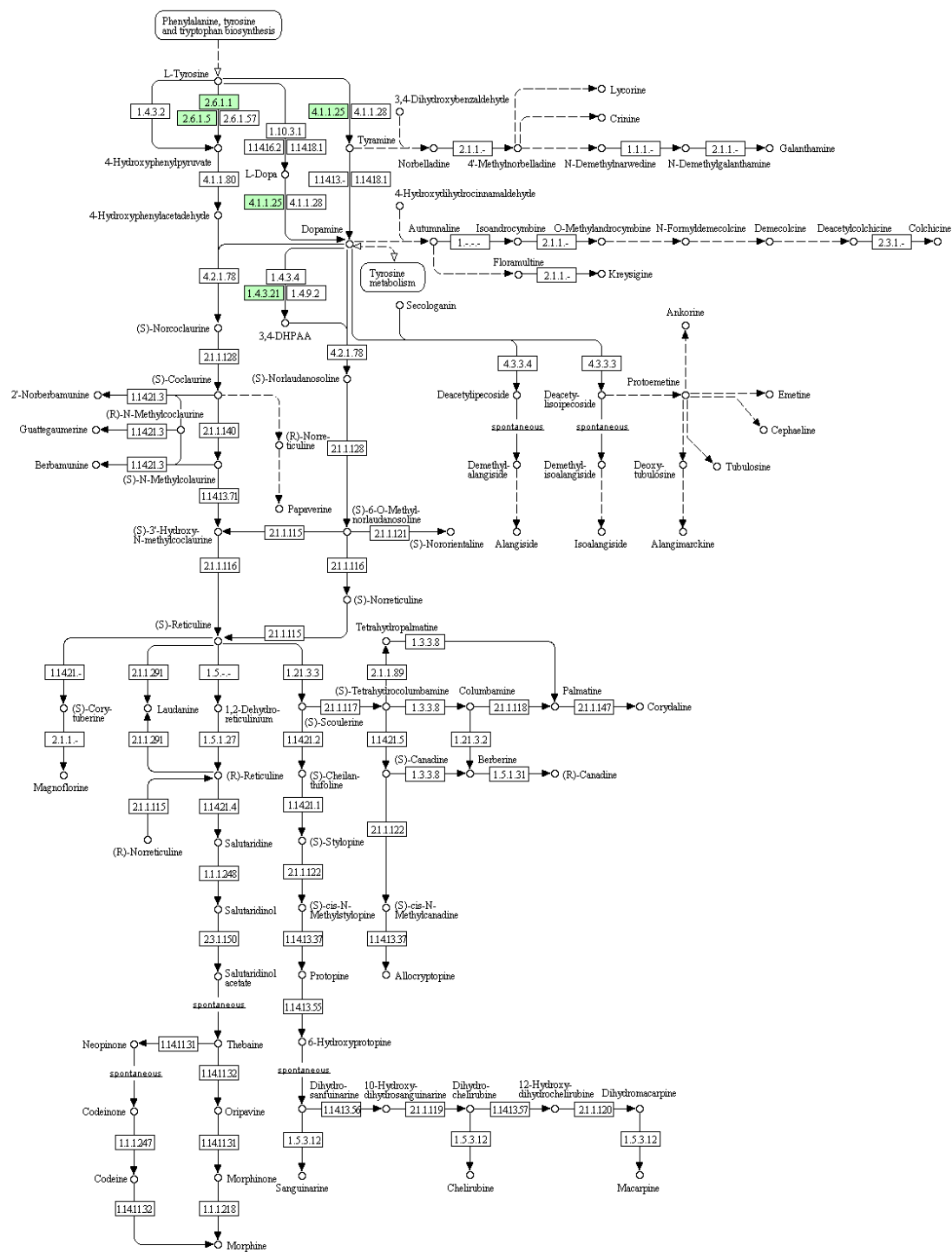
5-Myricetin

STILBENOID, DIARYLHEPTANOID AND GINGEROL BIOSYNTHESIS

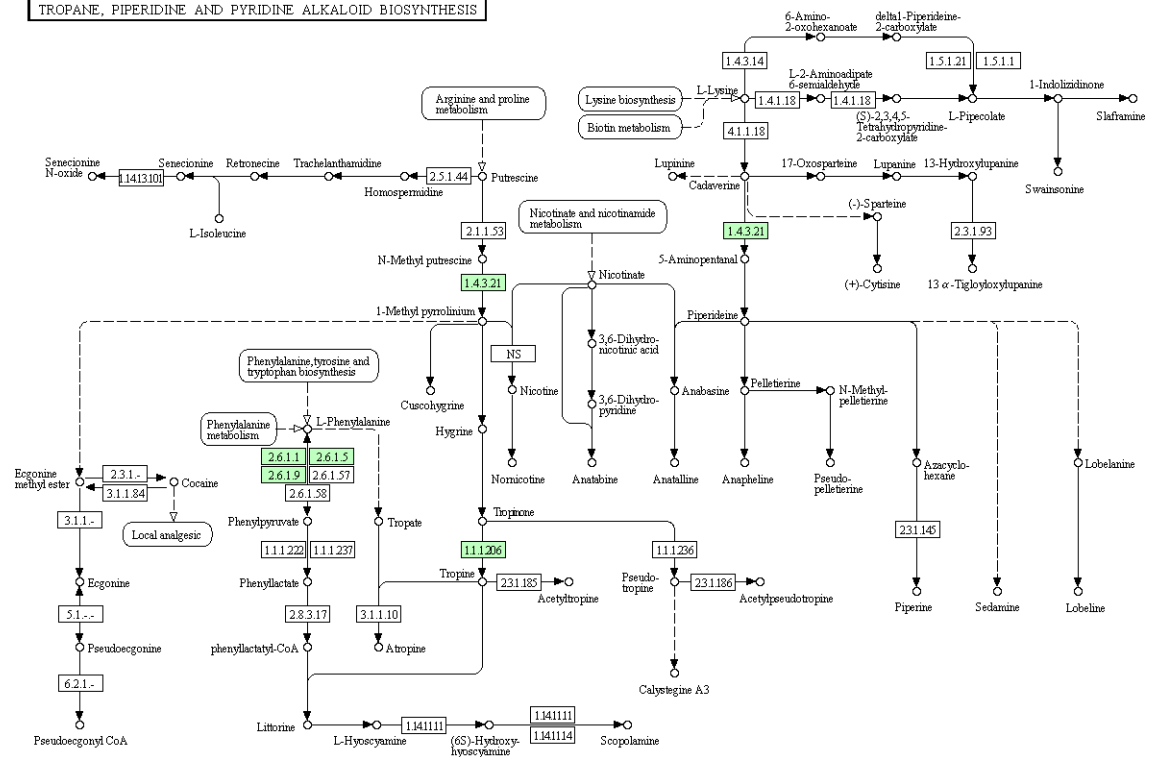


00945 6/13/13
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ISOQUINOLINE ALKALOID BIOSYNTHESIS

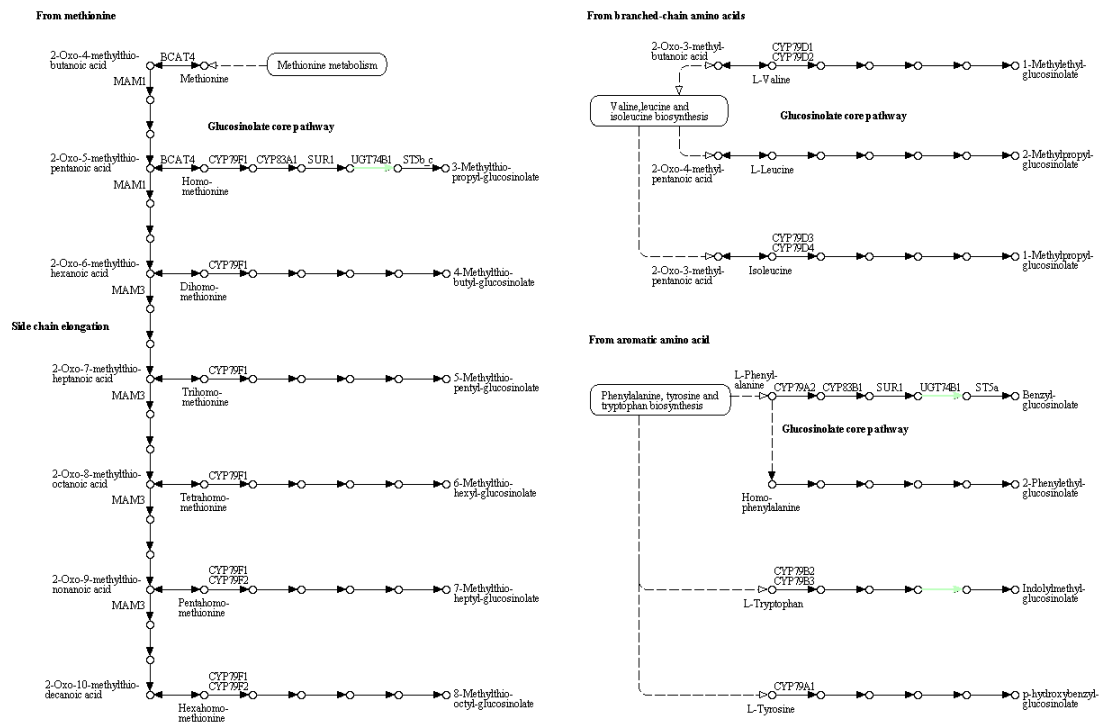


TROPANE, PIPERIDINE AND PYRIDINE ALKALOID BIOSYNTHESIS



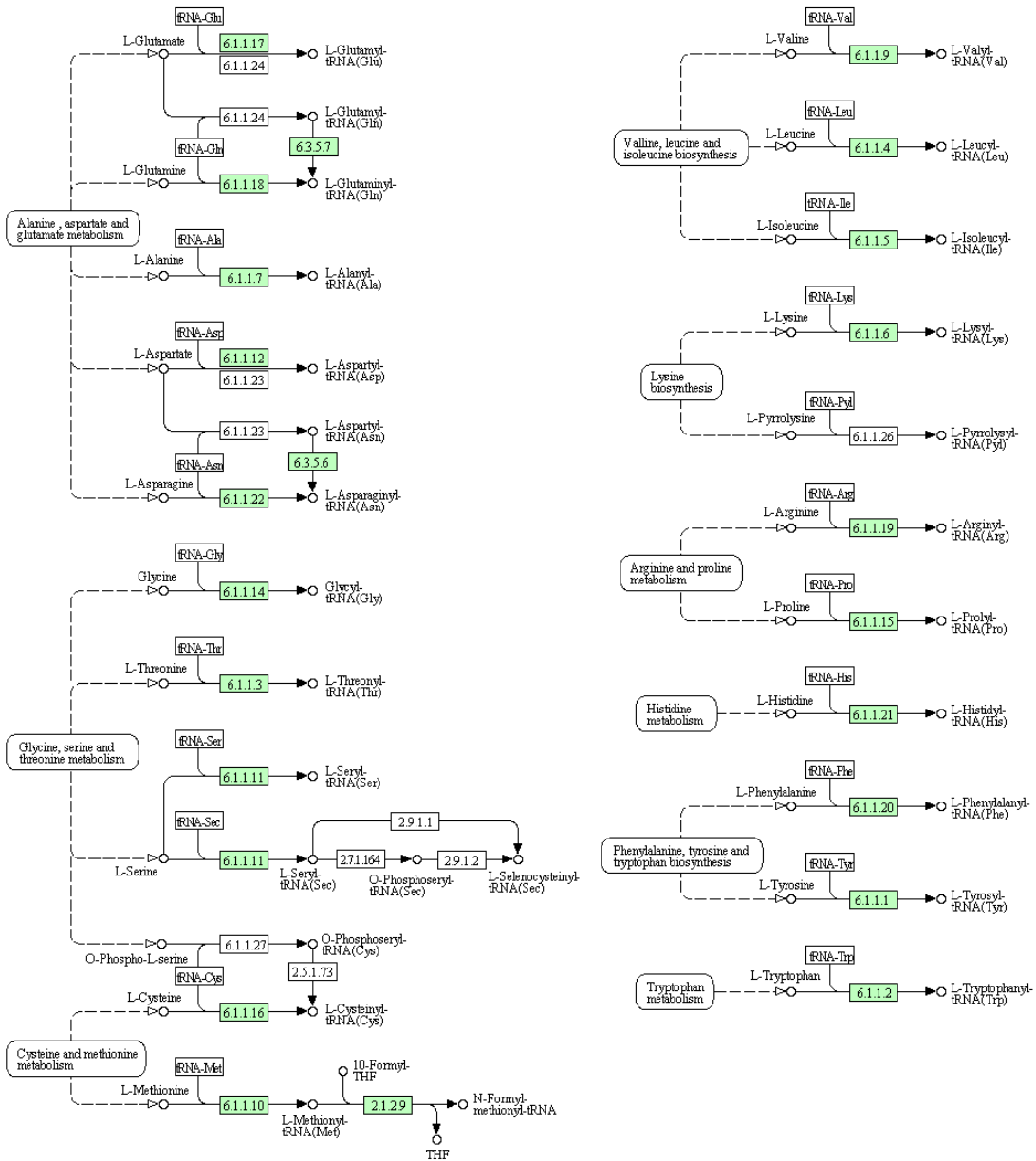
00960 6/27/12
(c) Kawahara Laboratories

GLUCOSINOLATE BIOSYNTHESIS

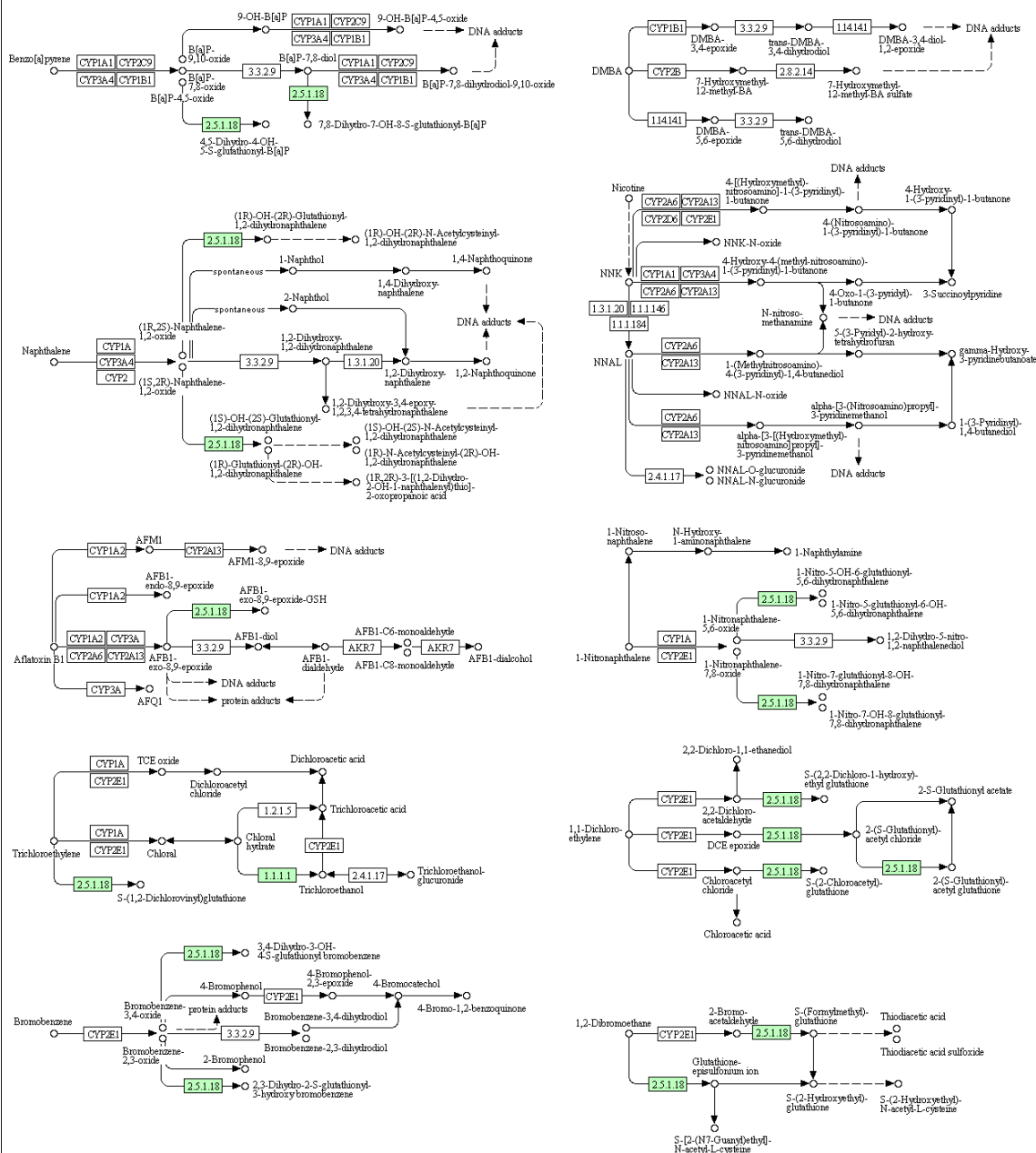


00966 5/2/14
(c) Kawahara Laboratories

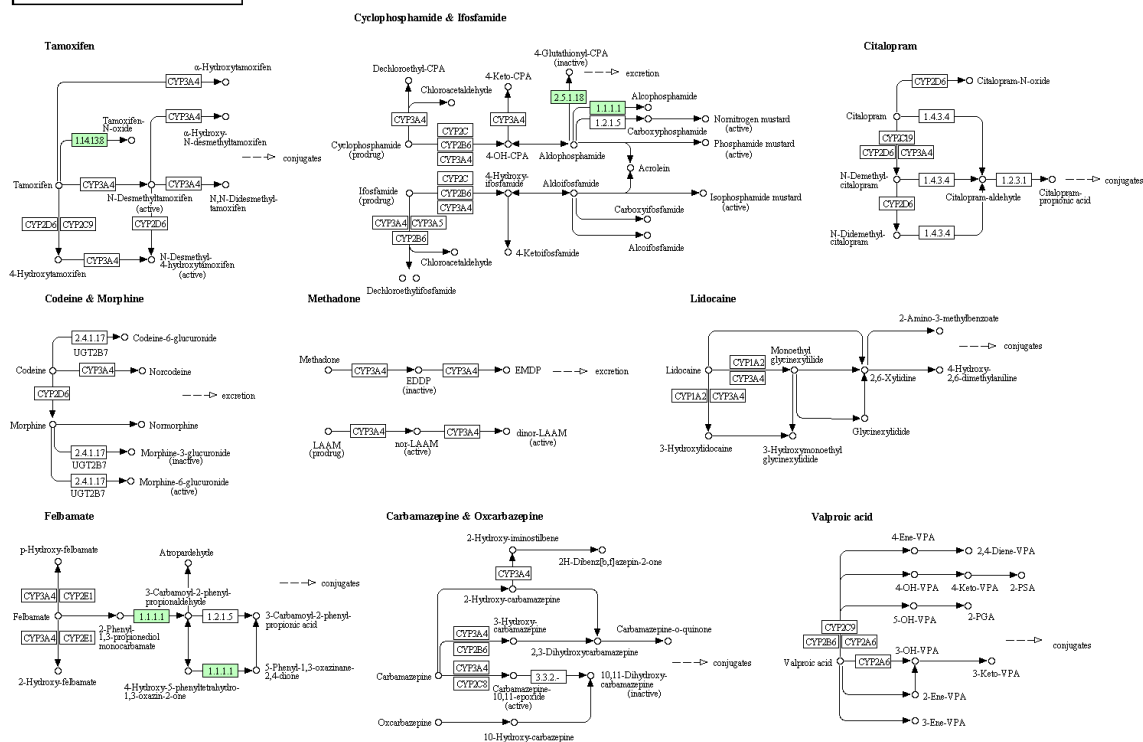
AMINOACYL-tRNA BIOSYNTHESIS



METABOLISM OF XENOBIOTICS BY CYTOCHROME P450



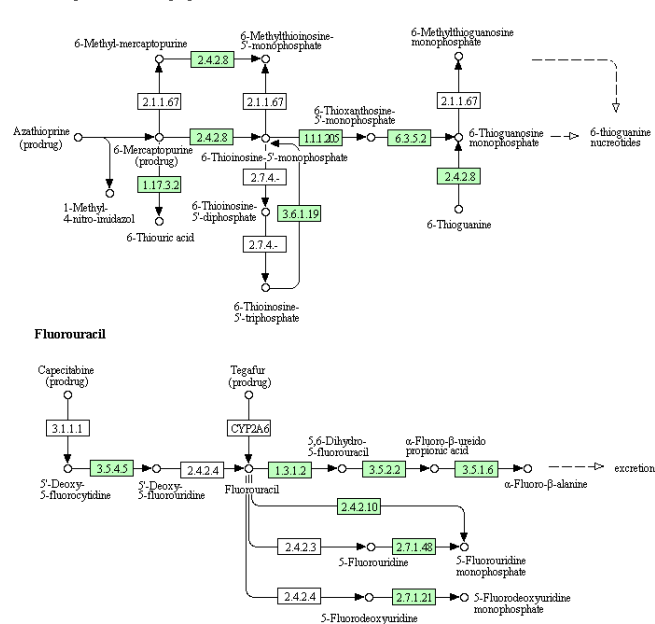
DRUG METABOLISM - CYTOCHROME P450



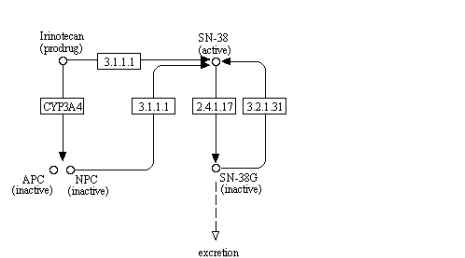
00982 11/11/13
(c) Kanehisa Laboratories

DRUG METABOLISM - OTHER ENZYMES

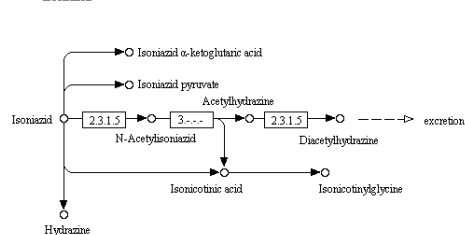
Azathioprine & 6-Mercaptopurine



Irinotecan

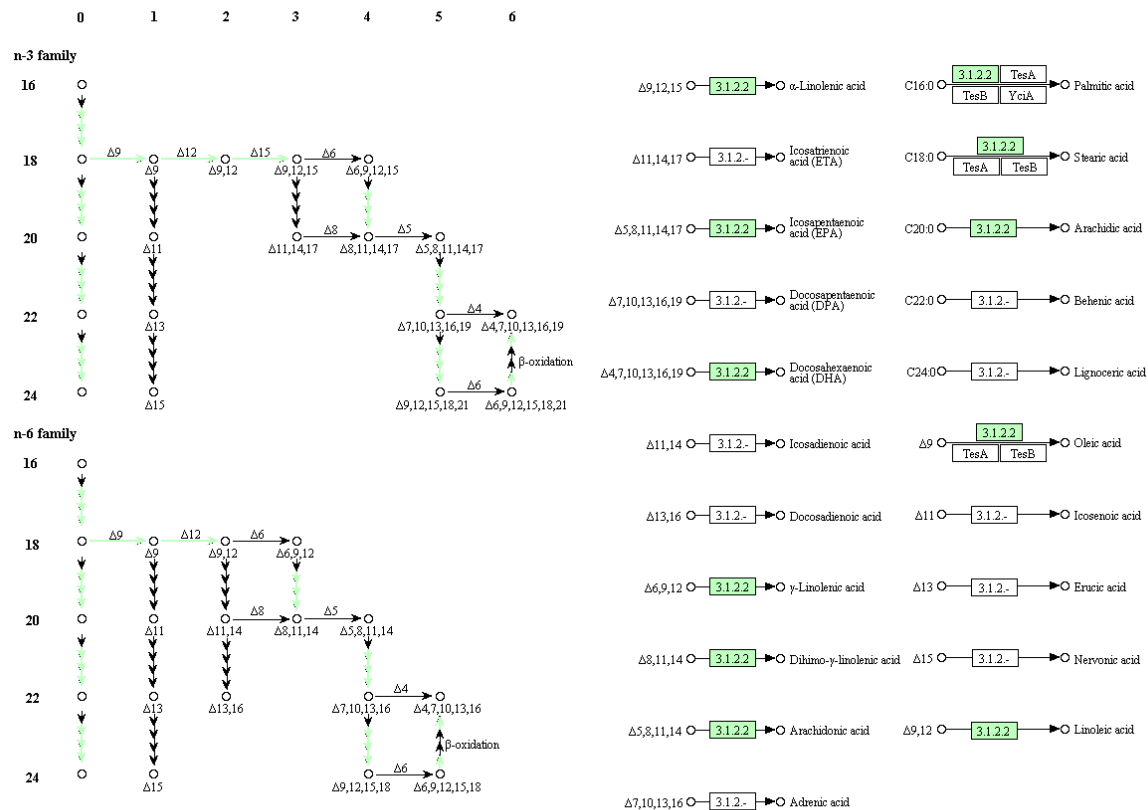


Isoniazid

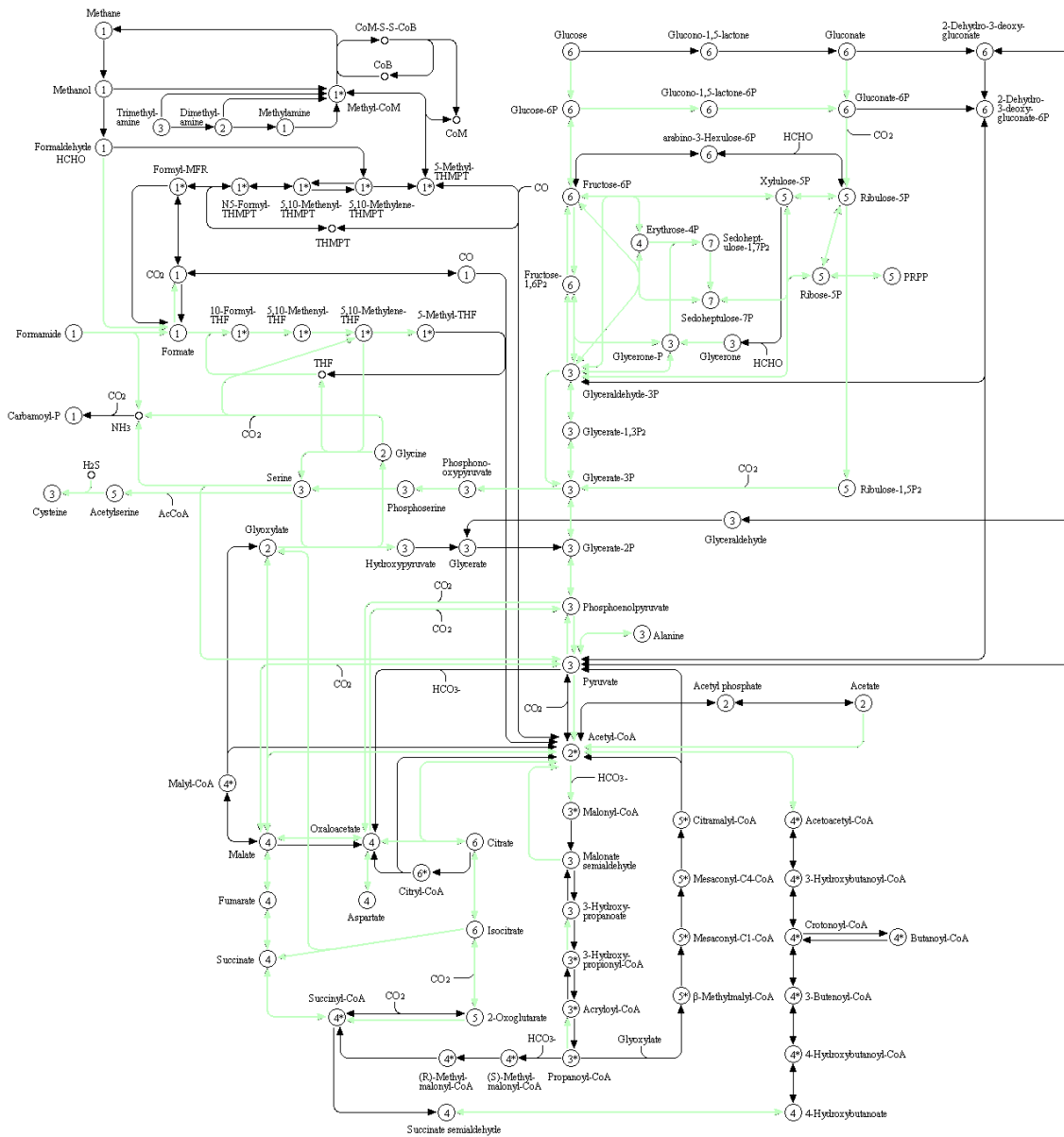


00983 10/28/13
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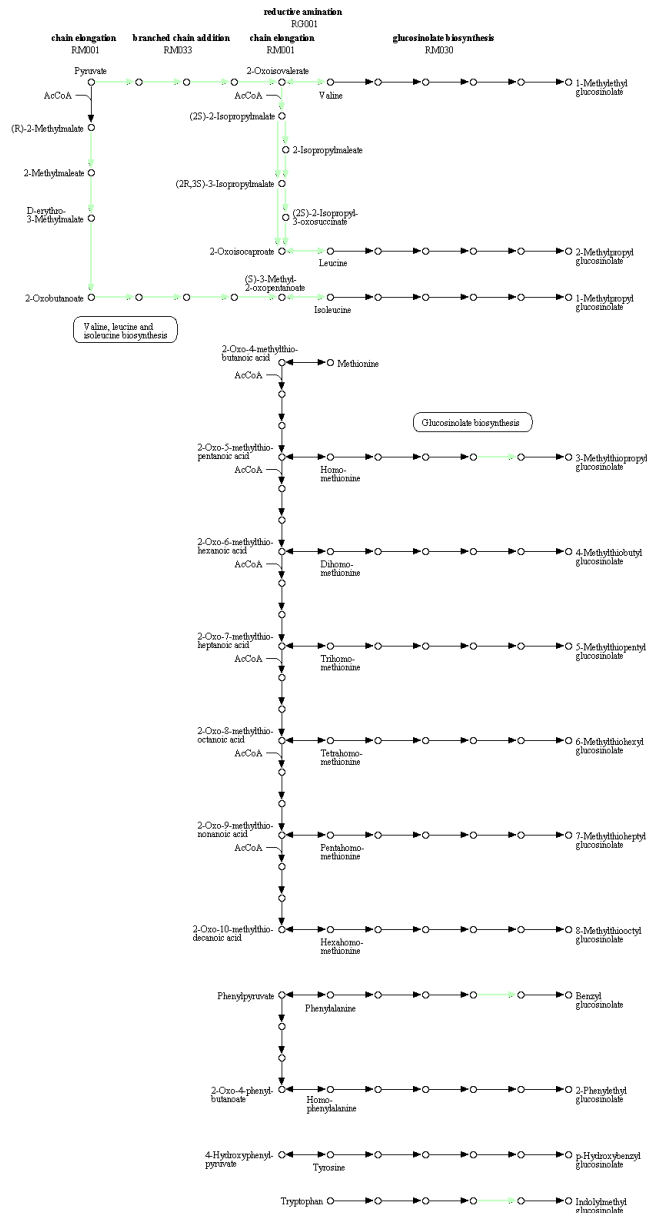
BIOSYNTHESIS OF UNSATURATED FATTY ACIDS



CARBON METABOLISM

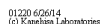


reductive amination

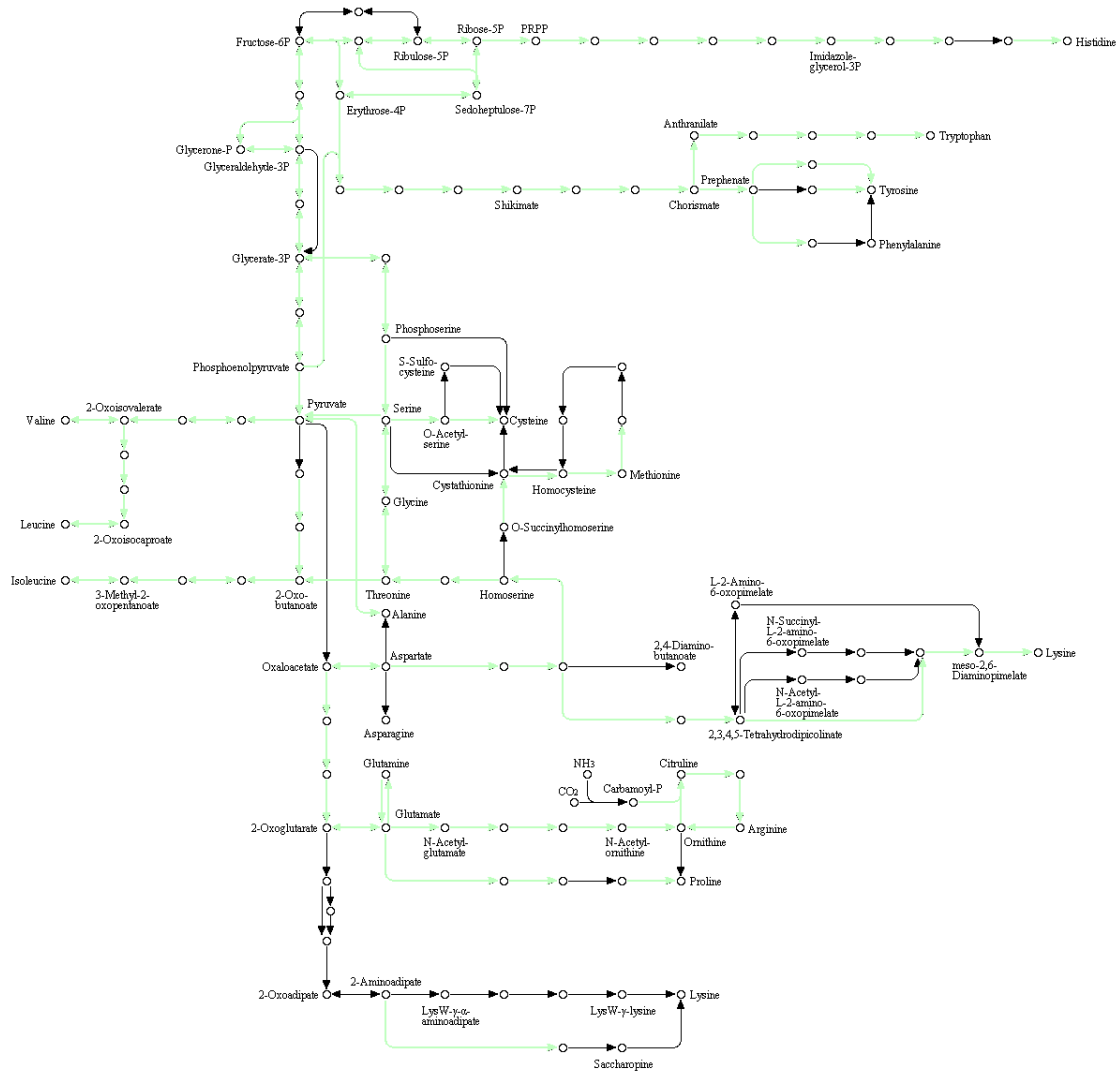


FATTY ACID METABOLISM





BIOSYNTHESIS OF AMINO ACIDS



ABC TRANSPORTERS

Prokaryotic-type ABC transporters

Mineral and organic ion transporters

Sulfite	○	CysP	CysU	CysA	→
Tungstate	○	TupA	TupB	TupC	→
Molybdate / Tungstate	○	WtpA	WtpB	WtpC	→
Nitrite / Nitrate / Cyanate	○	NrtA	NrtB	NrtC	→
Bicarbonate	○	CncP	CncB	CncC	→
Taurine	○	TauA	TauC	TauB	→
Alkanesulfonate	○	SsuA	SsuC	SsuB	→
HMP / FAMP	○	ThyY	ThyX	ThyZ	→
Phthalate	○	OphF	OphG	OphH	→
Molybdate	○	ModA	ModB	ModC	→
Iron (III)	○	AfrA	AfrB	AfrC	→
Thiamin	○	ThpA	ThpI	ThpQ	→
Spermidine / Putrescine	○	PotD	PotC	PotA	→
Putrescine	○	PotF	PotH	PotG	→
Mannopine	○	AmC	AmB	AmA1	→
2-Aminoethylphosphonate	○	PhsS	PhsV	PhsT	→
Oxylate betaine / Proline	○	ProX	ProW	ProY	→
Osmoprotectant	○	OpuB/C	OpuB/A	OpuB/A	→

Oligosaccharide, polyol and lipid transporters

Maltose / Maltodextrin	○	MalE	MalF	MalK	→
Oalectose oligomer / Maltotetraosaccharide	○	OatO	OatP	MenX	→
Raffinose/Stachyose/Mellicose	○	MenE	MenF	MenK	→
Lactose / L-arabinose	○	LacE	LacF	LacK	→
Sorbitol / Mannitol	○	SnoE	SnoF	SnoK	→
α-Glucoside	○	AgpE	AgpF	AgpK	→
Oligogalacturonide	○	TogB	TogM	TogA	→
α-1,4-Digalacturonate	○	AgpE	AgpF	?	→
Aldonuronate	○	LplA	LplB	?	→
Trehalose / Maltose	○	ThrE	ThrF	ThrK	→
Trehalose	○	ThrS	ThrT	ThrV	→
N-Acetylglucosamine	○	NgeE	NgeF	?	→
Cellulose	○	CelE	CelF	MenK	→
Chitobiose	○	DacA	DacB	MenK	→
Chitobiose	○	ChiE	ChiF	?	→
Aminopolysaccharide	○	AmN	AmP	MenX	→
Xylobiose	○	BxiE	BxiJ	?	→
Multiple sugar?	○	ChrE	OgrB	OgrA	→
Phospholipid	○	MlcC	MlcB	MlcF	→

Monosaccharide transporters

Glucose / Arabinose	○	GlcS	GlcT	GlcV	→
Glucose / Mannose	○	GbaA	GbaB	MalK	→
Ribose / Arabinose 2 / D-Xylose	○	RbsB	RbsC	RbsA	→
L-Arabinose	○	AnsF	AnsH	AnsG	→
Methyl-galactoside	○	MglB	MglC	MglA	→
D-Xylose	○	XylF	XylH	XylD	→
D-Allose	○	AlaB	AlaC	AlaA	→
Fructose	○	FrcB	FrcC	FrcA	→
Arabinose 2	○	LarB	LarC	LarA	→
Rhamnose	○	RhaS	RhaF	RhaT	→
Erythritol	○	EryG	EryF	EryE	→
Xytritol	○	XtrC	XtrB	XtrA	→
myo-Inositol	○	ItpA	ItpF	ItpA	→
myo-Inositol 1-phosphate	○	InoE	InoF	InoK	→
Glycerol	○	GlpV	GlpF	GlpE	→
sn-Glycerol 3-phosphate	○	UgpB	UgpA	UgpC	→

Phosphate and amino acid transporters

Phosphate	○	PhcE	PhcC	PhcB	→
Phosphonate	○	PhaD	PhaE	PhaC	→
Lysine / Arginine / Ornithine	○	ArgT	HsdM	HsdP	→
Histidine	○	HsdI	HsdM	HsdP	→
Glutamine	○	GlnH	GlnP	GlnQ	→
Glutamine?	○	GlnH	GlnP	GlnQ	→
Arginine	○	ArgI	ArgM	ArgP	→
Glutamate / Aspartate	○	GME	GME	GME	→
Octopine / Nopaline	○	OecT	OecM	OecP	→
General L-Amino acid	○	AspI	AspQ	AspP	→
Gluconate	○	GlnB	GlnC	GlnA	→
Cytidine	○	CytY	CytS	CytC	→
Cytidine	○	CytY	CytL	CytM	→
Arginine / Ornithine	○	ArgI	ArgM	ArgP	→
Arginine / Lysine / Histidine / Glutamine	○	ArgI	ArgM	ArgP	→
Lysine	○	LysX	LysX	LysY	→
Branched-chain amino acid	○	LivK	LivH	LivO	→
Neutral amino acid / Histidine	○	NatB	NatC	NatA	→
Urea	○	UrtA	UrtC	UrtE	→
D-Methionine	○	MetQ	MetI	MetN	→
Amino acid	○	YxeM	YxeN	YxeO	→

Peptide and nickel transporters

Oligopeptide	○	OpgA	OpgB	OpgD	→
Dipeptide / Heme / 6-Aminoheptanoic acid	○	DppA	DppB	DppC	→
Dipeptide	○	DppE	DppB	DppD	→
Nickel	○	NikA	NikB	NikC	→
Glutathione	○	GntB	GntC	GntA	→
Microcin C	○	YnfA	YnfB	YnfF	→
Iron complex	○	FhuD	FhuB	FhuC	→
Vitamin B12	○	BtuF	BtuC	BtuD	→
Manganese	○	MntC	MntB	MntA	→
Zinc	○	ZenA	ZenB	ZenC	→
Iron (II, III) / Manganese / Zinc	○	MntA	MntB	MntC	→
Iron (II) / Manganese	○	ShtA	ShtC	ShtB	→
Zinc / Manganese / Iron (II)	○	TroA	TroC	TroB	→
Cobalt	○	ChgN	ChgM	ChgO	→
Nickel	○	ChgN	ChgM	ChgO	→
Biotin	○	BioY	BioN	BioM	→
Biotin	○	BioY	EctY	EctA	→

Metallic cation, iron siderophore and vitamin B12 transporters

Iron complex	○	FhuD	FhuB	FhuC	→
Vitamin B12	○	BtuF	BtuC	BtuD	→
Manganese	○	MntC	MntB	MntA	→
Zinc	○	ZenA	ZenB	ZenC	→
Iron (II, III) / Manganese / Zinc	○	MntA	MntB	MntC	→
Iron (II) / Manganese	○	ShtA	ShtC	ShtB	→
Zinc / Manganese / Iron (II)	○	TroA	TroC	TroB	→
Cobalt	○	ChgN	ChgM	ChgO	→
Nickel	○	ChgN	ChgM	ChgO	→
Biotin	○	BioY	BioN	BioM	→
Biotin	○	BioY	EctY	EctA	→

ABC-2 and other transporters

Hemolysin	○	CytB	CytA
Capsular polysaccharide	○	KpsE	KpsT
Lipopolysaccharide	○	RfbA	RfbB
Tetrahic acid	○	TsgG	TsgH
Lipo-oligosaccharide	○	NodJ	NodI
Na ⁺	○	NatB	NatA
Hemine	○	HrtB	HrtA
Oleandrogenin	○	OleC3	OleC4
Bactracin	○	BceB	BceA
Lipoprotein	○	LoiC	LoiE
Heme	○	CcmC	CcmB
Cell division	○	FtsX	FtsE
Lipopolysaccharide	○	LypF	LypB
Fluoroxazinones	○	Rv2686	Rv2688
YnfF peptide	○	YnfU	YnfI
Acetoin utilization	○	YnfF	YnfO
		YnfE	YnfE

Eukaryotic-type ABC transporters

ABCA Subfamily

ABCA1	ABCA3
ABCA2	ABCA6
ABCA3	ABCA8
ABCA4	ABCA9
ABCA7	ABCA10
ABCA12	
ABCA13	

ABCB Subfamily

ABCB2	ABCB1	ABCB6	ABCB11	MdrA
ABCB3	ABCB4	ABCB7		HwB
ABCB5	ATM			RaxB
ABCB9				ItaA/B
ABCB10				AbcA
				SmA/B

ABCC Subfamily

ABCC1	ABCC8	MdrB	ABCC4
ABCC2	ABCC9	HsdD	CFTR
ABCC3	ABCC11	PndD	ABCC10
ABCC5	ABCC12	RndD	
ABCC6		EcdD	
ABCC13		LapB	
		CyflCD	

ABCD Subfamily

ABCD1	FXA12
ABCD2	
ABCD3	
ABCD4	

ABCG Subfamily

ABCG1	ABCG2	ABCG5	ABCG3
ABCG4	ABCG3	ABCG8	SNQ2

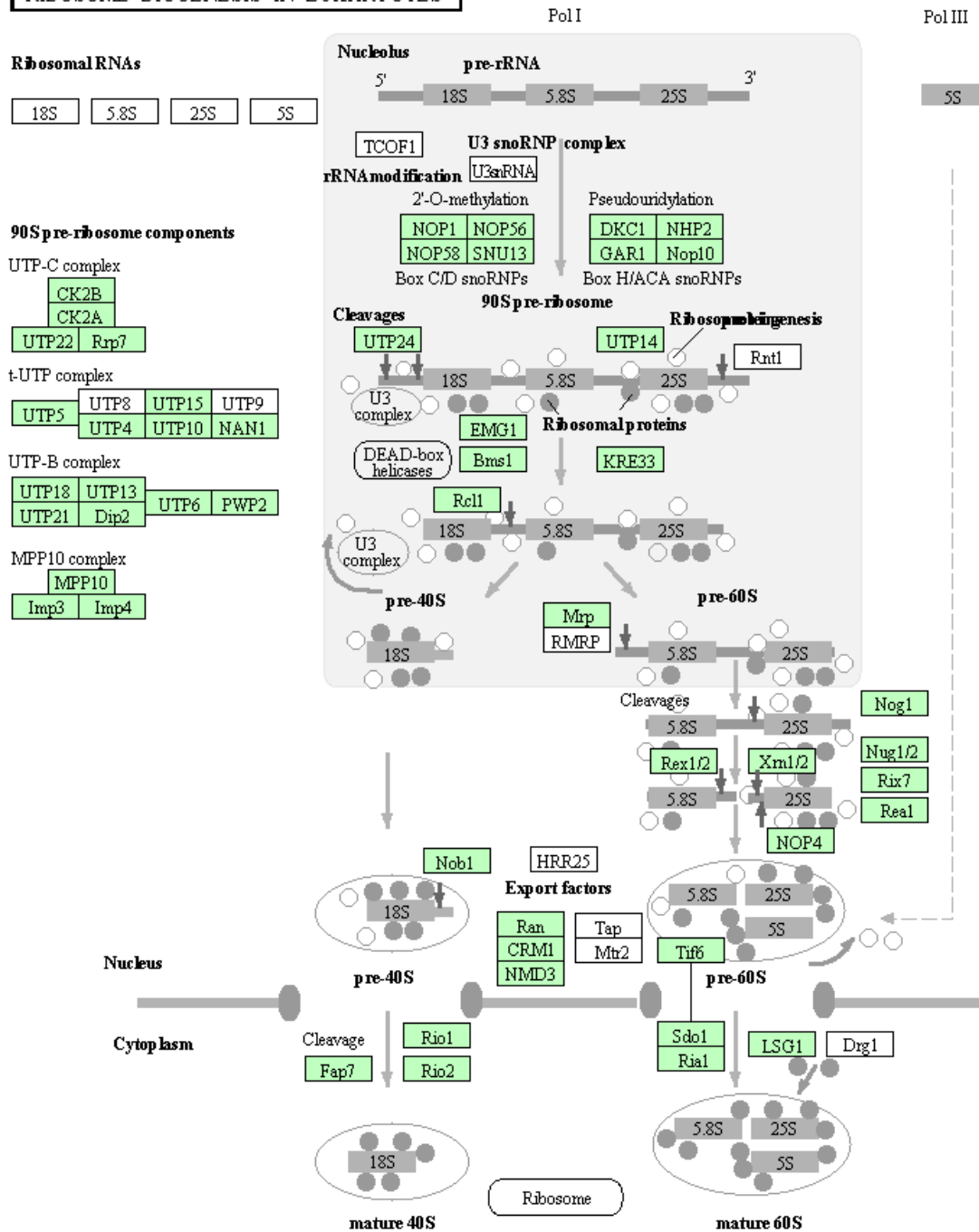
Macrolide exporters

MecB	TylC	MecA
------	------	------

Other putative ABC transporters

YojI
PvdE
SydD
Y44A

RIBOSOME BIOGENESIS IN EUKARYOTES



03010 7/29/13
(c) Kanehisa Laboratories

Bacteria / Archaea	23S	5S		16S
Eukaryotes	25S	5S	5.8S	18S

EF-Tu

S10	L3	L4	L23	L2	S19	L22	S3	RP-L16	L29
S20e	L3e	L4e	L23Ae	L8e	S15e	L17e	S3e		L35e

L10e

L7/L12 stalk

SecY

S17	L14	L34		L5	S14	S8	L6			L18	S5	L30	L15
S11e	L23e	L26e	S4e	L11e	S29e	S15Ae	L9e	L32e	L19e	L5e	S2e	L7e	L27Ae

IF1

L36	S13	S11	S4
S18e	S14e	S9e	

RpoA

L17	L13	S9
L18e	L13Ae	S16e

EF-Tu.G

S7	S12		L7A
S5e	S23e	L30e	L7Ae

RpoC.B

L7/L12	L12	L10	L1	L11
LP1,LP2	LP0	L10Ae	L12e	

EF-Ts

S2	
SAe	

IF2

S15
S13e

IF3

L35	L20	L34
-----	-----	-----

RF1

L31	L32	L9	S18	S6
-----	-----	----	-----	----

FeY,Fh

L28	L33	L21	L27	S16	L19	S1	S20	S21	L25
-----	-----	-----	-----	-----	-----	----	-----	-----	-----

L10e

L10e	L13e	L15e	L21e	L24e	L31e	L35Ae	L37e	L37Ae	L39e	L40e	L41e	L44e
------	------	------	------	------	------	-------	------	-------	------	------	------	------

S3Ae

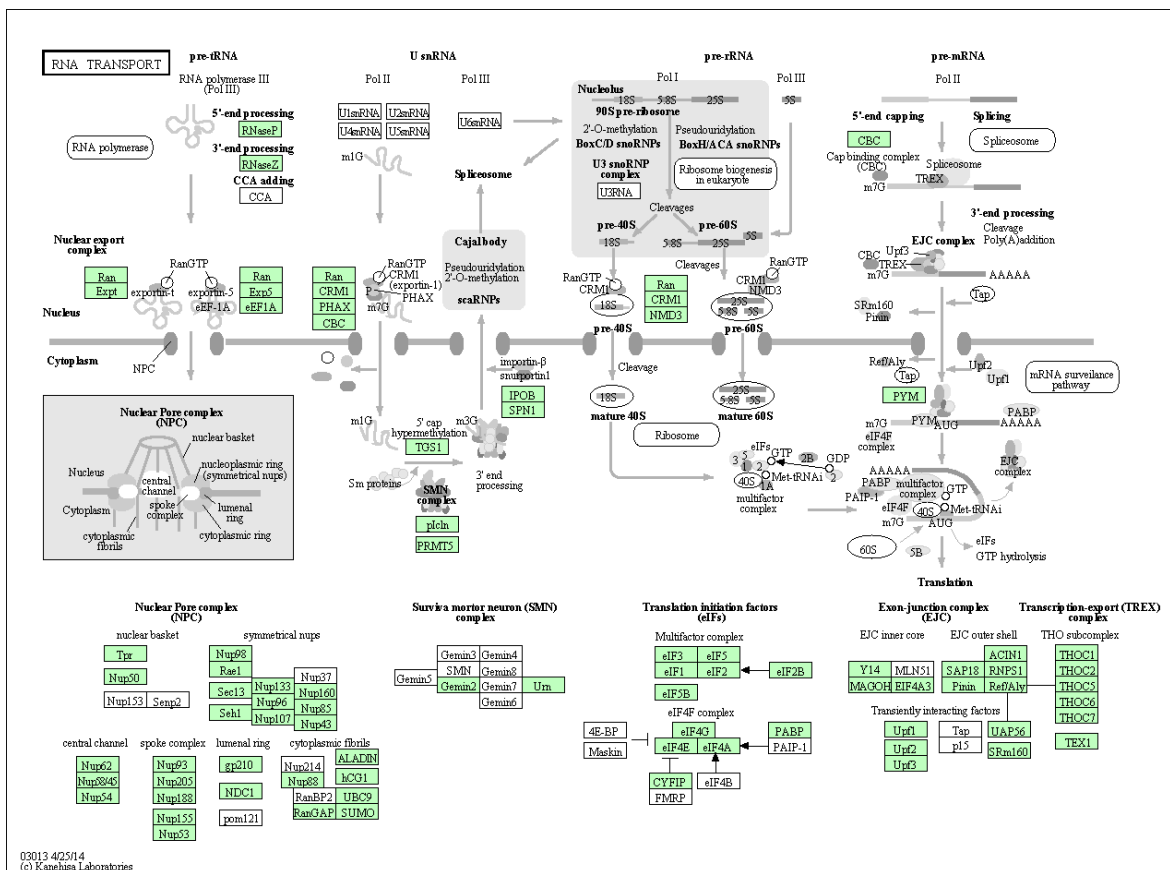
S3Ae	S6e	S8e	S17e	S19e	S24e	S25e	S26e	S27e	S27Ae	S28e	S30e
------	-----	-----	------	------	------	------	------	------	-------	------	------

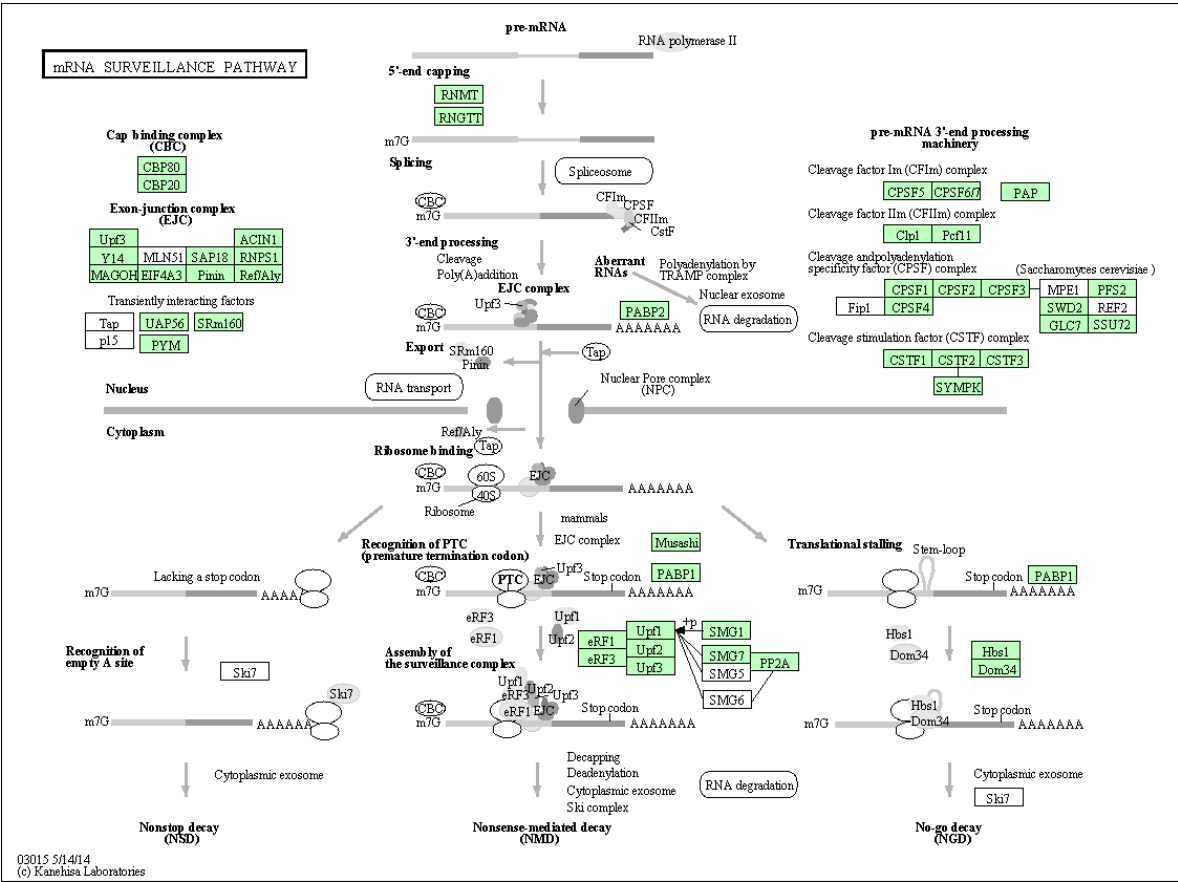
LX

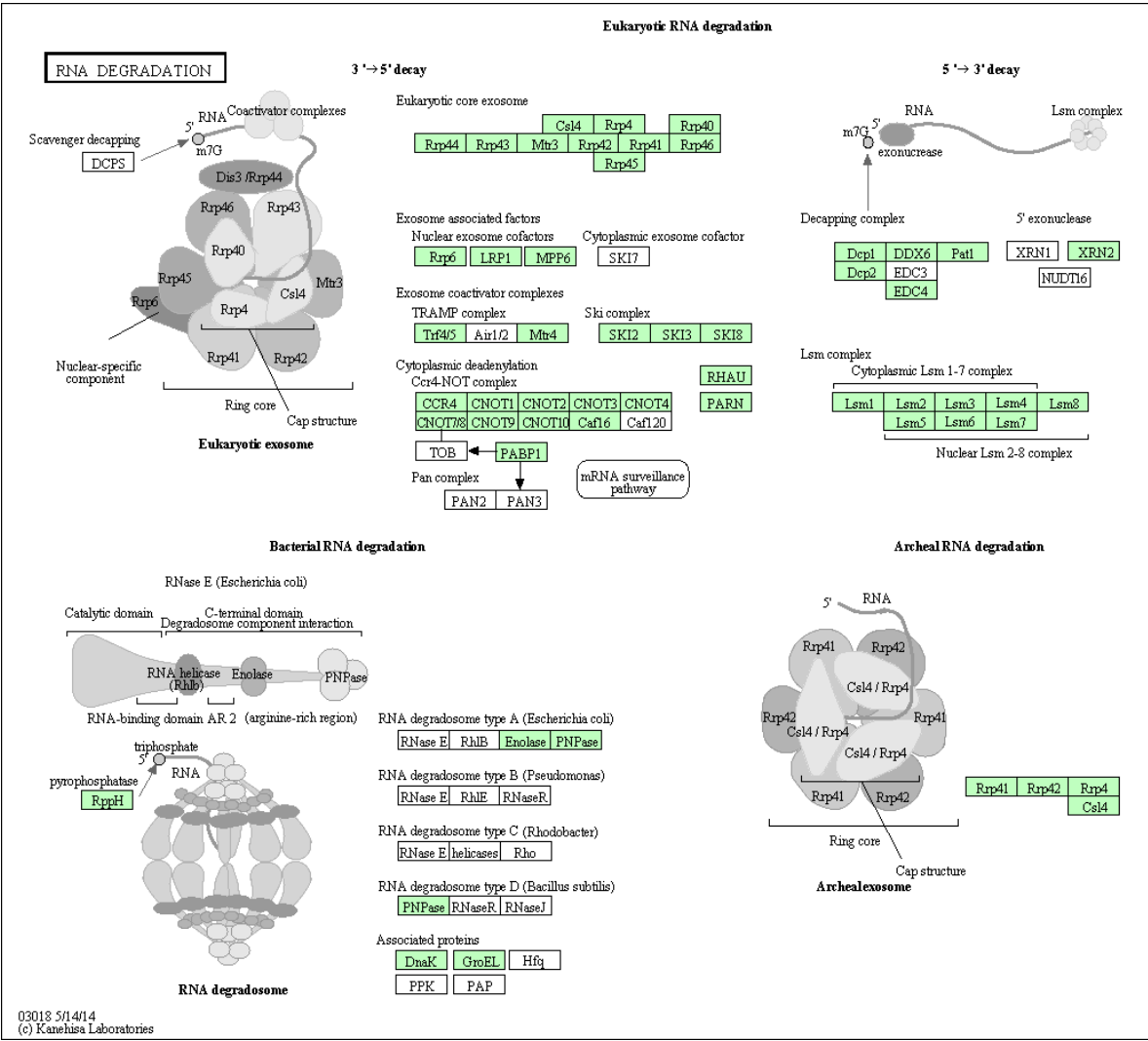
L6e	L18Ae	L22e	L27e	L28e	L29e	L36e	L38e
-----	-------	------	------	------	------	------	------

S7e

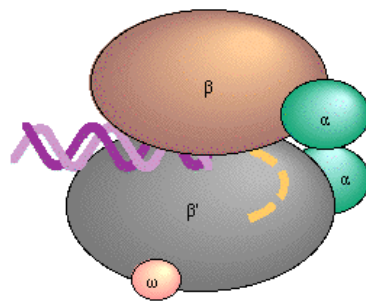
S7e	S10e	S12e	S21e
-----	------	------	------







RNA POLYMERASE



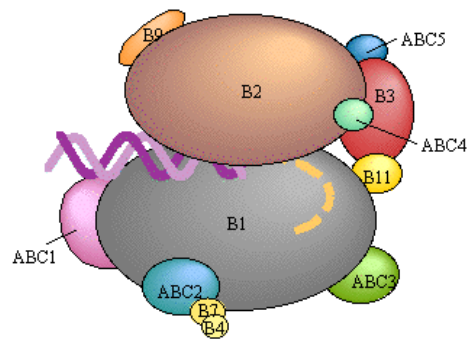
RNA polymerase (*Thermus aquaticus*)

Bacterial

β				
β'	α	ω	δ	

Archaeal

B	D	F	H	K	E
A	G		N	L	P



RNA polymerase II (*Saccharomyces cerevisiae*)

Eukaryotic Pol II

Core subunits	
B2	B3
B1	B11

Pol II specific subunits

B4	B7	B9
----	----	----

Pol I, II, and III common subunits

ABC1	ABC2	ABC3
ABC4	ABC5	

Eukaryotic Pol III

Core subunits	
C2	AC2
C1	AC1

Pol III specific subunits

C3	C4	C11	
C25	C31	C34	C37

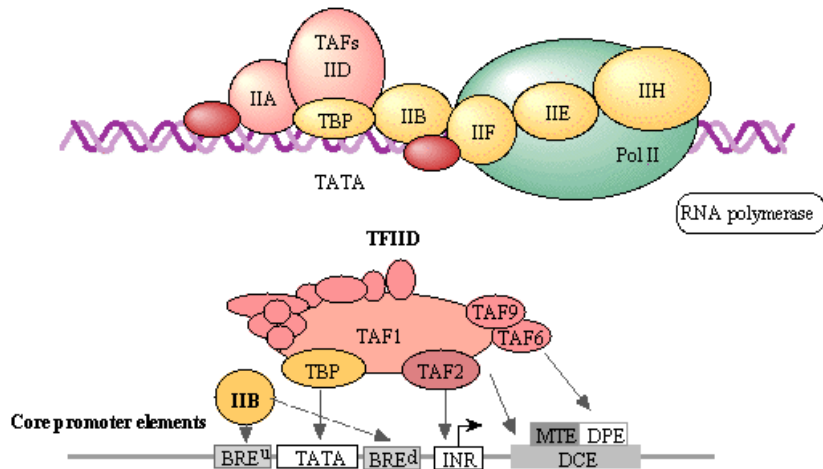
Eukaryotic Pol I

Core subunits	
A2	AC2
A1	AC1

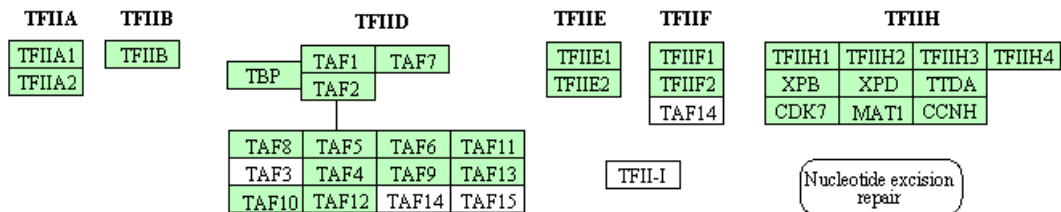
Pol I specific subunits

A12	A14	A34
A49	A43	

BASAL TRANSCRIPTION FACTORS (EUKARYOTES)

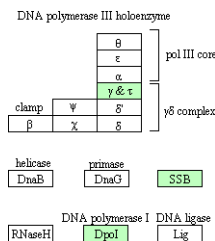
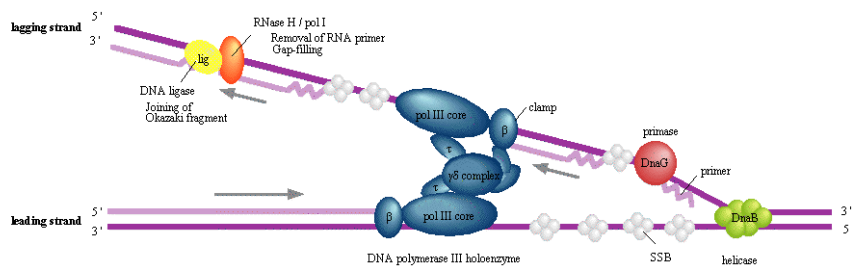


General transcription factors for RNA polymerase II

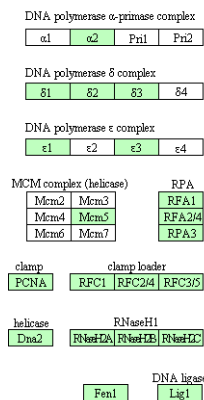
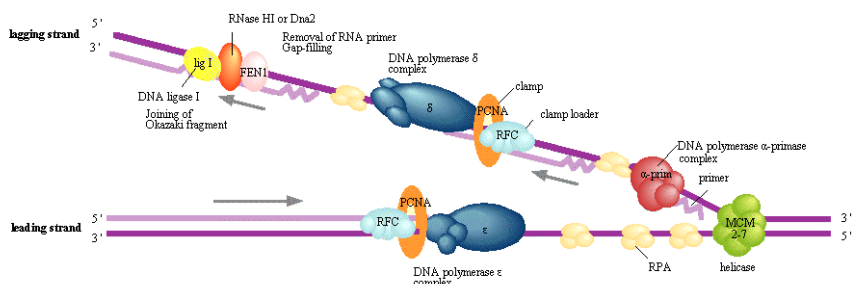


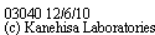
DNA REPLICATION

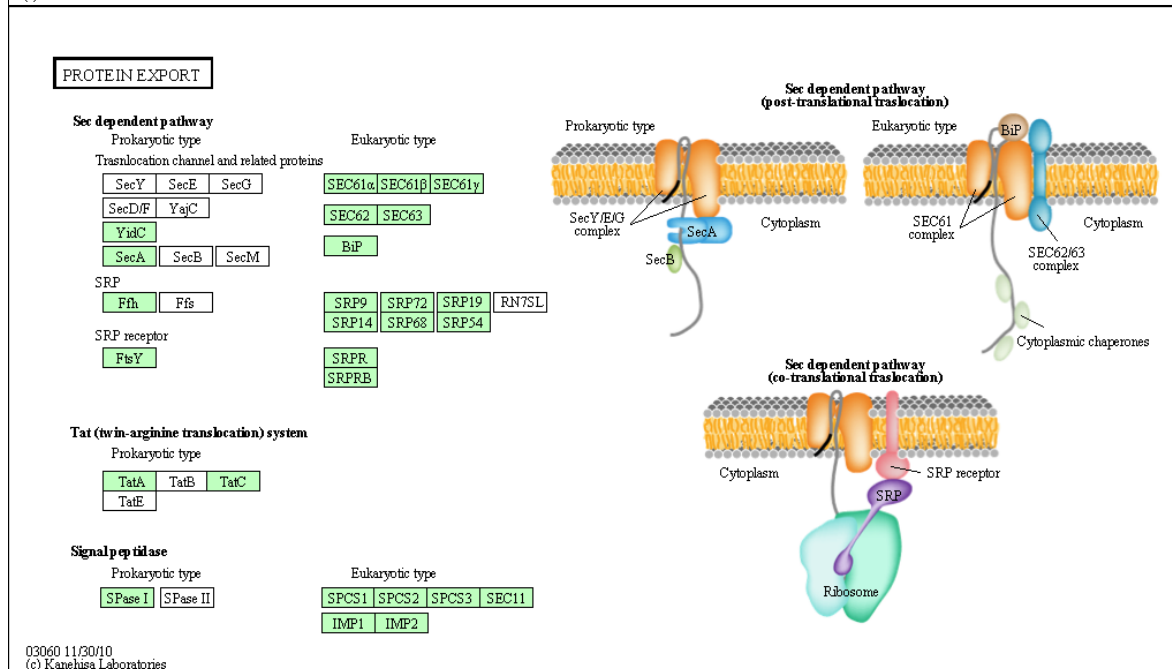
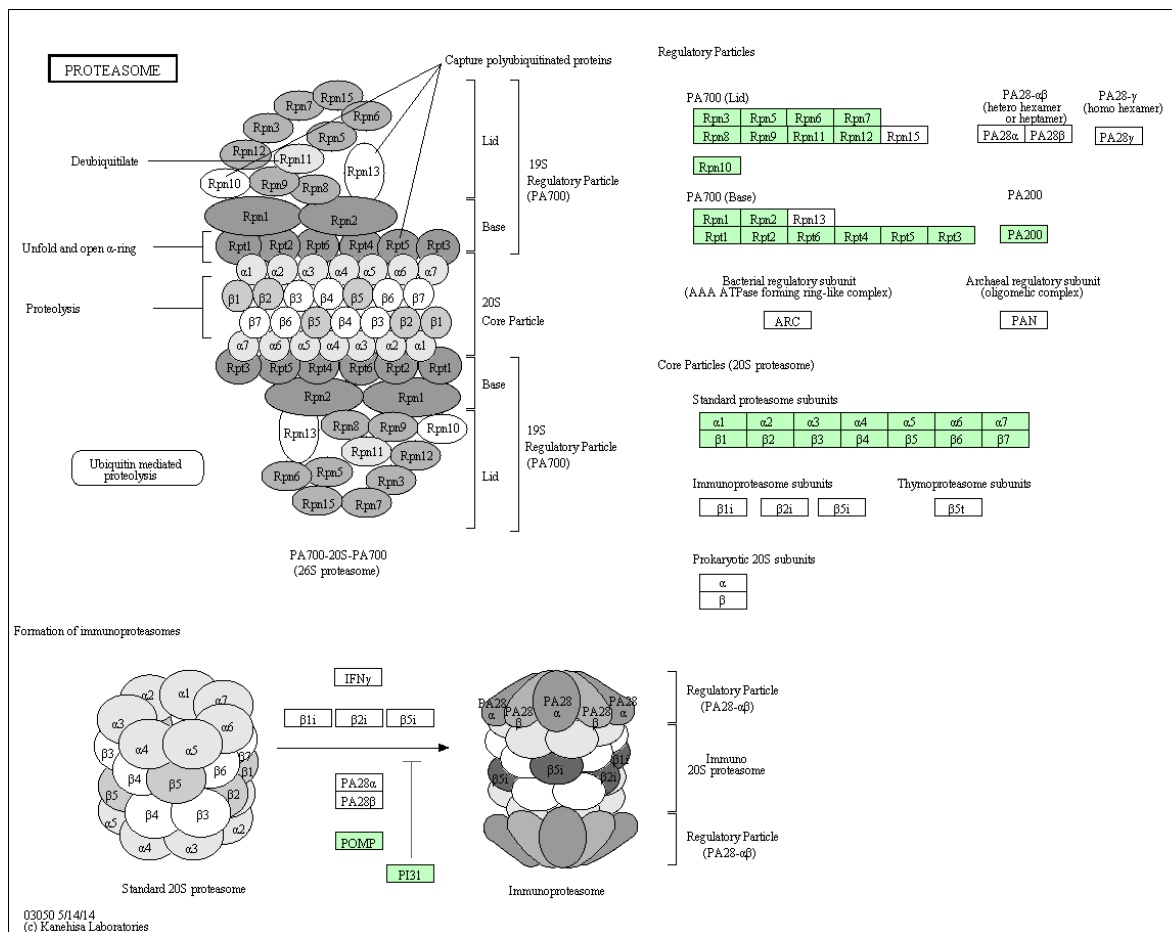
Replication complex (Prokaryotes)

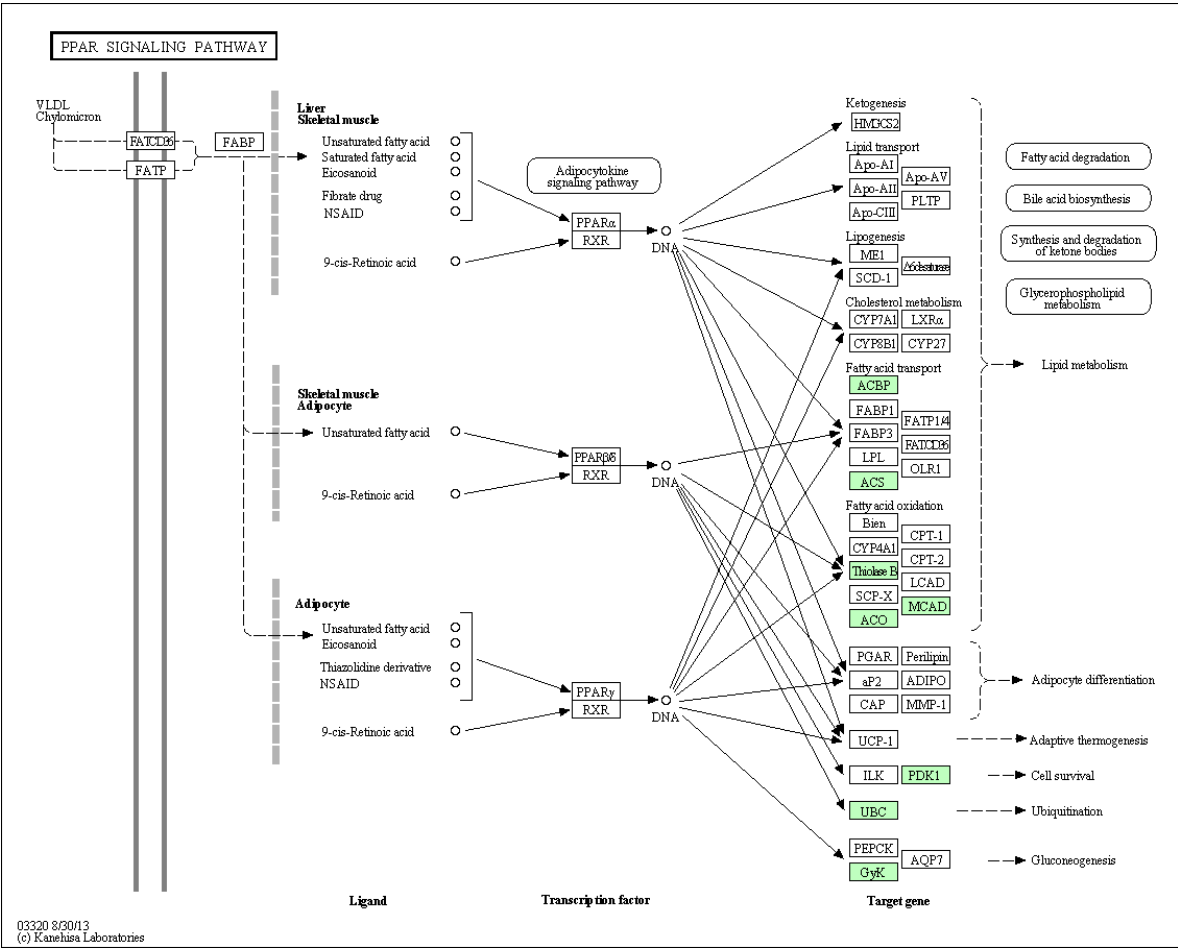


Replication complex (Eukaryotes)

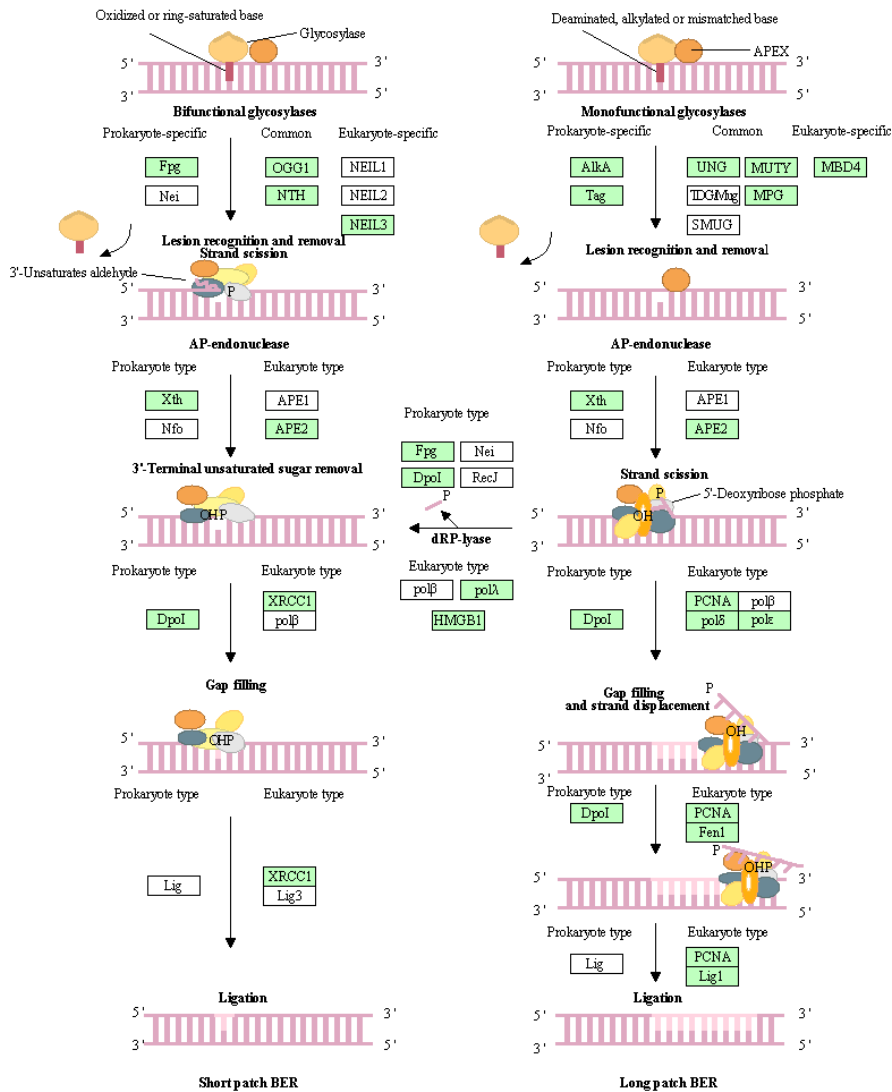






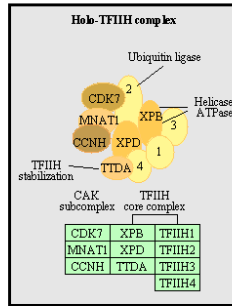
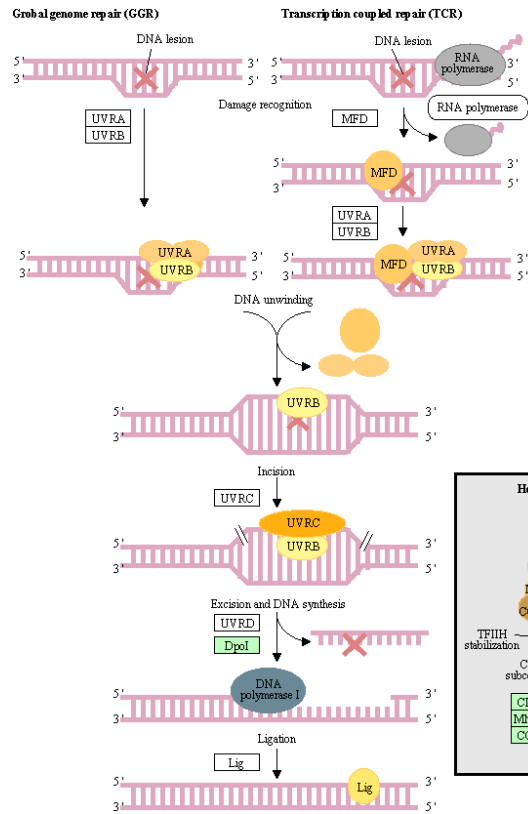


BASE EXCISION REPAIR

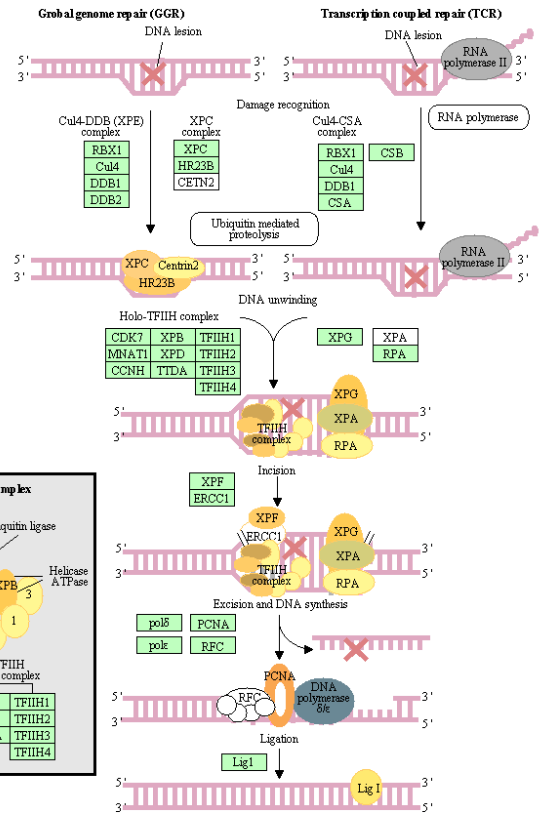


NUCLEOTIDE EXCISION REPAIR

Prokaryotic type

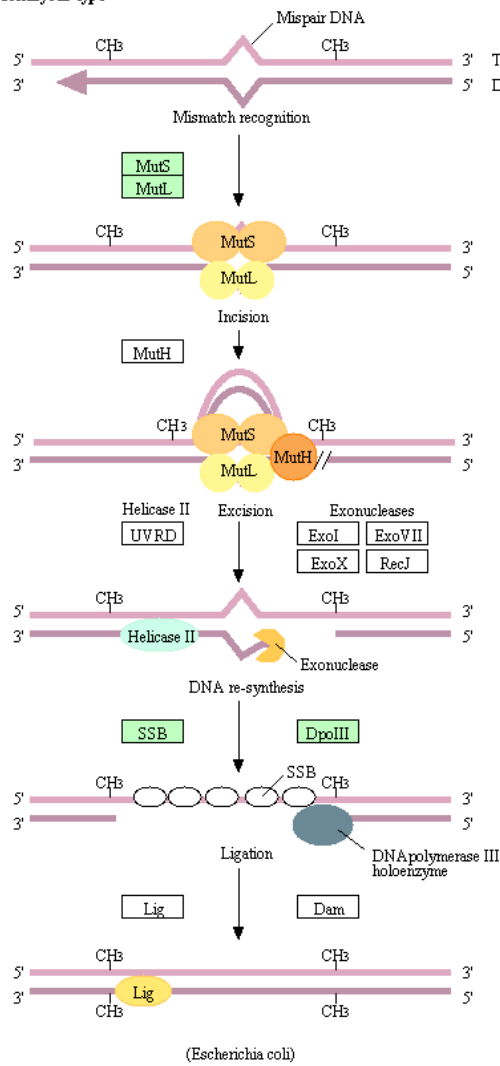


Eukaryotic type

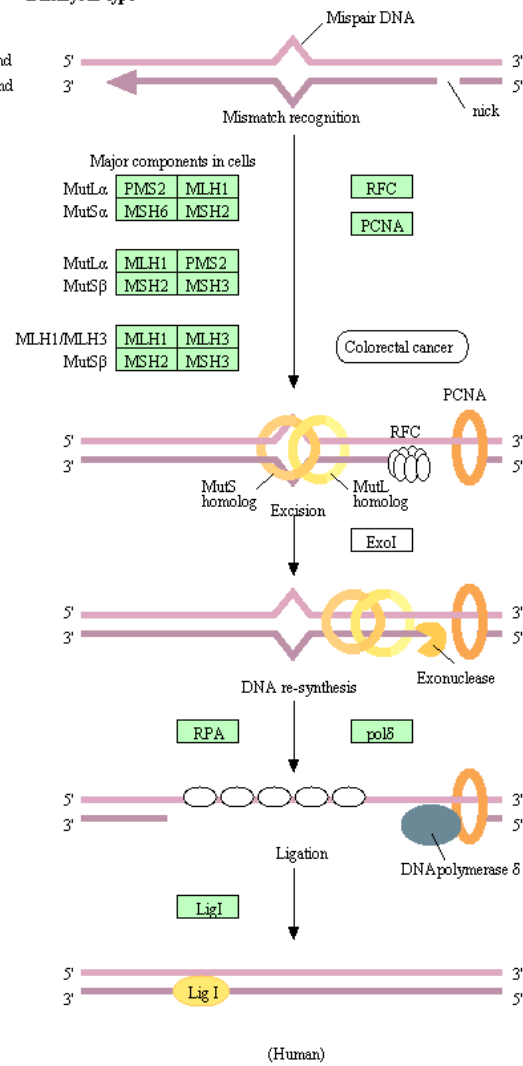


MISMATCH REPAIR

Prokaryotic type

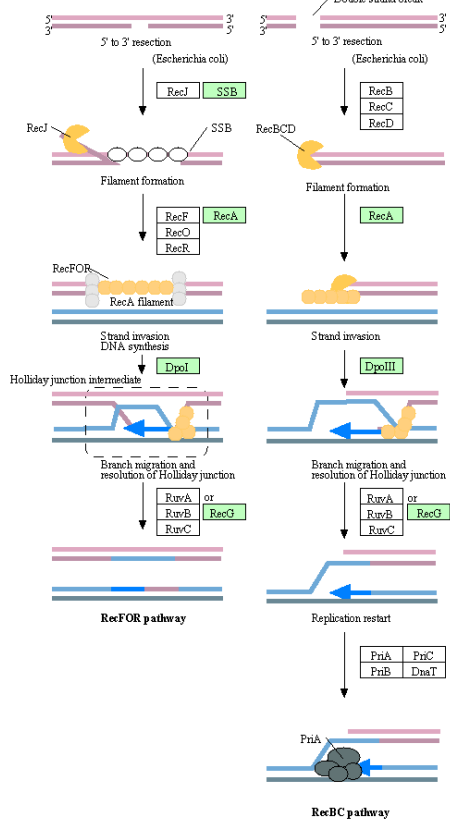


Eukaryotic type

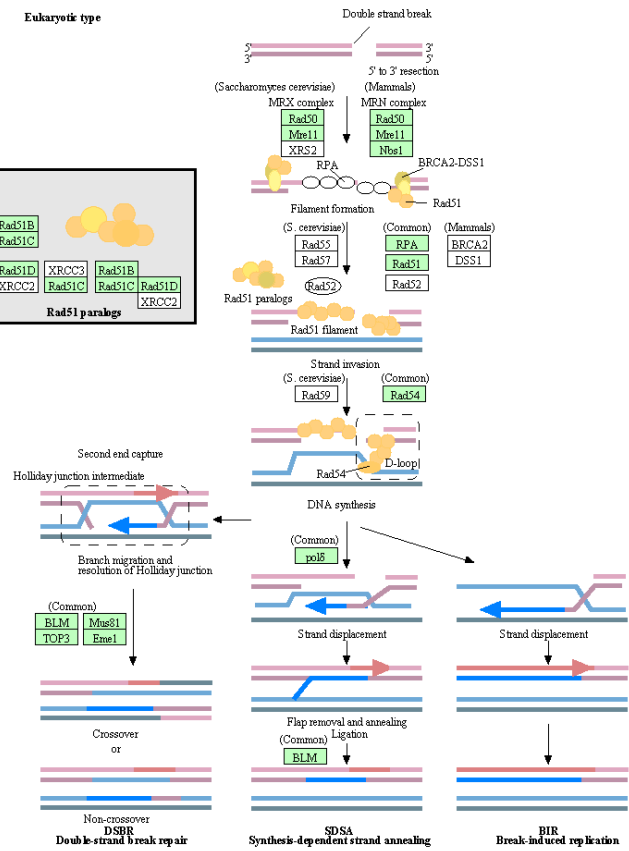
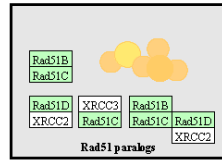


HOMOLOGOUS RECOMBINATION

Prokaryotic type

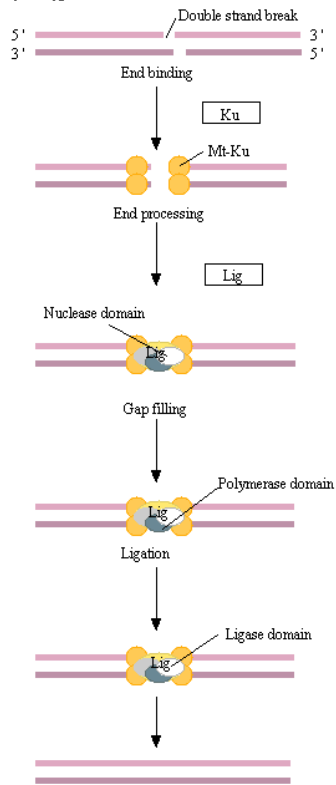


Eukaryotic type

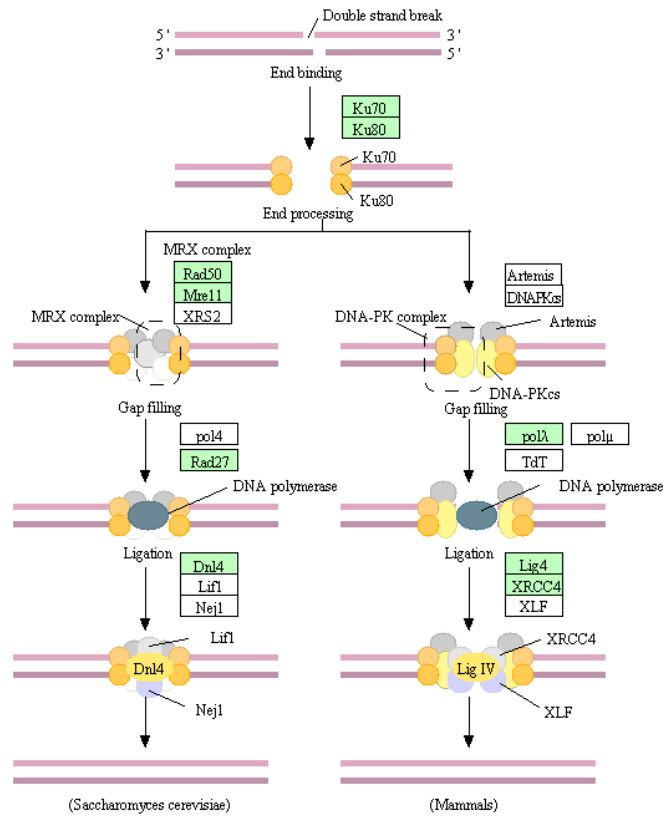


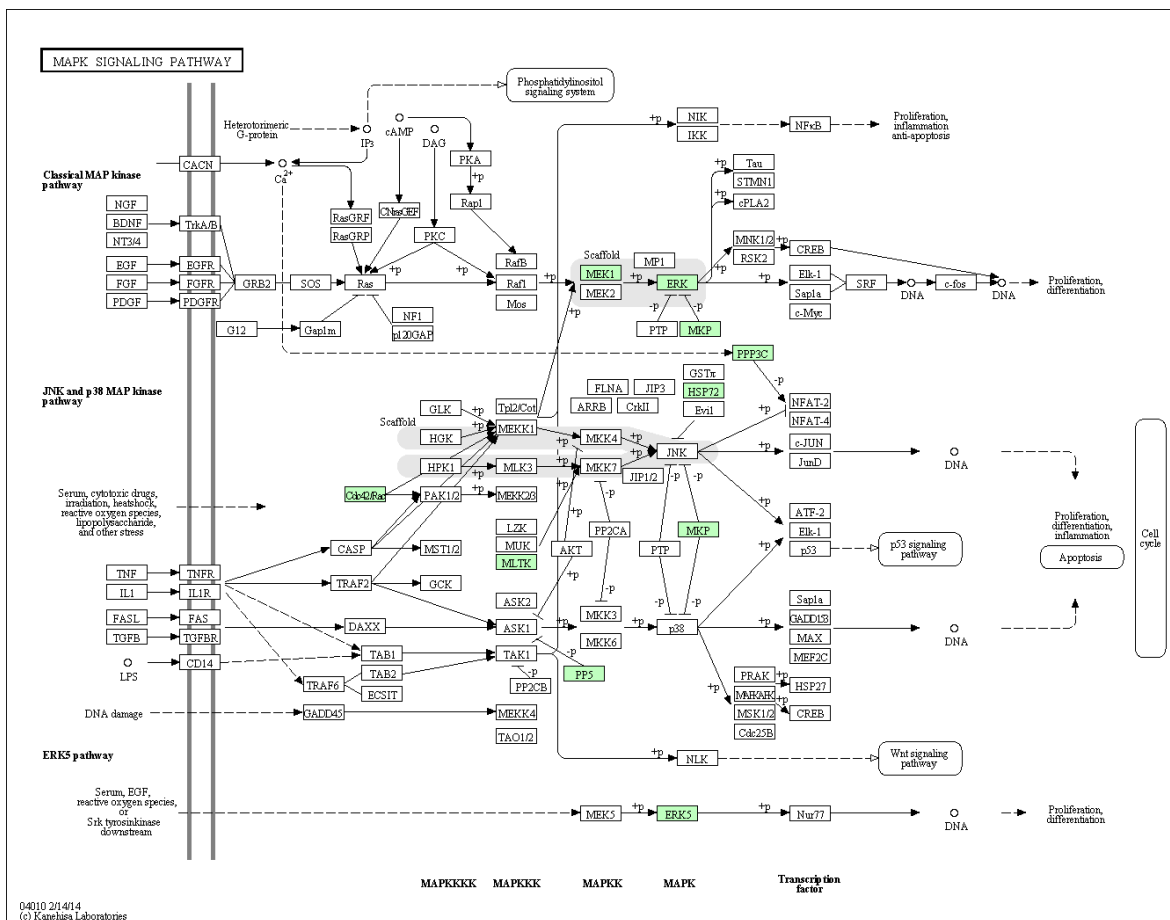
NON-HOMOLOGOUS END-JOINING

Prokaryotic type

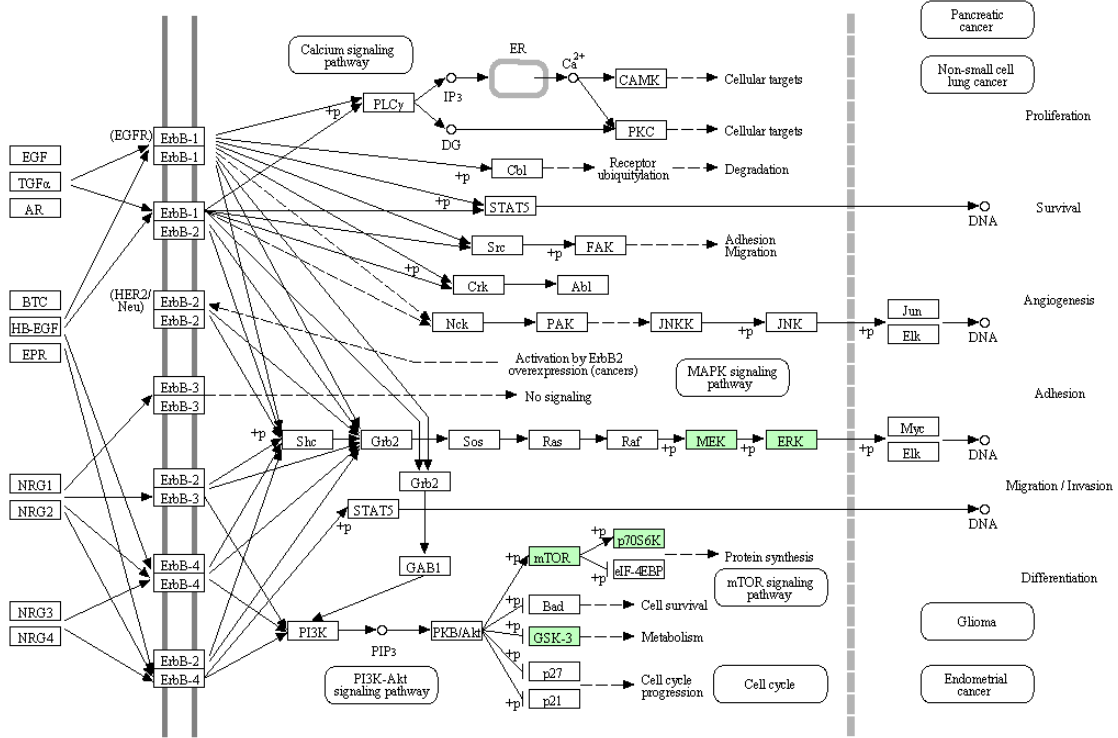


Eukaryotic type



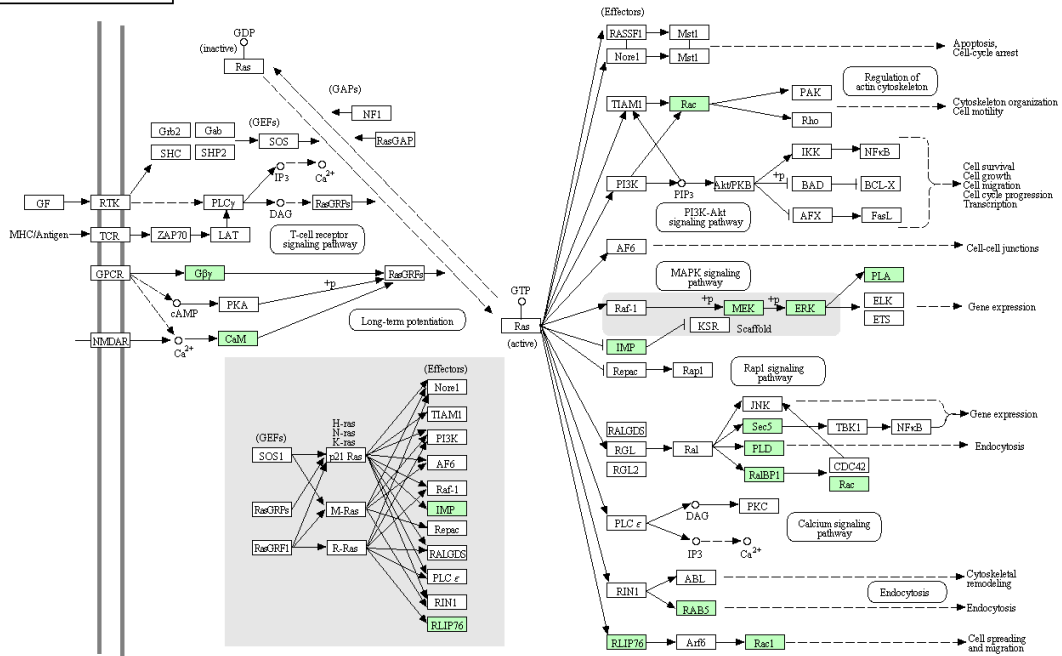


ERBB SIGNALING PATHWAY

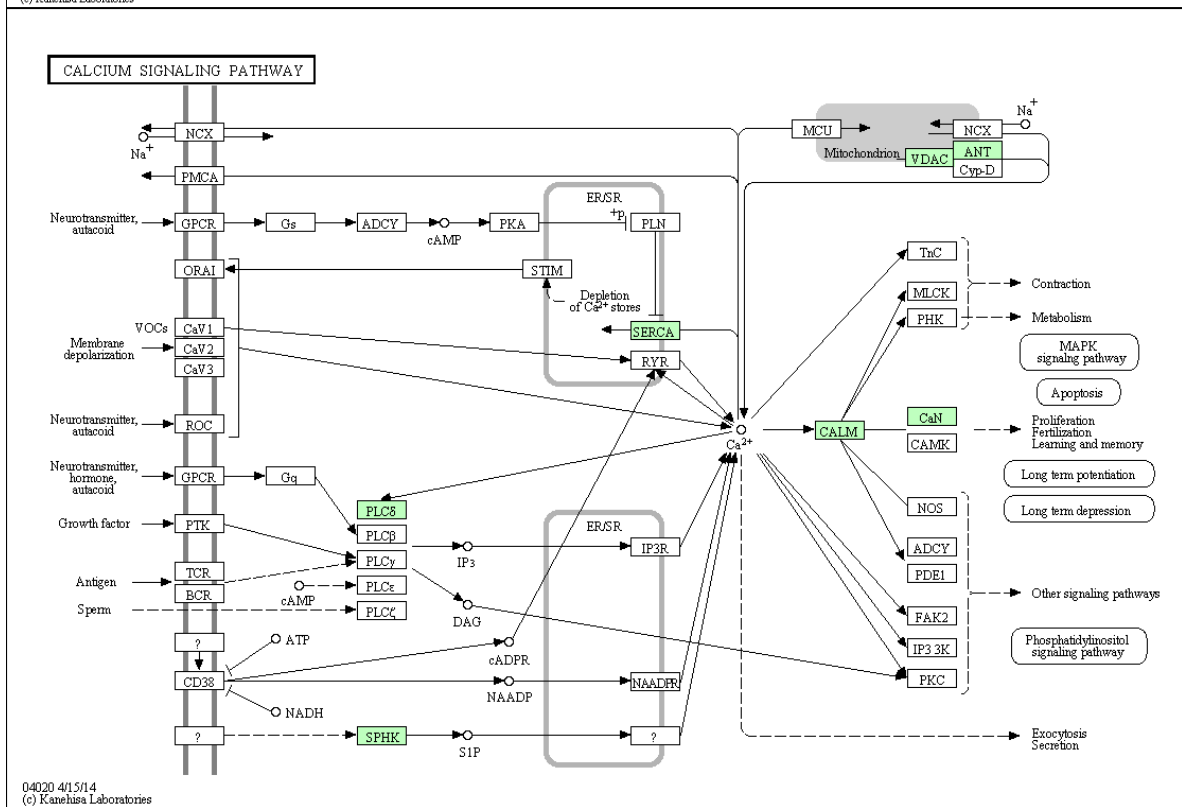
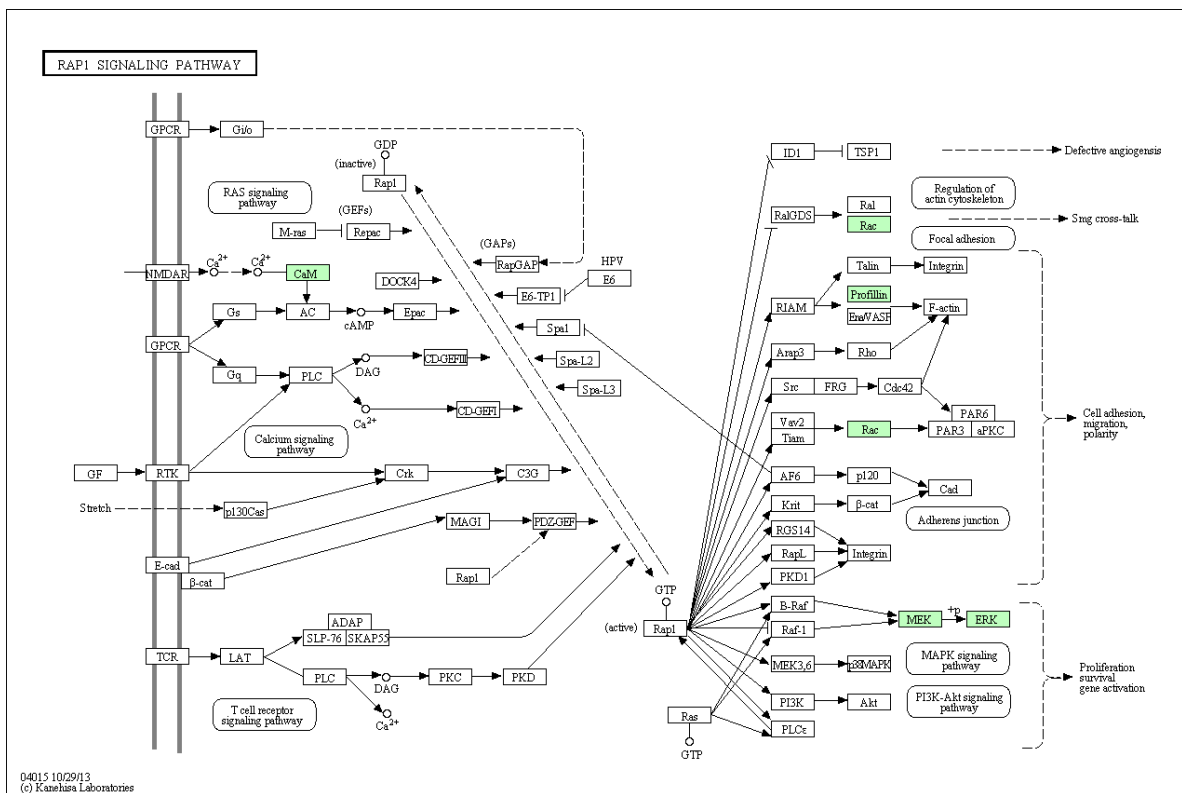


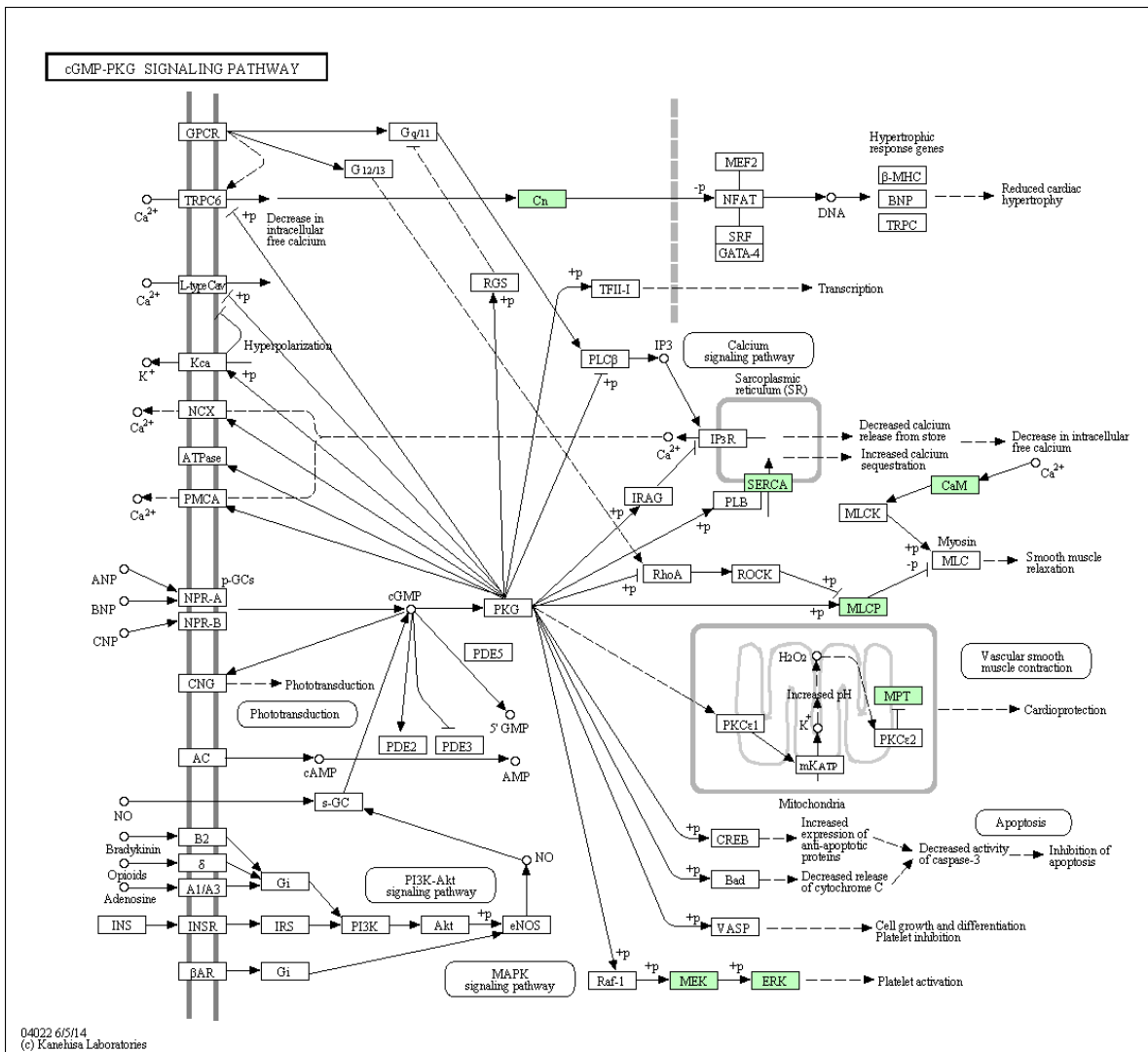
04012 8/2/13
(c) Kanehisa Laboratories

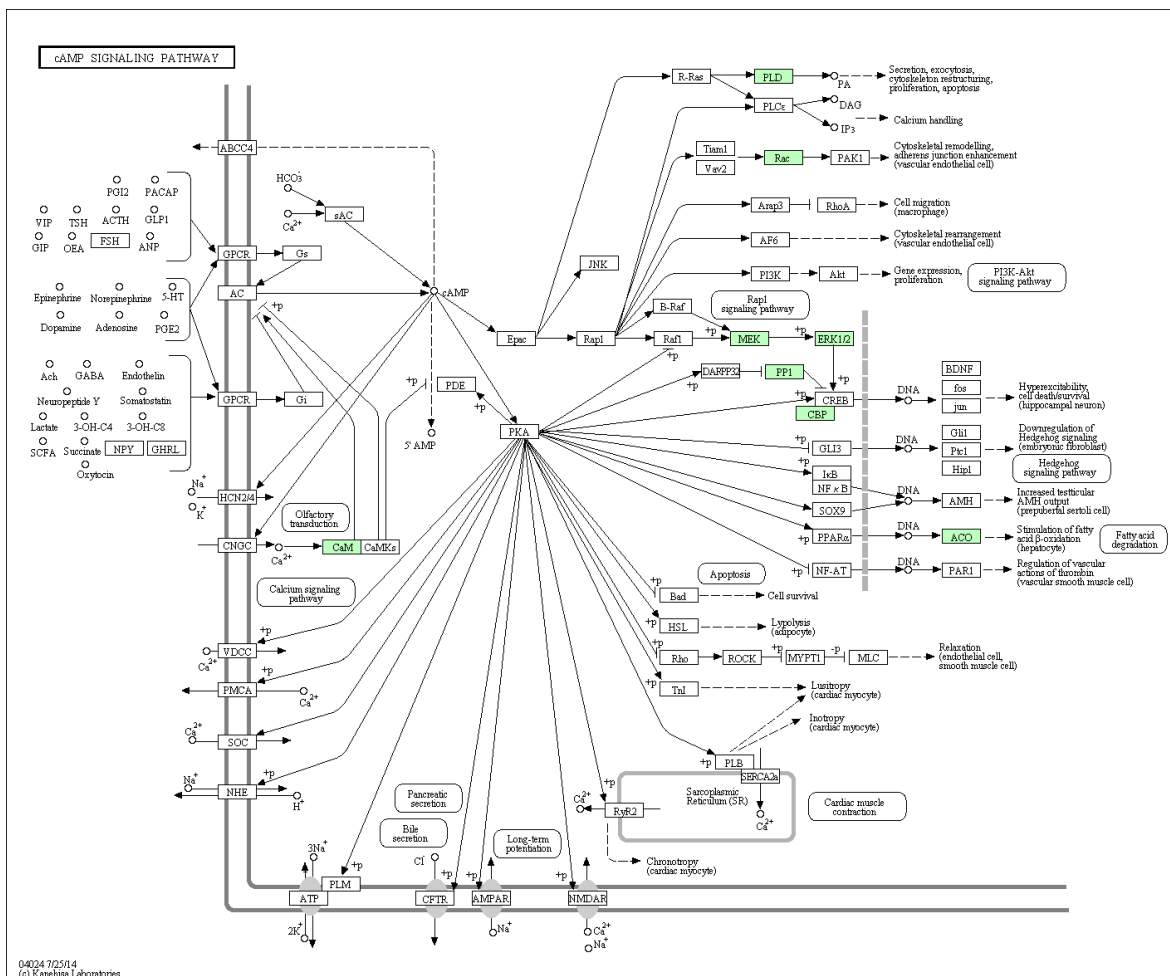
RAS SIGNALING PATHWAY



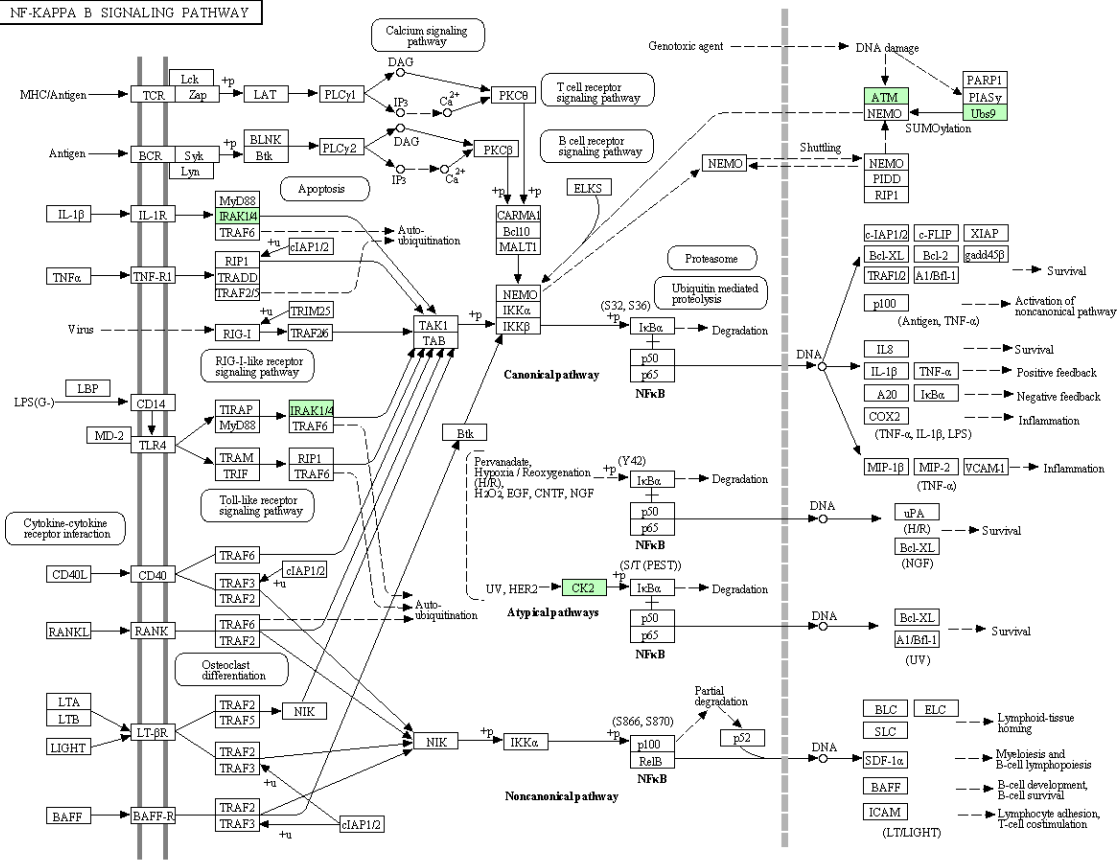
04014 10/7/13
(c) Kanehisa Laboratories







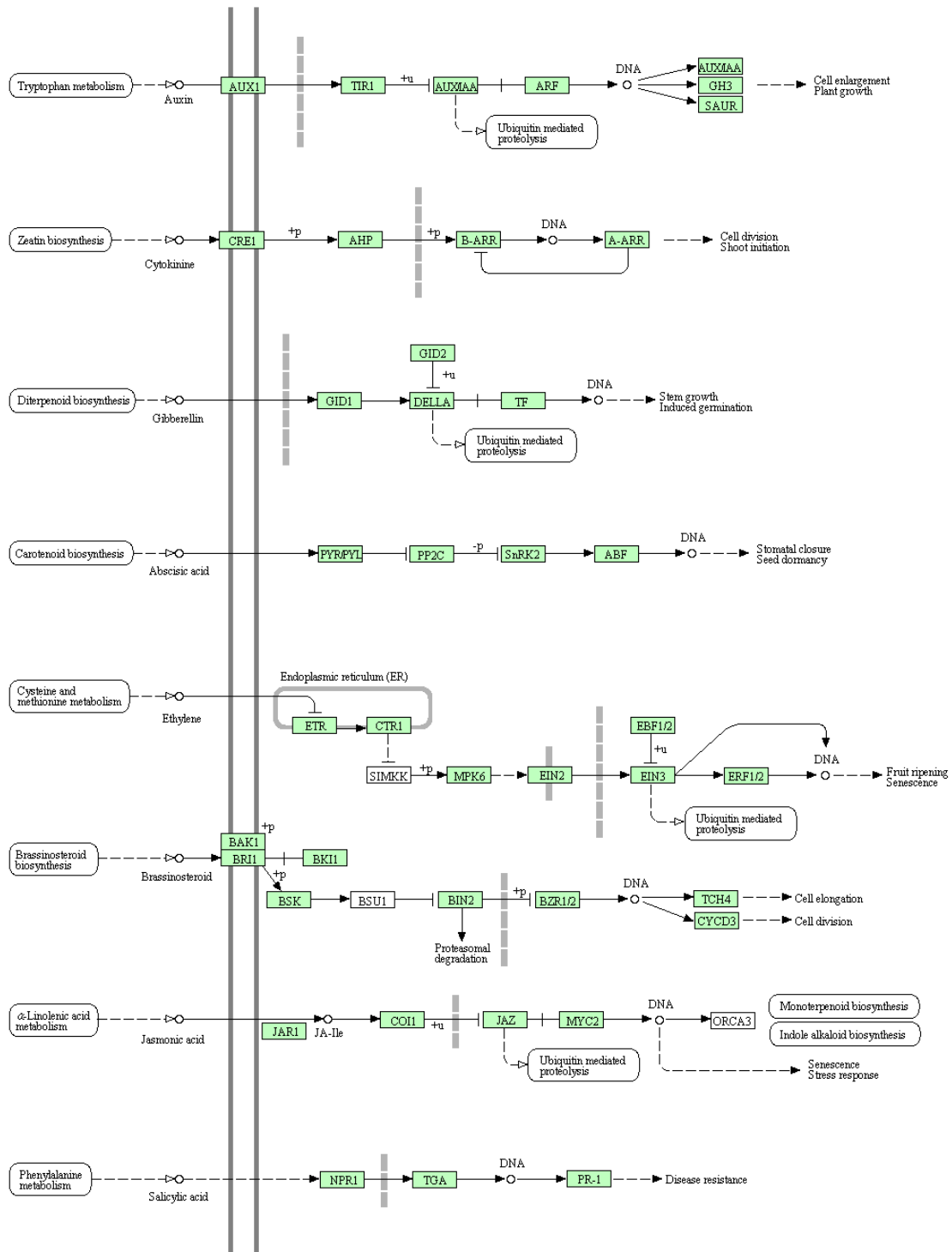
NF-KAPPA B SIGNALING PATHWAY

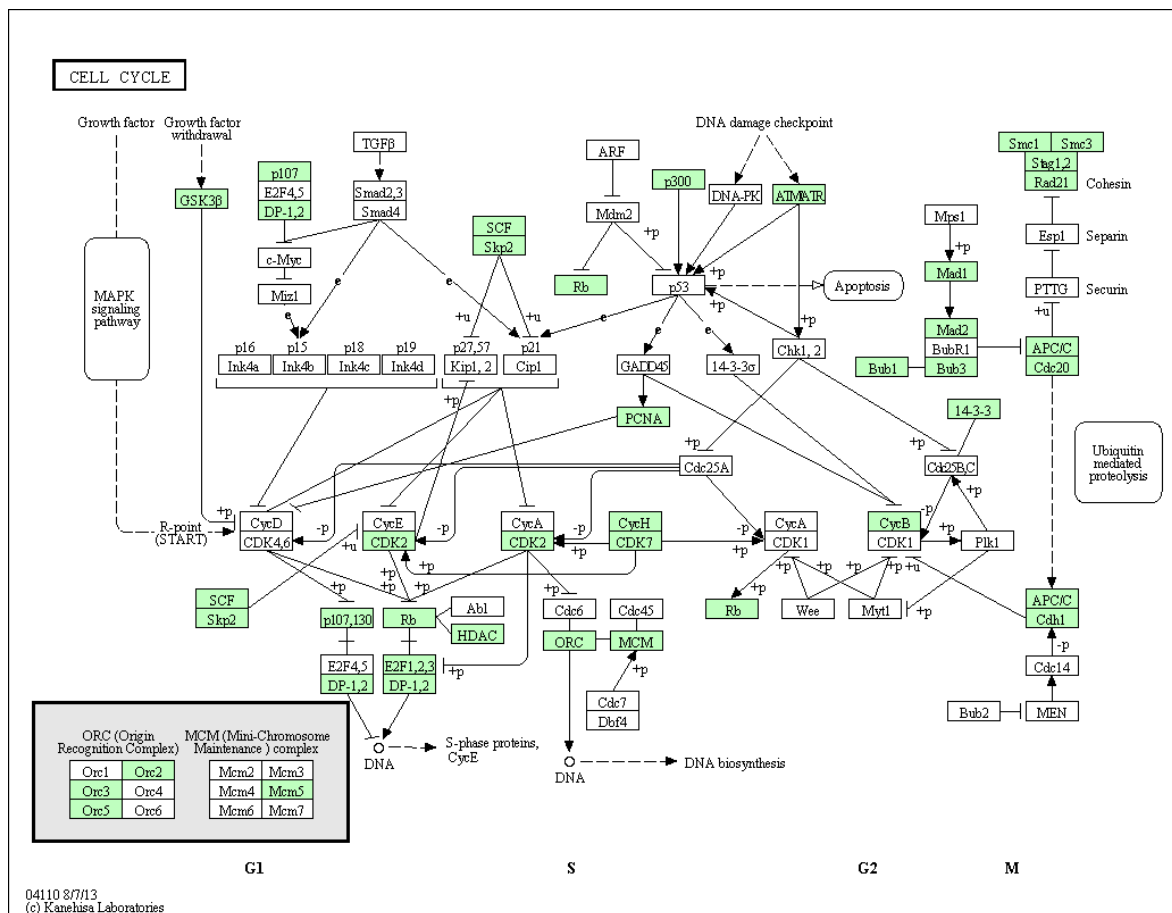


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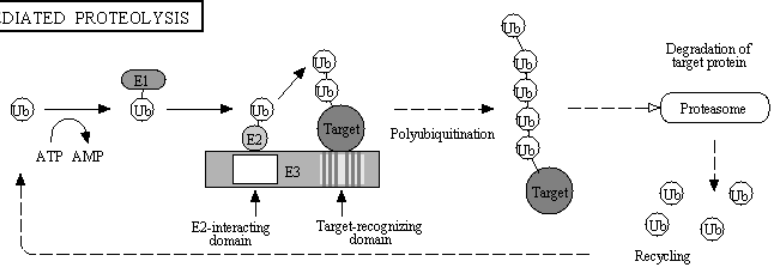
04070 6/21/13
(c) Kanehisa Laboratories

PLANT HORMONE SIGNAL TRANSDUCTION





UBIQUITIN MEDIATED PROTEOLYSIS



E1
(Ubiquitin-activating enzyme)

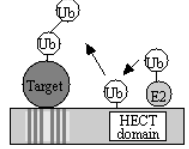
UBE1	UBE1A	UBE1B	UBE1C
------	-------	-------	-------

E2
(Ubiquitin-conjugating enzyme)

UBE2A	UBE2B	UBE2C	UBE2D	UBE2E	UBE2F	UBE2G1	UBE2G2	UBE2H
UBE2I	UBE2J1	UBE2J2	UBE2L3	UBE2L6	UBE2M	UBE2N	UBE2O	
UBE2Q	UBE2R	UBE2S	UBE2U	UBE2W	UBE2Z	HIP2	APC11CN	

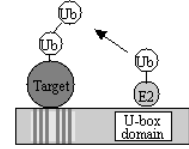
E3
(Ubiquitin ligase)

HECT type E3



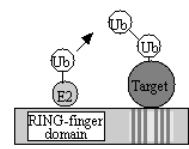
E6AP	UBE3B	UBE3C	Smurf	Itch
WWP1	WWP2	TRIP12	NEDD4	ARF-BP1
EDD1	HERC1	HERC2	HERC3	HERC4

U-box type E3



UBE4A	UBE4B	CHIP
CYC4	PRP19	UIP5

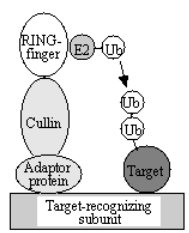
single RING-finger type E3



Mdm2	CBL	Perkin	SLAH-1	PML	TRAF6	MEKK1
COP1	PIRH2	cIAPs	PIAS	SYVN	NHLRC1	AIRE
MGRN1	BRCA1	FANCL	MID1	Trim32	Trim37	

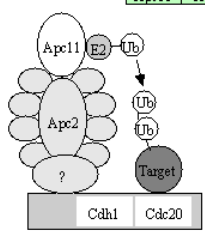
multi subunit RING-finger type E3

Cullin-Rbx E3



	RING finger	Cullin	Adaptor protein	Target recognizing subunit
SCF complex	RBX1	Cul1	Skp1	F-box
ECV complex	RBX1	Cul2	EloB	VHLbox
			EloC	
Cul3 complex	RBX1	Cul3		BTB
Cul4 complex	RBX1	Cul4	DDB1	DCAF
ECS complex	RBX2	Cul5	EloB	SOC3box
			EloC	
Cul7 complex	RBX1	Cul7	Skp1	Fbxw8

APC/C

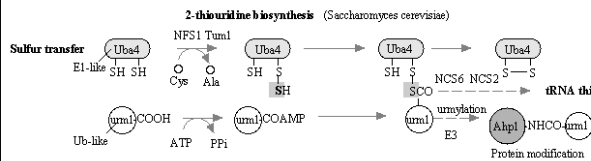


RING finger	Cullin	Adaptor protein	Target recognizing subunit	Other subunits
Apc11	Apc2	?	Cdc20	Apc1
			Cdh1	Apc4
				Apc6
				Apc8
				Apc10
				Apc12
				Apc13

ubiquitin pathway

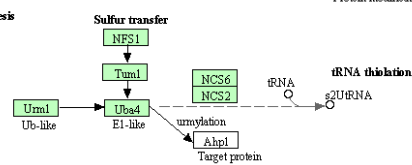


Sulfur-relay pathway

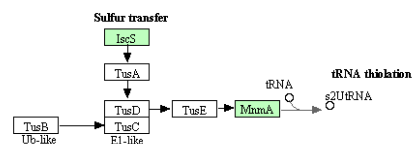
2-thiouridine biosynthesis (*Saccharomyces cerevisiae*)

2-thiouridine biosynthesis

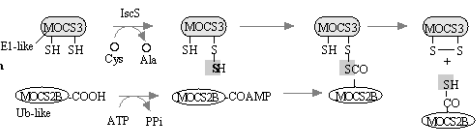
Eukaryote



Prokaryote

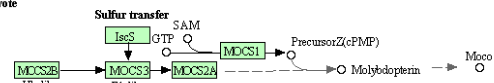


Molybdenum cofactor (Moco) biosynthesis (Mammals)

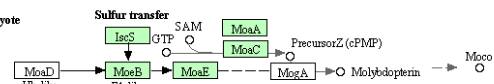


Moco biosynthesis

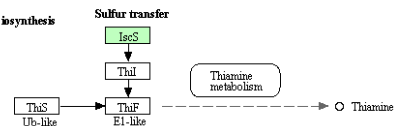
Eukaryote

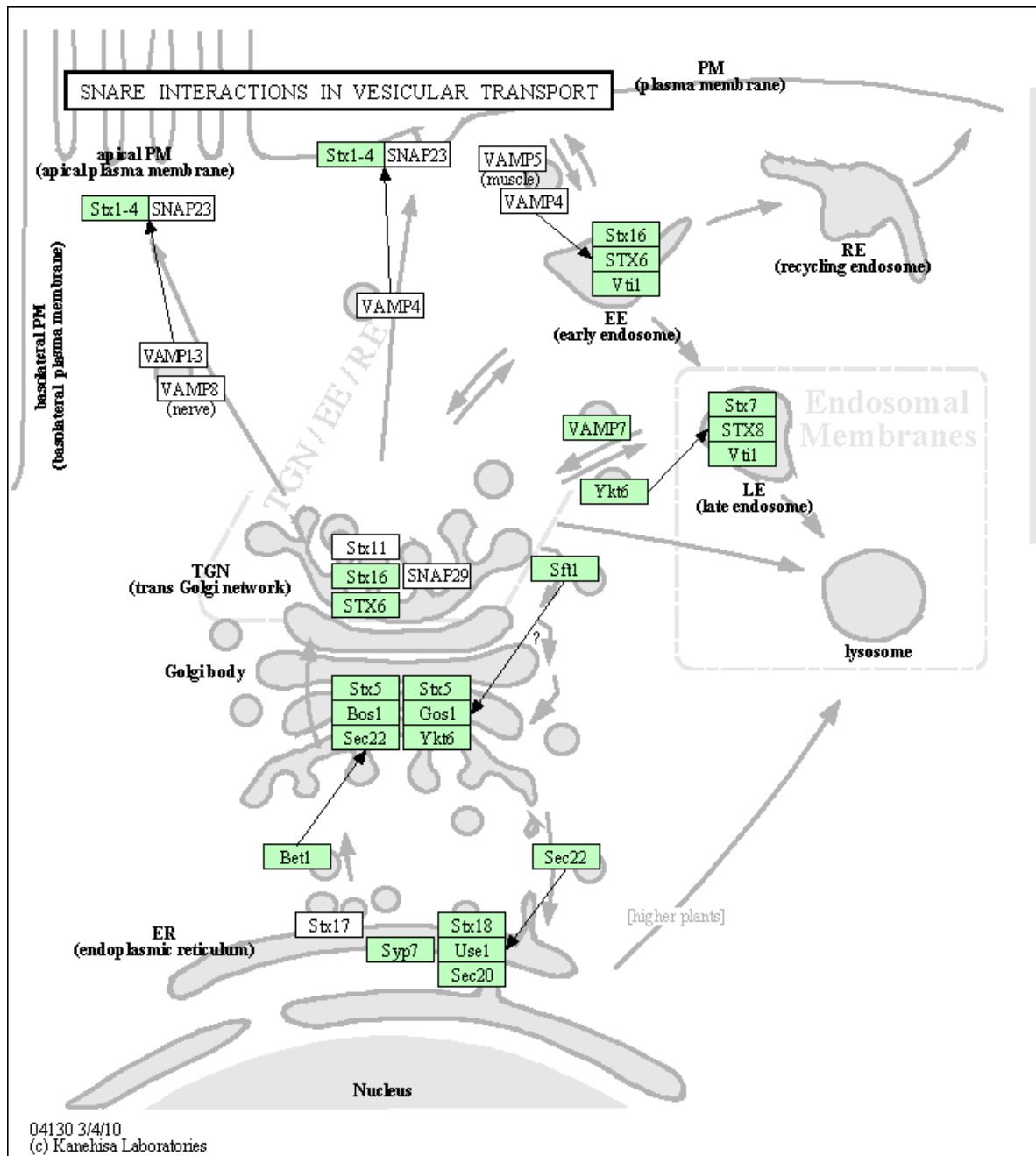


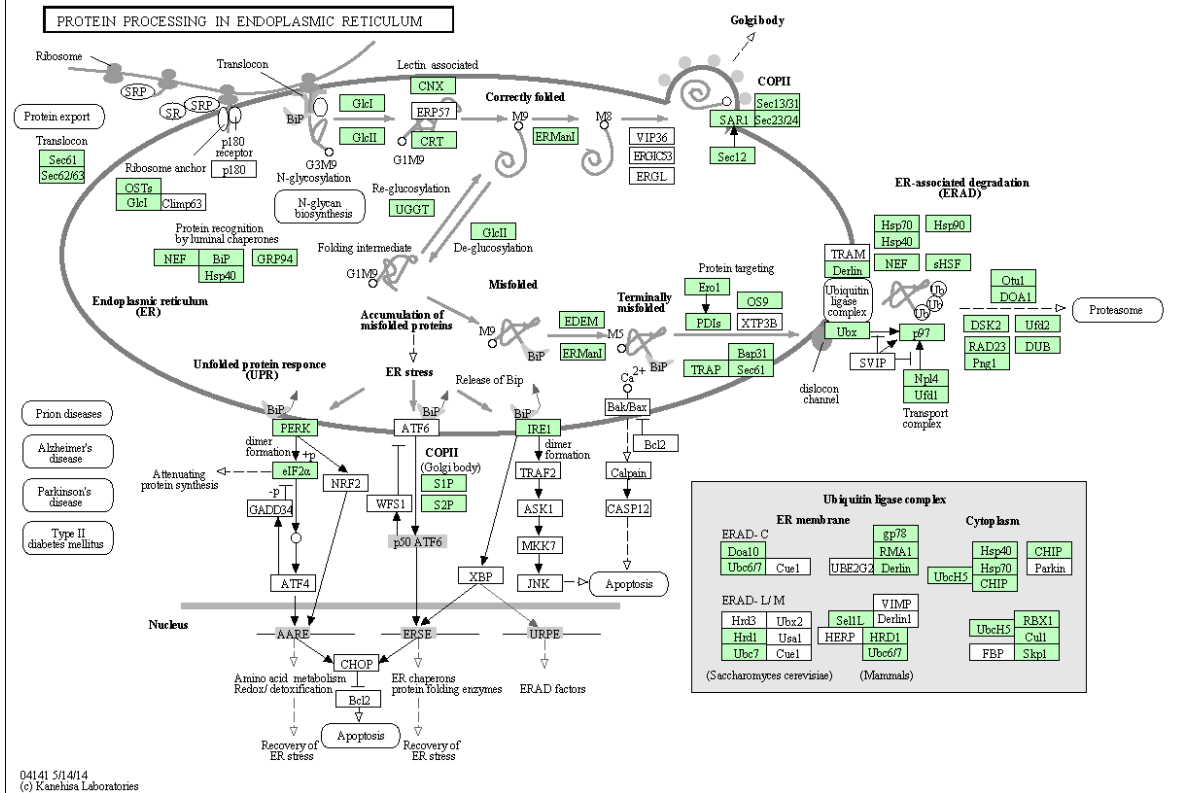
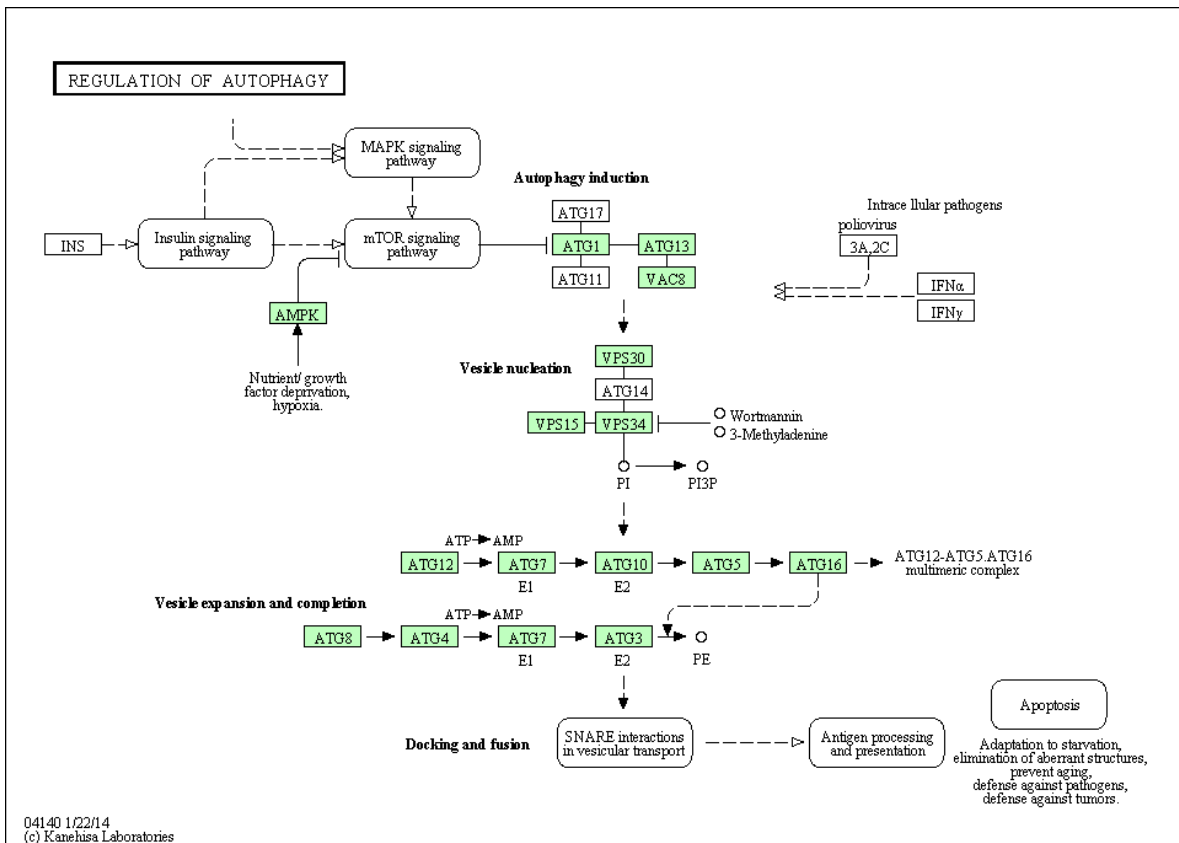
Prokaryote

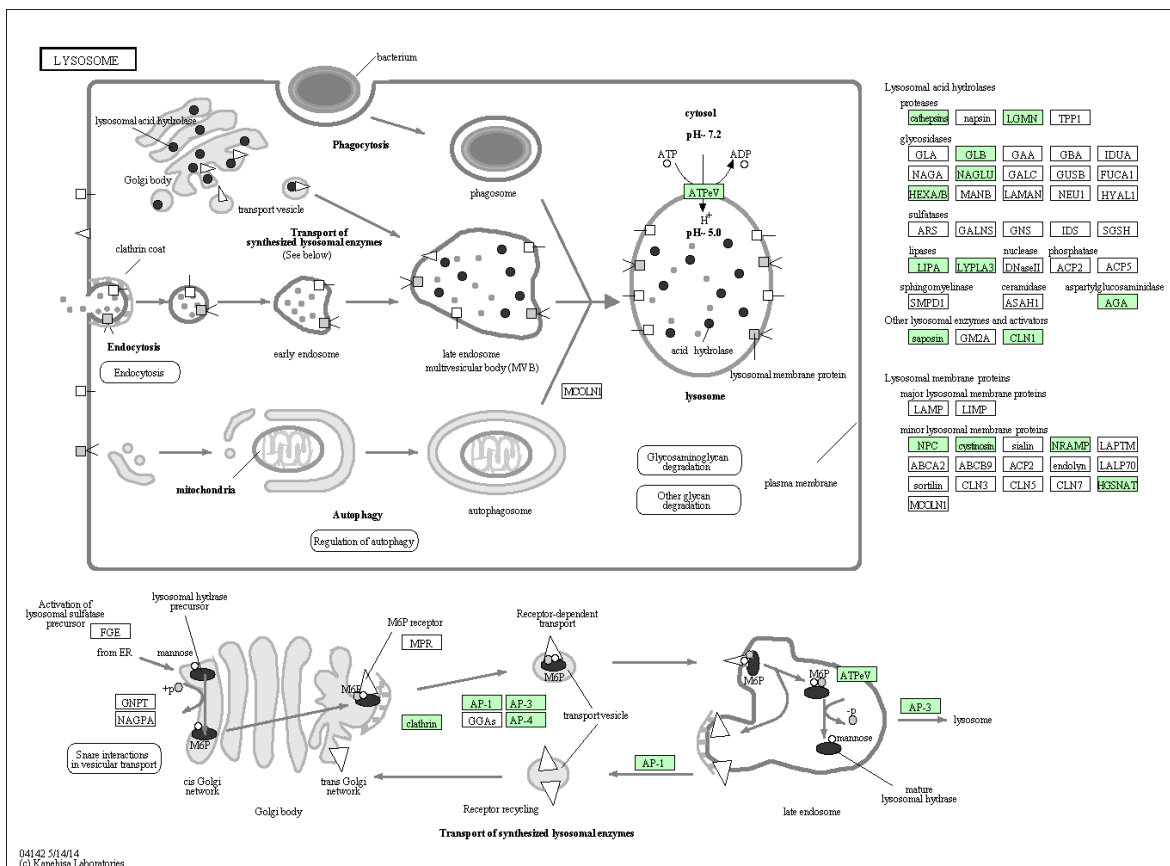


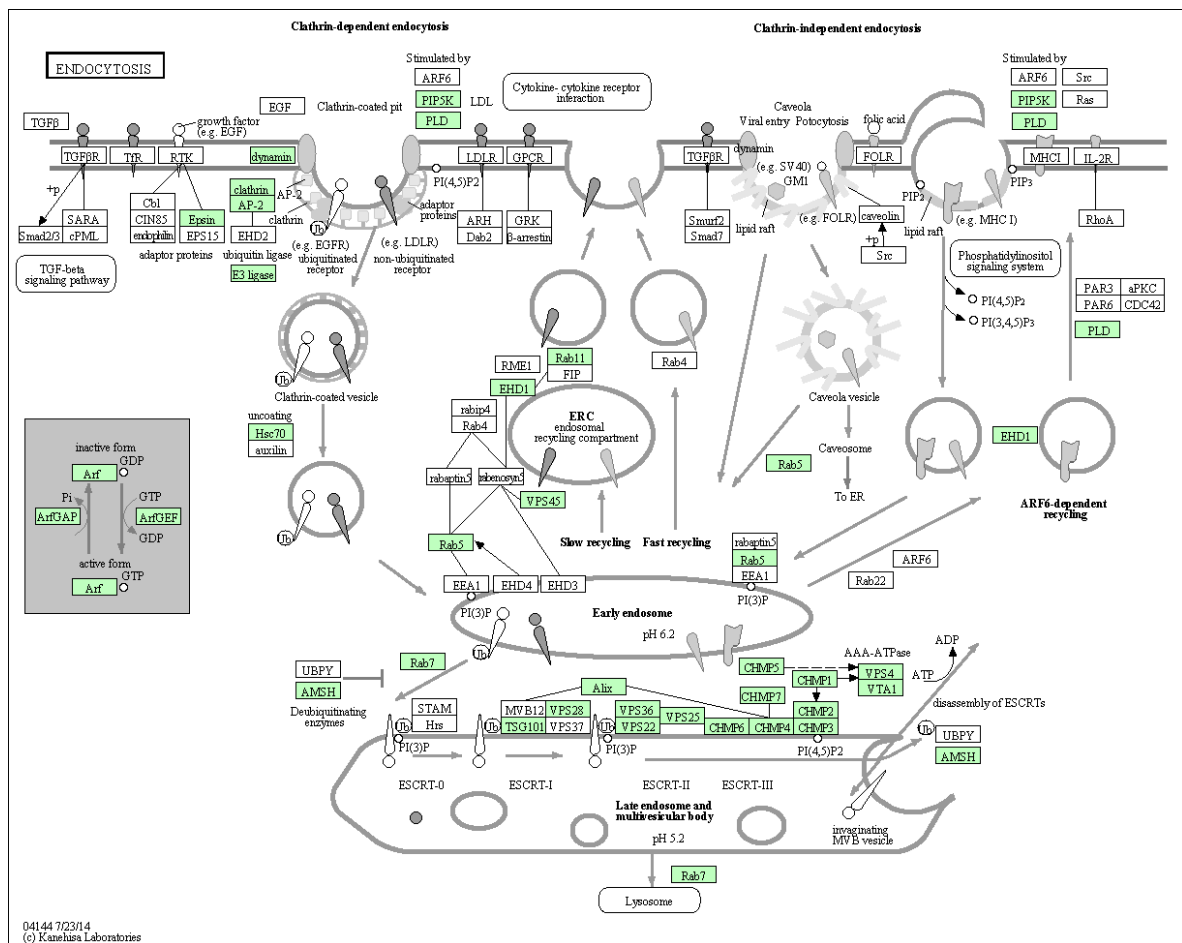
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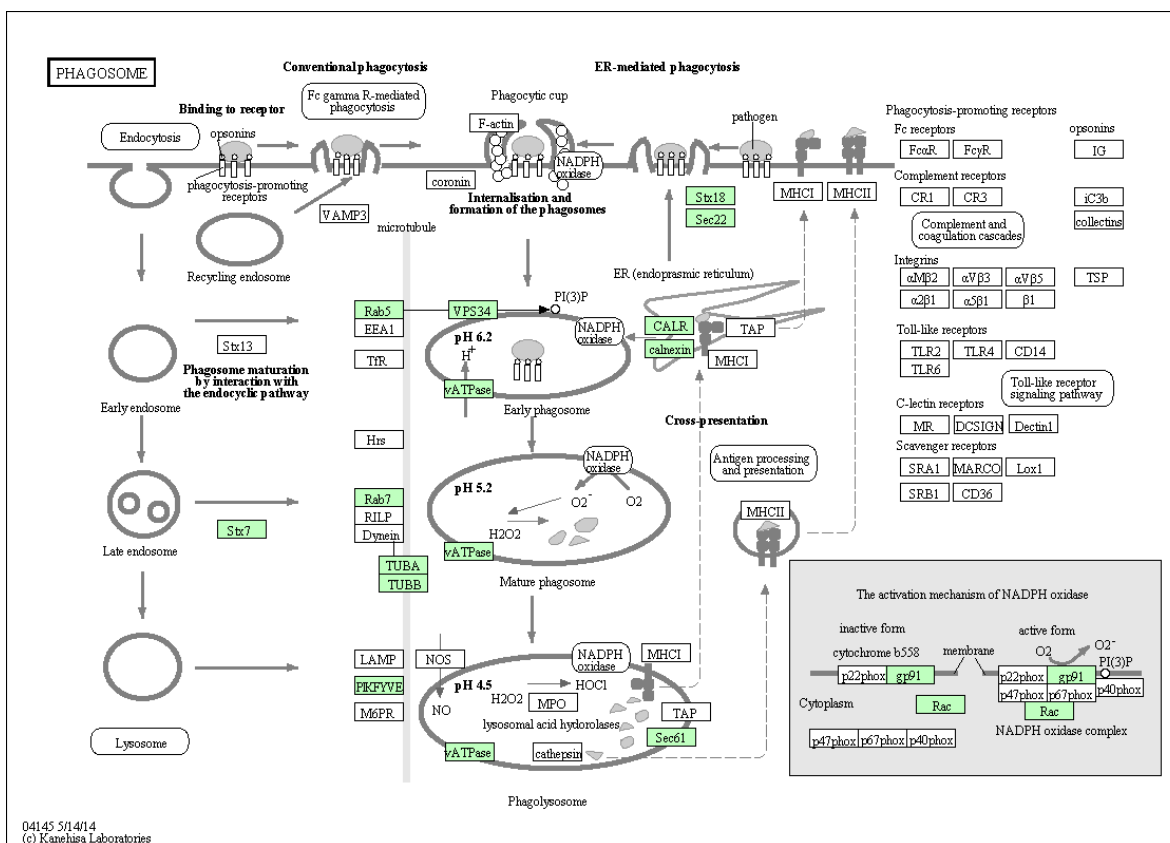


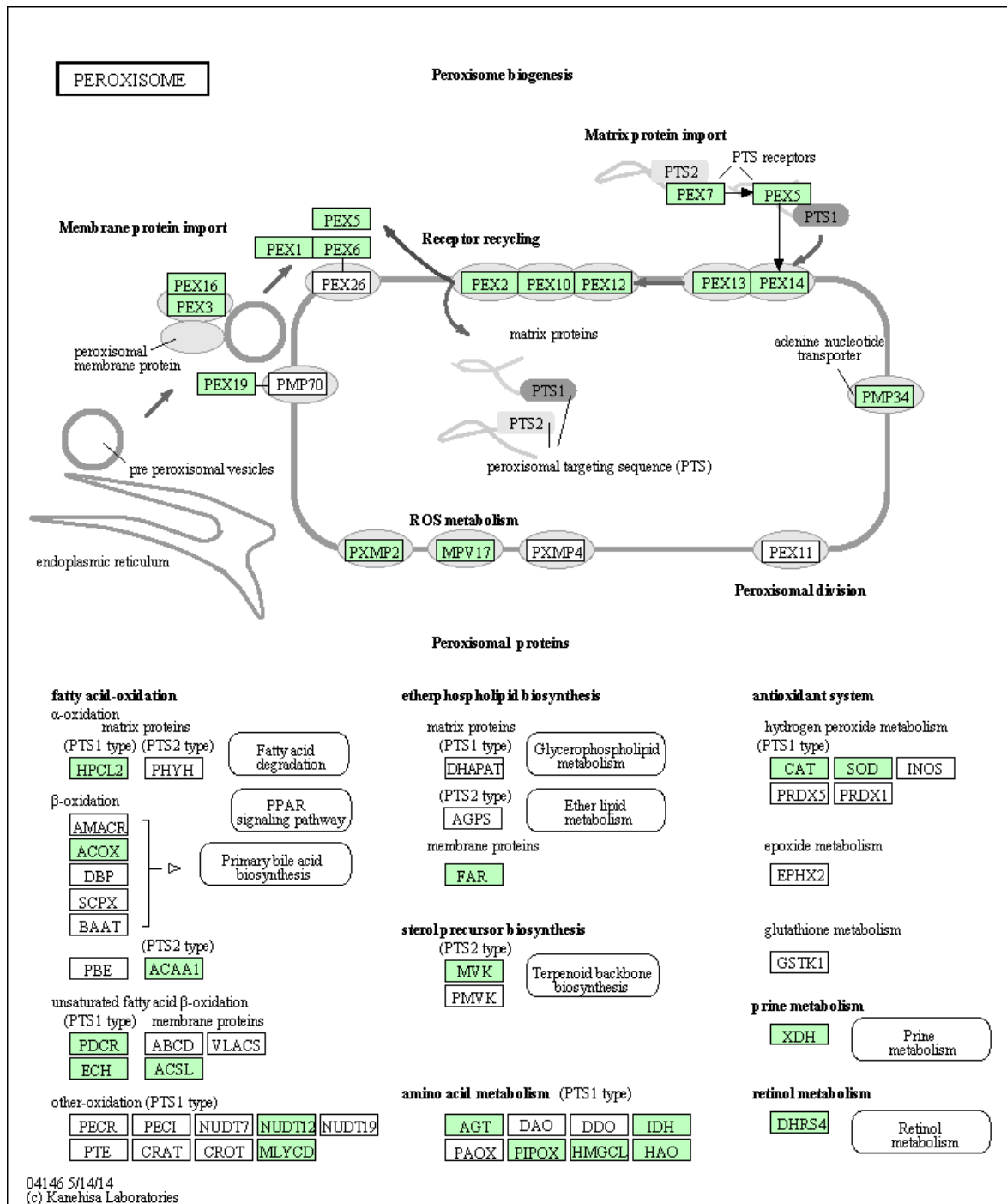




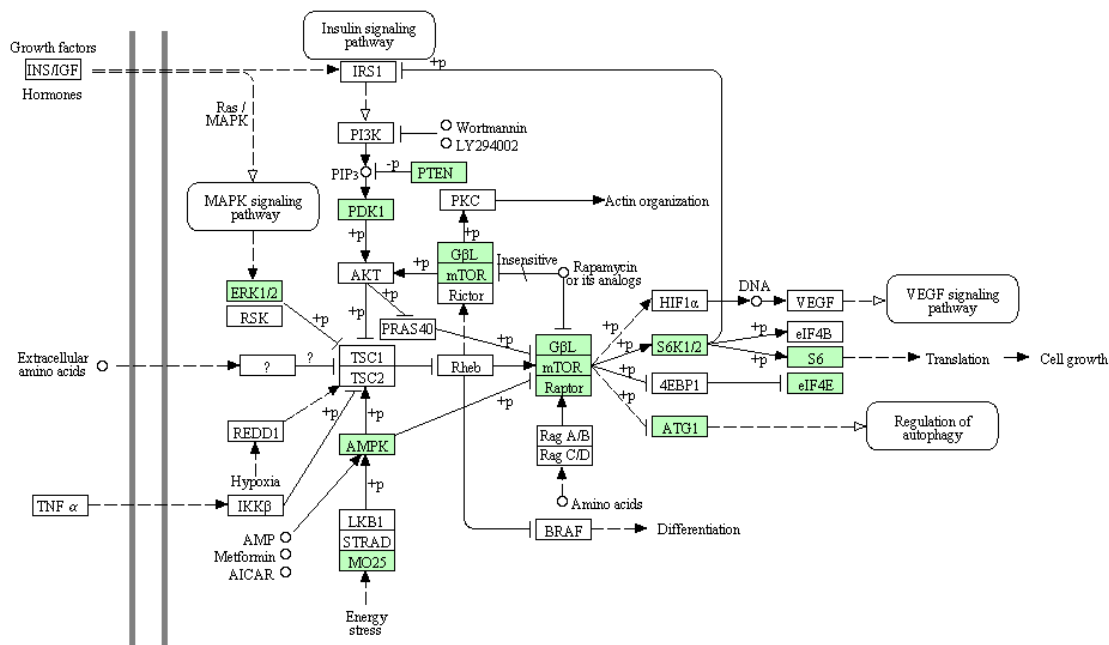






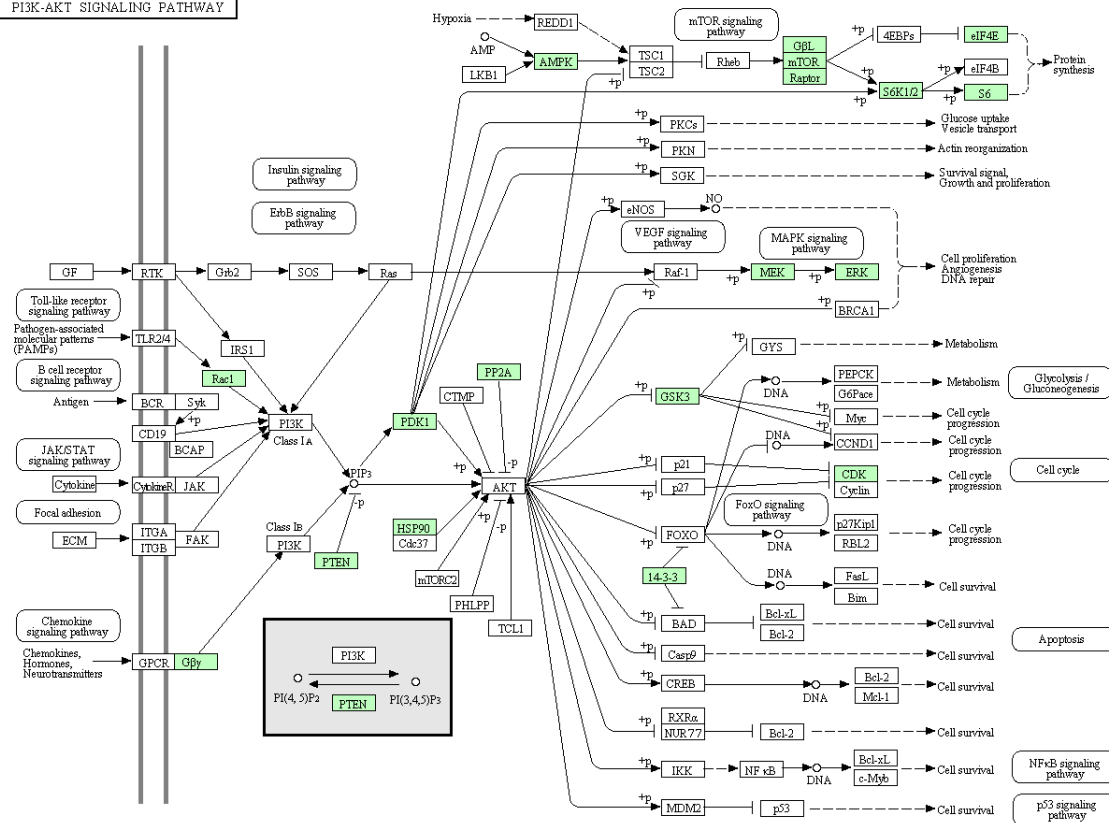


mTOR SIGNALING PATHWAY

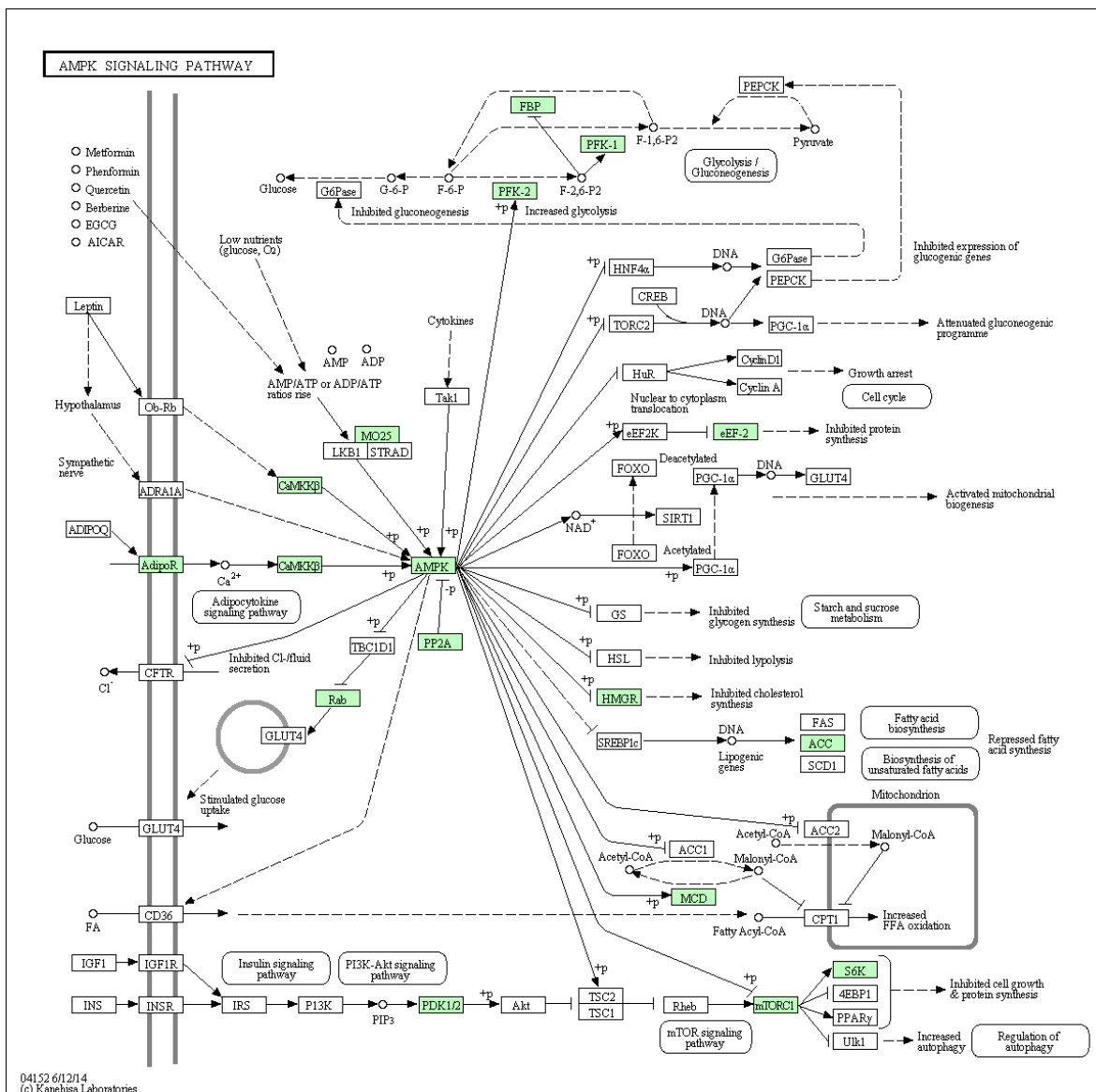


04150 5/30/13
(c) Kanehisa Laboratories

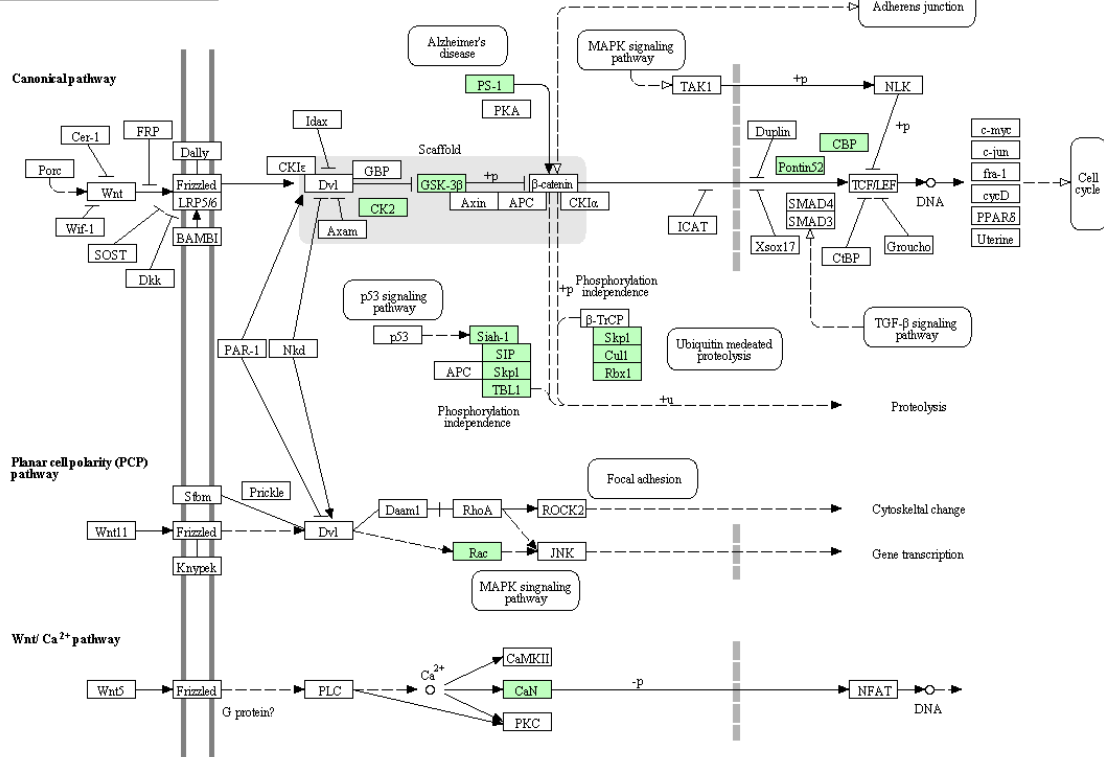
PI3K-AKT SIGNALING PATHWAY



04151 12/26/13
(c) Kanehisa Laboratories

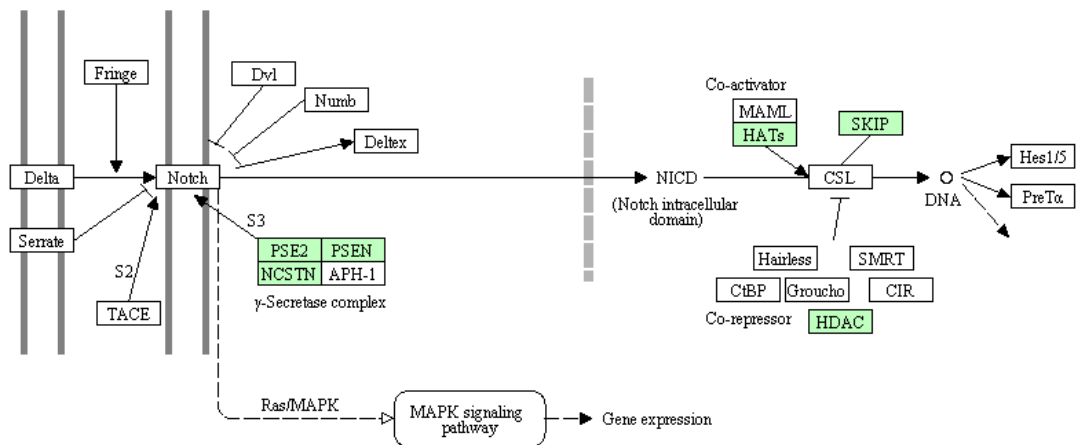


WNT SIGNALING PATHWAY



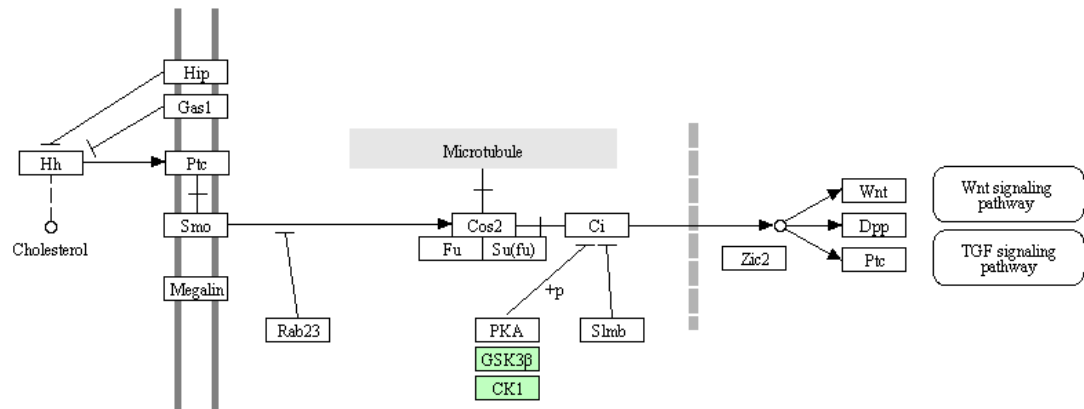
04310 7/26/13
(c) Kanehisa Laboratories

NOTCH SIGNALING PATHWAY



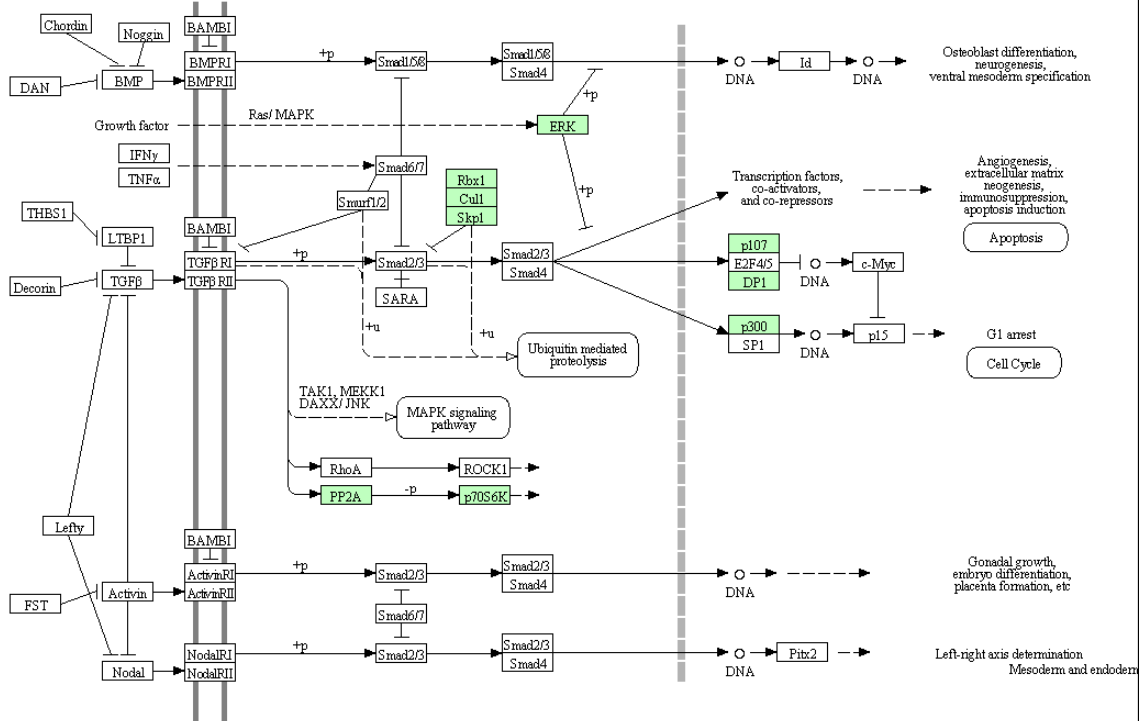
04330 3/31/09
(c) Kanehisa Laboratories

HEDGEHOG SIGNALING PATHWAY



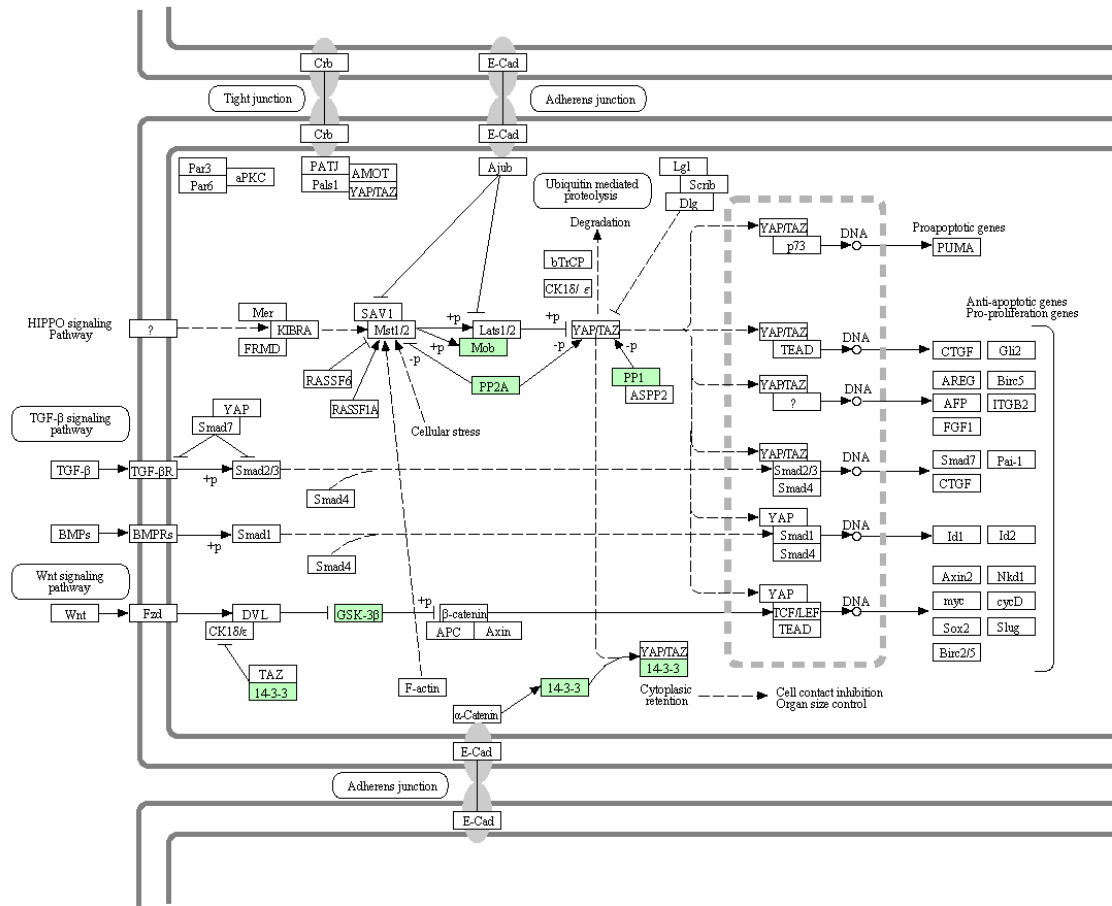
04340 2/7/13
(c) Kanehisa Laboratories

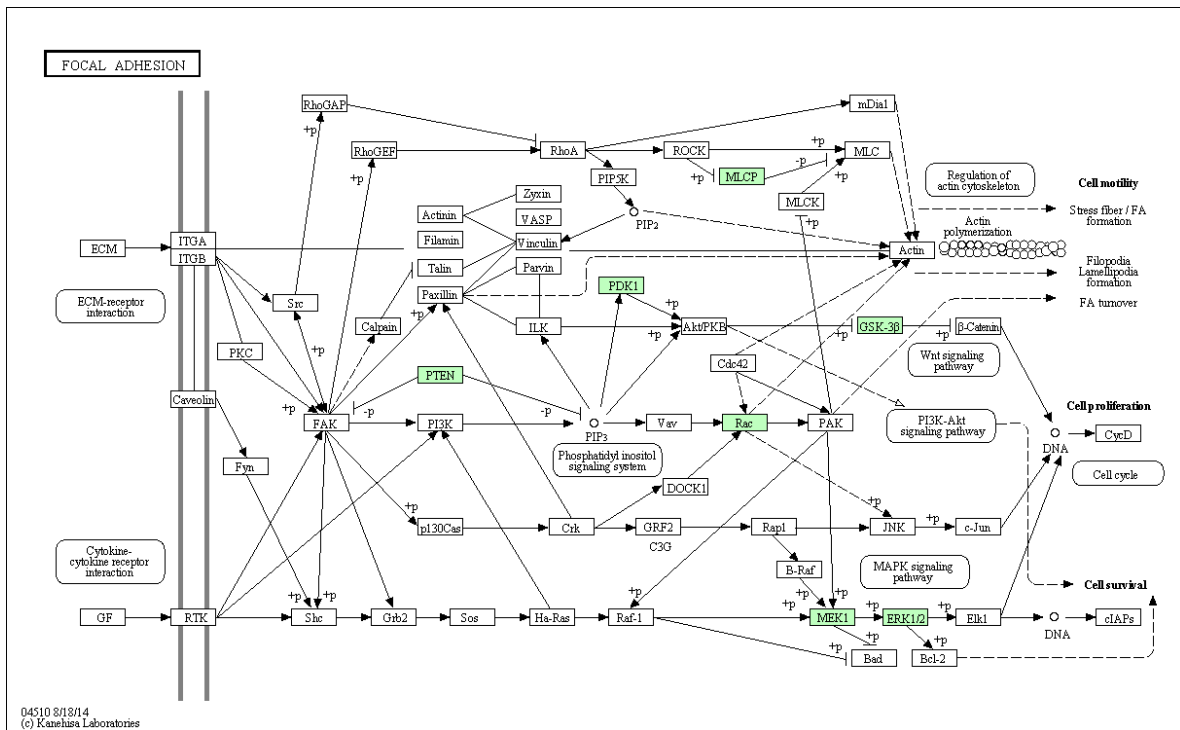
TGF-BETA SIGNALING PATHWAY



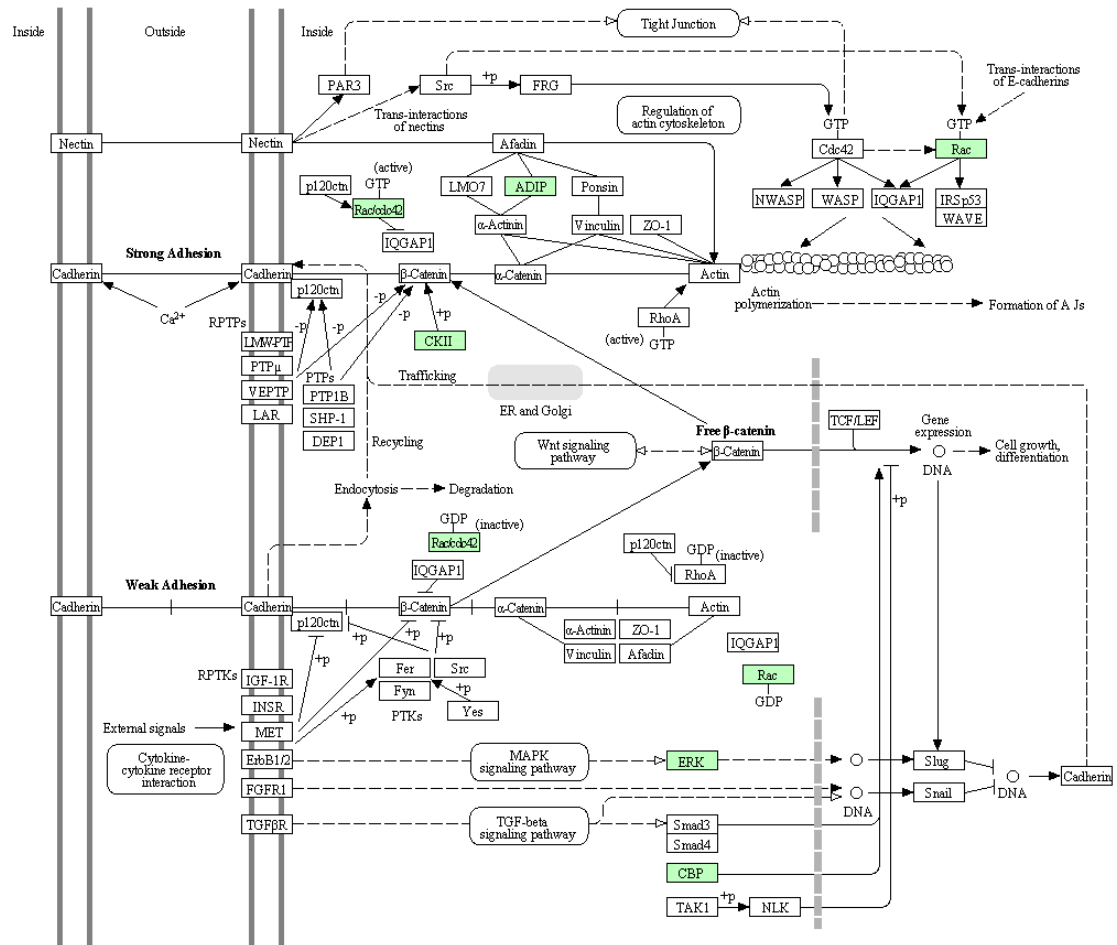
04350 10/29/13
(c) Kanehisa Laboratories

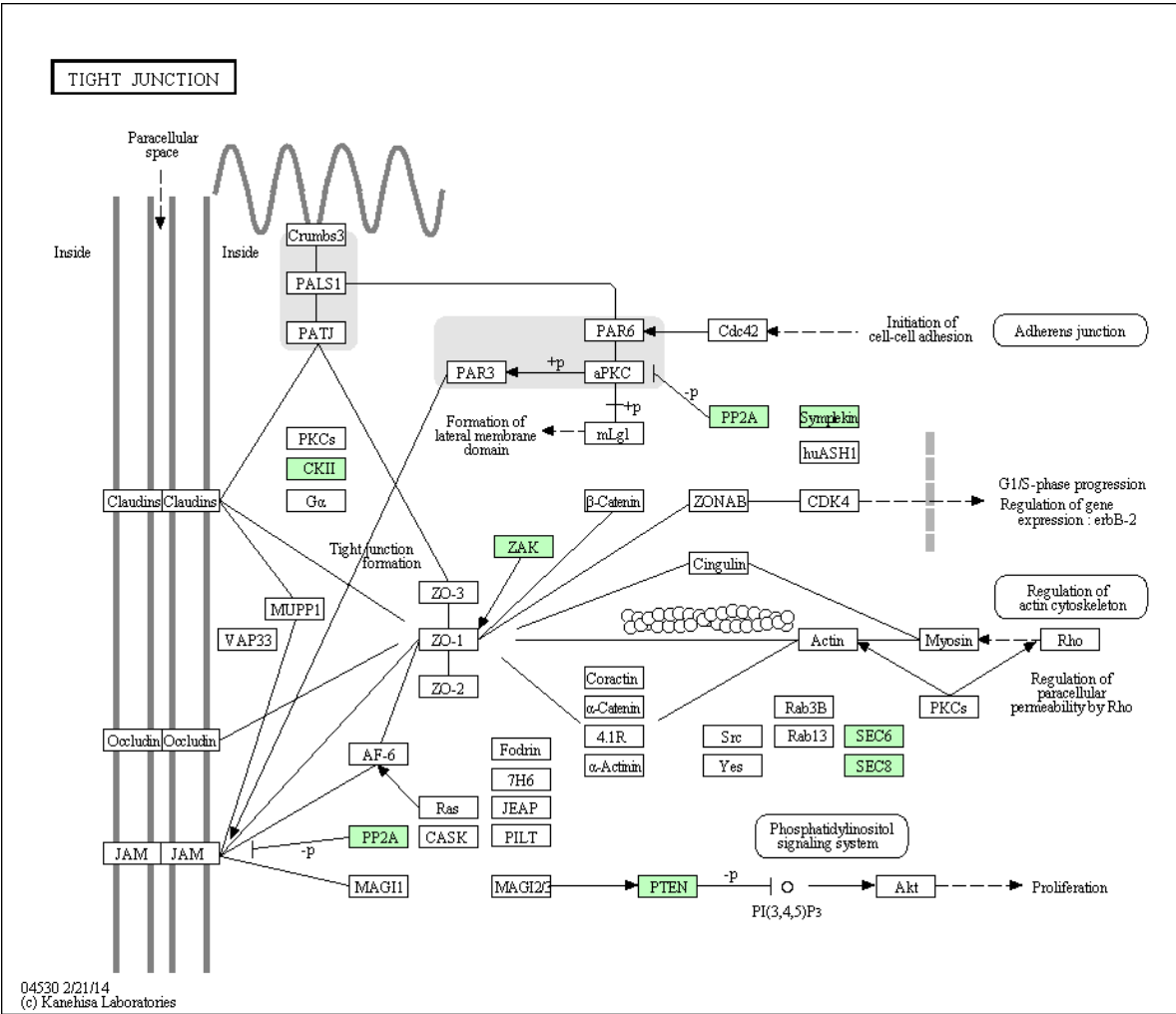
HIPPO SIGNALING PATHWAY

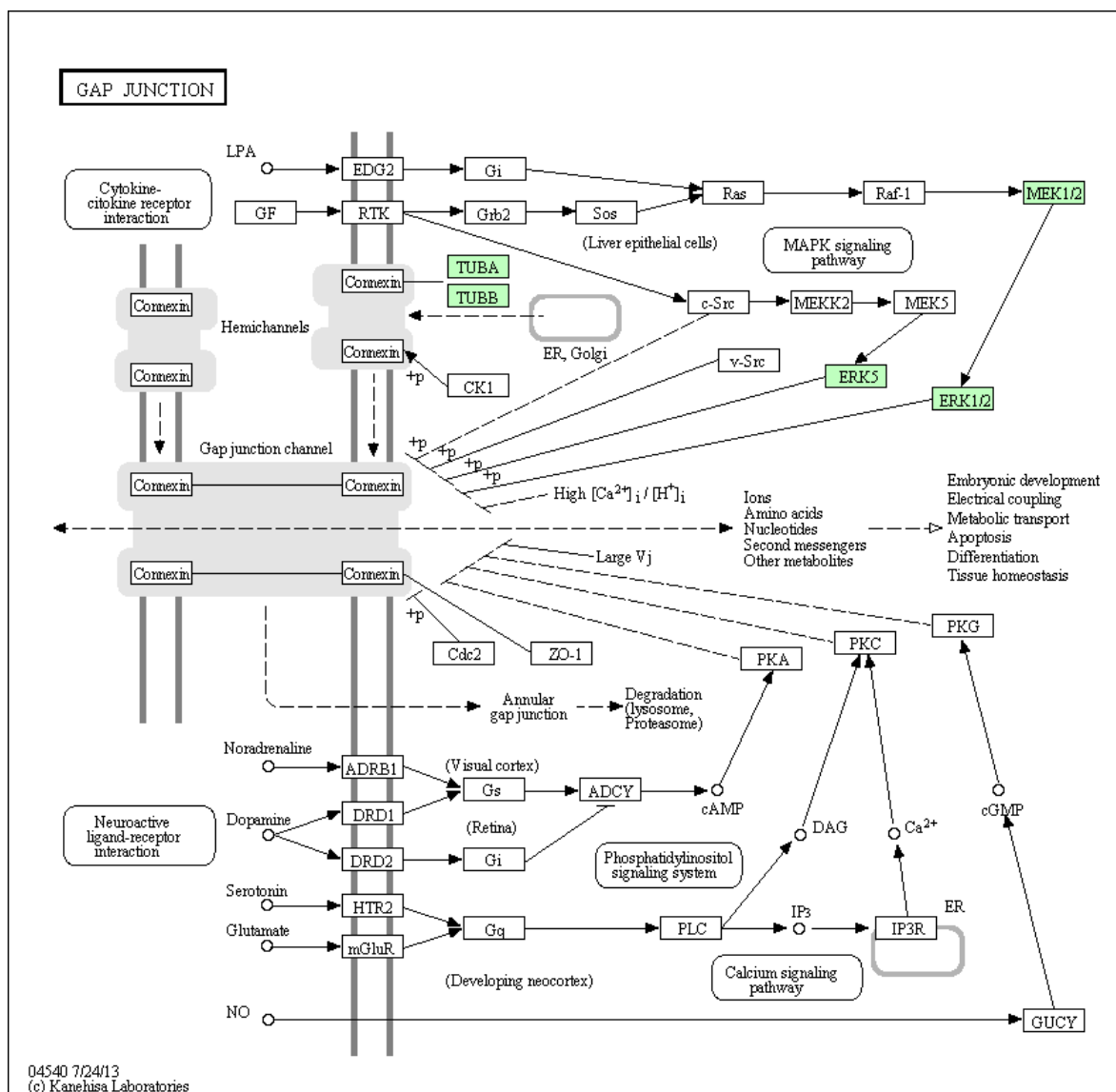


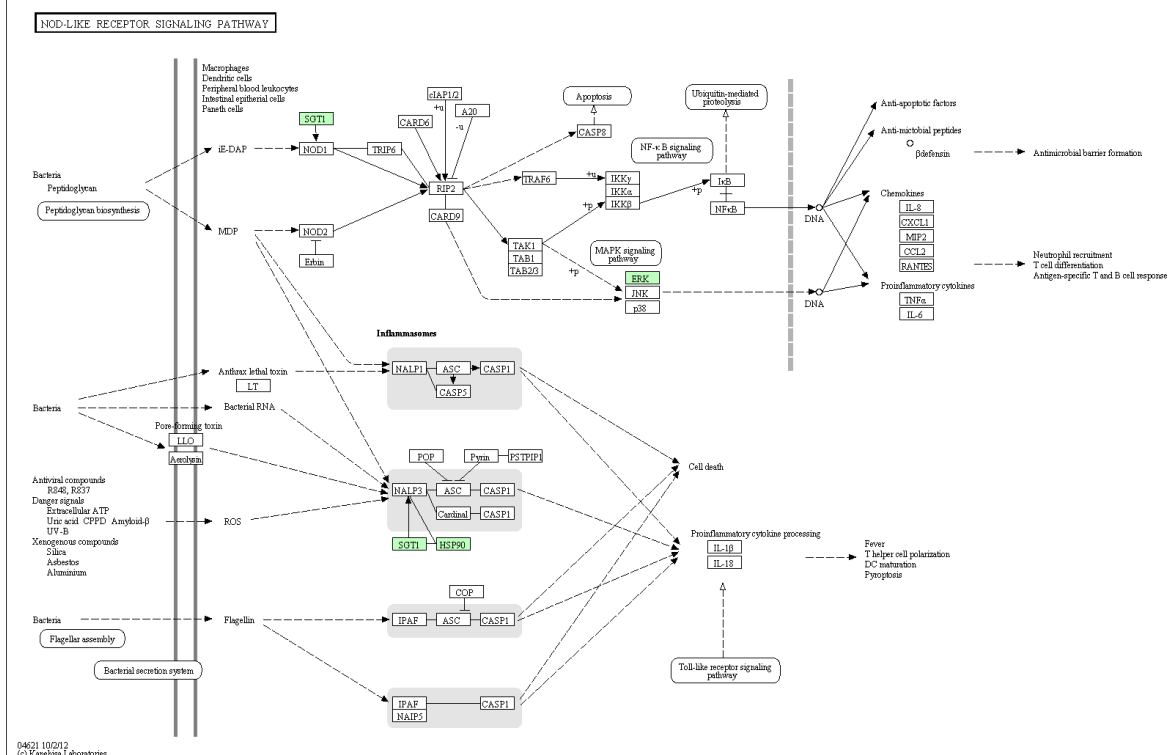
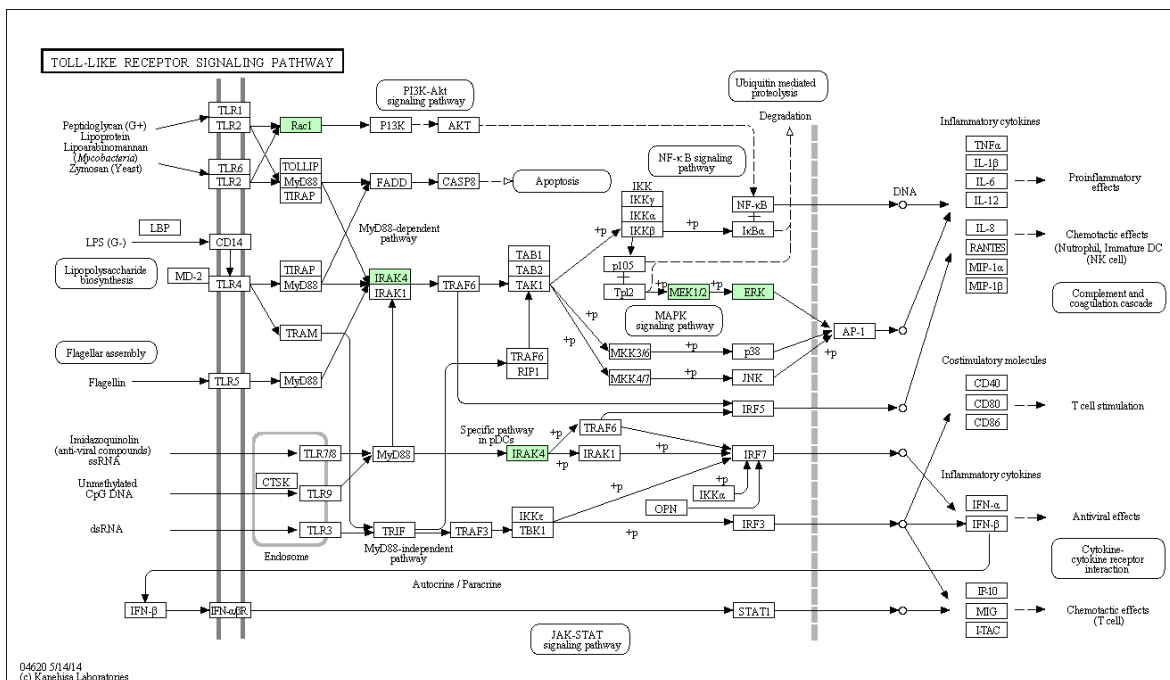


ADHERENS JUNCTION

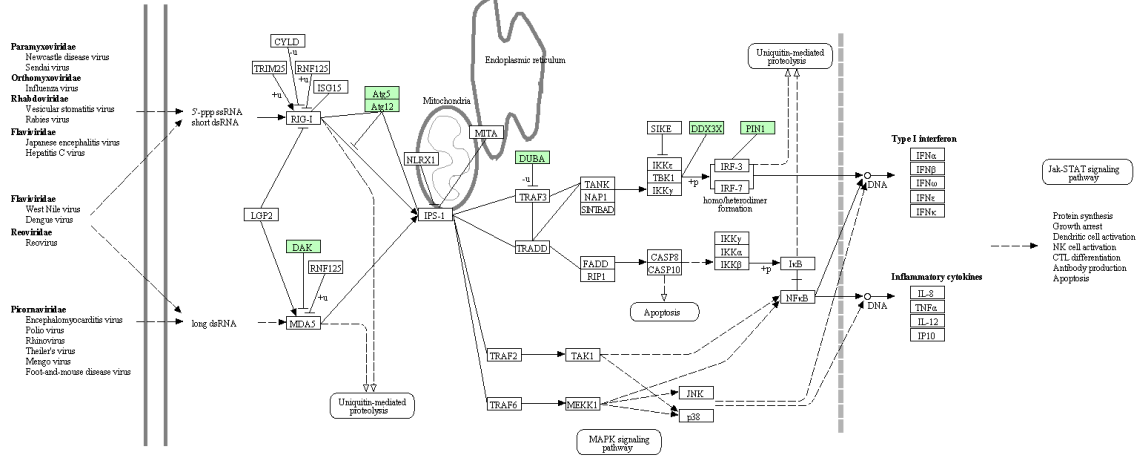




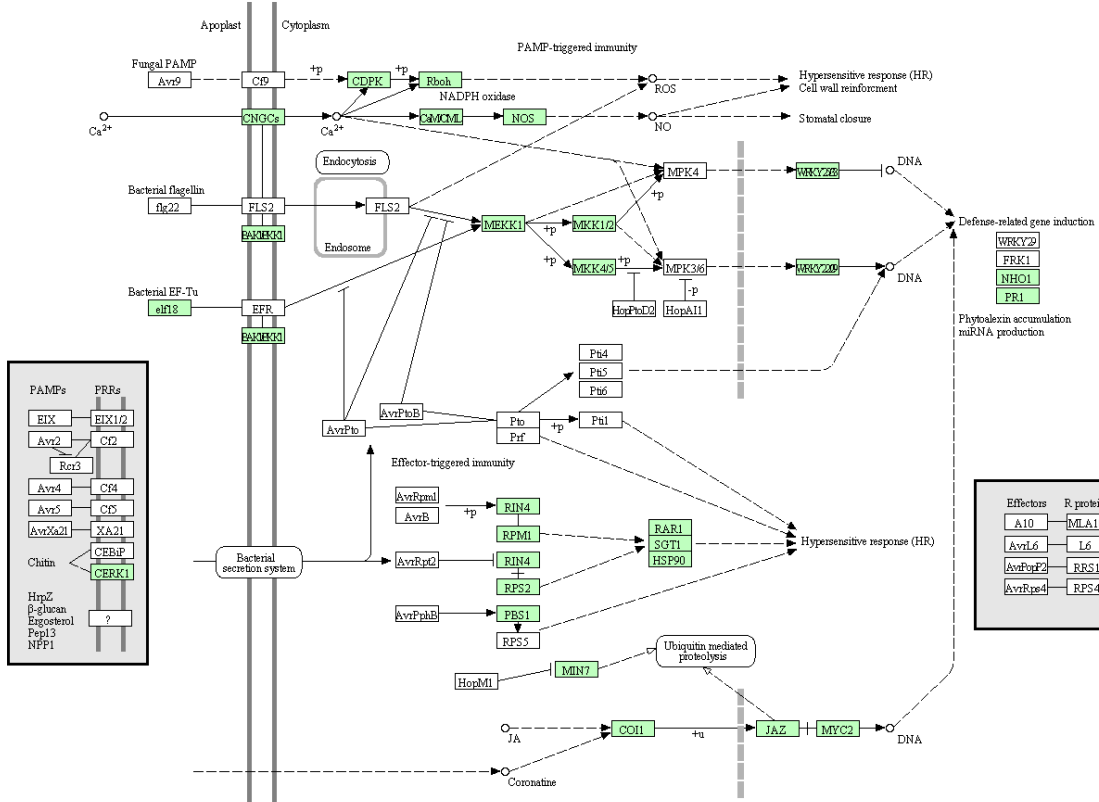




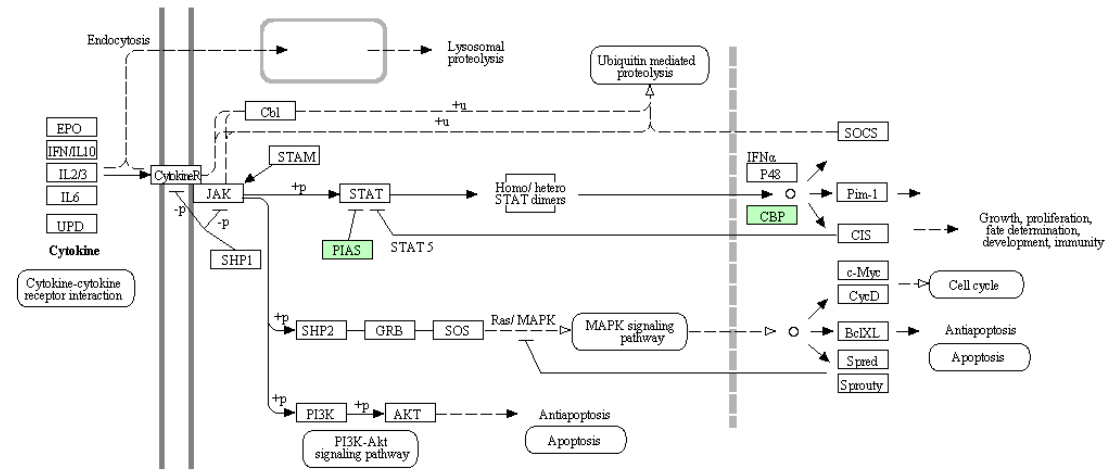
RIG-I-LIKE RECEPTOR SIGNALING PATHWAY



PLANT-PATHOGEN INTERACTION

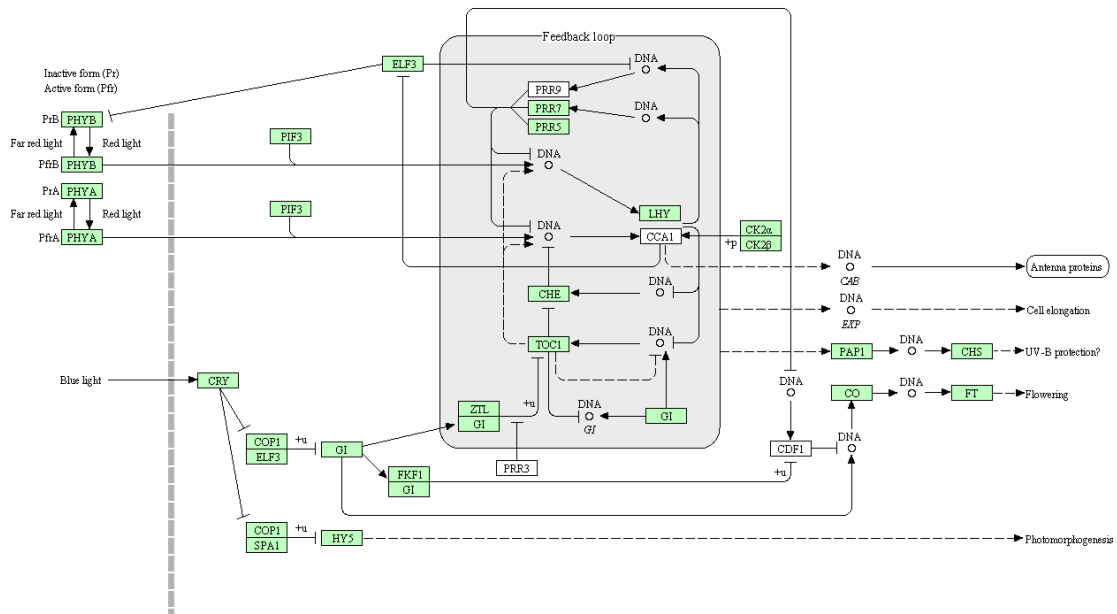


JAK-STAT SIGNALING PATHWAY



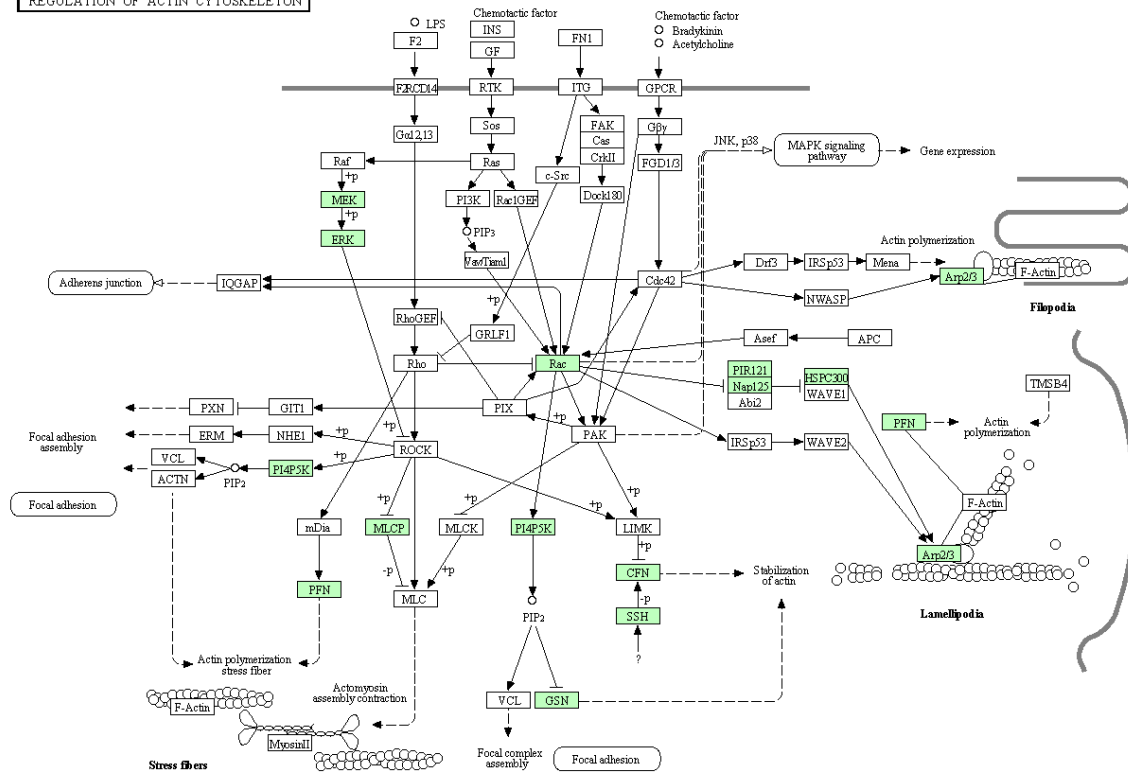
04630 5/7/14
(c) Kanehisa Laboratories

CIRCADIAN RHYTHM - PLANT



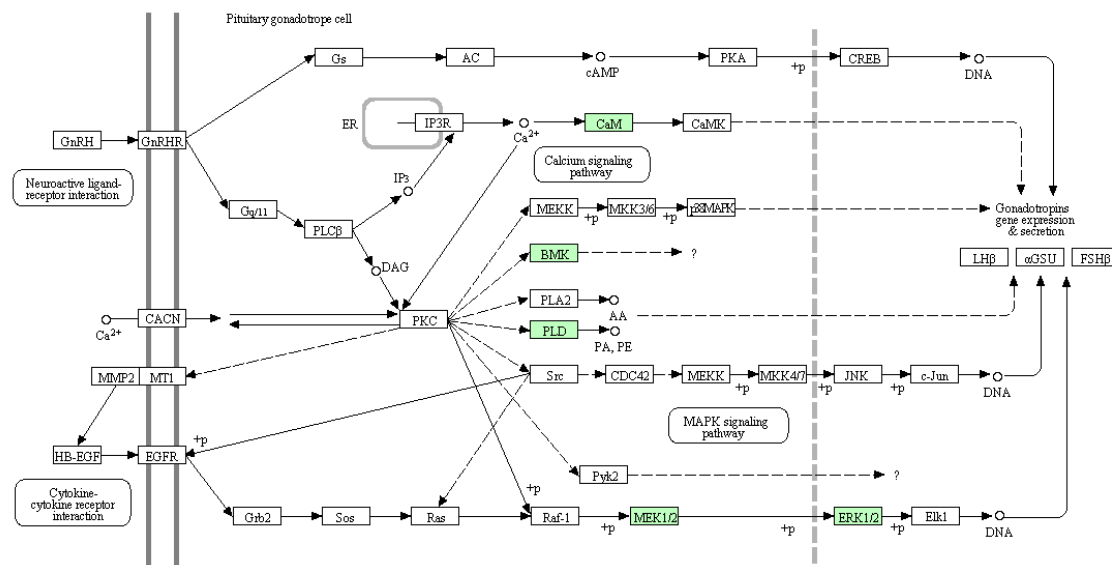
04712 8/31/12
(c) Kanehisa Laboratories

REGULATION OF ACTIN CYTOSKELETON



04810 3/8/13
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GnRH SIGNALING PATHWAY



04912 5/30/13
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MINERAL ABSORPTION

