

# Protocol S2: Time-simulation model of the FA $\beta$ -oxidation.

## Kinetic model

### Definitions of the various functions

CPT1[sf\_, V\_, Kms1\_, Kms2\_, Kmp1\_, Kmp2\_, Ki1\_, Keq\_, S1\_ ,

$$S2_ , P1_ , P2_ , I1_ , n_ ] := \frac{sf * V * \left( \frac{S1 * S2}{Kms1 * Kms2} - \frac{P1 * P2}{Kms1 * Kms2 * Keq} \right)}{\left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \left( \frac{I1}{Ki1} \right)^n \right) * \left( 1 + \frac{S2}{Kms2} + \frac{P2}{Kmp2} \right)}$$

CACT[Vf\_, Vr\_, Kms1\_, Kms2\_, Kmp1\_ ,

Kmp2\_, Kis1\_, Kip2\_, Keq\_, S1\_, S2\_, P1\_, P2\_] :=

$$Vf * \left( S1 * S2 - \frac{P1 * P2}{Keq} \right)$$

$$\frac{S1 * S2 + Kms2 * S1 + Kms1 * S2 * \left( 1 + \frac{P2}{Kip2} \right) + \frac{Vf}{Vr * Keq} * \left( Kmp2 * P1 * \left( 1 + \frac{S1}{Kis1} \right) + P2 * (Kmp1 + P1) \right)}{S1 * S2 + Kms2 * S1 + Kms1 * S2 * \left( 1 + \frac{P2}{Kip2} \right) + \frac{Vf}{Vr * Keq} * \left( Kmp2 * P1 * \left( 1 + \frac{S1}{Kis1} \right) + P2 * (Kmp1 + P1) \right)}$$

CPT2[sf\_, V\_, Kms1\_, Kms2\_, Kms3\_, Kms4\_, Kms5\_, Kms6\_, Kms7\_, Kms8\_ ,

Kmp1\_, Kmp2\_, Kmp3\_, Kmp4\_, Kmp5\_, Kmp6\_, Kmp7\_, Kmp8\_, Keq\_, S1\_, S2\_ ,

S3\_, S4\_, S5\_, S6\_, S7\_, S8\_, P1\_, P2\_, P3\_, P4\_, P5\_, P6\_, P7\_, P8\_] :=

$$\left( sf * V * \left( \frac{S1 * S8}{Kms1 * Kms8} - \frac{P1 * P8}{Kms1 * Kms8 * Keq} \right) \right) /$$

$$\left( \left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \right.$$

$$\left. \frac{S5}{Kms5} + \frac{P5}{Kmp5} + \frac{S6}{Kms6} + \frac{P6}{Kmp6} + \frac{S7}{Kms7} + \frac{P7}{Kmp7} \right) * \left( 1 + \frac{S8}{Kms8} + \frac{P8}{Kmp8} \right)$$

VLCAD[sf\_, V\_, Kms1\_, Kms2\_, Kms3\_, Kms4\_, Kmp1\_, Kmp2\_ ,

Kmp3\_, Kmp4\_, Keq\_, S1\_, S2\_, S3\_, S4\_, P1\_, P2\_, P3\_, P4\_] :=

$$sf * V * \left( \frac{S1 * (S4 - P4)}{Kms1 * Kms4} - \frac{P1 * P4}{Kms1 * Kms4 * Keq} \right)$$

$$\left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} \right) * \left( 1 + \frac{(S4 - P4)}{Kms4} + \frac{P4}{Kmp4} \right)$$

LCAD[sf\_, V\_, Kms1\_, Kms2\_, Kms3\_, Kms4\_, Kms5\_, Kms6\_, Kmp1\_, Kmp2\_, Kmp3\_, Kmp4\_ ,

Kmp5\_, Kmp6\_, Keq\_, S1\_, S2\_, S3\_, S4\_, S5\_, S6\_, P1\_, P2\_, P3\_, P4\_, P5\_, P6\_] :=

$$sf * V * \left( \frac{S1 * (S6 - P6)}{Kms1 * Kms6} - \frac{P1 * P6}{Kms1 * Kms6 * Keq} \right)$$

$$\left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} \right) * \left( 1 + \frac{(S6 - P6)}{Kms6} + \frac{P6}{Kmp6} \right)$$

MCAD[sf\_, V\_, Kms1\_, Kms2\_, Kms3\_, Kms4\_, Kms5\_, Kms6\_, Kmp1\_, Kmp2\_, Kmp3\_, Kmp4\_ ,

Kmp5\_, Kmp6\_, Keq\_, S1\_, S2\_, S3\_, S4\_, S5\_, S6\_, P1\_, P2\_, P3\_, P4\_, P5\_, P6\_] :=

$$sf * V * \left( \frac{S1 * (S6 - P6)}{Kms1 * Kms6} - \frac{P1 * P6}{Kms1 * Kms6 * Keq} \right)$$

$$\left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} \right) * \left( 1 + \frac{(S6 - P6)}{Kms6} + \frac{P6}{Kmp6} \right)$$

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SCAD [sf_, V_, Kms1_, Kms2_, Kms3_, Kmp1_, Kmp2_, Kmp3_, Keq_, S1_, S2_] :=
  sf * V *  $\left( \frac{S1 * (S3 - P3)}{Kms1 * Kms3} - \frac{P1 * P3}{Kms1 * Kms3 * Keq} \right)$ 
  S3_, P1_, P2_, P3_] :=  $\frac{sf * V * \left( \frac{S1 * (S3 - P3)}{Kms1 * Kms3} - \frac{P1 * P3}{Kms1 * Kms3 * Keq} \right)}{\left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} \right) * \left( 1 + \frac{(S3 - P3)}{Kms3} + \frac{P3}{Kmp3} \right)}$ 
CROT [sf_, V_, Kms1_, Kms2_, Kms3_, Kms4_, Kms5_, Kms6_, Kms7_, Kmp1_, Kmp2_, Kmp3_, Kmp4_, Kmp5_, Kmp6_, Kmp7_, Ki1_, Keq_, S1_, S2_, S3_, S4_, S5_, S6_, S7_, P1_, P2_, P3_, P4_, P5_, P6_, P7_, I1_] :=
  sf * V *  $\left( \frac{S1}{Kms1} - \frac{P1}{Kms1 * Keq} \right)$ 
   $\frac{1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} + \frac{S6}{Kms6} + \frac{P6}{Kmp6} + \frac{S7}{Kms7} + \frac{P7}{Kmp7} + \frac{I1}{Ki1}}{1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} + \frac{S6}{Kms6} + \frac{P6}{Kmp6} + \frac{S7}{Kms7} + \frac{P7}{Kmp7} + \frac{I1}{Ki1}}$ 
MSCHAD [sf_, V_, Kms1_, Kms2_, Kms3_, Kms4_, Kms5_, Kms6_, Kms7_, Kms8_, Kmp1_, Kmp2_, Kmp3_, Kmp4_, Kmp5_, Kmp6_, Kmp7_, Kmp8_, Keq_, S1_, S2_, S3_, S4_, S5_, S6_, S7_, S8_, P1_, P2_, P3_, P4_, P5_, P6_, P7_, P8_] :=
   $\left( sf * V * \left( \frac{S1 * (S8 - P8)}{Kms1 * Kms8} - \frac{P1 * P8}{Kms1 * Kms8 * Keq} \right) \right) /$ 
   $\left( \left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} + \frac{S6}{Kms6} + \frac{P6}{Kmp6} + \frac{S7}{Kms7} + \frac{P7}{Kmp7} \right) * \left( 1 + \frac{(S8 - P8)}{Kms8} + \frac{P8}{Kmp8} \right) \right)$ 
MCKATA [sf_, V_, Kms1_, Kms2_, Kms3_, Kms4_, Kms5_, Kms6_, Kms7_, Kms8_, Kmp1_, Kmp2_, Kmp3_, Kmp4_, Kmp5_, Kmp6_, Kmp7_, Kmp8_, Keq_, S1_, S2_, S3_, S4_, S5_, S6_, S7_, S8_, P1_, P2_, P3_, P4_, P5_, P6_, P7_, P8_] :=
   $\left( sf * V * \left( \frac{S1 * S8}{Kms1 * Kms8} - \frac{P1 * P8}{Kms1 * Kms8 * Keq} \right) \right) /$ 
   $\left( \left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} + \frac{S6}{Kms6} + \frac{P6}{Kmp6} + \frac{S7}{Kms7} + \frac{P7}{Kmp7} + \frac{P8}{Kmp8} \right) * \left( 1 + \frac{S8}{Kms8} + \frac{P8}{Kmp8} \right) \right)$ 
MCKATB [sf_, V_, Kms1_, Kms2_, Kms3_, Kms4_, Kms5_, Kms6_, Kms7_, Kms8_, Kmp1_, Kmp2_, Kmp3_, Kmp4_, Kmp5_, Kmp6_, Kmp7_, Kmp8_, Keq_, S1_, S2_, S3_, S4_, S5_, S6_, S7_, S8_, P1_, P2_, P3_, P4_, P5_, P6_, P7_, P8_] :=
   $\left( sf * V * \left( \frac{S1 * S8}{Kms1 * Kms8} - \frac{P8 * P8}{Kms1 * Kms8 * Keq} \right) \right) /$ 
   $\left( \left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} + \frac{S6}{Kms6} + \frac{P6}{Kmp6} + \frac{S7}{Kms7} + \frac{P7}{Kmp7} + \frac{P8}{Kmp8} \right) * \left( 1 + \frac{S8}{Kms8} + \frac{P8}{Kmp8} \right) \right)$ 

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MTP[sf_, v_, Kms1_, Kms2_, Kms3_, Kms4_, Kms5_, Kms7_, Kms8_, Kmp1_,
Kmp2_, Kmp3_, Kmp4_, Kmp5_, Kmp6_, Kmp7_, Kmp8_, Kil_, Keq_, S1_, S2_,
S3_, S4_, S5_, S7_, S8_, P1_, P2_, P3_, P4_, P5_, P6_, P7_, P8_, I1_] :=
sf * v * 
$$\left( \frac{S1 * (S7 - P7) * S8}{Kms1 * Kms7 * Kms8} - \frac{P1 * P7 * P8}{Kms1 * Kms7 * Kms8 * Keq} \right) /$$


$$\left( \left( 1 + \frac{S1}{Kms1} + \frac{P1}{Kmp1} + \frac{S2}{Kms2} + \frac{P2}{Kmp2} + \frac{S3}{Kms3} + \frac{P3}{Kmp3} + \frac{S4}{Kms4} + \frac{P4}{Kmp4} + \frac{S5}{Kms5} + \frac{P5}{Kmp5} + \frac{P6}{Kmp6} + \frac{I1}{Kil} \right) * \left( 1 + \frac{(S7 - P7)}{Kms7} + \frac{P7}{Kmp7} \right) * \left( 1 + \frac{S8}{Kms8} + \frac{P8}{Kmp8} \right) \right)$$

RES[Ks_, S_, Kil_] := Ks * (S - Kil)

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## Define the differential equations

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Odes = {
C16AcylCarCYT'[t] == 
$$\frac{vcpt1C16 - vcactC16}{VCYT},$$

C16AcylCarMAT'[t] == 
$$\frac{vcactC16 - vcpt2C16}{VMAT},$$

C16AcylCoAMAT'[t] == 
$$\frac{vcpt2C16 - vvlcadC16 - vlcadC16}{VMAT},$$

C16EnoylCoAMAT'[t] == 
$$\frac{vvlcadC16 + vlcadC16 - vcrotC16 - vmtcpC16}{VMAT},$$

C16HydroxyacylCoAMAT'[t] == 
$$\frac{vcrotC16 - vmschadC16}{VMAT},$$

C16KetoacylCoAMAT'[t] == 
$$\frac{vmschadC16 - vmckatC16}{VMAT},$$

C14AcylCarCYT'[t] == 
$$\frac{-vcactC14}{VCYT},$$

C14AcylCarMAT'[t] == 
$$\frac{vcactC14 - vcpt2C14}{VMAT},$$

C14AcylCoAMAT'[t] == 
$$\frac{vcpt2C14 + vmtcpC16 + vmckatC16 - vvlcadC14 - vlcadC14}{VMAT},$$

C14EnoylCoAMAT'[t] == 
$$\frac{vvlcadC14 + vlcadC14 - vcrotC14 - vmtcpC14}{VMAT},$$

C14HydroxyacylCoAMAT'[t] == 
$$\frac{vcrotC14 - vmschadC14}{VMAT},$$

C14KetoacylCoAMAT'[t] == 
$$\frac{vmschadC14 - vmckatC14}{VMAT},$$

C12AcylCarCYT'[t] == 
$$\frac{-vcactC12}{VCYT},$$

C12AcylCarMAT'[t] == 
$$\frac{vcactC12 - vcpt2C12}{VMAT},$$

C12AcylCoAMAT'[t] == 
$$\frac{1}{VMAT}$$

(vcpt2C12 + vmtcpC14 + vmckatC14 - vvlcadC12 - vlcadC12 - vmcadC12),
C12EnoylCoAMAT'[t] == 
$$\frac{vvlcadC12 + vlcadC12 + vmcadC12 - vcrotC12 - vmtcpC12}{VMAT},$$


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$$\begin{aligned}
C12HydroxyacylCoAMAT' [t] &= \frac{vcrotC12 - vmschadC12}{VMAT}, \\
C12KetoacylCoAMAT' [t] &= \frac{vmschadC12 - vmckatC12}{VMAT}, \\
C10AcylCarCYT' [t] &= \frac{-vcactC10}{VCYT}, \\
C10AcylCarMAT' [t] &= \frac{vcactC10 - vcpt2C10}{VMAT}, \\
C10AcylCoAMAT' [t] &= \frac{vcpt2C10 + vmtcpC12 + vmckatC12 - vlcadC10 - vmcadC10}{VMAT}, \\
C10EnoylCoAMAT' [t] &= \frac{vlcadC10 + vmcadC10 - vcrotC10 - vmtcpC10}{VMAT}, \\
C10HydroxyacylCoAMAT' [t] &= \frac{vcrotC10 - vmschadC10}{VMAT}, \\
C10KetoacylCoAMAT' [t] &= \frac{vmschadC10 - vmckatC10}{VMAT}, \\
C8AcylCarCYT' [t] &= \frac{-vcactC8}{VCYT}, \\
C8AcylCarMAT' [t] &= \frac{vcactC8 - vcpt2C8}{VMAT}, \\
C8AcylCoAMAT' [t] &= \frac{vcpt2C8 + vmtcpC10 + vmckatC10 - vlcadC8 - vmcadC8}{VMAT}, \\
C8EnoylCoAMAT' [t] &= \frac{vlcadC8 + vmcadC8 - vcrotC8 - vmtcpC8}{VMAT}, \\
C8HydroxyacylCoAMAT' [t] &= \frac{vcrotC8 - vmschadC8}{VMAT}, \\
C8KetoacylCoAMAT' [t] &= \frac{vmschadC8 - vmckatC8}{VMAT}, \\
C6AcylCarCYT' [t] &= \frac{-vcactC6}{VCYT}, \\
C6AcylCarMAT' [t] &= \frac{vcactC6 - vcpt2C6}{VMAT}, \\
C6AcylCoAMAT' [t] &= \frac{vcpt2C6 + vmtcpC8 + vmckatC8 - vmcadC6 - vscadC6}{VMAT}, \\
C6EnoylCoAMAT' [t] &= \frac{vmcadC6 + vscadC6 - vcrotC6}{VMAT}, \\
C6HydroxyacylCoAMAT' [t] &= \frac{vcrotC6 - vmschadC6}{VMAT}, \\
C6KetoacylCoAMAT' [t] &= \frac{vmschadC6 - vmckatC6}{VMAT}, \\
C4AcylCarCYT' [t] &= \frac{-vcactC4}{VCYT}, \\
C4AcylCarMAT' [t] &= \frac{vcactC4 - vcpt2C4}{VMAT}, \\
C4AcylCoAMAT' [t] &= \frac{vcpt2C4 + vmckatC6 - vmcadC4 - vscadC4}{VMAT}, \\
C4EnoylCoAMAT' [t] &= \frac{vmcadC4 + vscadC4 - vcrotC4}{VMAT},
\end{aligned}$$

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C4HydroxyacylCoAMAT'[t] =  $\frac{vcrotC4 - vmschadC4}{VMAT}$ ,
C4AcetoacylCoAMAT'[t] =  $\frac{vmschadC4 - vmckatC4}{VMAT}$ ,
AcetylCoAMAT'[t] =
 $\frac{1}{VMAT} (vmtpC16 + vmckatC16 + vmtpC14 + vmckatC14 + vmtpC12 + vmckatC12 + vmtpC10 +$ 
 $vmckatC10 + vmtpC8 + vmckatC8 + vmckatC6 + 2 * vmckatC4 - vacesink),$ 
FADHMAT'[t] =  $\frac{1}{VMAT} (vvlcadC16 + vvlcadC14 + vvlcadC12 + vlcadC16 +$ 
 $vlcadC14 + vlcadC12 + vlcadC10 + vlcadC8 + vmcadC12 + vmcadC10 +$ 
 $vmcadC8 + vmcadC6 + vmcadC4 + vscadC6 + vscadC4 - vfadhsink),$ 
NADHMAT'[t] =  $\frac{1}{VMAT} (vmtpC16 + vmtpC14 + vmtpC12 + vmtpC10 + vmtpC8 +$ 
 $vmschadC16 + vmschadC14 + vmschadC12 + vmschadC10 +$ 
 $vmschadC8 + vmschadC6 + vmschadC4 - vnadhsink)\};$ 

RateEqs = {vcpt1C16 → CPT1[sfcpt1C16, Vcpt1, Kmcppt1C16AcylCoACYT, Kmcppt1CarCYT,
Kmcppt1C16AcylCarCYT, Kmcppt1CoACYT, Kicpt1MalCoACYT, Keqcpt1,
C16AcylCoACYT, CarCYT, C16AcylCarCYT[t], CoACYT, MalCoACYT, ncpt1],
vcactC16 → CACT[Vfcact, Vrcact, KmcaactC16AcylCarCYT, KmcaactCarMAT,
KmcaactC16AcylCarMAT, KmcaactCarCYT, KicactC16AcylCarCYT, KicactCarCYT,
Keqcaact, C16AcylCarCYT[t], CarMAT, C16AcylCarMAT[t], CarCYT],
vcactC14 → CACT[Vfcact, Vrcact, KmcaactC14AcylCarCYT, KmcaactCarMAT,
KmcaactC14AcylCarMAT, KmcaactCarCYT, KicactC14AcylCarCYT, KicactCarCYT,
Keqcaact, C14AcylCarCYT[t], CarMAT, C14AcylCarMAT[t], CarCYT],
vcactC12 → CACT[Vfcact, Vrcact, KmcaactC12AcylCarCYT, KmcaactCarMAT,
KmcaactC12AcylCarMAT, KmcaactCarCYT, KicactC12AcylCarCYT, KicactCarCYT,
Keqcaact, C12AcylCarCYT[t], CarMAT, C12AcylCarMAT[t], CarCYT],
vcactC10 → CACT[Vfcact, Vrcact, KmcaactC10AcylCarCYT, KmcaactCarMAT,
KmcaactC10AcylCarMAT, KmcaactCarCYT, KicactC10AcylCarCYT, KicactCarCYT,
Keqcaact, C10AcylCarCYT[t], CarMAT, C10AcylCarMAT[t], CarCYT],
vcactC8 → CACT[Vfcact, Vrcact, KmcaactC8AcylCarCYT, KmcaactCarMAT,
KmcaactC8AcylCarMAT, KmcaactCarCYT, KicactC8AcylCarCYT, KicactCarCYT,
Keqcaact, C8AcylCarCYT[t], CarMAT, C8AcylCarMAT[t], CarCYT],
vcactC6 → CACT[Vfcact, Vrcact, KmcaactC6AcylCarCYT, KmcaactCarMAT,
KmcaactC6AcylCarMAT, KmcaactCarCYT, KicactC6AcylCarCYT, KicactCarCYT,
Keqcaact, C6AcylCarCYT[t], CarMAT, C6AcylCarMAT[t], CarCYT],
vcactC4 → CACT[Vfcact, Vrcact, KmcaactC4AcylCarCYT, KmcaactCarMAT,
KmcaactC4AcylCarMAT, KmcaactCarCYT, KicactC4AcylCarCYT, KicactCarCYT,
Keqcaact, C4AcylCarCYT[t], CarMAT, C4AcylCarMAT[t], CarCYT],
vcpt2C16 → CPT2[sfcpt2C16, Vcpt2, Kmcppt2C16AcylCarMAT, Kmcppt2C14AcylCarMAT,
Kmcppt2C12AcylCarMAT, Kmcppt2C10AcylCarMAT, Kmcppt2C8AcylCarMAT,
Kmcppt2C6AcylCarMAT, Kmcppt2C4AcylCarMAT, Kmcppt2CoAMAT,
Kmcppt2C16AcylCoAMAT, Kmcppt2C14AcylCoAMAT, Kmcppt2C12AcylCoAMAT,
Kmcppt2C10AcylCoAMAT, Kmcppt2C8AcylCoAMAT, Kmcppt2C6AcylCoAMAT,
Kmcppt2C4AcylCoAMAT, Kmcppt2CarMAT, Keqcpt2, C16AcylCarMAT[t],
C14AcylCarMAT[t], C12AcylCarMAT[t], C10AcylCarMAT[t], C8AcylCarMAT[t],
C6AcylCarMAT[t], C4AcylCarMAT[t], CoAMAT, C16AcylCoAMAT[t],
C14AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t],
C8AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], CarMAT],
vcpt2C14 → CPT2[sfcpt2C14, Vcpt2, Kmcppt2C14AcylCarMAT, Kmcppt2C16AcylCarMAT,
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Kmcpt2C12AcylCarMAT, Kmcpt2C10AcylCarMAT, Kmcpt2C8AcylCarMAT,  
 Kmcpt2C6AcylCarMAT, Kmcpt2C4AcylCoAMAT, Kmcpt2CoAMAT,  
 Kmcpt2C14AcylCoAMAT, Kmcpt2C16AcylCoAMAT, Kmcpt2C12AcylCoAMAT,  
 Kmcpt2C10AcylCoAMAT, Kmcpt2C8AcylCoAMAT, Kmcpt2C6AcylCoAMAT,  
 Kmcpt2C4AcylCoAMAT, Kmcpt2CarMAT, Keqcpt2, C14AcylCarMAT[t],  
 C16AcylCarMAT[t], C12AcylCarMAT[t], C10AcylCarMAT[t], C8AcylCarMAT[t],  
 C6AcylCarMAT[t], C4AcylCarMAT[t], CoAMAT, C14AcylCoAMAT[t],  
 C16AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t],  
 C8AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], CarMAT],  
 vcpt2C12 → CPT2[sfcpt2C12, Vcpt2, Kmcpt2C12AcylCarMAT, Kmcpt2C16AcylCarMAT,  
 Kmcpt2C14AcylCarMAT, Kmcpt2C10AcylCarMAT, Kmcpt2C8AcylCarMAT,  
 Kmcpt2C6AcylCarMAT, Kmcpt2C4AcylCarMAT, Kmcpt2CoAMAT,  
 Kmcpt2C12AcylCoAMAT, Kmcpt2C16AcylCoAMAT, Kmcpt2C14AcylCoAMAT,  
 Kmcpt2C10AcylCoAMAT, Kmcpt2C8AcylCoAMAT, Kmcpt2C6AcylCoAMAT,  
 Kmcpt2C4AcylCoAMAT, Kmcpt2CarMAT, Keqcpt2, C12AcylCarMAT[t],  
 C16AcylCarMAT[t], C14AcylCarMAT[t], C10AcylCarMAT[t], C8AcylCarMAT[t],  
 C6AcylCarMAT[t], C4AcylCarMAT[t], CoAMAT, C12AcylCoAMAT[t],  
 C16AcylCoAMAT[t], C14AcylCoAMAT[t], C10AcylCoAMAT[t],  
 C8AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], CarMAT],  
 vcpt2C10 → CPT2[sfcpt2C10, Vcpt2, Kmcpt2C10AcylCarMAT, Kmcpt2C16AcylCarMAT,  
 Kmcpt2C14AcylCarMAT, Kmcpt2C12AcylCarMAT, Kmcpt2C8AcylCarMAT,  
 Kmcpt2C6AcylCarMAT, Kmcpt2C4AcylCarMAT, Kmcpt2CoAMAT,  
 Kmcpt2C10AcylCoAMAT, Kmcpt2C16AcylCoAMAT, Kmcpt2C14AcylCoAMAT,  
 Kmcpt2C12AcylCoAMAT, Kmcpt2C8AcylCoAMAT, Kmcpt2C6AcylCoAMAT,  
 Kmcpt2C4AcylCoAMAT, Kmcpt2CarMAT, Keqcpt2, C10AcylCarMAT[t],  
 C16AcylCarMAT[t], C14AcylCarMAT[t], C12AcylCarMAT[t], C8AcylCarMAT[t],  
 C6AcylCarMAT[t], C4AcylCarMAT[t], CoAMAT, C10AcylCoAMAT[t],  
 C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C8AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], CarMAT],  
 vcpt2C8 → CPT2[sfcpt2C8, Vcpt2, Kmcpt2C8AcylCarMAT, Kmcpt2C16AcylCarMAT,  
 Kmcpt2C14AcylCarMAT, Kmcpt2C12AcylCarMAT, Kmcpt2C10AcylCarMAT,  
 Kmcpt2C6AcylCarMAT, Kmcpt2C4AcylCarMAT, Kmcpt2CoAMAT,  
 Kmcpt2C8AcylCoAMAT, Kmcpt2C16AcylCoAMAT, Kmcpt2C14AcylCoAMAT,  
 Kmcpt2C12AcylCoAMAT, Kmcpt2C10AcylCoAMAT, Kmcpt2C6AcylCoAMAT,  
 Kmcpt2C4AcylCoAMAT, Kmcpt2CarMAT, Keqcpt2, C8AcylCarMAT[t],  
 C16AcylCarMAT[t], C14AcylCarMAT[t], C12AcylCarMAT[t],  
 C10AcylCarMAT[t], C6AcylCarMAT[t], C4AcylCarMAT[t], CoAMAT,  
 C8AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], CarMAT],  
 vcpt2C6 → CPT2[sfcpt2C6, Vcpt2, Kmcpt2C6AcylCarMAT, Kmcpt2C16AcylCarMAT,  
 Kmcpt2C14AcylCarMAT, Kmcpt2C12AcylCarMAT, Kmcpt2C10AcylCarMAT,  
 Kmcpt2C8AcylCarMAT, Kmcpt2C4AcylCarMAT, Kmcpt2CoAMAT,  
 Kmcpt2C6AcylCoAMAT, Kmcpt2C16AcylCoAMAT, Kmcpt2C14AcylCoAMAT,  
 Kmcpt2C12AcylCoAMAT, Kmcpt2C10AcylCoAMAT, Kmcpt2C8AcylCoAMAT,  
 Kmcpt2C4AcylCoAMAT, Kmcpt2CarMAT, Keqcpt2, C6AcylCarMAT[t],  
 C16AcylCarMAT[t], C14AcylCarMAT[t], C12AcylCarMAT[t],  
 C10AcylCarMAT[t], C8AcylCarMAT[t], C4AcylCarMAT[t], CoAMAT,  
 C6AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], C8AcylCoAMAT[t], C4AcylCoAMAT[t], CarMAT],  
 vcpt2C4 → CPT2[sfcpt2C4, Vcpt2, Kmcpt2C4AcylCarMAT, Kmcpt2C16AcylCarMAT,  
 Kmcpt2C14AcylCarMAT, Kmcpt2C12AcylCarMAT, Kmcpt2C10AcylCarMAT,  
 Kmcpt2C8AcylCarMAT, Kmcpt2C6AcylCarMAT, Kmcpt2CoAMAT,  
 Kmcpt2C4AcylCoAMAT, Kmcpt2C16AcylCoAMAT, Kmcpt2C14AcylCoAMAT,

Kmcp2C12AcylCoAMAT, Kmcp2C10AcylCoAMAT, Kmcp2C8AcylCoAMAT,  
 Kmcp2C6AcylCoAMAT, Kmcp2CarMAT, Keqcpt2, C4AcylCarMAT[t],  
 C16AcylCarMAT[t], C14AcylCarMAT[t], C12AcylCarMAT[t],  
 C10AcylCarMAT[t], C8AcylCarMAT[t], C6AcylCarMAT[t], CoAMAT,  
 C4AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], C8AcylCoAMAT[t], C6AcylCoAMAT[t], CarMAT],  
 vvlcadC16 → VLCAD[sfvlcadC16, Vvlcad, KmvlcadC16AcylCoAMAT,  
 KmvlcadC14AcylCoAMAT, KmvlcadC12AcylCoAMAT, KmvlcadFAD,  
 KmvlcadC16EnoylCoAMAT, KmvlcadC14EnoylCoAMAT,  
 KmvlcadC12EnoylCoAMAT, KmvlcadFADH, Keqvlcad, C16AcylCoAMAT[t],  
 C14AcylCoAMAT[t], C12AcylCoAMAT[t], FADtMAT, C16EnoylCoAMAT[t],  
 C14EnoylCoAMAT[t], C12EnoylCoAMAT[t], FADHMAT[t]],  
 vvlcadC14 → VLCAD[sfvlcadC14, Vvlcad, KmvlcadC14AcylCoAMAT,  
 KmvlcadC16AcylCoAMAT, KmvlcadC12AcylCoAMAT, KmvlcadFAD,  
 KmvlcadC14EnoylCoAMAT, KmvlcadC16EnoylCoAMAT,  
 KmvlcadC12EnoylCoAMAT, KmvlcadFADH, Keqvlcad, C14AcylCoAMAT[t],  
 C16AcylCoAMAT[t], C12AcylCoAMAT[t], FADtMAT, C14EnoylCoAMAT[t],  
 C16EnoylCoAMAT[t], C12EnoylCoAMAT[t], FADHMAT[t]],  
 vvlcadC12 → VLCAD[sfvlcadC12, Vvlcad, KmvlcadC12AcylCoAMAT,  
 KmvlcadC16AcylCoAMAT, KmvlcadC14AcylCoAMAT, KmvlcadFAD,  
 KmvlcadC12EnoylCoAMAT, KmvlcadC16EnoylCoAMAT,  
 KmvlcadC14EnoylCoAMAT, KmvlcadFADH, Keqvlcad, C12AcylCoAMAT[t],  
 C16AcylCoAMAT[t], C14AcylCoAMAT[t], FADtMAT, C12EnoylCoAMAT[t],  
 C16EnoylCoAMAT[t], C14EnoylCoAMAT[t], FADHMAT[t]],  
 vlcadC16 → LCAD[sflcadC16, Vlcad, KmlcadC16AcylCoAMAT, KmlcadC14AcylCoAMAT,  
 KmlcadC12AcylCoAMAT, KmlcadC10AcylCoAMAT, KmlcadC8AcylCoAMAT, KmlcadFAD,  
 KmlcadC16EnoylCoAMAT, KmlcadC14EnoylCoAMAT, KmlcadC12EnoylCoAMAT,  
 KmlcadC10EnoylCoAMAT, KmlcadC8EnoylCoAMAT, KmlcadFADH, Keqlcad,  
 C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t],  
 C8AcylCoAMAT[t], FADtMAT, C16EnoylCoAMAT[t], C14EnoylCoAMAT[t],  
 C12EnoylCoAMAT[t], C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], FADHMAT[t]],  
 vlcadC14 → LCAD[sflcadC14, Vlcad, KmlcadC14AcylCoAMAT, KmlcadC16AcylCoAMAT,  
 KmlcadC12AcylCoAMAT, KmlcadC10AcylCoAMAT, KmlcadC8AcylCoAMAT, KmlcadFAD,  
 KmlcadC14EnoylCoAMAT, KmlcadC16EnoylCoAMAT, KmlcadC12EnoylCoAMAT,  
 KmlcadC10EnoylCoAMAT, KmlcadC8EnoylCoAMAT, KmlcadFADH, Keqlcad,  
 C14AcylCoAMAT[t], C16AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t],  
 C8AcylCoAMAT[t], FADtMAT, C14EnoylCoAMAT[t], C16EnoylCoAMAT[t],  
 C12EnoylCoAMAT[t], C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], FADHMAT[t]],  
 vlcadC12 → LCAD[sflcadC12, Vlcad, KmlcadC12AcylCoAMAT, KmlcadC16AcylCoAMAT,  
 KmlcadC14AcylCoAMAT, KmlcadC10AcylCoAMAT, KmlcadC8AcylCoAMAT, KmlcadFAD,  
 KmlcadC12EnoylCoAMAT, KmlcadC16EnoylCoAMAT, KmlcadC14EnoylCoAMAT,  
 KmlcadC10EnoylCoAMAT, KmlcadC8EnoylCoAMAT, KmlcadFADH, Keqlcad,  
 C12AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C10AcylCoAMAT[t],  
 C8AcylCoAMAT[t], FADtMAT, C14EnoylCoAMAT[t], C16EnoylCoAMAT[t],  
 C14EnoylCoAMAT[t], C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], FADHMAT[t]],  
 vlcadC10 → LCAD[sflcadC10, Vlcad, KmlcadC10AcylCoAMAT, KmlcadC16AcylCoAMAT,  
 KmlcadC14AcylCoAMAT, KmlcadC12AcylCoAMAT, KmlcadC8AcylCoAMAT, KmlcadFAD,  
 KmlcadC10EnoylCoAMAT, KmlcadC16EnoylCoAMAT, KmlcadC14EnoylCoAMAT,  
 KmlcadC12EnoylCoAMAT, KmlcadC8EnoylCoAMAT, KmlcadFADH, Keqlcad,  
 C10AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C8AcylCoAMAT[t], FADtMAT, C10EnoylCoAMAT[t], C16EnoylCoAMAT[t],  
 C14EnoylCoAMAT[t], C12EnoylCoAMAT[t], C8EnoylCoAMAT[t], FADHMAT[t]],  
 vlcadC8 → LCAD[sflcadC8, Vlcad, KmlcadC8AcylCoAMAT, KmlcadC16AcylCoAMAT,

KmlcadC14AcylCoAMAT, KmlcadC12AcylCoAMAT, KmlcadC10AcylCoAMAT, KmlcadFAD,  
 KmlcadC8EnoylCoAMAT, KmlcadC16EnoylCoAMAT, KmlcadC14EnoylCoAMAT,  
 KmlcadC12EnoylCoAMAT, KmlcadC10EnoylCoAMAT, KmlcadFADH, Keqlcad,  
 C8AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], FADtMAT, C8EnoylCoAMAT[t], C16EnoylCoAMAT[t],  
 C14EnoylCoAMAT[t], C12EnoylCoAMAT[t], C10EnoylCoAMAT[t], FADHMAT[t]],  
 vmcadC12 → MCAD [sfmcadC12, Vmcad, KmmcadC12AcylCoAMAT, KmmcadC10AcylCoAMAT,  
 KmmcadC8AcylCoAMAT, KmmcadC6AcylCoAMAT, KmmcadC4AcylCoAMAT, KmmcadFAD,  
 KmmcadC12EnoylCoAMAT, KmmcadC10EnoylCoAMAT, KmmcadC8EnoylCoAMAT,  
 KmmcadC6EnoylCoAMAT, KmmcadC4EnoylCoAMAT, KmmcadFADH, Keqmcad,  
 C12AcylCoAMAT[t], C10AcylCoAMAT[t], C8AcylCoAMAT[t], C6AcylCoAMAT[t],  
 C4AcylCoAMAT[t], FADtMAT, C12EnoylCoAMAT[t], C10EnoylCoAMAT[t],  
 C8EnoylCoAMAT[t], C6EnoylCoAMAT[t], C4EnoylCoAMAT[t], FADHMAT[t]],  
 vmcadC10 → MCAD [sfmcadC10, Vmcad, KmmcadC10AcylCoAMAT, KmmcadC12AcylCoAMAT,  
 KmmcadC8AcylCoAMAT, KmmcadC6AcylCoAMAT, KmmcadC4AcylCoAMAT, KmmcadFAD,  
 KmmcadC10EnoylCoAMAT, KmmcadC12EnoylCoAMAT, KmmcadC8EnoylCoAMAT,  
 KmmcadC6EnoylCoAMAT, KmmcadC4EnoylCoAMAT, KmmcadFADH, Keqmcad,  
 C10AcylCoAMAT[t], C12AcylCoAMAT[t], C8AcylCoAMAT[t], C6AcylCoAMAT[t],  
 C4AcylCoAMAT[t], FADtMAT, C10EnoylCoAMAT[t], C12EnoylCoAMAT[t],  
 C8EnoylCoAMAT[t], C6EnoylCoAMAT[t], C4EnoylCoAMAT[t], FADHMAT[t]],  
 vmcadC8 → MCAD [sfmcadC8, Vmcad, KmmcadC8AcylCoAMAT, KmmcadC12AcylCoAMAT,  
 KmmcadC10AcylCoAMAT, KmmcadC6AcylCoAMAT, KmmcadC4AcylCoAMAT, KmmcadFAD,  
 KmmcadC8EnoylCoAMAT, KmmcadC12EnoylCoAMAT, KmmcadC10EnoylCoAMAT,  
 KmmcadC6EnoylCoAMAT, KmmcadC4EnoylCoAMAT, KmmcadFADH, Keqmcad,  
 C8AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t], C6AcylCoAMAT[t],  
 C4AcylCoAMAT[t], FADtMAT, C8EnoylCoAMAT[t], C12EnoylCoAMAT[t],  
 C10EnoylCoAMAT[t], C6EnoylCoAMAT[t], C4EnoylCoAMAT[t], FADHMAT[t]],  
 vmcadC6 → MCAD [sfmcadC6, Vmcad, KmmcadC6AcylCoAMAT, KmmcadC12AcylCoAMAT,  
 KmmcadC10AcylCoAMAT, KmmcadC8AcylCoAMAT, KmmcadC4AcylCoAMAT, KmmcadFAD,  
 KmmcadC6EnoylCoAMAT, KmmcadC12EnoylCoAMAT, KmmcadC10EnoylCoAMAT,  
 KmmcadC8EnoylCoAMAT, KmmcadC4EnoylCoAMAT, KmmcadFADH, Keqmcad,  
 C6AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t], C8AcylCoAMAT[t],  
 C4AcylCoAMAT[t], FADtMAT, C6EnoylCoAMAT[t], C12EnoylCoAMAT[t],  
 C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], C4EnoylCoAMAT[t], FADHMAT[t]],  
 vmcadC4 → MCAD [sfmcadC4, Vmcad, KmmcadC4AcylCoAMAT, KmmcadC12AcylCoAMAT,  
 KmmcadC10AcylCoAMAT, KmmcadC8AcylCoAMAT, KmmcadC6AcylCoAMAT, KmmcadFAD,  
 KmmcadC4EnoylCoAMAT, KmmcadC12EnoylCoAMAT, KmmcadC10EnoylCoAMAT,  
 KmmcadC8EnoylCoAMAT, KmmcadC6EnoylCoAMAT, KmmcadFADH, Keqmcad,  
 C4AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t], C8AcylCoAMAT[t],  
 C6AcylCoAMAT[t], FADtMAT, C4EnoylCoAMAT[t], C12EnoylCoAMAT[t],  
 C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], C4EnoylCoAMAT[t], FADHMAT[t]],  
 vscadC6 → SCAD [sfscadC6, Vscad, KmscadC6AcylCoAMAT, KmscadC4AcylCoAMAT,  
 KmscadFAD, KmscadC6EnoylCoAMAT, KmscadC4EnoylCoAMAT,  
 KmscadFADH, Keqscad, C6AcylCoAMAT[t], C4AcylCoAMAT[t],  
 FADtMAT, C6EnoylCoAMAT[t], C4EnoylCoAMAT[t], FADHMAT[t]],  
 vscadC4 → SCAD [sfscadC4, Vscad, KmscadC4AcylCoAMAT, KmscadC6AcylCoAMAT,  
 KmscadFAD, KmscadC4EnoylCoAMAT, KmscadC6EnoylCoAMAT,  
 KmscadFADH, Keqscad, C4AcylCoAMAT[t], C6AcylCoAMAT[t],  
 FADtMAT, C4EnoylCoAMAT[t], C6EnoylCoAMAT[t], FADHMAT[t]],  
 vcrotC16 → CROT [sfrcrotC16, Vcrot, KmrcrotC16EnoylCoAMAT, KmrcrotC14EnoylCoAMAT,  
 KmrcrotC12EnoylCoAMAT, KmrcrotC10EnoylCoAMAT, KmrcrotC8EnoylCoAMAT,  
 KmrcrotC6EnoylCoAMAT, KmrcrotC4EnoylCoAMAT, KmrcrotC16HydroxyacylCoAMAT,  
 KmrcrotC14HydroxyacylCoAMAT, KmrcrotC12HydroxyacylCoAMAT,



KmcrötC8EnoylCoAMAT, KmcrötC4EnoylCoAMAT, KmcrötC6HydroxyacylCoAMAT,  
 KmcrötC16HydroxyacylCoAMAT, KmcrötC14HydroxyacylCoAMAT,  
 KmcrötC12HydroxyacylCoAMAT, KmcrötC10HydroxyacylCoAMAT,  
 KmcrötC8HydroxyacylCoAMAT, KmcrötC4HydroxyacylCoAMAT,  
 KicrötC4AcetoacylCoA, Keqcrot, C6EnoylCoAMAT[t], C16EnoylCoAMAT[t],  
 C14EnoylCoAMAT[t], C12EnoylCoAMAT[t], C10EnoylCoAMAT[t], C8EnoylCoAMAT[t],  
 C4EnoylCoAMAT[t], C6HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C14HydroxyacylCoAMAT[t], C12HydroxyacylCoAMAT[t], C10HydroxyacylCoAMAT[t],  
 C8HydroxyacylCoAMAT[t], C4HydroxyacylCoAMAT[t], C4AcetoacylCoAMAT[t]],  
 vcrotC4 → CROT[sfcrotC4, Vcrot, KmcrötC4EnoylCoAMAT, KmcrötC16EnoylCoAMAT,  
 KmcrötC14EnoylCoAMAT, KmcrötC12EnoylCoAMAT, KmcrötC10EnoylCoAMAT,  
 KmcrötC8EnoylCoAMAT, KmcrötC6EnoylCoAMAT, KmcrötC4HydroxyacylCoAMAT,  
 KmcrötC16HydroxyacylCoAMAT, KmcrötC14HydroxyacylCoAMAT,  
 KmcrötC12HydroxyacylCoAMAT, KmcrötC10HydroxyacylCoAMAT,  
 KmcrötC8HydroxyacylCoAMAT, KmcrötC6HydroxyacylCoAMAT,  
 KicrötC4AcetoacylCoA, Keqcrot, C4EnoylCoAMAT[t], C16EnoylCoAMAT[t],  
 C14EnoylCoAMAT[t], C12EnoylCoAMAT[t], C10EnoylCoAMAT[t], C8EnoylCoAMAT[t],  
 C6EnoylCoAMAT[t], C4HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C14HydroxyacylCoAMAT[t], C12HydroxyacylCoAMAT[t], C10HydroxyacylCoAMAT[t],  
 C8HydroxyacylCoAMAT[t], C6HydroxyacylCoAMAT[t], C4AcetoacylCoAMAT[t]],  
 vmschadC16 → MSCHAD[sfmschadC16, Vmschad, KmmschadC16HydroxyacylCoAMAT,  
 KmmschadC14HydroxyacylCoAMAT, KmmschadC12HydroxyacylCoAMAT,  
 KmmschadC10HydroxyacylCoAMAT, KmmschadC8HydroxyacylCoAMAT,  
 KmmschadC6HydroxyacylCoAMAT, KmmschadC4HydroxyacylCoAMAT,  
 KmmschadNADMAT, KmmschadC16KetoacylCoAMAT, KmmschadC14KetoacylCoAMAT,  
 KmmschadC12KetoacylCoAMAT, KmmschadC10KetoacylCoAMAT,  
 KmmschadC8KetoacylCoAMAT, KmmschadC6KetoacylCoAMAT,  
 KmmschadC4AcetoacylCoAMAT, KmmschadNADHMAT, Keqmschad,  
 C16HydroxyacylCoAMAT[t], C14HydroxyacylCoAMAT[t],  
 C12HydroxyacylCoAMAT[t], C10HydroxyacylCoAMAT[t],  
 C8HydroxyacylCoAMAT[t], C6HydroxyacylCoAMAT[t], C4HydroxyacylCoAMAT[t],  
 NADtMAT, C16KetoacylCoAMAT[t], C14KetoacylCoAMAT[t],  
 C12KetoacylCoAMAT[t], C10KetoacylCoAMAT[t], C8KetoacylCoAMAT[t],  
 C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], NADHMAT[t]],  
 vmschadC14 → MSCHAD[sfmschadC14, Vmschad, KmmschadC14HydroxyacylCoAMAT,  
 KmmschadC16HydroxyacylCoAMAT, KmmschadC12HydroxyacylCoAMAT,  
 KmmschadC10HydroxyacylCoAMAT, KmmschadC8HydroxyacylCoAMAT,  
 KmmschadC6HydroxyacylCoAMAT, KmmschadC4HydroxyacylCoAMAT,  
 KmmschadNADMAT, KmmschadC14KetoacylCoAMAT, KmmschadC16KetoacylCoAMAT,  
 KmmschadC12KetoacylCoAMAT, KmmschadC10KetoacylCoAMAT,  
 KmmschadC8KetoacylCoAMAT, KmmschadC6KetoacylCoAMAT,  
 KmmschadC4AcetoacylCoAMAT, KmmschadNADHMAT, Keqmschad,  
 C14HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C12HydroxyacylCoAMAT[t], C10HydroxyacylCoAMAT[t],  
 C8HydroxyacylCoAMAT[t], C6HydroxyacylCoAMAT[t], C4HydroxyacylCoAMAT[t],  
 NADtMAT, C14KetoacylCoAMAT[t], C16KetoacylCoAMAT[t],  
 C12KetoacylCoAMAT[t], C10KetoacylCoAMAT[t], C8KetoacylCoAMAT[t],  
 C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], NADHMAT[t]],  
 vmschadC12 → MSCHAD[sfmschadC12, Vmschad, KmmschadC12HydroxyacylCoAMAT,  
 KmmschadC16HydroxyacylCoAMAT, KmmschadC14HydroxyacylCoAMAT,  
 KmmschadC10HydroxyacylCoAMAT, KmmschadC8HydroxyacylCoAMAT,  
 KmmschadC6HydroxyacylCoAMAT, KmmschadC4HydroxyacylCoAMAT,  
 KmmschadNADMAT, KmmschadC12KetoacylCoAMAT, KmmschadC16KetoacylCoAMAT,

KmmschadC14KetoacylCoAMAT, KmmschadC10KetoacylCoAMAT,  
 KmmschadC8KetoacylCoAMAT, KmmschadC6KetoacylCoAMAT,  
 KmmschadC4AcetoacylCoAMAT, KmmschadNADHMAT, Keqmschad,  
 C12HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C14HydroxyacylCoAMAT[t], C10HydroxyacylCoAMAT[t],  
 C8HydroxyacylCoAMAT[t], C6HydroxyacylCoAMAT[t], C4HydroxyacylCoAMAT[t],  
 NADtMAT, C12KetoacylCoAMAT[t], C16KetoacylCoAMAT[t],  
 C14KetoacylCoAMAT[t], C10KetoacylCoAMAT[t], C8KetoacylCoAMAT[t],  
 C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], NADHMAT[t]],  
 vmschadC10 → MSCHAD [sfmschadC10, Vmschad, KmmschadC10HydroxyacylCoAMAT,  
 KmmschadC16HydroxyacylCoAMAT, KmmschadC14HydroxyacylCoAMAT,  
 KmmschadC12HydroxyacylCoAMAT, KmmschadC8HydroxyacylCoAMAT,  
 KmmschadC6HydroxyacylCoAMAT, KmmschadC4HydroxyacylCoAMAT,  
 KmmschadNADMAT, KmmschadC10KetoacylCoAMAT, KmmschadC16KetoacylCoAMAT,  
 KmmschadC14KetoacylCoAMAT, KmmschadC12KetoacylCoAMAT,  
 KmmschadC8KetoacylCoAMAT, KmmschadC6KetoacylCoAMAT,  
 KmmschadC4AcetoacylCoAMAT, KmmschadNADHMAT, Keqmschad,  
 C10HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C14HydroxyacylCoAMAT[t], C12HydroxyacylCoAMAT[t],  
 C8HydroxyacylCoAMAT[t], C6HydroxyacylCoAMAT[t], C4HydroxyacylCoAMAT[t],  
 NADtMAT, C10KetoacylCoAMAT[t], C16KetoacylCoAMAT[t],  
 C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t], C8KetoacylCoAMAT[t],  
 C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], NADHMAT[t]],  
 vmschadC8 → MSCHAD [sfmschadC8, Vmschad, KmmschadC8HydroxyacylCoAMAT,  
 KmmschadC16HydroxyacylCoAMAT, KmmschadC14HydroxyacylCoAMAT,  
 KmmschadC12HydroxyacylCoAMAT, KmmschadC10HydroxyacylCoAMAT,  
 KmmschadC6HydroxyacylCoAMAT, KmmschadC4HydroxyacylCoAMAT,  
 KmmschadNADMAT, KmmschadC8KetoacylCoAMAT, KmmschadC16KetoacylCoAMAT,  
 KmmschadC14KetoacylCoAMAT, KmmschadC12KetoacylCoAMAT,  
 KmmschadC10KetoacylCoAMAT, KmmschadC6KetoacylCoAMAT,  
 KmmschadC4AcetoacylCoAMAT, KmmschadNADHMAT, Keqmschad,  
 C8HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C14HydroxyacylCoAMAT[t], C12HydroxyacylCoAMAT[t],  
 C10HydroxyacylCoAMAT[t], C6HydroxyacylCoAMAT[t], C4HydroxyacylCoAMAT[t],  
 NADtMAT, C8KetoacylCoAMAT[t], C16KetoacylCoAMAT[t],  
 C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t], C10KetoacylCoAMAT[t],  
 C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], NADHMAT[t]],  
 vmschadC6 → MSCHAD [sfmschadC6, Vmschad, KmmschadC6HydroxyacylCoAMAT,  
 KmmschadC16HydroxyacylCoAMAT, KmmschadC14HydroxyacylCoAMAT,  
 KmmschadC12HydroxyacylCoAMAT, KmmschadC10HydroxyacylCoAMAT,  
 KmmschadC8HydroxyacylCoAMAT, KmmschadC4HydroxyacylCoAMAT,  
 KmmschadNADMAT, KmmschadC6KetoacylCoAMAT, KmmschadC16KetoacylCoAMAT,  
 KmmschadC14KetoacylCoAMAT, KmmschadC12KetoacylCoAMAT,  
 KmmschadC10KetoacylCoAMAT, KmmschadC8KetoacylCoAMAT,  
 KmmschadC4AcetoacylCoAMAT, KmmschadNADHMAT, Keqmschad,  
 C6HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C14HydroxyacylCoAMAT[t], C12HydroxyacylCoAMAT[t],  
 C10HydroxyacylCoAMAT[t], C8HydroxyacylCoAMAT[t], C4HydroxyacylCoAMAT[t],  
 NADtMAT, C6KetoacylCoAMAT[t], C16KetoacylCoAMAT[t],  
 C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t], C10KetoacylCoAMAT[t],  
 C8KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], NADHMAT[t]],  
 vmschadC4 → MSCHAD [sfmschadC4, Vmschad, KmmschadC4HydroxyacylCoAMAT,  
 KmmschadC16HydroxyacylCoAMAT, KmmschadC14HydroxyacylCoAMAT,

KmmschadC12HydroxyacylCoAMAT, KmmschadC10HydroxyacylCoAMAT,  
 KmmschadC8HydroxyacylCoAMAT, KmmschadC6HydroxyacylCoAMAT,  
 KmmschadNADMAT, KmmschadC4AcetoacylCoAMAT, KmmschadC16KetoacylCoAMAT,  
 KmmschadC14KetoacylCoAMAT, KmmschadC12KetoacylCoAMAT,  
 KmmschadC10KetoacylCoAMAT, KmmschadC8KetoacylCoAMAT,  
 KmmschadC6KetoacylCoAMAT, KmmschadNADHMAT, Keqmschad,  
 C4HydroxyacylCoAMAT[t], C16HydroxyacylCoAMAT[t],  
 C14HydroxyacylCoAMAT[t], C12HydroxyacylCoAMAT[t],  
 C10HydroxyacylCoAMAT[t], C8HydroxyacylCoAMAT[t], C6HydroxyacylCoAMAT[t],  
 NADtMAT, C4AcetoacylCoAMAT[t], C16KetoacylCoAMAT[t],  
 C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t], C10KetoacylCoAMAT[t],  
 C8KetoacylCoAMAT[t], C6KetoacylCoAMAT[t], NADHMAT[t]],  
 vmckatC16 → MCKATA [sfmckatC16, Vmckat, KmmckatC16KetoacylCoAMAT,  
 KmmckatC14KetoacylCoAMAT, KmmckatC12KetoacylCoAMAT,  
 KmmckatC10KetoacylCoAMAT, KmmckatC8KetoacylCoAMAT,  
 KmmckatC6KetoacylCoAMAT, KmmckatC4AcetoacylCoAMAT, KmmckatCoAMAT,  
 KmmckatC14AcylCoAMAT, KmmckatC16AcylCoAMAT, KmmckatC12AcylCoAMAT,  
 KmmckatC10AcylCoAMAT, KmmckatC8AcylCoAMAT, KmmckatC6AcylCoAMAT,  
 KmmckatC4AcylCoAMAT, KmmckatAcetylCoAMAT, Keqmkat, C16KetoacylCoAMAT[t],  
 C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t], C10KetoacylCoAMAT[t],  
 C8KetoacylCoAMAT[t], C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], CoAMAT,  
 C14AcylCoAMAT[t], C16AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t],  
 C8AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], AcetylCoAMAT[t]],  
 vmckatC14 → MCKATA [sfmckatC14, Vmckat, KmmckatC14KetoacylCoAMAT,  
 KmmckatC16KetoacylCoAMAT, KmmckatC12KetoacylCoAMAT,  
 KmmckatC10KetoacylCoAMAT, KmmckatC8KetoacylCoAMAT,  
 KmmckatC6KetoacylCoAMAT, KmmckatC4AcetoacylCoAMAT, KmmckatCoAMAT,  
 KmmckatC12AcylCoAMAT, KmmckatC16AcylCoAMAT, KmmckatC14AcylCoAMAT,  
 KmmckatC10AcylCoAMAT, KmmckatC8AcylCoAMAT, KmmckatC6AcylCoAMAT,  
 KmmckatC4AcylCoAMAT, KmmckatAcetylCoAMAT, Keqmkat, C14KetoacylCoAMAT[t],  
 C16KetoacylCoAMAT[t], C12KetoacylCoAMAT[t], C10KetoacylCoAMAT[t],  
 C8KetoacylCoAMAT[t], C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], CoAMAT,  
 C12AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C10AcylCoAMAT[t],  
 C8AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], AcetylCoAMAT[t]],  
 vmckatC12 → MCKATA [sfmckatC12, Vmckat, KmmckatC12KetoacylCoAMAT,  
 KmmckatC16KetoacylCoAMAT, KmmckatC14KetoacylCoAMAT,  
 KmmckatC10KetoacylCoAMAT, KmmckatC8KetoacylCoAMAT,  
 KmmckatC6KetoacylCoAMAT, KmmckatC4AcetoacylCoAMAT, KmmckatCoAMAT,  
 KmmckatC10AcylCoAMAT, KmmckatC16AcylCoAMAT, KmmckatC14AcylCoAMAT,  
 KmmckatC12AcylCoAMAT, KmmckatC8AcylCoAMAT, KmmckatC6AcylCoAMAT,  
 KmmckatC4AcylCoAMAT, KmmckatAcetylCoAMAT, Keqmkat, C12KetoacylCoAMAT[t],  
 C16KetoacylCoAMAT[t], C14KetoacylCoAMAT[t], C10KetoacylCoAMAT[t],  
 C8KetoacylCoAMAT[t], C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], CoAMAT,  
 C10AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C8AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], AcetylCoAMAT[t]],  
 vmckatC10 → MCKATA [sfmckatC10, Vmckat, KmmckatC10KetoacylCoAMAT,  
 KmmckatC16KetoacylCoAMAT, KmmckatC14KetoacylCoAMAT,  
 KmmckatC12KetoacylCoAMAT, KmmckatC8KetoacylCoAMAT,  
 KmmckatC6KetoacylCoAMAT, KmmckatC4AcetoacylCoAMAT, KmmckatCoAMAT,  
 KmmckatC8AcylCoAMAT, KmmckatC16AcylCoAMAT, KmmckatC14AcylCoAMAT,  
 KmmckatC12AcylCoAMAT, KmmckatC10AcylCoAMAT, KmmckatC6AcylCoAMAT,  
 KmmckatC4AcylCoAMAT, KmmckatAcetylCoAMAT, Keqmkat, C10KetoacylCoAMAT[t],  
 C16KetoacylCoAMAT[t], C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t],

C8KetoacylCoAMAT[t], C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], CoAMAT,  
 C8AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], C6AcylCoAMAT[t], C4AcylCoAMAT[t], AcetylCoAMAT[t]],  
 vmcakatC8 → MCKATA [sfmckatC8, Vmckat, KmmckatC8KetoacylCoAMAT,  
 KmmckatC16KetoacylCoAMAT, KmmckatC14KetoacylCoAMAT,  
 KmmckatC12KetoacylCoAMAT, KmmckatC10KetoacylCoAMAT,  
 KmmckatC6KetoacylCoAMAT, KmmckatC4AcetoacylCoAMAT, KmmckatCoAMAT,  
 KmmckatC6AcylCoAMAT, KmmckatC16AcylCoAMAT, KmmckatC14AcylCoAMAT,  
 KmmckatC12AcylCoAMAT, KmmckatC10AcylCoAMAT, KmmckatC8AcylCoAMAT,  
 KmmckatC4AcylCoAMAT, KmmckatAcetylCoAMAT, Keqmckat, C8KetoacylCoAMAT[t],  
 C16KetoacylCoAMAT[t], C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t],  
 C10KetoacylCoAMAT[t], C6KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], CoAMAT,  
 C6AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], C8AcylCoAMAT[t], C4AcylCoAMAT[t], AcetylCoAMAT[t]],  
 vmcakatC6 → MCKATA [sfmckatC6, Vmckat, KmmckatC6KetoacylCoAMAT,  
 KmmckatC16KetoacylCoAMAT, KmmckatC14KetoacylCoAMAT,  
 KmmckatC12KetoacylCoAMAT, KmmckatC10KetoacylCoAMAT,  
 KmmckatC8KetoacylCoAMAT, KmmckatC4AcetoacylCoAMAT, KmmckatCoAMAT,  
 KmmckatC4AcylCoAMAT, KmmckatC16AcylCoAMAT, KmmckatC14AcylCoAMAT,  
 KmmckatC12AcylCoAMAT, KmmckatC10AcylCoAMAT, KmmckatC8AcylCoAMAT,  
 KmmckatC6AcylCoAMAT, KmmckatAcetylCoAMAT, Keqmckat, C6KetoacylCoAMAT[t],  
 C16KetoacylCoAMAT[t], C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t],  
 C10KetoacylCoAMAT[t], C8KetoacylCoAMAT[t], C4AcetoacylCoAMAT[t], CoAMAT,  
 C4AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], C8AcylCoAMAT[t], C6AcylCoAMAT[t], AcetylCoAMAT[t]],  
 vmcakatC4 → MCKATB [sfmckatC4, Vmckat, KmmckatC4AcetoacylCoAMAT,  
 KmmckatC16KetoacylCoAMAT, KmmckatC14KetoacylCoAMAT,  
 KmmckatC12KetoacylCoAMAT, KmmckatC10KetoacylCoAMAT,  
 KmmckatC8KetoacylCoAMAT, KmmckatC6KetoacylCoAMAT, KmmckatCoAMAT,  
 KmmckatC4AcylCoAMAT, KmmckatC16AcylCoAMAT, KmmckatC14AcylCoAMAT,  
 KmmckatC12AcylCoAMAT, KmmckatC10AcylCoAMAT, KmmckatC8AcylCoAMAT,  
 KmmckatC6AcylCoAMAT, KmmckatAcetylCoAMAT, Keqmckat, C4AcetoacylCoAMAT[t],  
 C16KetoacylCoAMAT[t], C14KetoacylCoAMAT[t], C12KetoacylCoAMAT[t],  
 C10KetoacylCoAMAT[t], C8KetoacylCoAMAT[t], C6KetoacylCoAMAT[t], CoAMAT,  
 C4AcylCoAMAT[t], C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t],  
 C10AcylCoAMAT[t], C8AcylCoAMAT[t], C6AcylCoAMAT[t], AcetylCoAMAT[t]],  
 vmtPc16 → MTP [sfmtpC16, Vmtp, KmmtpC16EnoylCoAMAT, KmmtpC14EnoylCoAMAT,  
 KmmtpC12EnoylCoAMAT, KmmtpC10EnoylCoAMAT, KmmtpC8EnoylCoAMAT,  
 KmmtpNADMAT, KmmtpCoAMAT, KmmtpC14AcylCoAMAT, KmmtpC16AcylCoAMAT,  
 KmmtpC12AcylCoAMAT, KmmtpC10AcylCoAMAT, KmmtpC8AcylCoAMAT,  
 KmmtpC6AcylCoAMAT, KmmtpNADHMAT, KmmtpAcetylCoAMAT, KicrotC4AcetoacylCoA,  
 KeqmtP, C16EnoylCoAMAT[t], C14EnoylCoAMAT[t], C12EnoylCoAMAT[t],  
 C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], NADtMAT, CoAMAT, C14AcylCoAMAT[t],  
 C16AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t], C8AcylCoAMAT[t],  
 C6AcylCoAMAT[t], NADHMAT[t], AcetylCoAMAT[t], C4AcetoacylCoAMAT[t]],  
 vmtPc14 → MTP [sfmtpC14, Vmtp, KmmtpC14EnoylCoAMAT, KmmtpC16EnoylCoAMAT,  
 KmmtpC12EnoylCoAMAT, KmmtpC10EnoylCoAMAT, KmmtpC8EnoylCoAMAT,  
 KmmtpNADMAT, KmmtpCoAMAT, KmmtpC12AcylCoAMAT, KmmtpC16AcylCoAMAT,  
 KmmtpC14AcylCoAMAT, KmmtpC10AcylCoAMAT, KmmtpC8AcylCoAMAT,  
 KmmtpC6AcylCoAMAT, KmmtpNADHMAT, KmmtpAcetylCoAMAT, KicrotC4AcetoacylCoA,  
 KeqmtP, C14EnoylCoAMAT[t], C16EnoylCoAMAT[t], C12EnoylCoAMAT[t],  
 C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], NADtMAT, CoAMAT, C12AcylCoAMAT[t],  
 C16AcylCoAMAT[t], C14AcylCoAMAT[t], C10AcylCoAMAT[t], C8AcylCoAMAT[t],

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C6AcylCoAMAT[t], NADHMAT[t], AcetylCoAMAT[t], C4AcetoacylCoAMAT[t]],

vmtcp12 → MTP[sfntpC12, Vmtp, KmmtpC12EnoylCoAMAT, KmmtpC16EnoylCoAMAT,
KmmtpC14EnoylCoAMAT, KmmtpC10EnoylCoAMAT, KmmtpC8EnoylCoAMAT,
KmmtpNADMAT, KmmtpCoAMAT, KmmtpC10AcylCoAMAT, KmmtpC16AcylCoAMAT,
KmmtpC14AcylCoAMAT, KmmtpC12AcylCoAMAT, KmmtpC8AcylCoAMAT,
KmmtpC6AcylCoAMAT, KmmtpNADMAT, KmmtpAcetylCoAMAT, KicrotC4AcetoacylCoA,
Keqntp, C12EnoylCoAMAT[t], C16EnoylCoAMAT[t], C14EnoylCoAMAT[t],
C10EnoylCoAMAT[t], C8EnoylCoAMAT[t], NADtMAT, CoAMAT, C10AcylCoAMAT[t],
C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t], C8AcylCoAMAT[t],
C6AcylCoAMAT[t], NADHMAT[t], AcetylCoAMAT[t], C4AcetoacylCoAMAT[t]],

vmtcp10 → MTP[sfntpC10, Vmtp, KmmtpC10EnoylCoAMAT, KmmtpC16EnoylCoAMAT,
KmmtpC14EnoylCoAMAT, KmmtpC12EnoylCoAMAT, KmmtpC8EnoylCoAMAT,
KmmtpNADMAT, KmmtpCoAMAT, KmmtpC8AcylCoAMAT, KmmtpC16AcylCoAMAT,
KmmtpC14AcylCoAMAT, KmmtpC12AcylCoAMAT, KmmtpC10AcylCoAMAT,
KmmtpC6AcylCoAMAT, KmmtpNADMAT, KmmtpAcetylCoAMAT, KicrotC4AcetoacylCoA,
Keqntp, C10EnoylCoAMAT[t], C16EnoylCoAMAT[t], C14EnoylCoAMAT[t],
C12EnoylCoAMAT[t], C8EnoylCoAMAT[t], NADtMAT, CoAMAT, C8AcylCoAMAT[t],
C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t],
C6AcylCoAMAT[t], NADHMAT[t], AcetylCoAMAT[t], C4AcetoacylCoAMAT[t]],

vmtcp8 → MTP[sfntpC8, Vmtp, KmmtpC8EnoylCoAMAT, KmmtpC16EnoylCoAMAT,
KmmtpC14EnoylCoAMAT, KmmtpC12EnoylCoAMAT, KmmtpC10EnoylCoAMAT,
KmmtpNADMAT, KmmtpCoAMAT, KmmtpC6AcylCoAMAT, KmmtpC16AcylCoAMAT,
KmmtpC14AcylCoAMAT, KmmtpC12AcylCoAMAT, KmmtpC10AcylCoAMAT,
KmmtpC8AcylCoAMAT, KmmtpNADMAT, KmmtpAcetylCoAMAT, KicrotC4AcetoacylCoA,
Keqntp, C8EnoylCoAMAT[t], C16EnoylCoAMAT[t], C14EnoylCoAMAT[t],
C12EnoylCoAMAT[t], C10EnoylCoAMAT[t], NADtMAT, CoAMAT, C6AcylCoAMAT[t],
C16AcylCoAMAT[t], C14AcylCoAMAT[t], C12AcylCoAMAT[t], C10AcylCoAMAT[t],
C8AcylCoAMAT[t], NADHMAT[t], AcetylCoAMAT[t], C4AcetoacylCoAMAT[t]],

vacesink → RES[Ksacesink, AcetylCoAMAT[t], Klacesink],
vfadhsink → RES[Ksfadhsink, FADHMAT[t], K1fadhsink],
vnadhsink → RES[Ksnadhsink, NADHMAT[t], K1nadhsink}};


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CoAMATX = {CoAMAT → CoAMAT - C16AcylCoAMAT[t] - C16EnoylCoAMAT[t] -
C16HydroxyacylCoAMAT[t] - C16KetoacylCoAMAT[t] - C14AcylCoAMAT[t] -
C14EnoylCoAMAT[t] - C14HydroxyacylCoAMAT[t] - C14KetoacylCoAMAT[t] -
C12AcylCoAMAT[t] - C12EnoylCoAMAT[t] - C12HydroxyacylCoAMAT[t] -
C12KetoacylCoAMAT[t] - C10AcylCoAMAT[t] - C10EnoylCoAMAT[t] -
C10HydroxyacylCoAMAT[t] - C10KetoacylCoAMAT[t] - C8AcylCoAMAT[t] -
C8EnoylCoAMAT[t] - C8HydroxyacylCoAMAT[t] - C8KetoacylCoAMAT[t] -
C6AcylCoAMAT[t] - C6EnoylCoAMAT[t] - C6HydroxyacylCoAMAT[t] -
C6KetoacylCoAMAT[t] - C4AcylCoAMAT[t] - C4EnoylCoAMAT[t] -
C4HydroxyacylCoAMAT[t] - C4AcetoacylCoAMAT[t] - AcetylCoAMAT[t]};


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Parm = {
  sfcpt1C16 → 1, Vcpt1 → 0.012, Kmcpt1C16AcylCoACYT → 13.8,
  Kmcpt1CarCYT → 125, Kmcpt1C16AcylCarCYT → 136, Kmcpt1CoACYT → 40.7,
  Kicpt1MalCoACYT → 9.1, Keqcpt1 → 0.45, ncpt1 → 2.4799,
  Vfcact → 0.42, Vrcact → 0.42, KmcactC16AcylCarCYT → 15,
  KmcactC14AcylCarCYT → 15, KmcactC12AcylCarCYT → 15, KmcactC10AcylCarCYT → 15,
  KmcactC8AcylCarCYT → 15, KmcactC6AcylCarCYT → 15, KmcactC4AcylCarCYT → 15,
  KmcactCarMAT → 130, KmcactC16AcylCarMAT → 15, KmcactC14AcylCarMAT → 15,
  KmcactC12AcylCarMAT → 15, KmcactC10AcylCarMAT → 15, KmcactC8AcylCarMAT → 15,
  KmcactC6AcylCarMAT → 15, KmcactC4AcylCarMAT → 15, KmcactCarCYT → 130,
};


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KicactC16AcylCarCYT → 56, KicactC14AcylCarCYT → 56, KicactC12AcylCarCYT → 56,  
 KicactC10AcylCarCYT → 56, KicactC8AcylCarCYT → 56, KicactC6AcylCarCYT → 56,  
 KicactC4AcylCarCYT → 56, KicactCarCYT → 200, Keqcact → 1,  
 sfcpt2C16 → 0.85, sfcppt2C14 → 1, sfcppt2C12 → 0.95, sfcppt2C10 → 0.95,  
 sfcppt2C8 → 0.35, sfcppt2C6 → 0.15, sfcppt2C4 → 0.01, Vcpt2 → 0.391,  
 Kmcppt2C16AcylCarMAT → 51, Kmcppt2C14AcylCarMAT → 51, Kmcppt2C12AcylCarMAT → 51,  
 Kmcppt2C10AcylCarMAT → 51, Kmcppt2C8AcylCarMAT → 51, Kmcppt2C6AcylCarMAT → 51,  
 Kmcppt2C4AcylCarMAT → 51, Kmcppt2CoAMAT → 30, Kmcppt2C16AcylCoAMAT → 38,  
 Kmcppt2C14AcylCoAMAT → 38, Kmcppt2C12AcylCoAMAT → 38,  
 Kmcppt2C10AcylCoAMAT → 38, Kmcppt2C8AcylCoAMAT → 38, Kmcppt2C6AcylCoAMAT → 1000,  
 Kmcppt2C4AcylCoAMAT → 1 000 000, Kmcppt2CarMAT → 350, Keqcpt2 → 2.22,  
 sfvlcadC16 → 1, sfvlcadC14 → 0.42, sfvlcadC12 → 0.11, Vvlcad → 0.008,  
 KmvlcadC16AcylCoAMAT → 6.5, KmvlcadC14AcylCoAMAT → 4,  
 KmvlcadC12AcylCoAMAT → 2.7, KmvlcadFAD → 0.12,  
 KmvlcadC16EnoylCoAMAT → 1.08, KmvlcadC14EnoylCoAMAT → 1.08,  
 KmvlcadC12EnoylCoAMAT → 1.08, KmvlcadFADH → 24.2, Keqvlcad → 6,  
 sflcadC16 → 0.9, sflcadC14 → 1, sflcadC12 → 0.9, sflcadC10 → 0.75,  
 sflcadC8 → 0.4, Vlcad → 0.01, KmlcadC16AcylCoAMAT → 2.5,  
 KmlcadC14AcylCoAMAT → 7.4, KmlcadC12AcylCoAMAT → 9,  
 KmlcadC10AcylCoAMAT → 24.3, KmlcadC8AcylCoAMAT → 123, KmlcadFAD → 0.12,  
 KmlcadC16EnoylCoAMAT → 1.08, KmlcadC14EnoylCoAMAT → 1.08,  
 KmlcadC12EnoylCoAMAT → 1.08, KmlcadC10EnoylCoAMAT → 1.08,  
 KmlcadC8EnoylCoAMAT → 1.08, KmlcadFADH → 24.2, Keqlcad → 6,  
 sfmcadC12 → 0.38, sfmcadC10 → 0.8, sfmcadC8 → 0.87, sfmcadC6 → 1,  
 sfmcadC4 → 0.12, Vmcad → 0.081, KmmcadC12AcylCoAMAT → 5.7,  
 KmmcadC10AcylCoAMAT → 5.4, KmmcadC8AcylCoAMAT → 4,  
 KmmcadC6AcylCoAMAT → 9.4, KmmcadC4AcylCoAMAT → 135, KmmcadFAD → 0.12,  
 KmmcadC12EnoylCoAMAT → 1.08, KmmcadC10EnoylCoAMAT → 1.08,  
 KmmcadC8EnoylCoAMAT → 1.08, KmmcadC6EnoylCoAMAT → 1.08,  
 KmmcadC4EnoylCoAMAT → 1.08, KmmcadFADH → 24.2, Keqmcad → 6,  
 sfscadC6 → 0.3, sfscadC4 → 1, Vscad → 0.081, KmscadC6AcylCoAMAT → 285,  
 KmscadC4AcylCoAMAT → 10.7, KmscadFAD → 0.12, KmscadC6EnoylCoAMAT → 1.08,  
 KmscadC4EnoylCoAMAT → 1.08, KmscadFADH → 24.2, Keqscad → 6,  
 sfrcrotC16 → 0.13, sfrcrotC14 → 0.2, sfrcrotC12 → 0.25, sfrcrotC10 → 0.33,  
 sfrcrotC8 → 0.58, sfrcrotC6 → 0.83, sfrcrotC4 → 1, Vcrot → 3.6,  
 KmrcrotC16EnoylCoAMAT → 150, KmrcrotC14EnoylCoAMAT → 100,  
 KmrcrotC12EnoylCoAMAT → 25, KmrcrotC10EnoylCoAMAT → 25,  
 KmrcrotC8EnoylCoAMAT → 25, KmrcrotC6EnoylCoAMAT → 25, KmrcrotC4EnoylCoAMAT → 40,  
 KmrcrotC16HydroxyacylCoAMAT → 45, KmrcrotC14HydroxyacylCoAMAT → 45,  
 KmrcrotC12HydroxyacylCoAMAT → 45, KmrcrotC10HydroxyacylCoAMAT → 45,  
 KmrcrotC8HydroxyacylCoAMAT → 45, KmrcrotC6HydroxyacylCoAMAT → 45,  
 KmrcrotC4HydroxyacylCoAMAT → 45, KicrotC4AcetoacylCoA → 1.6, Keqcrot → 3.13,  
 sfmschadC16 → 0.6, sfmschadC14 → 0.5, sfmschadC12 → 0.43,  
 sfmschadC10 → 0.64, sfmschadC8 → 0.89, sfmschadC6 → 1,  
 sfmschadC4 → 0.67, Vmschad → 1, KmmschadC16HydroxyacylCoAMAT → 1.5,  
 KmmschadC14HydroxyacylCoAMAT → 1.8, KmmschadC12HydroxyacylCoAMAT → 3.7,  
 KmmschadC10HydroxyacylCoAMAT → 8.8, KmmschadC8HydroxyacylCoAMAT → 16.3,  
 KmmschadC6HydroxyacylCoAMAT → 28.6, KmmschadC4HydroxyacylCoAMAT → 69.9,  
 KmmschadNADMAT → 58.5, KmmschadC16KetoacylCoAMAT → 1.4,  
 KmmschadC14KetoacylCoAMAT → 1.4, KmmschadC12KetoacylCoAMAT → 1.6,  
 KmmschadC10KetoacylCoAMAT → 2.3, KmmschadC8KetoacylCoAMAT → 4.1,  
 KmmschadC6KetoacylCoAMAT → 5.8, KmmschadC4AcetoacylCoAMAT → 16.9,  
 KmmschadNADHMAT → 5.4, Keqmschad →  $2.17 \times 10^{-4}$ ,

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sfmckatC16 → 0, sfmckatC14 → 0.2, sfmckatC12 → 0.38, sfmckatC10 → 0.65,
sfmckatC8 → 0.81, sfmckatC6 → 1, sfmckatC4 → 0.49, Vmckat → 0.377,
KmmckatC16KetoacylCoAMAT → 1.1, KmmckatC14KetoacylCoAMAT → 1.2,
KmmckatC12KetoacylCoAMAT → 1.3, KmmckatC10KetoacylCoAMAT → 2.1,
KmmckatC8KetoacylCoAMAT → 3.2, KmmckatC6KetoacylCoAMAT → 6.7,
KmmckatC4AcetoacylCoAMAT → 12.4, KmmckatCoAMAT → 26.6,
KmmckatC14AcylCoAMAT → 13.83, KmmckatC16AcylCoAMAT → 13.83,
KmmckatC12AcylCoAMAT → 13.83, KmmckatC10AcylCoAMAT → 13.83,
KmmckatC8AcylCoAMAT → 13.83, KmmckatC6AcylCoAMAT → 13.83,
KmmckatC4AcylCoAMAT → 13.83, KmmckatAcetylCoAMAT → 30, Keqmckat → 1051,
sfmtcpC16 → 1, sfmtpc14 → 0.9, sfmtpc12 → 0.81, sfmtcpC10 → 0.73,
sfmtcpC8 → 0.34, Vmtp → 2.84, KmmtpC16EnoylCoAMAT → 25,
KmmtpC14EnoylCoAMAT → 25, KmmtpC12EnoylCoAMAT → 25,
KmmtpC10EnoylCoAMAT → 25, KmmtpC8EnoylCoAMAT → 25, KmmtpNADMAT → 60,
KmmtpCoAMAT → 30, KmmtpC14AcylCoAMAT → 13.83, KmmtpC16AcylCoAMAT → 13.83,
KmmtpC12AcylCoAMAT → 13.83, KmmtpC10AcylCoAMAT → 13.83,
KmmtpC8AcylCoAMAT → 13.83, KmmtpC6AcylCoAMAT → 13.83,
KmmtpNADHMAT → 50, KmmtpAcetylCoAMAT → 30, Keqmtip → 0.71,
Ksacesink → 6 000 000, Klacesink → 30, Ksfadhsink → 6 000 000,
K1fadhsink → 0.46, Ksnadhsink → 6 000 000, K1nadhsink → 16,
C16AcylCoACYT → x, CarCYT → 400, CoACYT → 140, MalCoACYT → 0,
CarMAT -> 950, FADtMAT → 0.77, NADtMAT → 250, CoAMATT → 5000,
VCYT → 10 * 10-3, VMAT → 1.8 * 10-6}};

InitialConditions = {
  C16AcylCarCYT[0] == 0.171, C16AcylCarMAT[0] == 0, C16AcylCoAMAT[0] == 0,
  C16EnoylCoAMAT[0] == 0, C16HydroxyacylCoAMAT[0] == 0, C16KetoacylCoAMAT[0] == 0,
  C14AcylCarCYT[0] == 0.023, C14AcylCarMAT[0] == 0, C14AcylCoAMAT[0] == 0,
  C14EnoylCoAMAT[0] == 0, C14HydroxyacylCoAMAT[0] == 0, C14KetoacylCoAMAT[0] == 0,
  C12AcylCarCYT[0] == 0.110, C12AcylCarMAT[0] == 0, C12AcylCoAMAT[0] == 0,
  C12EnoylCoAMAT[0] == 0, C12HydroxyacylCoAMAT[0] == 0, C12KetoacylCoAMAT[0] == 0,
  C10AcylCarCYT[0] == 0.019, C10AcylCarMAT[0] == 0, C10AcylCoAMAT[0] == 0,
  C10EnoylCoAMAT[0] == 0, C10HydroxyacylCoAMAT[0] == 0, C10KetoacylCoAMAT[0] == 0,
  C8AcylCarCYT[0] == 0.052, C8AcylCarMAT[0] == 0, C8AcylCoAMAT[0] == 0,
  C8EnoylCoAMAT[0] == 0, C8HydroxyacylCoAMAT[0] == 0, C8KetoacylCoAMAT[0] == 0,
  C6AcylCarCYT[0] == 0.017, C6AcylCarMAT[0] == 0, C6AcylCoAMAT[0] == 0,
  C6EnoylCoAMAT[0] == 0, C6HydroxyacylCoAMAT[0] == 0, C6KetoacylCoAMAT[0] == 0,
  C4AcylCarCYT[0] == 0.008, C4AcylCarMAT[0] == 0, C4AcylCoAMAT[0] == 0,
  C4EnoylCoAMAT[0] == 0, C4HydroxyacylCoAMAT[0] == 0, C4AcetoacylCoAMAT[0] == 0,
  AcetylCoAMAT[0] == 30, FADHMAT[0] == 0.46, NADHMAT[0] == 16};

Vars = {
  C16AcylCarCYT, C16AcylCarMAT, C16AcylCoAMAT,
  C16EnoylCoAMAT, C16HydroxyacylCoAMAT, C16KetoacylCoAMAT,
  C14AcylCarCYT, C14AcylCarMAT, C14AcylCoAMAT, C14EnoylCoAMAT,
  C14HydroxyacylCoAMAT, C14KetoacylCoAMAT,
  C12AcylCarCYT, C12AcylCarMAT, C12AcylCoAMAT, C12EnoylCoAMAT,
  C12HydroxyacylCoAMAT, C12KetoacylCoAMAT,
  C10AcylCarCYT, C10AcylCarMAT, C10AcylCoAMAT, C10EnoylCoAMAT,
  C10HydroxyacylCoAMAT, C10KetoacylCoAMAT,
  C8AcylCarCYT, C8AcylCarMAT, C8AcylCoAMAT, C8EnoylCoAMAT,
  C8HydroxyacylCoAMAT, C8KetoacylCoAMAT,
  C6AcylCarCYT, C6AcylCarMAT, C6AcylCoAMAT, C6EnoylCoAMAT,

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C6HydroxyacylCoAMAT, C6KetoacylCoAMAT,
C4AcylCarCYT, C4AcylCarMAT, C4AcylCoAMAT, C4EnoylCoAMAT,
C4HydroxyacylCoAMAT, C4AcetoacylCoAMAT,
AcetylCoAMAT, FADHMAT, NADHMAT}];

TableForm[Odes];
TableForm[RateEqs];
TableForm[Odes /. RateEqs /. CoAMATX /. Parm];
TableForm[RateEqs /. Parm];
TableForm[InitialConditions];

tsol = NDSolve[Join[Odes /. RateEqs /. CoAMATX /. Parm, InitialConditions] /.
x → 26.8 * e-0.18*t, Vars, {t, 0, 30}];

```

## Graphs metabolite concentrations

```

<< PlotLegends` 

Plot1 = Plot[
Evaluate[
{C16AcylCarCYT[t], C14AcylCarCYT[t], C12AcylCarCYT[t], C10AcylCarCYT[t],
C8AcylCarCYT[t], C6AcylCarCYT[t], C4AcylCarCYT[t]} /. tsol],
{t, 0, 25}, PlotStyle → {{Red, Thick}, {Green, Thick}, {Blue, Thick},
{Magenta, Thick}, {Cyan, Thick}, {Orange, Thick}, {Purple, Thick}},
PlotLegend → {"C16AcylCarCYT", "C14AcylCarCYT", "C12AcylCarCYT",
"C10AcylCarCYT", "C8AcylCarCYT", "C6AcylCarCYT",
"C4AcylCarCYT"}, LegendPosition → {1, -0.5},
PlotRange → All, Frame → True, FrameLabel →
{"Time (min)", "Concentrations (\u00b5M)" },
BaseStyle → {FontSize → 14, FontFamily → "Helvetica", FontWeight → "Bold"}, 
FrameStyle → Thickness[0.005], ImageSize → Scaled[0.5]]

Plot2 = Plot[
Evaluate[
{CoAMATt - C16AcylCoAMAT[t] - C16EnoylCoAMAT[t] - C16HydroxyacylCoAMAT[t] -
C16KetoacylCoAMAT[t] - C14AcylCoAMAT[t] - C14EnoylCoAMAT[t] -
C14HydroxyacylCoAMAT[t] - C14KetoacylCoAMAT[t] - C12AcylCoAMAT[t] -
C12EnoylCoAMAT[t] - C12HydroxyacylCoAMAT[t] - C12KetoacylCoAMAT[t] -
C10AcylCoAMAT[t] - C10EnoylCoAMAT[t] - C10HydroxyacylCoAMAT[t] -
C10KetoacylCoAMAT[t] - C8AcylCoAMAT[t] - C8EnoylCoAMAT[t] -
C8HydroxyacylCoAMAT[t] - C8KetoacylCoAMAT[t] - C6AcylCoAMAT[t] -
C6EnoylCoAMAT[t] - C6HydroxyacylCoAMAT[t] - C6KetoacylCoAMAT[t] -
C4AcylCoAMAT[t] - C4EnoylCoAMAT[t] - C4HydroxyacylCoAMAT[t] -
C4AcetoacylCoAMAT[t] - AcetylCoAMAT[t] /. RateEqs /. Parm} /. tsol],
{t, 0, 25}, PlotStyle → {{Black, Thick}}},
PlotRange → {All, {0, 5000}}, Frame → True,
FrameLabel → {"Time (min)", "Concentration (\u00b5M)" },
BaseStyle → {FontSize → 14, FontFamily → "Helvetica", FontWeight → "Bold"}, 
FrameStyle → Thickness[0.005], ImageSize → Scaled[0.5]]

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# Graphs rates

```

Plot11 = Plot[
  Evaluate[{{(vnadhsink + vfadhsink) / 2 * 1000} /. RateEqs /. CoAMATX /. Parm /. tsol],
  {t, 0, 8}, PlotStyle -> {{Black, Thick}},
  PlotLegend -> {"vnadhsink"}, LegendPosition -> {1, -0.5},
  PlotRange -> {All, {0, 50}}, Frame -> True,
  FrameLabel -> {"Time (min)", "v (\u00b5mol/min/gProtein)" },
  BaseStyle -> {FontSize -> 14, FontFamily -> "Helvetica", FontWeight -> "Bold"},
  FrameStyle -> Thickness[0.005], ImageSize -> Scaled[0.5]]

TableForm[
  Table[{{(vnadhsink + vfadhsink) / 2 * 1000} /. RateEqs /. CoAMATX /. Parm /. tsol},
  {t, 0, 8.24, 0.01}]]

TableForm[Table[{C16AcylCarCYT[t] /. tsol}, {t, 0, 24, 0.1}]]]
TableForm[Table[{C14AcylCarCYT[t] /. tsol}, {t, 0, 24, 0.1}]]]
TableForm[Table[{C12AcylCarCYT[t] /. tsol}, {t, 0, 24, 0.1}]]]
TableForm[Table[{C10AcylCarCYT[t] /. tsol}, {t, 0, 24, 0.1}]]]
TableForm[Table[{C8AcylCarCYT[t] /. tsol}, {t, 0, 24, 0.1}]]]
TableForm[Table[{C6AcylCarCYT[t] /. tsol}, {t, 0, 24, 0.1}]]]
TableForm[Table[{C4AcylCarCYT[t] /. tsol}, {t, 0, 24, 0.1}]]]

```