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<?xml version="1.0"?>

<!-- FILE : fatty_acid_synthesis_model.xml

CREATED : 14th June 2002

LAST MODIFIED : 22nd July 2002

AUTHOR : Catherine Lloyd
         The Bioengineering Institute
         The University of Auckland

MODEL STATUS : This model conforms to the CellML 1.0 Specification released on
                10th August 2001, and the 16/01/2002 CellML Metadata 1.0
                Specification.

DESCRIPTION : This file contains a CellML description of a generic model of
              fatty acid synthesis.

CHANGES:
  22/07/2002 - CML - Added more metadata.
-->

<model name="fatty_acid_synthesis_model" pathway_editor:rendering_config_file="fatty_acid_sy
  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:bgs="http://www.cel
  <!--
    The following RDF block contains metadata that applies to this document
    as a whole, as indicated by the empty about attribute on the
    <rdf:Description> element.
  -->
  <rdf:Description rdf:about="">
    <!--
      The Model Builder Metadata. The Dublin Core "creator" element is used
      to indicate the person who translated the model into CellML.
    -->
    <dc:creator rdf:parseType="Resource">
      <vCard:N rdf:parseType="Resource">
        <vCard:Family>Lloyd</vCard:Family>
        <vCard:Given>Catherine</vCard:Given>
        <vCard:Other>May</vCard:Other>
      </vCard:N>
      <vCard:EMAIL rdf:parseType="Resource">
        <rdf:value>c.lloyd@auckland.ac.nz</rdf:value>
        <rdf:type rdf:resource="http://imc.org/vCard/3.0#internet" />
      </vCard:EMAIL>
      <vCard:ORG rdf:parseType="Resource">
        <vCard:Orgname>The University of Auckland</vCard:Orgname>
        <vCard:Orgunit>The Bioengineering Institute</vCard:Orgunit>
      </vCard:ORG>
    </dc:creator>

    <!--
      The Creation Date metadata. This is the date on which the model
      was translated into CellML.
    -->
    <dcterms:created rdf:parseType="Resource">
      <dcterms:W3CDTF>2002-06-14</dcterms:W3CDTF>
    </dcterms:created>

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<!--
  The Last Modified Date metadata. This is the date on which
  the model was last changed.
-->

<!-- The Publisher metadata. -->
<dc:publisher>
  The University of Auckland, Bioengineering Institute
</dc:publisher>
</rdf:Description>

<!--
  The following metadata refers to the model itself, as indicated by the
  reference to the ID "fatty_acid_synthesis_model", which is declared on
  the <model> element.
-->
<rdf:Description rdf:about="#fatty_acid_synthesis_model">
  <!-- A human readable name for the model. -->
  <dc:title>A Generic Model Of Fatty Acid Synthesis</dc:title>

  <!-- A comment regarding the model. -->
  <cmeta:comment rdf:parseType="Resource">
    <rdf:value>
      Below is a CellML description of a general model of fatty acid
      synthesis. It is not based on a specific published mathematical
      model, but instead it is based on a textbook defined pathway. The
      general sequential structure and all the reactant, product and enzyme
      components are included. Michaelis-Menten enzyme kinetics are
      assumed.

      The purpose of this description is to illustrate how CellML can be
      used to model a general metabolic pathway.
    </rdf:value>
    <!-- The creator of the comment. -->
    <dc:creator>
      <vCard:FN>Catherine Lloyd</vCard:FN>
    </dc:creator>
  </cmeta:comment>

  <cmeta:species>Homo sapiens</cmeta:species>

  <!-- Keyword(s) -->
  <bqs:reference rdf:parseType="Resource">
    <dc:subject rdf:parseType="Resource">
      <bqs:subject_type>keyword</bqs:subject_type>
      <rdf:value>metabolism</rdf:value>
    </dc:subject>
  </bqs:reference>

  <bqs:Book rdf:parseType="Resource">
    <dc:creator rdf:parseType="Resource">
      <bqs:Person rdf:parseType="Resource">
        <vCard:N rdf:parseType="Resource">
          <vCard:Family>Bronk</vCard:Family>
          <vCard:Given>J</vCard:Given>
          <vCard:Other>Ramsey</vCard:Other>
        </vCard:N>
      </bqs:Person>
    </dc:creator>
  </bqs:Book>

```

```
<dc:title>Human Metabolism</dc:title>
<dcterms:issued rdf:parseType="Resource">
  <dcterms:W3CDTF>1999</dcterms:W3CDTF>
</dcterms:issued>
<dc:publisher rdf:parseType="Resource">
  <bqs:Organisation>Addison Wesley Longman Limited</bqs:Organisation>
  <bqs:Property rdf:parseType="Resource">
    <bqs:property_type>location</bqs:property_type>
    <rdf:value>England</rdf:value>
  </bqs:Property>
</dc:publisher>
</bqs:Book>
</rdf:Description>
</rdf:RDF>
```

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<!--
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```
We start the model definition with a definition of some named
sets of units for use throughout the model.
```

```
-->
```

```
<units name="micromolar">
  <unit prefix="micro" units="mole" />
  <unit units="litre" exponent="-1" />
</units>
```

```
<units name="flux">
  <unit units="micromolar" />
  <unit units="second" exponent="-1" />
</units>
```

```
<units name="first_order_rate_constant">
  <unit units="second" exponent="-1" />
</units>
```

```
<units name="second_order_rate_constant">
  <unit units="micromolar" exponent="-1" />
  <unit units="second" exponent="-1" />
</units>
```

```
<units name="third_order_rate_constant">
  <unit units="micromolar" exponent="-2" />
  <unit units="second" exponent="-1" />
</units>
```

```
<!--
```

```
The following component is defined for modelling convenience. It contains
all the universal variables, in this case, only time.
```

```
-->
```

```
<component name="global_variables">
  <variable name="time" public_interface="out" units="second" />
</component>
```

```
<!--
```

```
The following components describe all the metabolites - both reactants and
products - involved in fatty acid synthesis.
```

```
-->
```

```
<component name="Acetyl_CoA" cmeta:id="Acetyl_CoA">
  <variable name="Acetyl_CoA" public_interface="out" initial_value="1.0" units="micromolar">
```

```

<variable name="delta_Acetyl_CoA_rxn0" public_interface="in" units="flux" />
<variable name="time" public_interface="in" units="second" />
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply><eq />
    <apply><diff />
      <bvar>
        <ci>time</ci>
      </bvar>
      <ci>Acetyl_CoA</ci>
    </apply>
    <ci>delta_Acetyl_CoA_rxn0</ci>
  </apply>
</math>
</component>

<component name="Malonyl_CoA" cmeta:id="Malonyl_CoA">
  <variable name="Malonyl_CoA" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_Malonyl_CoA_rxn1" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>Malonyl_CoA</ci>
      </apply>
      <ci>delta_Malonyl_CoA_rxn1</ci>
    </apply>
  </math>
</component>

<component name="Malonyl_ACP" cmeta:id="Malonyl_ACP">
  <variable name="Malonyl_ACP" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_Malonyl_ACP_rxn1" public_interface="in" units="flux" />
  <variable name="delta_Malonyl_ACP_rxn3" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>Malonyl_ACP</ci>
      </apply>
      <apply><plus />
        <ci>delta_Malonyl_ACP_rxn1</ci>
        <ci>delta_Malonyl_ACP_rxn3</ci>
      </apply>
    </apply>
  </math>
</component>

<component name="Acetyl_ACP" cmeta:id="Acetyl_ACP">
  <variable name="Acetyl_ACP" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_Acetyl_ACP_rxn0" public_interface="in" units="flux" />
  <variable name="delta_Acetyl_ACP_rxn2" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">

```

```

<apply><eq />
  <apply><diff />
    <bvar>
      <ci>time</ci>
    </bvar>
    <ci>Acetyl_ACP</ci>
  </apply>
  <apply><plus />
    <ci>delta_Acetyl_ACP_rxn0</ci>
    <ci>delta_Acetyl_ACP_rxn2</ci>
  </apply>
</apply>
</math>
</component>

<component name="Acetoacetyl_ACP" cmeta:id="Acetoacetyl_ACP">
  <variable name="Acetoacetyl_ACP" public_interface="out" initial_value="1.0" units="micromol" />
  <variable name="delta_Acetoacetyl_ACP_rxn3" public_interface="in" units="flux" />
  <variable name="delta_Acetoacetyl_ACP_rxn4" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>Acetoacetyl_ACP</ci>
      </apply>
      <apply><plus />
        <ci>delta_Acetoacetyl_ACP_rxn3</ci>
        <ci>delta_Acetoacetyl_ACP_rxn4</ci>
      </apply>
    </apply>
  </math>
</component>

<component name="D_beta_Hydroxybutyryl_ACP" cmeta:id="D_beta_Hydroxybutyryl_ACP">
  <variable name="D_beta_Hydroxybutyryl_ACP" public_interface="out" initial_value="1.0" units="micromol" />
  <variable name="delta_D_beta_Hydroxybutyryl_ACP_rxn4" public_interface="in" units="flux" />
  <variable name="delta_D_beta_Hydroxybutyryl_ACP_rxn6" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>D_beta_Hydroxybutyryl_ACP</ci>
      </apply>
      <apply><plus />
        <ci>delta_D_beta_Hydroxybutyryl_ACP_rxn4</ci>
        <ci>delta_D_beta_Hydroxybutyryl_ACP_rxn6</ci>
      </apply>
    </apply>
  </math>
</component>

<component name="alpha_beta_trans_Butenoyl_ACP" cmeta:id="alpha_beta_trans_Butenoyl_ACP">
  <variable name="alpha_beta_trans_Butenoyl_ACP" public_interface="out" initial_value="1.0" units="micromol" />

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```

<variable name="delta_alpha_beta_trans_Butenoyl_ACP_rxn6" public_interface="in" units="f
<variable name="delta_alpha_beta_trans_Butenoyl_ACP_rxn5" public_interface="in" units="f
<variable name="time" public_interface="in" units="second" />
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply><eq />
    <apply><diff />
      <bvar>
        <ci>time</ci>
      </bvar>
      <ci>alpha_beta_trans_Butenoyl_ACP</ci>
    </apply>
    <apply><plus />
      <ci>delta_alpha_beta_trans_Butenoyl_ACP_rxn6</ci>
      <ci>delta_alpha_beta_trans_Butenoyl_ACP_rxn5</ci>
    </apply>
  </apply>
</math>
</component>

<component name="Butyryl_ACP" cmeta:id="Butyryl_ACP">
  <variable name="Butyryl_ACP" public_interface="out" initial_value="1.0" units="micromolar
  <variable name="delta_Butyryl_ACP_rxn5" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>Butyryl_ACP</ci>
      </apply>
      <ci>delta_Butyryl_ACP_rxn5</ci>
    </apply>
  </math>
</component>

<component name="CoA_SH" cmeta:id="CoA_SH">
  <variable name="CoA_SH" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_CoA_SH_rxn0" public_interface="in" units="flux" />
  <variable name="delta_CoA_SH_rxn1" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>CoA_SH</ci>
      </apply>
      <apply><plus />
        <ci>delta_CoA_SH_rxn0</ci>
        <ci>delta_CoA_SH_rxn1</ci>
      </apply>
    </apply>
  </math>
</component>

<component name="CE_SH" cmeta:id="CE_SH">
  <variable name="CE_SH" public_interface="out" initial_value="1.0" units="micromolar" />

```

```

<variable name="delta_CE_SH_rxn3" public_interface="in" units="flux" />
<variable name="delta_CE_SH_rxn0" public_interface="in" units="flux" />
<variable name="delta_CE_SH_rxn2" public_interface="in" units="flux" />
<variable name="time" public_interface="in" units="second" />
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply><eq />
    <apply><diff />
      <bvar>
        <ci>time</ci>
      </bvar>
      <ci>CE_SH</ci>
    </apply>
    <apply><plus />
      <ci>delta_CE_SH_rxn3</ci>
      <ci>delta_CE_SH_rxn0</ci>
      <ci>delta_CE_SH_rxn2</ci>
    </apply>
  </math>
</component>

<component name="ACP_SH" cmeta:id="ACP_SH">
  <variable name="ACP_SH" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_ACP_SH_rxn2" public_interface="in" units="flux" />
  <variable name="delta_ACP_SH_rxn1" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>ACP_SH</ci>
      </apply>
      <apply><plus />
        <ci>delta_ACP_SH_rxn2</ci>
        <ci>delta_ACP_SH_rxn1</ci>
      </apply>
    </math>
  </component>

<component name="CO2" cmeta:id="CO2">
  <variable name="CO2" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_CO2_rxn3" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>CO2</ci>
      </apply>
      <ci>delta_CO2_rxn3</ci>
    </math>
  </component>

```

```

<component name="Acetyl_S_CE" cmeta:id="Acetyl_S_CE">
  <variable name="Acetyl_S_CE" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_Acetyl_S_CE_rxn2" public_interface="in" units="flux" />
  <variable name="delta_Acetyl_S_CE_rxn3" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>Acetyl_S_CE</ci>
      </apply>
      <apply><plus />
        <ci>delta_Acetyl_S_CE_rxn2</ci>
        <ci>delta_Acetyl_S_CE_rxn3</ci>
      </apply>
    </apply>
  </math>
</component>

```

```

<component name="NADPH" cmeta:id="NADPH">
  <variable name="NADPH" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_NADPH_rxn4" public_interface="in" units="flux" />
  <variable name="delta_NADPH_rxn5" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>NADPH</ci>
      </apply>
      <apply><plus />
        <ci>delta_NADPH_rxn4</ci>
        <ci>delta_NADPH_rxn5</ci>
      </apply>
    </apply>
  </math>
</component>

```

```

<component name="H" cmeta:id="H">
  <variable name="H" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_H_rxn4" public_interface="in" units="flux" />
  <variable name="delta_H_rxn5" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>H</ci>
      </apply>
      <apply><plus />
        <ci>delta_H_rxn4</ci>
        <ci>delta_H_rxn5</ci>
      </apply>
    </apply>
  </math>

```

```
    </apply>
  </math>
</component>
```

```
<component name="NADP" cmeta:id="NADP">
  <variable name="NADP" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_NADP_rxn4" public_interface="in" units="flux" />
  <variable name="delta_NADP_rxn5" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>NADP</ci>
      </apply>
      <apply><plus />
        <ci>delta_NADP_rxn4</ci>
        <ci>delta_NADP_rxn5</ci>
      </apply>
    </apply>
  </math>
</component>
```

```
<component name="H2O" cmeta:id="H2O">
  <variable name="H2O" public_interface="out" initial_value="1.0" units="micromolar" />
  <variable name="delta_H2O_rxn6" public_interface="in" units="flux" />
  <variable name="time" public_interface="in" units="second" />
  <math xmlns="http://www.w3.org/1998/Math/MathML">
    <apply><eq />
      <apply><diff />
        <bvar>
          <ci>time</ci>
        </bvar>
        <ci>H2O</ci>
      </apply>
      <ci>delta_H2O_rxn6</ci>
    </apply>
  </math>
</component>
```

```
<!--
  The following components describe all the enzymes involved in fatty acid
  synthesis.
-->
```

```
<component name="Acyltransferase" cmeta:id="Acyltransferase">
  <variable name="Acyltransferase" public_interface="out" initial_value="1.0" units="micromolar" />
</component>
```

```
<component name="Malonyltransferase" cmeta:id="Malonyltransferase">
  <variable name="Malonyltransferase" public_interface="out" initial_value="1.0" units="micromolar" />
</component>
```

```
<component name="beta_hydroxyacyl_ACP_dehydrase" cmeta:id="beta_hydroxyacyl_ACP_dehydrase">
  <variable name="beta_hydroxyacyl_ACP_dehydrase" public_interface="out" initial_value="1.0" units="micromolar" />
</component>
```

```

<component name="beta_Ketoacyl_ACP_reductase" cmeta:id="beta_Ketoacyl_ACP_reductase">
  <variable name="beta_Ketoacyl_ACP_reductase" public_interface="out" initial_value="1.0" u
</component>

<component name="beta_Hydroxyacyl_ACP_dehydrase" cmeta:id="beta_Hydroxyacyl_ACP_dehydrase">
  <variable name="beta_Hydroxyacyl_ACP_dehydrase" public_interface="out" initial_value="1.0
</component>

<component name="Enol_ACP_reductase" cmeta:id="Enol_ACP_reductase">
  <variable name="Enol_ACP_reductase" public_interface="out" initial_value="1.0" units="mic
</component>

<!--
  The following components represent the reaction steps of fatty acid
  synthesis.
-->

<component name="reaction0">
  <variable name="Acetyl_CoA" public_interface="in" units="micromolar" />
  <variable name="CE_SH" public_interface="in" units="micromolar" />
  <variable name="Acetyl_ACP" public_interface="in" units="micromolar" />
  <variable name="CoA_SH" public_interface="in" units="micromolar" />
  <variable name="Acyltransferase" public_interface="in" units="micromolar" />
  <variable name="delta_Acetyl_CoA_rxn0" public_interface="out" units="flux" />
  <variable name="delta_CE_SH_rxn0" public_interface="out" units="flux" />
  <variable name="delta_Acetyl_ACP_rxn0" public_interface="out" units="flux" />
  <variable name="delta_CoA_SH_rxn0" public_interface="out" units="flux" />
  <variable name="km0" initial_value="1.0" units="micromolar" />
  <variable name="vmax0" initial_value="1.0" units="second_order_rate_constant" />
  <variable name="rate" units="flux" />
  <reaction reversible="no">
    <variable_ref variable="Acetyl_CoA">
      <role role="reactant" delta_variable="delta_Acetyl_CoA_rxn0" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="CE_SH">
      <role role="reactant" delta_variable="delta_CE_SH_rxn0" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="Acetyl_ACP">
      <role role="product" delta_variable="delta_Acetyl_ACP_rxn0" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="CoA_SH">
      <role role="product" delta_variable="delta_CoA_SH_rxn0" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="Acyltransferase">
      <role role="catalyst" />
    </variable_ref>
    <variable_ref variable="rate">
      <role role="rate">
        <math xmlns="http://www.w3.org/1998/Math/MathML">
          <apply><eq />
            <ci>rate</ci>
            <apply><divide />
              <apply><times />
                <ci>Acetyl_CoA</ci>
                <ci>CE_SH</ci>
                <ci>vmax0</ci>
              </apply>
            <apply><plus />
              <ci>km0</ci>
          </math>
        </role>
      </variable_ref>
    </reaction>
  </component>

```

```

        <ci>Acetyl.CoA</ci>
        <ci>CE.SH</ci>
    </apply>
</apply>
</math>
</role>
</variable_ref>
</reaction>
</component>

<component name="reaction1">
  <variable name="Malonyl.CoA" public_interface="in" units="micromolar" />
  <variable name="ACP.SH" public_interface="in" units="micromolar" />
  <variable name="CoA.SH" public_interface="in" units="micromolar" />
  <variable name="Malonyl.ACP" public_interface="in" units="micromolar" />
  <variable name="Malonyltransferase" public_interface="in" units="micromolar" />
  <variable name="delta_Malonyl.CoA_rxn1" public_interface="out" units="flux" />
  <variable name="delta_ACP.SH_rxn1" public_interface="out" units="flux" />
  <variable name="delta_CoA.SH_rxn1" public_interface="out" units="flux" />
  <variable name="delta_Malonyl.ACP_rxn1" public_interface="out" units="flux" />
  <variable name="kml" initial_value="1.0" units="micromolar" />
  <variable name="vmax1" initial_value="1.0" units="second_order_rate_constant" />
  <variable name="rate" units="flux" />
  <reaction reversible="no">
    <variable_ref variable="Malonyl.CoA">
      <role role="reactant" delta_variable="delta_Malonyl.CoA_rxn1" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="ACP.SH">
      <role role="reactant" delta_variable="delta_ACP.SH_rxn1" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="CoA.SH">
      <role role="product" delta_variable="delta_CoA.SH_rxn1" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="Malonyl.ACP">
      <role role="product" delta_variable="delta_Malonyl.ACP_rxn1" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="Malonyltransferase">
      <role role="catalyst" />
    </variable_ref>
    <variable_ref variable="rate">
      <role role="rate">
        <math xmlns="http://www.w3.org/1998/Math/MathML">
          <apply><eq />
            <ci>rate</ci>
            <apply><divide />
              <apply><times />
                <ci>Malonyl.CoA</ci>
                <ci>ACP.SH</ci>
                <ci>vmax1</ci>
              </apply>
            <apply><plus />
              <ci>kml</ci>
              <ci>Malonyl.CoA</ci>
              <ci>ACP.SH</ci>
            </apply>
          </math>
        </role>
      </variable_ref>
    </reaction>
  </component>

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    </role>
  </variable_ref>
</reaction>
</component>

<component name="reaction2">
  <variable name="CE_SH" public_interface="in" units="micromolar" />
  <variable name="Acetyl_ACP" public_interface="in" units="micromolar" />
  <variable name="ACP_SH" public_interface="in" units="micromolar" />
  <variable name="Acetyl_S_CE" public_interface="in" units="micromolar" />
  <variable name="delta_CE_SH_rxn2" public_interface="out" units="flux" />
  <variable name="delta_Acetyl_ACP_rxn2" public_interface="out" units="flux" />
  <variable name="delta_ACP_SH_rxn2" public_interface="out" units="flux" />
  <variable name="delta_Acetyl_S_CE_rxn2" public_interface="out" units="flux" />
  <variable name="k2" initial_value="1.0" units="second_order_rate_constant" />
  <variable name="rate" units="flux" />
  <reaction reversible="no">
    <variable_ref variable="CE_SH">
      <role role="reactant" delta_variable="delta_CE_SH_rxn2" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="Acetyl_ACP">
      <role role="reactant" delta_variable="delta_Acetyl_ACP_rxn2" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="ACP_SH">
      <role role="product" delta_variable="delta_ACP_SH_rxn2" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="Acetyl_S_CE">
      <role role="product" delta_variable="delta_Acetyl_S_CE_rxn2" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="rate">
      <role role="rate">
        <math xmlns="http://www.w3.org/1998/Math/MathML">
          <apply><eq />
            <ci>rate</ci>
            <apply><times />
              <ci>k2</ci>
              <ci>CE_SH</ci>
              <ci>Acetyl_ACP</ci>
            </apply>
          </math>
        </role>
      </variable_ref>
    </reaction>
  </component>

<component name="reaction3">
  <variable name="Acetyl_S_CE" public_interface="in" units="micromolar" />
  <variable name="Malonyl_ACP" public_interface="in" units="micromolar" />
  <variable name="CE_SH" public_interface="in" units="micromolar" />
  <variable name="CO2" public_interface="in" units="micromolar" />
  <variable name="Acetoacetyl_ACP" public_interface="in" units="micromolar" />
  <variable name="delta_Acetyl_S_CE_rxn3" public_interface="out" units="flux" />
  <variable name="delta_Malonyl_ACP_rxn3" public_interface="out" units="flux" />
  <variable name="delta_CE_SH_rxn3" public_interface="out" units="flux" />
  <variable name="delta_CO2_rxn3" public_interface="out" units="flux" />
  <variable name="delta_Acetoacetyl_ACP_rxn3" public_interface="out" units="flux" />
  <variable name="k3" initial_value="1.0" units="second_order_rate_constant" />
  <variable name="rate" units="flux" />

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<reaction reversible="no">
  <variable_ref variable="Acetyl_S_CE">
    <role role="reactant" delta_variable="delta_Acetyl_S_CE_rxn3" stoichiometry="1" />
  </variable_ref>
  <variable_ref variable="Malonyl_ACP">
    <role role="reactant" delta_variable="delta_Malonyl_ACP_rxn3" stoichiometry="1" />
  </variable_ref>
  <variable_ref variable="CE_SH">
    <role role="product" delta_variable="delta_CE_SH_rxn3" stoichiometry="1" />
  </variable_ref>
  <variable_ref variable="CO2">
    <role role="product" delta_variable="delta_CO2_rxn3" stoichiometry="1" />
  </variable_ref>
  <variable_ref variable="Acetoacetyl_ACP">
    <role role="product" delta_variable="delta_Acetoacetyl_ACP_rxn3" stoichiometry="1" />
  </variable_ref>
  <variable_ref variable="rate">
    <role role="rate">
      <math xmlns="http://www.w3.org/1998/Math/MathML">
        <apply><eq />
          <ci>rate</ci>
          <apply><times />
            <ci>k3</ci>
            <ci>Acetyl_S_CE</ci>
            <ci>Malonyl_ACP</ci>
          </apply>
        </math>
      </role>
    </variable_ref>
  </reaction>
</component>

<component name="reaction4">
  <variable name="Acetoacetyl_ACP" public_interface="in" units="micromolar" />
  <variable name="NADPH" public_interface="in" units="micromolar" />
  <variable name="H" public_interface="in" units="micromolar" />
  <variable name="D_beta_Hydroxybutyryl_ACP" public_interface="in" units="micromolar" />
  <variable name="beta_Ketoacyl_ACP_reductase" public_interface="in" units="micromolar" />
  <variable name="NADP" public_interface="in" units="micromolar" />
  <variable name="delta_Acetoacetyl_ACP_rxn4" public_interface="out" units="flux" />
  <variable name="delta_NADPH_rxn4" public_interface="out" units="flux" />
  <variable name="delta_H_rxn4" public_interface="out" units="flux" />
  <variable name="delta_D_beta_Hydroxybutyryl_ACP_rxn4" public_interface="out" units="flux" />
  <variable name="delta_NADP_rxn4" public_interface="out" units="flux" />
  <variable name="km4" initial_value="1.0" units="micromolar" />
  <variable name="vmax4" initial_value="1.0" units="third_order_rate_constant" />
  <variable name="rate" units="flux" />
  <reaction reversible="no">
    <variable_ref variable="Acetoacetyl_ACP">
      <role role="reactant" delta_variable="delta_Acetoacetyl_ACP_rxn4" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="NADPH">
      <role role="reactant" delta_variable="delta_NADPH_rxn4" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="H">
      <role role="reactant" delta_variable="delta_H_rxn4" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="D_beta_Hydroxybutyryl_ACP">

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    <role role="product" delta_variable="delta_D_beta_Hydroxybutyryl_ACP_rxn4" stoichiome
</variable_ref>
<variable_ref variable="NADP">
    <role role="product" delta_variable="delta_NADP_rxn4" stoichiometry="1" />
</variable_ref>
<variable_ref variable="beta_Ketoacyl_ACP_reductase">
    <role role="catalyst" direction="forward" />
</variable_ref>
<variable_ref variable="rate">
    <role role="rate">
        <math xmlns="http://www.w3.org/1998/Math/MathML">
            <apply><eq />
                <ci>rate</ci>
                <apply><divide />
                    <apply><times />
                        <ci>Acetoacetyl_ACP</ci>
                        <ci>NADPH</ci>
                        <ci>H</ci>
                        <ci>vmax4</ci>
                    </apply>
                <apply><plus />
                    <ci>km4</ci>
                    <ci>Acetoacetyl_ACP</ci>
                    <ci>NADPH</ci>
                    <ci>H</ci>
                </apply>
            </apply>
        </math>
    </role>
</variable_ref>
</reaction>
</component>

<component name="reaction5">
    <variable name="NADPH" public_interface="in" units="micromolar" />
    <variable name="H" public_interface="in" units="micromolar" />
    <variable name="alpha_beta_trans_Butenoyl_ACP" public_interface="in" units="micromolar" />
    <variable name="NADP" public_interface="in" units="micromolar" />
    <variable name="beta_Hydroxyacyl_ACP_dehydrase" public_interface="in" units="micromolar" />
    <variable name="Butyryl_ACP" public_interface="in" units="micromolar" />
    <variable name="delta_NADPH_rxn5" public_interface="out" units="flux" />
    <variable name="delta_H_rxn5" public_interface="out" units="flux" />
    <variable name="delta_alpha_beta_trans_Butenoyl_ACP_rxn5" public_interface="out" units="flux" />
    <variable name="delta_NADP_rxn5" public_interface="out" units="flux" />
    <variable name="delta_Butyryl_ACP_rxn5" public_interface="out" units="flux" />
    <variable name="km5" initial_value="1.0" units="micromolar" />
    <variable name="vmax5" initial_value="1.0" units="third_order_rate_constant" />
    <variable name="rate" units="flux" />
    <reaction reversible="no">
        <variable_ref variable="NADPH">
            <role role="reactant" delta_variable="delta_NADPH_rxn5" stoichiometry="1" />
        </variable_ref>
        <variable_ref variable="H">
            <role role="reactant" delta_variable="delta_H_rxn5" stoichiometry="1" />
        </variable_ref>
        <variable_ref variable="alpha_beta_trans_Butenoyl_ACP">
            <role role="reactant" delta_variable="delta_alpha_beta_trans_Butenoyl_ACP_rxn5" stoichiometry="1" />
        </variable_ref>
    </reaction>

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<variable_ref variable="NADP">
  <role role="product" delta_variable="delta_NADP_rxn5" stoichiometry="1" />
</variable_ref>
<variable_ref variable="Butyryl_ACP">
  <role role="product" delta_variable="delta_Butyryl_ACP_rxn5" stoichiometry="1" />
</variable_ref>
<variable_ref variable="beta_Hydroxyacyl_ACP_dehydrase">
  <role role="catalyst" direction="forward" />
</variable_ref>
<variable_ref variable="rate">
  <role role="rate">
    <math xmlns="http://www.w3.org/1998/Math/MathML">
      <apply><eq />
      <ci>rate</ci>
      <apply><divide />
      <apply><times />
      <ci>NADPH</ci>
      <ci>H</ci>
      <ci>alpha_beta_trans_Butenoyl_ACP</ci>
      <ci>vmax5</ci>
    </apply>
    <apply><plus />
    <ci>km5</ci>
    <ci>NADPH</ci>
    <ci>H</ci>
    <ci>alpha_beta_trans_Butenoyl_ACP</ci>
  </apply>
</math>
  </role>
</variable_ref>
</reaction>
</component>

<component name="reaction6">
  <variable name="D_beta_Hydroxybutyryl_ACP" public_interface="in" units="micromolar" />
  <variable name="H2O" public_interface="in" units="micromolar" />
  <variable name="alpha_beta_trans_Butenoyl_ACP" public_interface="in" units="micromolar" />
  <variable name="beta_hydroxyacyl_ACP_dehydrase" public_interface="in" units="micromolar" />
  <variable name="delta_D_beta_Hydroxybutyryl_ACP_rxn6" public_interface="out" units="flux" />
  <variable name="delta_H2O_rxn6" public_interface="out" units="flux" />
  <variable name="delta_alpha_beta_trans_Butenoyl_ACP_rxn6" public_interface="out" units="flux" />
  <variable name="km6" initial_value="1.0" units="micromolar" />
  <variable name="vmax6" initial_value="1.0" units="first_order_rate_constant" />
  <variable name="rate" units="flux" />
  <reaction reversible="no">
    <variable_ref variable="D_beta_Hydroxybutyryl_ACP">
      <role role="reactant" delta_variable="delta_D_beta_Hydroxybutyryl_ACP_rxn6" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="H2O">
      <role role="product" delta_variable="delta_H2O_rxn6" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="alpha_beta_trans_Butenoyl_ACP">
      <role role="product" delta_variable="delta_alpha_beta_trans_Butenoyl_ACP_rxn6" stoichiometry="1" />
    </variable_ref>
    <variable_ref variable="beta_hydroxyacyl_ACP_dehydrase">
      <role role="catalyst" />
    </variable_ref>
  </reaction>
</component>

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<variable_ref variable="rate">
  <role role="rate">
    <math xmlns="http://www.w3.org/1998/Math/MathML">
      <apply><eq />
        <ci>rate</ci>
        <apply><divide />
          <apply><times />
            <ci>D_beta_Hydroxybutyryl_ACP</ci>
            <ci>vmax6</ci>
          </apply>
        <apply><plus />
          <ci>km6</ci>
          <ci>D_beta_Hydroxybutyryl_ACP</ci>
        </apply>
      </apply>
    </math>
  </role>
</variable_ref>
</reaction>
</component>

<connection>
  <map_components component_1="Acetyl_CoA" component_2="reaction0" />
  <map_variables variable_1="Acetyl_CoA" variable_2="Acetyl_CoA" />
  <map_variables variable_1="delta_Acetyl_CoA_rxn0" variable_2="delta_Acetyl_CoA_rxn0" />
</connection>

<connection>
  <map_components component_1="Malonyl_CoA" component_2="reaction1" />
  <map_variables variable_1="Malonyl_CoA" variable_2="Malonyl_CoA" />
  <map_variables variable_1="delta_Malonyl_CoA_rxn1" variable_2="delta_Malonyl_CoA_rxn1" />
</connection>

<connection>
  <map_components component_1="Malonyl_ACP" component_2="reaction1" />
  <map_variables variable_1="Malonyl_ACP" variable_2="Malonyl_ACP" />
  <map_variables variable_1="delta_Malonyl_ACP_rxn1" variable_2="delta_Malonyl_ACP_rxn1" />
</connection>

<connection>
  <map_components component_1="Malonyl_ACP" component_2="reaction3" />
  <map_variables variable_1="Malonyl_ACP" variable_2="Malonyl_ACP" />
  <map_variables variable_1="delta_Malonyl_ACP_rxn3" variable_2="delta_Malonyl_ACP_rxn3" />
</connection>

<connection>
  <map_components component_1="Acetyl_ACP" component_2="reaction0" />
  <map_variables variable_1="Acetyl_ACP" variable_2="Acetyl_ACP" />
  <map_variables variable_1="delta_Acetyl_ACP_rxn0" variable_2="delta_Acetyl_ACP_rxn0" />
</connection>

<connection>
  <map_components component_1="Acetyl_ACP" component_2="reaction2" />
  <map_variables variable_1="Acetyl_ACP" variable_2="Acetyl_ACP" />
  <map_variables variable_1="delta_Acetyl_ACP_rxn2" variable_2="delta_Acetyl_ACP_rxn2" />
</connection>

<connection>

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    <map_components component_1="Acetoacetyl_ACP" component_2="reaction3" />
    <map_variables variable_1="Acetoacetyl_ACP" variable_2="Acetoacetyl_ACP" />
    <map_variables variable_1="delta_Acetoacetyl_ACP_rxn3" variable_2="delta_Acetoacetyl_ACP" />
</connection>

<connection>
    <map_components component_1="Acetoacetyl_ACP" component_2="reaction4" />
    <map_variables variable_1="Acetoacetyl_ACP" variable_2="Acetoacetyl_ACP" />
    <map_variables variable_1="delta_Acetoacetyl_ACP_rxn4" variable_2="delta_Acetoacetyl_ACP" />
</connection>

<connection>
    <map_components component_1="D_beta_Hydroxybutyryl_ACP" component_2="reaction4" />
    <map_variables variable_1="D_beta_Hydroxybutyryl_ACP" variable_2="D_beta_Hydroxybutyryl_ACP" />
    <map_variables variable_1="delta_D_beta_Hydroxybutyryl_ACP_rxn4" variable_2="delta_D_beta_Hydroxybutyryl_ACP" />
</connection>

<connection>
    <map_components component_1="D_beta_Hydroxybutyryl_ACP" component_2="reaction6" />
    <map_variables variable_1="D_beta_Hydroxybutyryl_ACP" variable_2="D_beta_Hydroxybutyryl_ACP" />
    <map_variables variable_1="delta_D_beta_Hydroxybutyryl_ACP_rxn6" variable_2="delta_D_beta_Hydroxybutyryl_ACP" />
</connection>

<connection>
    <map_components component_1="alpha_beta_trans_Butenoyl_ACP" component_2="reaction6" />
    <map_variables variable_1="alpha_beta_trans_Butenoyl_ACP" variable_2="alpha_beta_trans_Butenoyl_ACP" />
    <map_variables variable_1="delta_alpha_beta_trans_Butenoyl_ACP_rxn6" variable_2="delta_alpha_beta_trans_Butenoyl_ACP" />
</connection>

<connection>
    <map_components component_1="alpha_beta_trans_Butenoyl_ACP" component_2="reaction5" />
    <map_variables variable_1="alpha_beta_trans_Butenoyl_ACP" variable_2="alpha_beta_trans_Butenoyl_ACP" />
    <map_variables variable_1="delta_alpha_beta_trans_Butenoyl_ACP_rxn5" variable_2="delta_alpha_beta_trans_Butenoyl_ACP" />
</connection>

<connection>
    <map_components component_1="Butyryl_ACP" component_2="reaction5" />
    <map_variables variable_1="Butyryl_ACP" variable_2="Butyryl_ACP" />
    <map_variables variable_1="delta_Butyryl_ACP_rxn5" variable_2="delta_Butyryl_ACP_rxn5" />
</connection>

<connection>
    <map_components component_1="CoA_SH" component_2="reaction0" />
    <map_variables variable_1="CoA_SH" variable_2="CoA_SH" />
    <map_variables variable_1="delta_CoA_SH_rxn0" variable_2="delta_CoA_SH_rxn0" />
</connection>

<connection>
    <map_components component_1="CoA_SH" component_2="reaction1" />
    <map_variables variable_1="CoA_SH" variable_2="CoA_SH" />
    <map_variables variable_1="delta_CoA_SH_rxn1" variable_2="delta_CoA_SH_rxn1" />
</connection>

<connection>
    <map_components component_1="CE_SH" component_2="reaction3" />
    <map_variables variable_1="CE_SH" variable_2="CE_SH" />
    <map_variables variable_1="delta_CE_SH_rxn3" variable_2="delta_CE_SH_rxn3" />
</connection>

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```
<connection>
  <map_components component_1="CE_SH" component_2="reaction0" />
  <map_variables variable_1="CE_SH" variable_2="CE_SH" />
  <map_variables variable_1="delta_CE_SH_rxn0" variable_2="delta_CE_SH_rxn0" />
</connection>

<connection>
  <map_components component_1="CE_SH" component_2="reaction2" />
  <map_variables variable_1="CE_SH" variable_2="CE_SH" />
  <map_variables variable_1="delta_CE_SH_rxn2" variable_2="delta_CE_SH_rxn2" />
</connection>

<connection>
  <map_components component_1="ACP_SH" component_2="reaction2" />
  <map_variables variable_1="ACP_SH" variable_2="ACP_SH" />
  <map_variables variable_1="delta_ACP_SH_rxn2" variable_2="delta_ACP_SH_rxn2" />
</connection>

<connection>
  <map_components component_1="ACP_SH" component_2="reaction1" />
  <map_variables variable_1="ACP_SH" variable_2="ACP_SH" />
  <map_variables variable_1="delta_ACP_SH_rxn1" variable_2="delta_ACP_SH_rxn1" />
</connection>

<connection>
  <map_components component_1="CO2" component_2="reaction3" />
  <map_variables variable_1="CO2" variable_2="CO2" />
  <map_variables variable_1="delta_CO2_rxn3" variable_2="delta_CO2_rxn3" />
</connection>

<connection>
  <map_components component_1="Acetyl_S_CE" component_2="reaction2" />
  <map_variables variable_1="Acetyl_S_CE" variable_2="Acetyl_S_CE" />
  <map_variables variable_1="delta_Acetyl_S_CE_rxn2" variable_2="delta_Acetyl_S_CE_rxn2" />
</connection>

<connection>
  <map_components component_1="Acetyl_S_CE" component_2="reaction3" />
  <map_variables variable_1="Acetyl_S_CE" variable_2="Acetyl_S_CE" />
  <map_variables variable_1="delta_Acetyl_S_CE_rxn3" variable_2="delta_Acetyl_S_CE_rxn3" />
</connection>

<connection>
  <map_components component_1="NADPH" component_2="reaction4" />
  <map_variables variable_1="NADPH" variable_2="NADPH" />
  <map_variables variable_1="delta_NADPH_rxn4" variable_2="delta_NADPH_rxn4" />
</connection>

<connection>
  <map_components component_1="NADPH" component_2="reaction5" />
  <map_variables variable_1="NADPH" variable_2="NADPH" />
  <map_variables variable_1="delta_NADPH_rxn5" variable_2="delta_NADPH_rxn5" />
</connection>

<connection>
  <map_components component_1="H" component_2="reaction4" />
  <map_variables variable_1="H" variable_2="H" />
  <map_variables variable_1="delta_H_rxn4" variable_2="delta_H_rxn4" />
</connection>
```

```
<connection>
  <map_components component_1="H" component_2="reaction5" />
  <map_variables variable_1="H" variable_2="H" />
  <map_variables variable_1="delta_H_rxn5" variable_2="delta_H_rxn5" />
</connection>

<connection>
  <map_components component_1="NADP" component_2="reaction4" />
  <map_variables variable_1="NADP" variable_2="NADP" />
  <map_variables variable_1="delta_NADP_rxn4" variable_2="delta_NADP_rxn4" />
</connection>

<connection>
  <map_components component_1="NADP" component_2="reaction5" />
  <map_variables variable_1="NADP" variable_2="NADP" />
  <map_variables variable_1="delta_NADP_rxn5" variable_2="delta_NADP_rxn5" />
</connection>

<connection>
  <map_components component_1="H2O" component_2="reaction6" />
  <map_variables variable_1="H2O" variable_2="H2O" />
  <map_variables variable_1="delta_H2O_rxn6" variable_2="delta_H2O_rxn6" />
</connection>

<connection>
  <map_components component_1="beta_hydroxyacyl_ACP_dehydrase" component_2="reaction6" />
  <map_variables variable_1="beta_hydroxyacyl_ACP_dehydrase" variable_2="beta_hydroxyacyl_ACP_dehydrase" />
</connection>

<connection>
  <map_components component_1="Acetyl_CoA" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="Malonyl_CoA" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="Malonyl_ACP" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="Acetyl_ACP" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="Acetoacetyl_ACP" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="D_beta_Hydroxybutyryl_ACP" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>
```

```
<connection>
  <map_components component_1="alpha_beta_trans_Butenoyl_ACP" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="Butyryl_ACP" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="CoA_SH" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="CE_SH" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
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<connection>
  <map_components component_1="ACP_SH" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
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<connection>
  <map_components component_1="CO2" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
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<connection>
  <map_components component_1="Acetyl_S_CE" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
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<connection>
  <map_components component_1="NADPH" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
</connection>

<connection>
  <map_components component_1="H" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
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<connection>
  <map_components component_1="NADP" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
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<connection>
  <map_components component_1="H2O" component_2="global_variables" />
  <map_variables variable_1="time" variable_2="time" />
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<connection>
  <map_components component_1="Acyltransferase" component_2="reaction0" />
  <map_variables variable_1="Acyltransferase" variable_2="Acyltransferase" />
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</connection>

<connection>
  <map_components component_1="Malonyltransferase" component_2="reaction1" />
  <map_variables variable_1="Malonyltransferase" variable_2="Malonyltransferase" />
</connection>

<connection>
  <map_components component_1="beta_Ketoacyl_ACP_reductase" component_2="reaction4" />
  <map_variables variable_1="beta_Ketoacyl_ACP_reductase" variable_2="beta_Ketoacyl_ACP_re" />
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<connection>
  <map_components component_1="beta_Hydroxyacyl_ACP_dehydrase" component_2="reaction5" />
  <map_variables variable_1="beta_Hydroxyacyl_ACP_dehydrase" variable_2="beta_Hydroxyacyl_A" />
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</model>
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