

Quantitative phosphoproteomics reveals the role of SnRK1 as metabolic master regulator under energy deprivation

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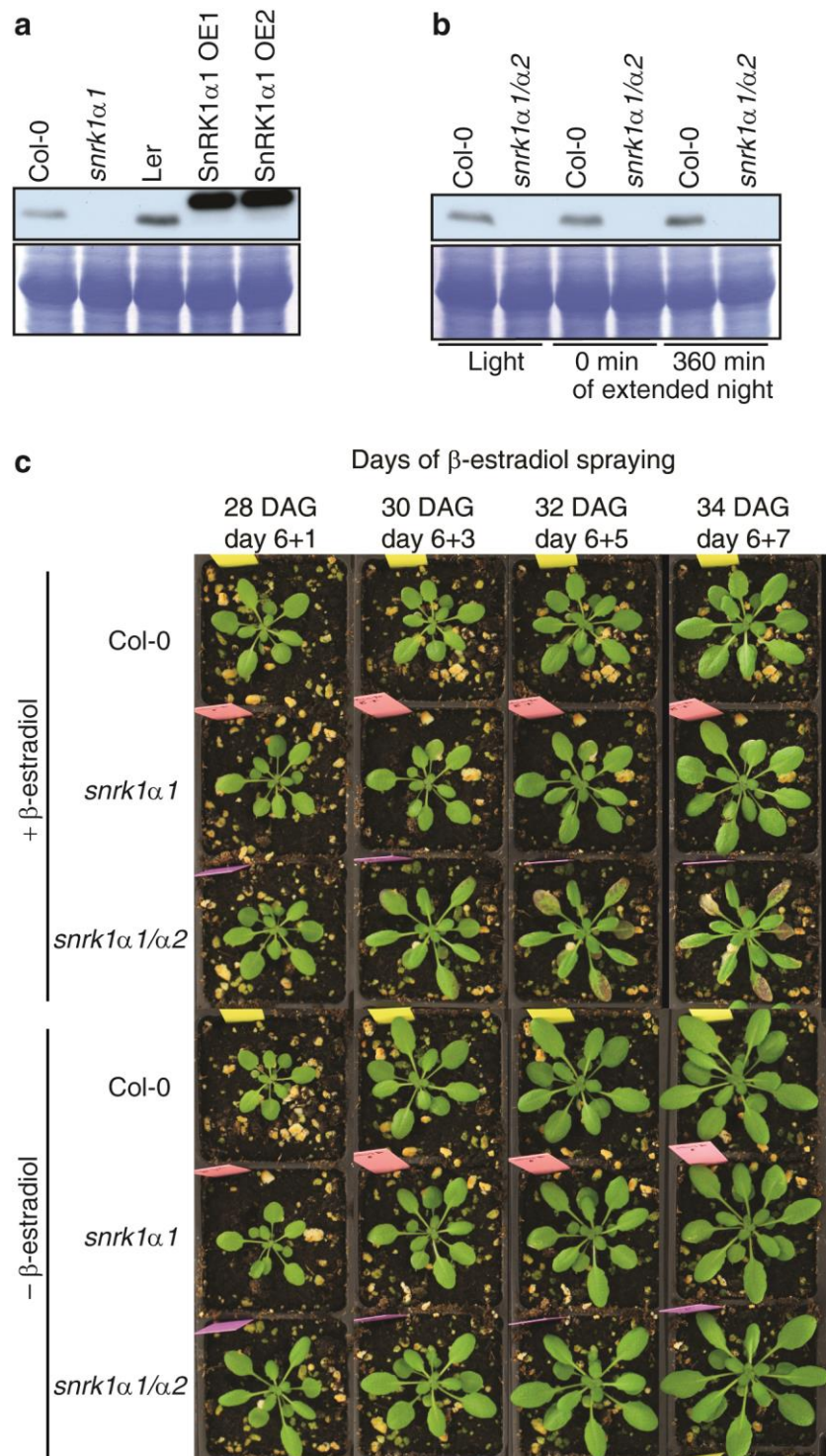
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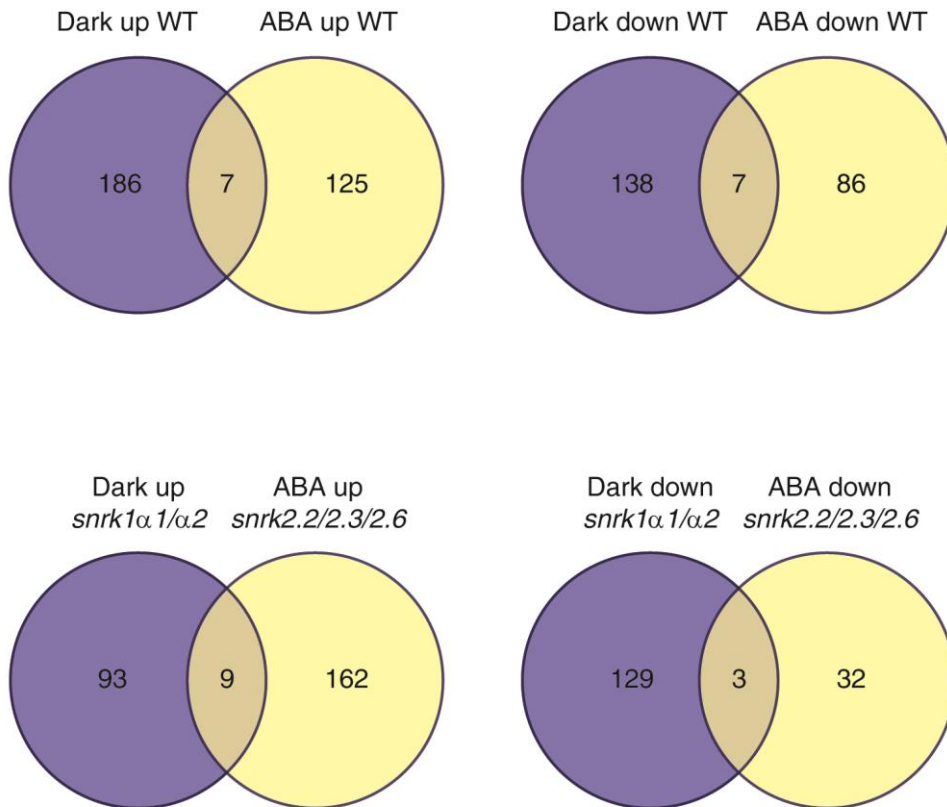
⁷ Instituto Gulbenkian de Ciência, Oeiras, Portugal

* These authors contributed equally to this work

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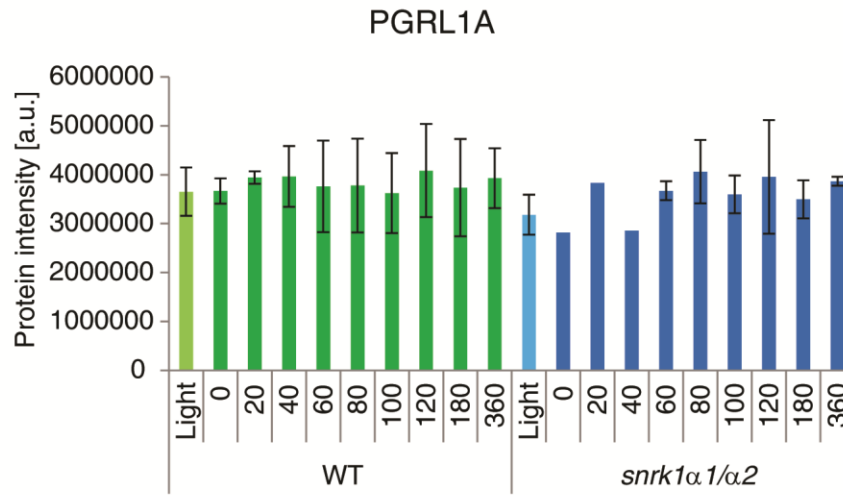


Supplementary Figure S1. (a) Abundance of SnRK1α1 in Col-0 wild type, *snrk1α1* ko, Ler wild type, SnRK1 OE1, and SnRK1 OE2. Immunodetection was done with anti-AKIN10 antibody. (b) The expression of SnRK1α1 in Col-0 and *snrk1α1/α2* in the time series experiment for 3 time points (Light, 0 min and 360 min of extended night) is shown with anti-AKIN10 antibody. (c) Phenotype of Col-0 wild type, *snrk1α1* and *snrk1α1/α2* mutants in 12 h/12 h day/night cycle. Knocking down of SnRK1α2 was started after 22 days after germination (DAG). Plants were either sprayed with 10 μM β-estradiol or with same solution without β-estradiol. SnRK1α2 protein is relatively stable and it decreases after 5-6 days after start of β-estradiol treatment (Pedrotti et al. in preparation). The knock down of SnRK1α2 is labelled as day 6 + number of days of knock down.

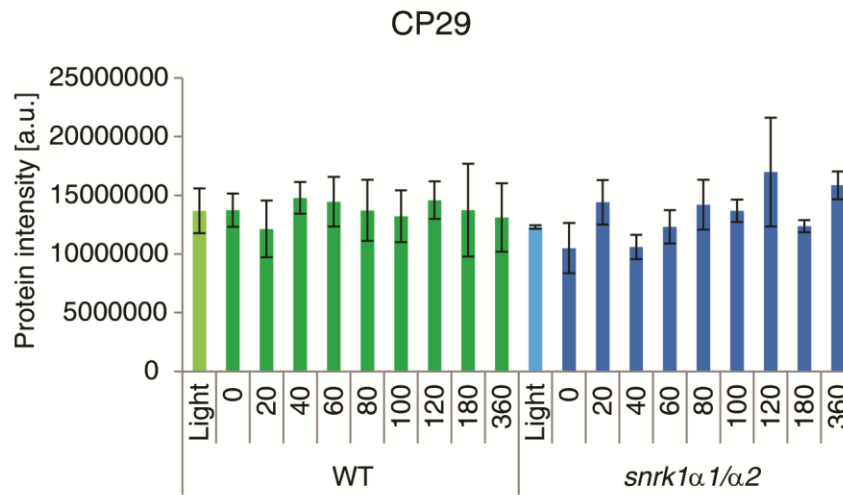


Supplementary Figure S2. Comparison of phosphorylated proteins in *snrk1 α 1/ α 2* mutant and *snrk2.2/2.3/2.6* triple mutant (Wang, P. et al. (2013) Quantitative phosphoproteomics identifies SnRK2 protein kinase substrates and reveals the effectors of abscisic acid action. Proc Natl Acad Sci USA 110, 11205-11210). All values of the dark time points were averaged and compared to the averaged light values (fold change >1.5 and <0.67).

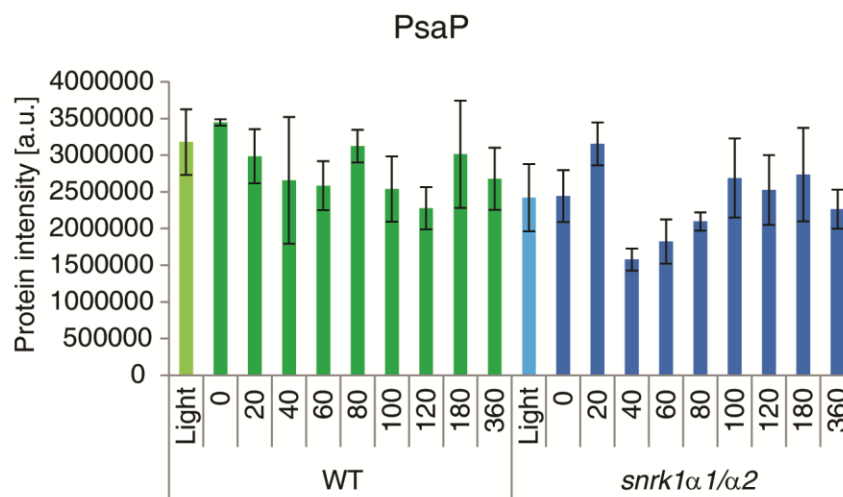
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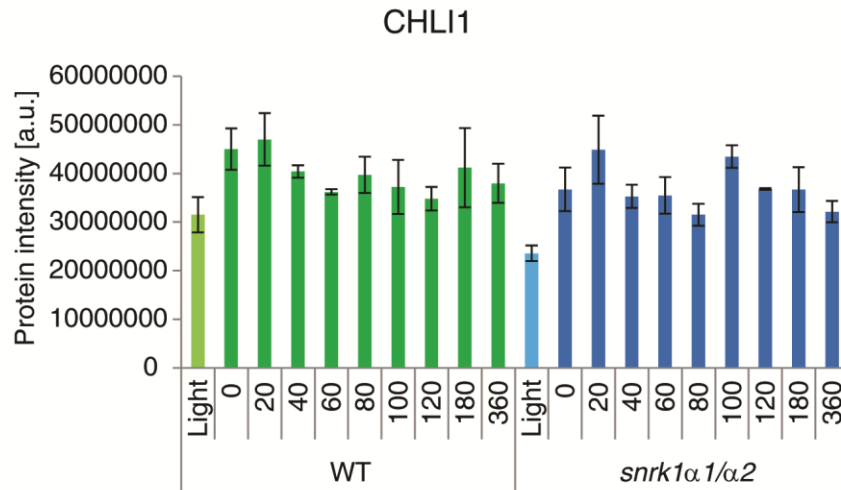
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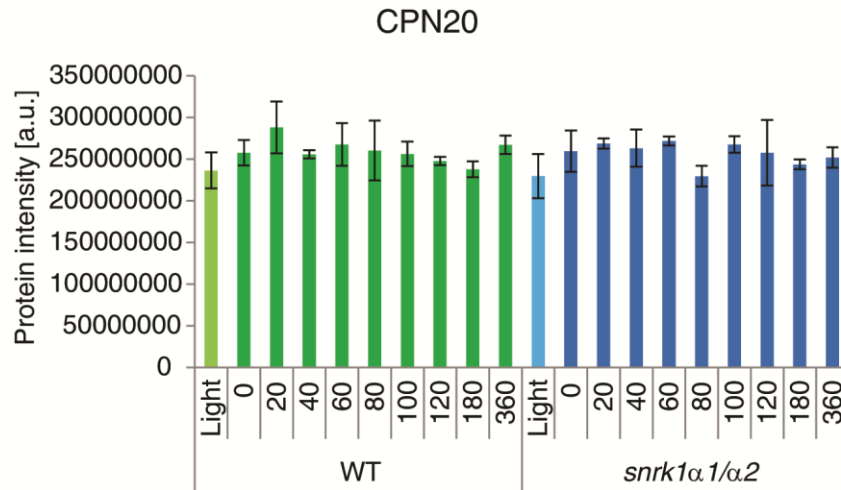
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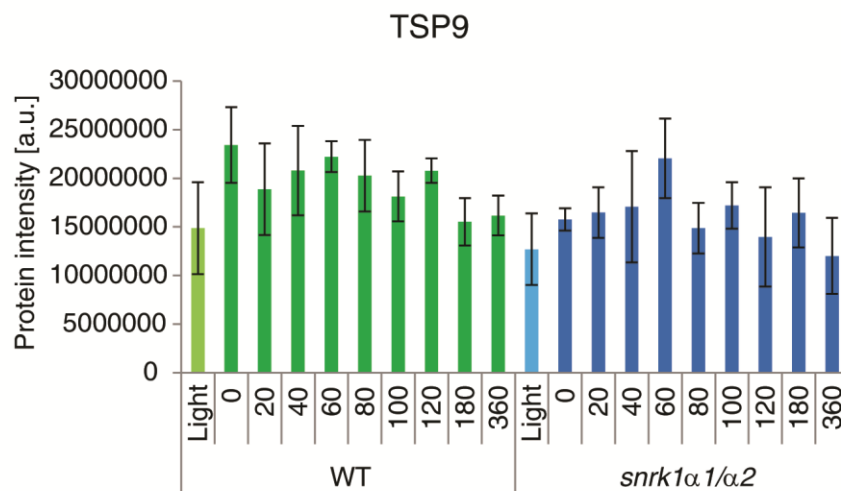
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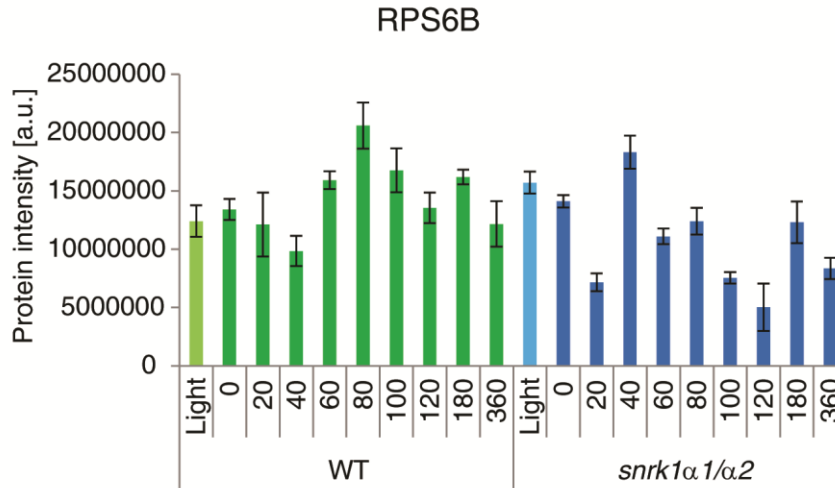


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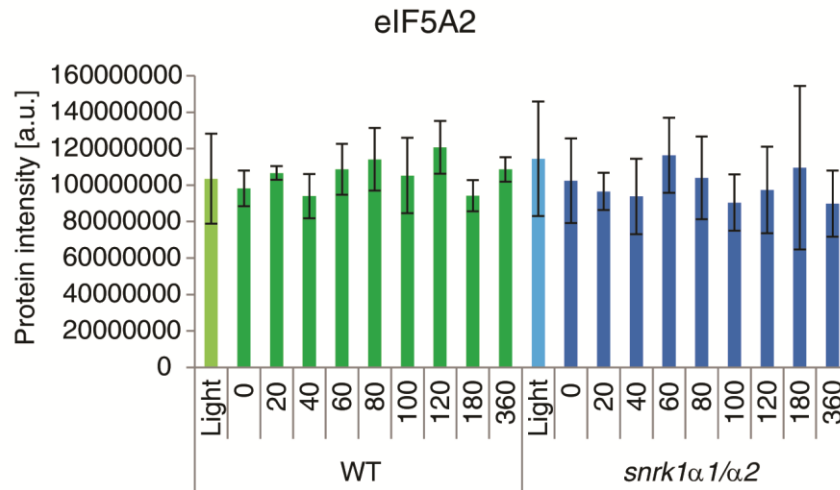


Supplementary Figure S3. Total protein abundance of chloroplastic proteins that were differentially phosphorylated in *snrk1α1/α2* mutant and in Col-0 wild type. x-axis represents timepoints (minutes) in extended night.

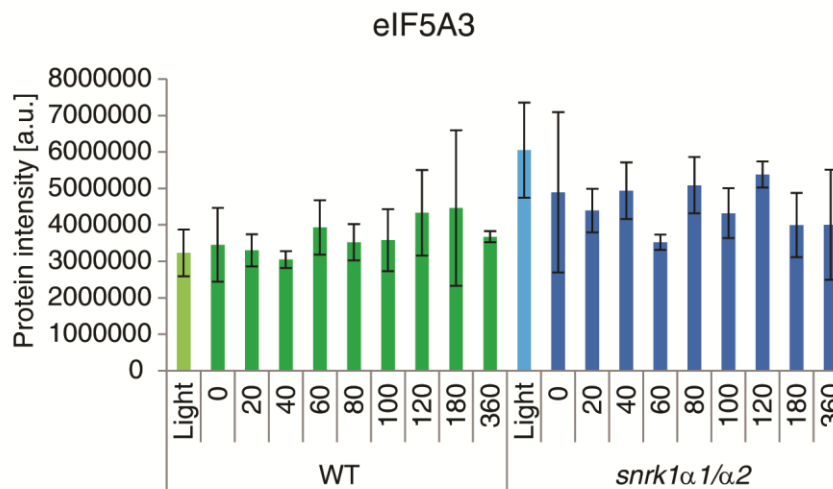
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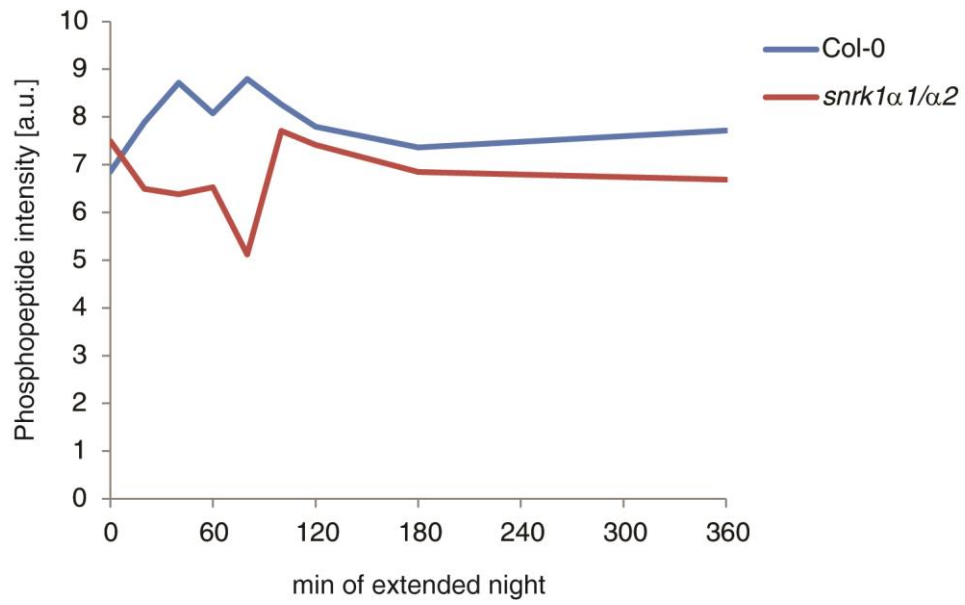
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Supplementary Figure S4. Total protein abundance of proteins having function in proteins translation that were differentially phosphorylated in *snrk1α.1/α.2* mutant and in Col-0 wild type. x-axis represents timepoints (minutes) in extended night.



Supplementary Figure S5. Abundance of fructose-2,6-bisphosphatase peptide SLS³⁰³ASSFLIDTK during extended night.

Supplementary File S1

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Supplementary File S2

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Supplementary File S3

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Supplementary File S4

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  compartment="rootCompartment"/>
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  hasOnlySubstanceUnits="true" initialAmount="1"
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  hasOnlySubstanceUnits="true" initialAmount="1"
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  compartment="rootCompartment"/>
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  compartment="rootCompartment"/>
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  hasOnlySubstanceUnits="true" initialAmount="1"
  compartment="rootCompartment"/>
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  hasOnlySubstanceUnits="true" initialAmount="1"
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  hasOnlySubstanceUnits="true" initialAmount="1"
  compartment="rootCompartment"/>
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  hasOnlySubstanceUnits="true" initialAmount="1"
  compartment="rootCompartment"/>
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- <listOfParameters>
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- <listOfReactions>
  - <reaction name="v1" id="v1" reversible="false">
    - <listOfProducts>
      <speciesReference stoichiometry="1" species="AC"/>
    </listOfProducts>
    - <kineticLaw>
      - <math xmlns="http://www.w3.org/1998/Math/MathML">
        <ci> k1 </ci>
      </math>
    </kineticLaw>
  </reaction>
  - <reaction name="v2" id="v2" reversible="false">
    - <listOfReactants>
      <speciesReference stoichiometry="1" species="AC"/>
      <speciesReference stoichiometry="1" species="Glu"/>
    </listOfReactants>
    - <listOfProducts>
      <speciesReference stoichiometry="1" species="Gly"/>
      <speciesReference stoichiometry="1" species="KGA"/>
    </listOfProducts>
    - <kineticLaw>
      - <math xmlns="http://www.w3.org/1998/Math/MathML">
        - <apply>

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        <times/>
        <ci> k2 </ci>
        <ci> AC </ci>
        <ci> Glu </ci>
    </apply>
</math>
</kineticLaw>
</reaction>
- <reaction name="v3" id="v3" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Gly"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Ser"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k3 </ci>
        <ci> Gly </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v4" id="v4" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Ser"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k4 </ci>
        <ci> Ser </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v5" id="v5" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="AC"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Shikimate"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k5 </ci>
        <ci> AC </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>

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        </math>
    </kineticLaw>
</reaction>
- <reaction name="v6" id="v6" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Shikimate"/>
    <speciesReference stoichiometry="1" species="Glu"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Phe"/>
    <speciesReference stoichiometry="1" species="KGA"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k6 </ci>
        <ci> Shikimate </ci>
        <ci> Glu </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v7" id="v7" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Phe"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k7 </ci>
        <ci> Phe </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v8" id="v8" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Shikimate"/>
    <speciesReference stoichiometry="1" species="Glu"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Tyr"/>
    <speciesReference stoichiometry="1" species="KGA"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k8 </ci>
        <ci> Shikimate </ci>
        <ci> Glu </ci>

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        </apply>
      </math>
    </kineticLaw>
  </reaction>
- <reaction name="v9" id="v9" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Tyr"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k9 </ci>
        <ci> Tyr </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v10" id="v10" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Ser"/>
    <speciesReference stoichiometry="1" species="Shikimate"/>
    <speciesReference stoichiometry="1" species="Gln"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="AC"/>
    <speciesReference stoichiometry="1" species="Trp"/>
    <speciesReference stoichiometry="1" species="Pyr"/>
    <speciesReference stoichiometry="1" species="Glu"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k10 </ci>
        <ci> Shikimate </ci>
        <ci> Gln </ci>
        <ci> Ser </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v11" id="v11" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Trp"/>
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  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k11 </ci>
        <ci> Trp </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>

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        </math>
    </kineticLaw>
</reaction>
- <reaction name="v12" id="v12" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="AC"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Suc"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k12 </ci>
        <ci> AC </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v13" id="v13" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Suc"/>
    <speciesReference stoichiometry="1" species="Gol"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Raf"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k13 </ci>
        <ci> Suc </ci>
        <ci> Gol </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v14" id="v14" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Raf"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Fru"/>
    <speciesReference stoichiometry="1" species="Mel"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k14 </ci>
        <ci> Raf </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>

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        </apply>
      </math>
    </kineticLaw>
  </reaction>
- <reaction name="v15" id="v15" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Mel"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Glc"/>
    <speciesReference stoichiometry="1" species="Gal"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k15 </ci>
        <ci> Mel </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v16" id="v16" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Gal"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="AC"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k16 </ci>
        <ci> Gal </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v17" id="v17" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Glc"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="AC"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k17 </ci>
        <ci> Glc </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>

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    </math>
  </kineticLaw>
</reaction>
- <reaction name="v18" id="v18" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Suc"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Fru"/>
    <speciesReference stoichiometry="1" species="Glc"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k18 </ci>
        <ci> Suc </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v19" id="v19" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Fru"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="AC"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k19 </ci>
        <ci> Fru </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v20" id="v20" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="AC"/>
    <speciesReference stoichiometry="1" species="myoIn"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Gol"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k20 </ci>
        <ci> myoIn </ci>
        <ci> AC </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>

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        </apply>
      </math>
    </kineticLaw>
  </reaction>
- <reaction name="v21" id="v21" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="AC"/>
    <speciesReference stoichiometry="1" species="myoIn"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Asc"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k21 </ci>
        <ci> myoIn </ci>
        <ci> AC </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v22" id="v22" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Asc"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k22 </ci>
        <ci> Asc </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v23" id="v23" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="AC"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Pyr"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k23 </ci>
        <ci> AC </ci>
      </apply>
    </math>
  </kineticLaw>

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</reaction>
- <reaction name="v24" id="v24" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Pyr"/>
    <speciesReference stoichiometry="1" species="Glu"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Val"/>
    <speciesReference stoichiometry="1" species="KGA"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k24 </ci>
        <ci> Pyr </ci>
        <ci> Glu </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v25" id="v25" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Pyr"/>
    <speciesReference stoichiometry="1" species="Val"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Ala"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k25 </ci>
        <ci> Pyr </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v26" id="v26" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Val"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k26 </ci>
        <ci> Val </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>

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- <reaction name="v27" id="v27" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Pyr"/>
    <speciesReference stoichiometry="1" species="Glu"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Leu"/>
    <speciesReference stoichiometry="1" species="KGA"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k27 </ci>
        <ci> Pyr </ci>
        <ci> Glu </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v28" id="v28" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Leu"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k28 </ci>
        <ci> Leu </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v29" id="v29" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Ala"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k29 </ci>
        <ci> Ala </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v30" id="v30" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Pyr"/>
    <speciesReference stoichiometry="1" species="Oxac"/>
  </listOfReactants>

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- <listOfProducts>
  <speciesReference stoichiometry="1" species="Cit"/>
</listOfProducts>
- <kineticLaw>
  - <math xmlns="http://www.w3.org/1998/Math/MathML">
    - <apply>
      <times/>
      <ci> k30 </ci>
      <ci> Pyr </ci>
      <ci> Oxac </ci>
    </apply>
  </math>
</kineticLaw>
</reaction>
- <reaction name="v31" id="v31" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Cit"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="KGA"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k31 </ci>
        <ci> Cit </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v32" id="v32" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="KGA"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Succ"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k32 </ci>
        <ci> KGA </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v33" id="v33" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Succ"/>
  </listOfReactants>
  - <listOfProducts>

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        <speciesReference stoichiometry="1" species="Fum"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k33 </ci>
                <ci> Succ </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v34" id="v34" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Fum"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Mal"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k34 </ci>
                <ci> Fum </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v35" id="v35" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Mal"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Oxac"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k35 </ci>
                <ci> Mal </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v36" id="v36" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Oxac"/>
        <speciesReference stoichiometry="1" species="Glu"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Asp"/>

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        <speciesReference stoichiometry="1" species="KGA"/>
    </listOfProducts>
- <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
        - <apply>
            <times/>
            <ci> k36 </ci>
            <ci> Oxac </ci>
            <ci> Glu </ci>
        </apply>
    </math>
</kineticLaw>
</reaction>
- <reaction name="v37" id="v37" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Asp"/>
        <speciesReference stoichiometry="1" species="Gln"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Asn"/>
        <speciesReference stoichiometry="1" species="Glu"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k37 </ci>
                <ci> Asp </ci>
                <ci> Gln </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v38" id="v38" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Asn"/>
    </listOfReactants>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k38 </ci>
                <ci> Asn </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v39" id="v39" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Asp"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Thr"/>

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</listOfProducts>
- <kineticLaw>
  - <math xmlns="http://www.w3.org/1998/Math/MathML">
    - <apply>
      <times/>
      <ci> k39 </ci>
      <ci> Asp </ci>
    </apply>
  </math>
</kineticLaw>
</reaction>
- <reaction name="v39a" id="v39a" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Asp"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Lys"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k39a </ci>
        <ci> Asp </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v39b" id="v39b" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Lys"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k39b </ci>
        <ci> Lys </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v39c" id="v39c" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Asp"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Met"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>

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                <ci> k39c </ci>
                <ci> Asp </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v39d" id="v39d" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Met"/>
    </listOfReactants>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k39d </ci>
                <ci> Met </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v40" id="v40" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Thr"/>
        <speciesReference stoichiometry="1" species="Glu"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Ile"/>
        <speciesReference stoichiometry="1" species="KGA"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k40 </ci>
                <ci> Thr </ci>
                <ci> Glu </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v40a" id="v40a" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Ile"/>
        <speciesReference stoichiometry="1" species="KGA"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Glu"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k40a </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>

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                <ci> Ile </ci>
                <ci> KGA </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v41" id="v41" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="KGA"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Glu"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k41 </ci>
                <ci> KGA </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v42" id="v42" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Glu"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Gln"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k42 </ci>
                <ci> Glu </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v43" id="v43" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Gln"/>
    </listOfReactants>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k43 </ci>
                <ci> Gln </ci>
            </apply>
        </math>
    </kineticLaw>

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</reaction>
- <reaction name="v44" id="v44" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Glu"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="Pro"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k44 </ci>
        <ci> Glu </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v45" id="v45" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Pro"/>
  </listOfReactants>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k45 </ci>
        <ci> Pro </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v46" id="v46" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="2" species="Glu"/>
  </listOfReactants>
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="KGA"/>
    <speciesReference stoichiometry="1" species="Orn"/>
  </listOfProducts>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k46 </ci>
        <ci> Glu </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
- <reaction name="v46a" id="v46a" reversible="false">
  - <listOfReactants>
    <speciesReference stoichiometry="1" species="Asp"/>

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        <speciesReference stoichiometry="1" species="Orn"/>
    </listOfReactants>
- <listOfProducts>
    <speciesReference stoichiometry="1" species="Fum"/>
    <speciesReference stoichiometry="1" species="Arg"/>
</listOfProducts>
- <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
        - <apply>
            <times/>
            <ci> k46a </ci>
            <ci> Orn </ci>
            <ci> Asp </ci>
        </apply>
    </math>
</kineticLaw>
</reaction>
- <reaction name="v47" id="v47" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Arg"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Put"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k47 </ci>
                <ci> Arg </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v48" id="v48" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Put"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Spdine"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k48 </ci>
                <ci> Put </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v49" id="v49" reversible="false">
    - <listOfReactants>

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        <speciesReference stoichiometry="1" species="Put"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Succ"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k49 </ci>
                <ci> Put </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v50" id="v50" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Spdine"/>
    </listOfReactants>
    - <listOfProducts>
        <speciesReference stoichiometry="1" species="Put"/>
    </listOfProducts>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k50 </ci>
                <ci> Spdine </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v51" id="v51" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Spdine"/>
    </listOfReactants>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>
                <times/>
                <ci> k51 </ci>
                <ci> Spdine </ci>
            </apply>
        </math>
    </kineticLaw>
</reaction>
- <reaction name="v52" id="v52" reversible="false">
    - <listOfReactants>
        <speciesReference stoichiometry="1" species="Suc"/>
    </listOfReactants>
    - <kineticLaw>
        - <math xmlns="http://www.w3.org/1998/Math/MathML">
            - <apply>

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```

        <times/>
        <ci> k52 </ci>
        <ci> Suc </ci>
    </apply>
</math>
</kineticLaw>
</reaction>
- <reaction name="v53" id="v53" reversible="false">
  - <listOfProducts>
    <speciesReference stoichiometry="1" species="myoIn"/>
  </listOfProducts>
  - <listOfModifiers>
    <modifierSpeciesReference species="AC"/>
  </listOfModifiers>
  - <kineticLaw>
    - <math xmlns="http://www.w3.org/1998/Math/MathML">
      - <apply>
        <times/>
        <ci> k53 </ci>
        <ci> AC </ci>
      </apply>
    </math>
  </kineticLaw>
</reaction>
</listOfReactions>
</model>
</sbml>

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