Supplementary Material for Molecular Modeling of the ErbB4/HER4 Kinase in the Context of the HER4 Signaling Network Helps Rationalize the Effects of Clinically Identified HER4 Somatic Mutations on the Cell Phenotype

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Figure S1: Schematic of the protein-protein interaction network downstream of HER4 activation.

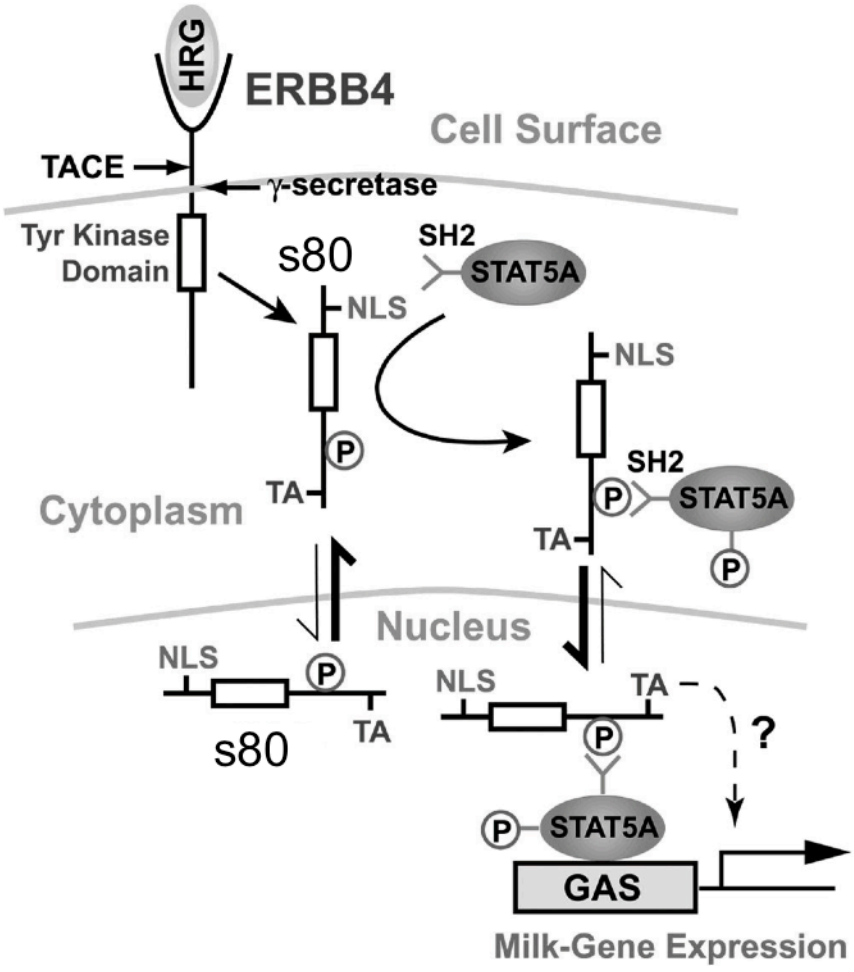


Figure S2: A list of clinical mutations in HER4/ErbB4 and their spatial distribution in the ErbB4 kinase domain.

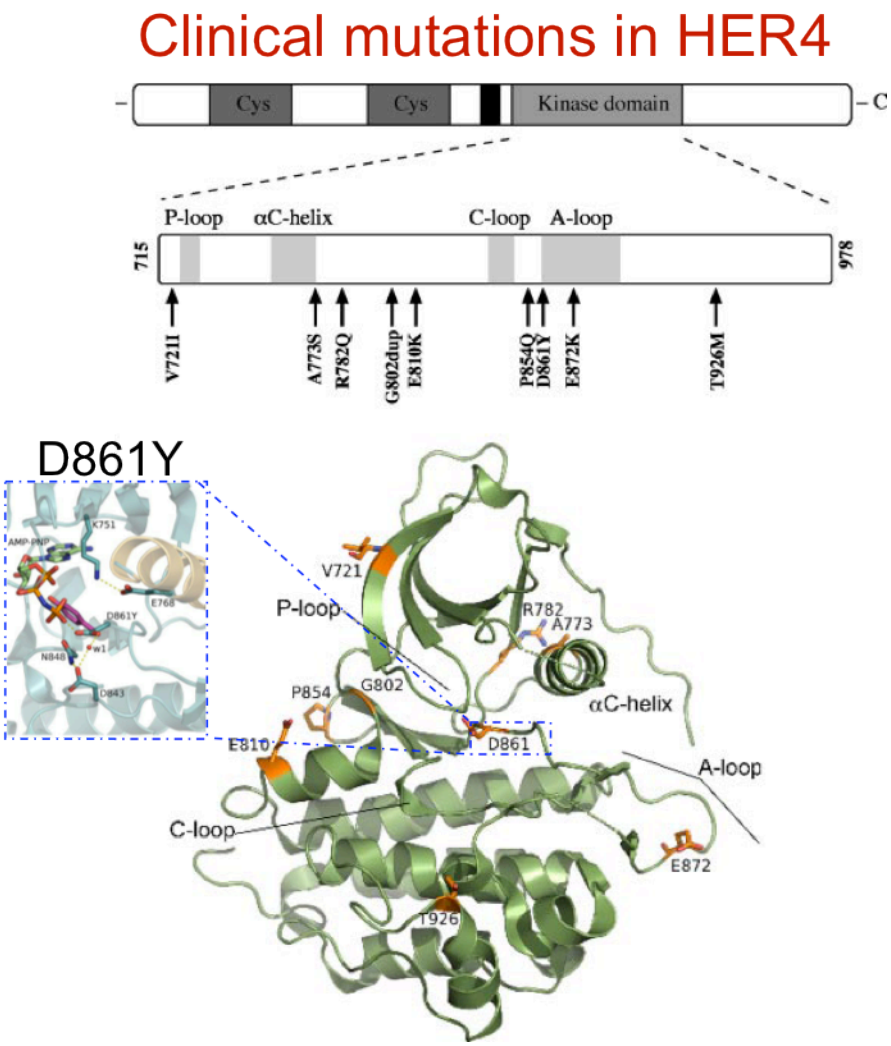
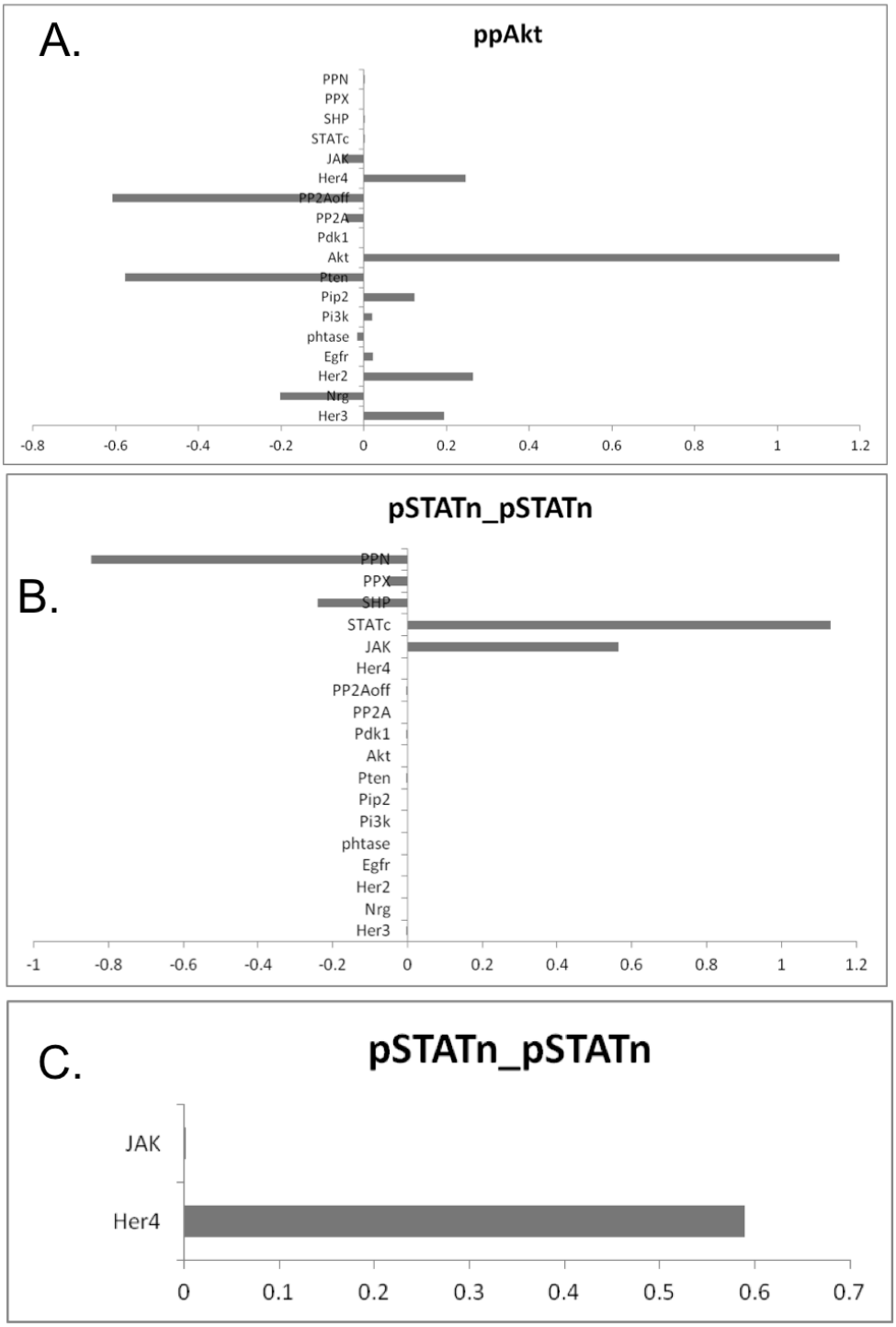


Figure S3: Parameter sensitivity analysis for (A) ppAKT, (B) pSTATn dimers in the wild-type HER4 model in response to 5 nM NRG. (C) Parameter sensitivity analysis for pSTATn_pSTATn for HER4:JAK2 < 1 and stimulation with 5 nM NRG.



SBML Model Attachment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<listOfProducts>
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</listOfProducts>
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    <apply>
      <times/>
      <ci> kf1 </ci>
      <ci> Nrg </ci>
      <ci> Her3 </ci>
    </apply>
    <apply>
      <times/>
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      <ci> Her3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R2" metaid="metaid_0000129" reversible="true">
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<speciesReference species="Her3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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      <ci> Her3_2 </ci>
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    <apply>
      <times/>
      <ci> kr2 </ci>
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    </apply>
  </apply>
```

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</math>
</kineticLaw>
</reaction>
<reaction id="R7" metaid="metaid_0000130" reversible="true">
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<listOfProducts>
<speciesReference species="Her3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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      <ci> Her3_Nrg </ci>
      <ci> Her2 </ci>
    </apply>
    <apply>
      <times/>
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      <ci> Her3_2_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R8" metaid="metaid_0000131" reversible="true">
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<speciesReference species="pHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
      <times/>
      <ci> kf7 </ci>
      <ci> pHer3_Nrg </ci>
      <ci> pHer2 </ci>
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    </apply>
    <apply>
      <times/>
      <ci> kr7 </ci>
      <ci> pHer3_2_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R9" metaid="metaid_0000132" reversible="false">
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<speciesReference species="Her2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <times/>
    <ci> kf7 </ci>
    <ci> pHer3_Nrg </ci>
    <ci> Her2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
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<speciesReference species="Egfr" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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    <apply>
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      <ci> Her3_Nrg </ci>
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    <apply>
     <times/>
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     <ci> Her3_1_Nrg </ci>
    </apply>
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</math>
</kineticLaw>
</reaction>
<reaction id="R11" metaid="metaid_0000134" reversible="true">
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<speciesReference species="Egfr" stoichiometry="1"/>
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<listOfProducts>
<speciesReference species="pHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
     <times/>
     <ci> kf10 </ci>
     <ci> pHer3_Nrg </ci>
     <ci> Egfr </ci>
    </apply>
    <apply>
     <times/>
     <ci> kr7 </ci>
     <ci> pHer3_1_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R12" metaid="metaid_0000135" reversible="false">
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<speciesReference species="Her2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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    <times/>
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    <ci> Her2 </ci>
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<reaction id="R13" metaid="metaid_0000136" reversible="true">
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<listOfProducts>
<speciesReference species="pHer2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> pHer2 </ci>
      <ci> pHer2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> pHer2_2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R25" metaid="metaid_0000137" reversible="true">
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<speciesReference species="Her3" stoichiometry="1"/>
<speciesReference species="Her2" stoichiometry="1"/>
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<listOfProducts>
<speciesReference species="Her3_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
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<times/>
<ci> kf12 </ci>
<ci> Her3 </ci>
<ci> Her2 </ci>
</apply>
<apply>
<times/>
<ci> kr12 </ci>
<ci> Her3_2 </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R26" metaid="metaid_0000138" reversible="true">
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<speciesReference species="Egfr" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_1" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf12 </ci>
<ci> Her3 </ci>
<ci> Egfr </ci>
</apply>
<apply>
<times/>
<ci> kr12 </ci>
<ci> Her3_1 </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R27" metaid="metaid_0000139" reversible="true">
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<speciesReference species="Egfr" stoichiometry="1"/>
<speciesReference species="Her2" stoichiometry="1"/>
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<listOfProducts>

<speciesReference species="Her1_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
 <apply>
  <minus/>
  <apply>
   <times/>
   <ci> kf12 </ci>
   <ci> Egfr </ci>
   <ci> Her2 </ci>
  </apply>
  <apply>
   <times/>
   <ci> kr12 </ci>
   <ci> Her1_2 </ci>
  </apply>
 </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R28" metaid="metaid_0000140" reversible="true">
<listOfReactants>
<speciesReference species="Egfr" stoichiometry="2"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her1_1" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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  <minus/>
  <apply>
   <times/>
   <ci> kf12 </ci>
   <ci> Egfr </ci>
   <ci> Egfr </ci>
  </apply>
  <apply>
   <times/>
   <ci> kr12 </ci>
   <ci> Her1_1 </ci>
  </apply>
 </apply>
</math>
</kineticLaw>
</reaction>

<reaction id="R29" metaid="metaid_0000141" reversible="true">
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</listOfReactants>
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<speciesReference species="Her2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> Her2 </ci>
      <ci> Her2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> Her2_2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R30" metaid="metaid_0000142" reversible="false">
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</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
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    <ci> Her3_2_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R31" metaid="metaid_0000143" reversible="false">
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</listOfReactants>

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<listOfProducts>
<speciesReference species="pHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <ci> Her3_1_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
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</listOfReactants>
<listOfProducts>
<speciesReference species="Her3" stoichiometry="1"/>
<speciesReference species="Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kr1 </ci>
    <ci> pHer3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R38" metaid="metaid_0000146" reversible="true">
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<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_2_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
      <times/>
      <ci> kf38 </ci>
      <ci> pHer3_2_Nrg </ci>
```

```
      <ci> phtase </ci>
    </apply>
    <apply>
      <times/>
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      <ci> pHer3_2_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R39" metaid="metaid_0000147" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_1_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_1_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf38 </ci>
      <ci> pHer3_1_Nrg </ci>
      <ci> phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr38 </ci>
      <ci> pHer3_1_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R44" metaid="metaid_0000148" reversible="true">
<listOfReactants>
<speciesReference species="pHer2_2" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer2_2_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf38 </ci>
<ci> pHer2_2 </ci>
<ci> phtase </ci>
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<ci> pHer2_2_phtase </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R45" metaid="metaid_0000149" reversible="false">
<listOfReactants>
<speciesReference species="pHer3_2_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_2_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
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<ci> kf45 </ci>
<ci> pHer3_2_Nrg_phtase </ci>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R46" metaid="metaid_0000150" reversible="false">
<listOfReactants>
<speciesReference species="pHer3_1_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_1_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>

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    <times/>
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    <ci> pHer3_1_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R51" metaid="metaid_0000151" reversible="false">
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</listOfReactants>
<listOfProducts>
<speciesReference species="Her2_2" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <times/>
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    <ci> pHer2_2_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R52" metaid="metaid_0000152" reversible="true">
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<speciesReference species="pHer3_2_Nrg" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_2_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
      <times/>
      <ci> kf52 </ci>
      <ci> pHer3_2_Nrg </ci>
      <ci> Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr52 </ci>
      <ci> pHer3_2_Nrg_Pi3k </ci>
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    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R53" metaid="metaid_0000153" reversible="true">
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<speciesReference species="pHer3_1_Nrg" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_1_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf52 </ci>
      <ci> pHer3_1_Nrg </ci>
      <ci> Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr52 </ci>
      <ci> pHer3_1_Nrg_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R54" metaid="metaid_0000154" reversible="true">
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<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer2_2_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf54 </ci>
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      <ci> pHer2_2 </ci>
      <ci> Pi3k </ci>
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    <apply>
      <times/>
      <ci> kr54 </ci>
      <ci> pHer2_2_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R59" metaid="metaid_0000155" reversible="true">
<listOfReactants>
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<speciesReference species="Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_2_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf59 </ci>
      <ci> pHer3_2_Nrg_Pi3k </ci>
      <ci> Pip2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr59 </ci>
      <ci> pHer3_2_Nrg_Pi3k_Pip2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
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<listOfReactants>
<speciesReference species="pHer3_1_Nrg_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_1_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
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<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
      <times/>
      <ci> kf59 </ci>
      <ci> pHer3_1_Nrg_Pi3k </ci>
      <ci> Pip2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr59 </ci>
      <ci> pHer3_1_Nrg_Pi3k_Pip2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R61" metaid="metaid_0000157" reversible="true">
<listOfReactants>
<speciesReference species="pHer2_2_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer2_2_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf61 </ci>
      <ci> pHer2_2_Pi3k </ci>
      <ci> Pip2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr61 </ci>
      <ci> pHer2_2_Pi3k_Pip2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R66" metaid="metaid_0000158" reversible="false">

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<listOfReactants>
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</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_2_Nrg_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip3" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf66 </ci>
    <ci> pHer3_2_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R67" metaid="metaid_0000159" reversible="false">
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<speciesReference species="pHer3_1_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_1_Nrg_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip3" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
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    <ci> pHer3_1_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R68" metaid="metaid_0000160" reversible="false">
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<speciesReference species="pHer2_2_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer2_2_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip3" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
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    <ci> kf68 </ci>
    <ci> pHer2_2_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R73" metaid="metaid_0000161" reversible="true">
<listOfReactants>
<speciesReference species="Pip3" stoichiometry="1"/>
<speciesReference species="Pten" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3_Pten" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf73 </ci>
      <ci> Pip3 </ci>
      <ci> Pten </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr73 </ci>
      <ci> Pip3_Pten </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R74" metaid="metaid_0000162" reversible="false">
<listOfReactants>
<speciesReference species="Pip3_Pten" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip2" stoichiometry="1"/>
<speciesReference species="Pten" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf74 </ci>
    <ci> Pip3_Pten </ci>
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  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R75" metaid="metaid_0000163" reversible="true">
<listOfReactants>
<speciesReference species="Pip3" stoichiometry="1"/>
<speciesReference species="Akt" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3_Akt" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf75 </ci>
      <ci> Pip3 </ci>
      <ci> Akt </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr75 </ci>
      <ci> Pip3_Akt </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R76" metaid="metaid_0000164" reversible="true">
<listOfReactants>
<speciesReference species="Pip3_Akt" stoichiometry="1"/>
<speciesReference species="Pdk1" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3_Akt_Pdk1" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf76 </ci>
      <ci> Pip3_Akt </ci>
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      <ci> Pdk1 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr76 </ci>
      <ci> Pip3_Akt_Pdk1 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R77" metaid="metaid_0000165" reversible="false">
<listOfReactants>
<speciesReference species="Pip3_Akt_Pdk1" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3_Pdk1" stoichiometry="1"/>
<speciesReference species="pAkt" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf77 </ci>
    <ci> Pip3_Akt_Pdk1 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R78" metaid="metaid_0000166" reversible="false">
<listOfReactants>
<speciesReference species="Pip3_Pdk1" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3" stoichiometry="1"/>
<speciesReference species="Pdk1" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf78 </ci>
    <ci> Pip3_Pdk1 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
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<reaction id="R79" metaid="metaid_0000167" reversible="true">
<listOfReactants>
<speciesReference species="Pip3" stoichiometry="1"/>
<speciesReference species="pAkt" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3_pAkt" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf75 </ci>
      <ci> Pip3 </ci>
      <ci> pAkt </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr75 </ci>
      <ci> Pip3_pAkt </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R80" metaid="metaid_0000168" reversible="true">
<listOfReactants>
<speciesReference species="Pip3_pAkt" stoichiometry="1"/>
<speciesReference species="Pdk1" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3_pAkt_Pdk1" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf76 </ci>
      <ci> Pip3_pAkt </ci>
      <ci> Pdk1 </ci>
    </apply>
    <apply>
      <times/>
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      <ci> kr76 </ci>
      <ci> Pip3_pAkt_Pdk1 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R81" metaid="metaid_0000169" reversible="false">
<listOfReactants>
<speciesReference species="Pip3_pAkt_Pdk1" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Pip3_Pdk1" stoichiometry="1"/>
<speciesReference species="ppAkt" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf81 </ci>
    <ci> Pip3_pAkt_Pdk1 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R82" metaid="metaid_0000170" reversible="true">
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<speciesReference species="ppAkt" stoichiometry="1"/>
<speciesReference species="PP2A" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ppAkt_PP2A" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf82 </ci>
      <ci> ppAkt </ci>
      <ci> PP2A </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr82 </ci>
      <ci> ppAkt_PP2A </ci>
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    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R83" metaid="metaid_0000171" reversible="false">
<listOfReactants>
<speciesReference species="ppAkt_PP2A" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pAkt" stoichiometry="1"/>
<speciesReference species="PP2A" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf83 </ci>
    <ci> ppAkt_PP2A </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R84" metaid="metaid_0000172" reversible="true">
<listOfReactants>
<speciesReference species="pAkt" stoichiometry="1"/>
<speciesReference species="PP2A" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pAkt_PP2A" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf82 </ci>
      <ci> pAkt </ci>
      <ci> PP2A </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr82 </ci>
      <ci> pAkt_PP2A </ci>
    </apply>
  </apply>
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</math>
</kineticLaw>
</reaction>
<reaction id="R85" metaid="metaid_0000173" reversible="false">
<listOfReactants>
<speciesReference species="pAkt_PP2A" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Akt" stoichiometry="1"/>
<speciesReference species="PP2A" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
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    <ci> pAkt_PP2A </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R86" metaid="metaid_0000174" reversible="true">
<listOfReactants>
<speciesReference species="ppAkt" stoichiometry="1"/>
<speciesReference species="PP2Aoff" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ppAkt_PP2Aoff" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf86 </ci>
      <ci> ppAkt </ci>
      <ci> PP2Aoff </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr86 </ci>
      <ci> ppAkt_PP2Aoff </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
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</reaction>
<reaction id="R87" metaid="metaid_0000175" reversible="false">
<listOfReactants>
<speciesReference species="ppAkt_PP2Aoff" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ppAkt" stoichiometry="1"/>
<speciesReference species="PP2A" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <times/>
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    <ci> ppAkt_PP2Aoff </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R88" metaid="metaid_0000275" reversible="true">
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<speciesReference species="Her3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf88 </ci>
      <ci> Her3_Nrg </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr88 </ci>
      <ci> iHer3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R89" metaid="metaid_0000276" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_Nrg" stoichiometry="1"/>
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf88 </ci>
      <ci> pHer3_Nrg </ci>
    </apply>
    <apply>
      <times/>
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      <ci> ipHer3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R90" metaid="metaid_0000277" reversible="true">
<listOfReactants>
<speciesReference species="pHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf88 </ci>
      <ci> pHer2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr88 </ci>
      <ci> ipHer2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
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<reaction id="R93" metaid="metaid_0000278" reversible="true">
<listOfReactants>
<speciesReference species="Her3_2_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> Her3_2_Nrg </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> iHer3_2_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R94" metaid="metaid_0000279" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_2_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer3_2_Nrg </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer3_2_Nrg </ci>
    </apply>
  </apply>
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</math>
</kineticLaw>
</reaction>
<reaction id="R95" metaid="metaid_0000280" reversible="true">
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
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      <ci> kf93 </ci>
      <ci> pHer3_2_Nrg_phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer3_2_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R96" metaid="metaid_0000281" reversible="true">
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
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      <ci> pHer3_2_Nrg_Pi3k </ci>
    </apply>
    <apply>
      <times/>
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    <ci> ipHer3_2_Nrg_Pi3k </ci>
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</math>
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</reaction>
<reaction id="R97" metaid="metaid_0000282" reversible="true">
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<listOfProducts>
<speciesReference species="ipHer3_2_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
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      <ci> pHer3_2_Nrg_Pi3k_Pip2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer3_2_Nrg_Pi3k_Pip2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R98" metaid="metaid_0000283" reversible="true">
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<speciesReference species="Her3_1_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
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</kineticLaw>
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<reaction id="R99" metaid="metaid_0000284" reversible="true">
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<listOfProducts>
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</listOfProducts>
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     <ci> pHer3_1_Nrg </ci>
    </apply>
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     <times/>
     <ci> kr98 </ci>
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    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R100" metaid="metaid_0000285" reversible="true">
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<listOfProducts>
<speciesReference species="ipHer3_1_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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    <minus/>
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     <times/>
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      <ci> kf98 </ci>
      <ci> pHer3_1_Nrg_phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr98 </ci>
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    </apply>
  </apply>
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</kineticLaw>
</reaction>
<reaction id="R101" metaid="metaid_0000286" reversible="true">
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_1_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
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    <apply>
      <times/>
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    </apply>
    <apply>
      <times/>
      <ci> kr98 </ci>
      <ci> ipHer3_1_Nrg_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R102" metaid="metaid_0000287" reversible="true">
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_1_Nrg_Pi3k_Pip2" stoichiometry="1"/>
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<apply>
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<ci> pHer3_1_Nrg_Pi3k_Pip2 </ci>
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<ci> ipHer3_1_Nrg_Pi3k_Pip2 </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R103" metaid="metaid_0000288" reversible="true">
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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<minus/>
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</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R104" metaid="metaid_0000289" reversible="true">
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<listOfProducts>
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</listOfProducts>

<kineticLaw>
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      <ci> kf93 </ci>
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    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R105" metaid="metaid_0000290" reversible="true">
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer2_2_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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      <ci> kf93 </ci>
      <ci> pHer2_2_Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer2_2_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R106" metaid="metaid_0000291" reversible="true">
<listOfReactants>
<speciesReference species="pHer2_2_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>

<listOfProducts>
<speciesReference species="ipHer2_2_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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      <ci> pHer2_2_Pi3k_Pip2 </ci>
    </apply>
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      <ci> kr93 </ci>
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  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R127" metaid="metaid_0000292" reversible="true">
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<speciesReference species="iNrg" stoichiometry="1"/>
<speciesReference species="iHer3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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      <ci> kf127 </ci>
      <ci> iNrg </ci>
      <ci> iHer3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr1 </ci>
      <ci> iHer3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>

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</reaction>
<reaction id="R128" metaid="metaid_0000293" reversible="true">
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<speciesReference species="iNrg" stoichiometry="1"/>
<speciesReference species="iHer3_2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf127 </ci>
      <ci> iNrg </ci>
      <ci> iHer3_2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr1 </ci>
      <ci> iHer3_2_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R133" metaid="metaid_0000294" reversible="true">
<listOfReactants>
<speciesReference species="iHer3_Nrg" stoichiometry="1"/>
<speciesReference species="iHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf7 </ci>
      <ci> iHer3_Nrg </ci>
      <ci> iHer2 </ci>
    </apply>
    <apply>
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<times/>
<ci> kr7 </ci>
<ci> iHer3_2_Nrg </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R134" metaid="metaid_0000295" reversible="true">
<listOfReactants>
<speciesReference species="ipHer3_Nrg" stoichiometry="1"/>
<speciesReference species="ipHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf7 </ci>
<ci> ipHer3_Nrg </ci>
<ci> ipHer2 </ci>
</apply>
<apply>
<times/>
<ci> kr7 </ci>
<ci> ipHer3_2_Nrg </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R135" metaid="metaid_0000296" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_Nrg" stoichiometry="1"/>
<speciesReference species="iHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<times/>

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    <ci> kf7 </ci>
    <ci> ipHer3_Nrg </ci>
    <ci> iHer2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R136" metaid="metaid_0000297" reversible="true">
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<speciesReference species="iHer3_Nrg" stoichiometry="1"/>
<speciesReference species="iEgfr" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf10 </ci>
      <ci> iHer3_Nrg </ci>
      <ci> iEgfr </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7 </ci>
      <ci> iHer3_1_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R137" metaid="metaid_0000298" reversible="true">
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<speciesReference species="ipHer3_Nrg" stoichiometry="1"/>
<speciesReference species="iEgfr" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
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<times/>
<ci> kf10 </ci>
<ci> ipHer3_Nrg </ci>
<ci> iEgfr </ci>
</apply>
<apply>
<times/>
<ci> kr7 </ci>
<ci> ipHer3_1_Nrg </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R138" metaid="metaid_0000299" reversible="false">
<listOfReactants>
<speciesReference species="ipHer2" stoichiometry="1"/>
<speciesReference species="iHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<times/>
<ci> kf12 </ci>
<ci> ipHer2 </ci>
<ci> iHer2 </ci>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R139" metaid="metaid_0000300" reversible="true">
<listOfReactants>
<speciesReference species="ipHer2" stoichiometry="2"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf12 </ci>

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      <ci> ipHer2 </ci>
      <ci> ipHer2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> ipHer2_2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R151" metaid="metaid_0000301" reversible="true">
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<speciesReference species="iHer3" stoichiometry="1"/>
<speciesReference species="iHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> iHer3 </ci>
      <ci> iHer2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> iHer3_2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R152" metaid="metaid_0000302" reversible="true">
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<speciesReference species="iHer3" stoichiometry="1"/>
<speciesReference species="iEgfr" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_1" stoichiometry="1"/>
</listOfProducts>
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<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> iHer3 </ci>
      <ci> iEgfr </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> iHer3_1 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R153" metaid="metaid_0000303" reversible="true">
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<speciesReference species="iHer2" stoichiometry="1"/>
<speciesReference species="iEgfr" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer2_1" stoichiometry="1"/>
</listOfProducts>
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    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> iHer2 </ci>
      <ci> iEgfr </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> iHer2_1 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R154" metaid="metaid_0000304" reversible="true">

<listOfReactants>
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</listOfReactants>
<listOfProducts>
<speciesReference species="iEgfr_Egfr" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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    <minus/>
    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> iEgfr </ci>
      <ci> iEgfr </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> iEgfr_Egfr </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R155" metaid="metaid_0000305" reversible="true">
<listOfReactants>
<speciesReference species="iHer2" stoichiometry="2"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> iHer2 </ci>
      <ci> iHer2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> iHer2_2 </ci>
    </apply>

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  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R156" metaid="metaid_0000306" reversible="false">
<listOfReactants>
<speciesReference species="iHer3_2_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf30 </ci>
    <ci> iHer3_2_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R157" metaid="metaid_0000307" reversible="false">
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<speciesReference species="iHer3_1_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf30 </ci>
    <ci> iHer3_1_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R162" metaid="metaid_0000308" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3" stoichiometry="1"/>
<speciesReference species="iNrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<times/>
<ci> kr1 </ci>
<ci> ipHer3_Nrg </ci>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R164" metaid="metaid_0000309" reversible="true">
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<speciesReference species="ipHer3_2_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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<minus/>
<apply>
<times/>
<ci> kf38 </ci>
<ci> ipHer3_2_Nrg </ci>
<ci> phtase </ci>
</apply>
<apply>
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<ci> kr38 </ci>
<ci> ipHer3_2_Nrg_phtase </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R165" metaid="metaid_0000310" reversible="true">
<listOfReactants>
<speciesReference species="ipHer3_1_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_1_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>

<minus/>
<apply>
<times/>
<ci> kf38 </ci>
<ci> ipHer3_1_Nrg </ci>
<ci> phtase </ci>
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<apply>
<times/>
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<ci> ipHer3_1_Nrg_phtase </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R166" metaid="metaid_0000311" reversible="true">
<listOfReactants>
<speciesReference species="ipHer2_2" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer2_2_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf38 </ci>
<ci> ipHer2_2 </ci>
<ci> phtase </ci>
</apply>
<apply>
<times/>
<ci> kr38 </ci>
<ci> ipHer2_2_phtase </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R171" metaid="metaid_0000312" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_2_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>

<listOfProducts>
<speciesReference species="iHer3_2_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf45 </ci>
    <ci> ipHer3_2_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R172" metaid="metaid_0000313" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_1_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_1_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf45 </ci>
    <ci> ipHer3_1_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R173" metaid="metaid_0000314" reversible="false">
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<speciesReference species="ipHer2_2_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer2_2" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf45 </ci>
    <ci> ipHer2_2_phtase </ci>
  </apply>

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</math>
</kineticLaw>
</reaction>
<reaction id="R178" metaid="metaid_0000315" reversible="true">
<listOfReactants>
<speciesReference species="ipHer3_2_Nrg" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_2_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf52 </ci>
      <ci> ipHer3_2_Nrg </ci>
      <ci> Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr52 </ci>
      <ci> ipHer3_2_Nrg_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R179" metaid="metaid_0000316" reversible="true">
<listOfReactants>
<speciesReference species="ipHer3_1_Nrg" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_1_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf52 </ci>
      <ci> ipHer3_1_Nrg </ci>
      <ci> Pi3k </ci>
```

```
    </apply>
    <apply>
      <times/>
      <ci> kr52 </ci>
      <ci> ipHer3_1_Nrg_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R180" metaid="metaid_0000317" reversible="true">
<listOfReactants>
<speciesReference species="ipHer2_2" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer2_2_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf54 </ci>
      <ci> ipHer2_2 </ci>
      <ci> Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr54 </ci>
      <ci> ipHer2_2_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R185" metaid="metaid_0000318" reversible="false">
<listOfReactants>
<speciesReference species="iNrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dNrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
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    <times/>
    <ci> kf185 </ci>
    <ci> iNrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R187" metaid="metaid_0000319" reversible="false">
<listOfReactants>
<speciesReference species="iHer3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dHer3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf187 </ci>
    <ci> iHer3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R189" metaid="metaid_0000320" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf187 </ci>
    <ci> ipHer3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R191" metaid="metaid_0000321" reversible="false">
<listOfReactants>
<speciesReference species="ipHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer2" stoichiometry="1"/>
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</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf187 </ci>
    <ci> ipHer2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R192" metaid="metaid_0000322" reversible="false">
<listOfReactants>
<speciesReference species="iHer3_2_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> iHer3_2_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R193" metaid="metaid_0000323" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_2_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer3_2_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R194" metaid="metaid_0000324" reversible="false">
<listOfReactants>
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<speciesReference species="ipHer3_2_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_2_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer3_2_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R195" metaid="metaid_0000325" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_2_Nrg_Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_2_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
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    <ci> ipHer3_2_Nrg_Pi3k </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R196" metaid="metaid_0000326" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_2_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_2_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer3_2_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>

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</kineticLaw>
</reaction>
<reaction id="R197" metaid="metaid_0000327" reversible="false">
<listOfReactants>
<speciesReference species="ipHer2_2" stoichiometry="1"/>
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<speciesReference species="dpHer2_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
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    <ci> kf192 </ci>
    <ci> ipHer2_2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R198" metaid="metaid_0000328" reversible="false">
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<speciesReference species="ipHer2_2_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer2_2_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer2_2_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R199" metaid="metaid_0000329" reversible="false">
<listOfReactants>
<speciesReference species="ipHer2_2_Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer2_2_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
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    <ci> kf192 </ci>
    <ci> ipHer2_2_Pi3k </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R200" metaid="metaid_0000330" reversible="false">
<listOfReactants>
<speciesReference species="ipHer2_2_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer2_2_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer2_2_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R201" metaid="metaid_0000331" reversible="false">
<listOfReactants>
<speciesReference species="iHer3_1_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf201 </ci>
    <ci> iHer3_1_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R202" metaid="metaid_0000332" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_1_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_1_Nrg" stoichiometry="1"/>
</listOfProducts>
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<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf201 </ci>
    <ci> ipHer3_1_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R203" metaid="metaid_0000333" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_1_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_1_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf201 </ci>
    <ci> ipHer3_1_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R204" metaid="metaid_0000334" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_1_Nrg_Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_1_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf201 </ci>
    <ci> ipHer3_1_Nrg_Pi3k </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R205" metaid="metaid_0000335" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_1_Nrg_Pi3k_Pip2" stoichiometry="1"/>

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</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_1_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf201 </ci>
    <ci> ipHer3_1_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R206" metaid="metaid_0000354" reversible="true">
<listOfReactants>
<speciesReference species="Her3" stoichiometry="2"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_3" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> Her3 </ci>
      <ci> Her3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> Her3_3 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R207" metaid="metaid_0000355" reversible="true">
<listOfReactants>
<speciesReference species="Her3_3" stoichiometry="1"/>
<speciesReference species="Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_3_Nrg" stoichiometry="1"/>
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</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
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      <times/>
      <ci> kf1 </ci>
      <ci> Nrg </ci>
      <ci> Her3_3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr1 </ci>
      <ci> Her3_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R208" metaid="metaid_0000356" reversible="true">
<listOfReactants>
<speciesReference species="Her3_Nrg" stoichiometry="1"/>
<speciesReference species="Her3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf7 </ci>
      <ci> Her3_Nrg </ci>
      <ci> Her3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7 </ci>
      <ci> Her3_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
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<reaction id="R209" metaid="metaid_0000357" reversible="false">
<listOfReactants>
<speciesReference species="Her3_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf30_weak </ci>
    <ci> Her3_3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R210" metaid="metaid_0000358" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_3_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_3_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf38 </ci>
      <ci> pHer3_3_Nrg </ci>
      <ci> phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr38 </ci>
      <ci> pHer3_3_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R211" metaid="metaid_0000359" reversible="false">
<listOfReactants>
<speciesReference species="pHer3_3_Nrg_phtase" stoichiometry="1"/>

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</listOfReactants>
<listOfProducts>
<speciesReference species="Her3_3_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf45 </ci>
    <ci> pHer3_3_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R212" metaid="metaid_0000360" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_3_Nrg" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf52 </ci>
      <ci> pHer3_3_Nrg </ci>
      <ci> Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr52 </ci>
      <ci> pHer3_3_Nrg_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R213" metaid="metaid_0000361" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_3_Nrg_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip2" stoichiometry="1"/>
</listOfReactants>
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<listOfProducts>
<speciesReference species="pHer3_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf59 </ci>
      <ci> pHer3_3_Nrg_Pi3k </ci>
      <ci> Pip2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr59 </ci>
      <ci> pHer3_3_Nrg_Pi3k_Pip2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R214" metaid="metaid_0000362" reversible="false">
<listOfReactants>
<speciesReference species="pHer3_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_3_Nrg_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip3" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf66 </ci>
    <ci> pHer3_3_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R215" metaid="metaid_0000363" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_Nrg" stoichiometry="1"/>
<speciesReference species="Her3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer3_3_Nrg" stoichiometry="1"/>

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</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
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    <apply>
      <times/>
      <ci> kf10_weak </ci>
      <ci> pHer3_Nrg </ci>
      <ci> Her3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7 </ci>
      <ci> pHer3_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R216" metaid="metaid_0000364" reversible="true">
<listOfReactants>
<speciesReference species="Her3_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer3_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> Her3_3_Nrg </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> iHer3_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R217" metaid="metaid_0000365" reversible="true">
<listOfReactants>
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<speciesReference species="pHer3_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer3_3_Nrg </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer3_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R218" metaid="metaid_0000366" reversible="true">
<listOfReactants>
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_3_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer3_3_Nrg_phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer3_3_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>

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</reaction>
<reaction id="R219" metaid="metaid_0000367" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer3_3_Nrg_Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer3_3_Nrg_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R220" metaid="metaid_0000368" reversible="true">
<listOfReactants>
<speciesReference species="pHer3_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer3_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer3_3_Nrg_Pi3k_Pip2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer3_3_Nrg_Pi3k_Pip2 </ci>
    </apply>
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  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R221" metaid="metaid_0000369" reversible="false">
<listOfReactants>
<speciesReference species="iHer3_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dHer3_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> iHer3_3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R222" metaid="metaid_0000370" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer3_3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R223" metaid="metaid_0000371" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_3_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_3_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer3_3_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R224" metaid="metaid_0000372" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer3_3_Nrg_Pi3k </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R225" metaid="metaid_0000373" reversible="false">
<listOfReactants>
<speciesReference species="ipHer3_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer3_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer3_3_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
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<reaction id="R300" metaid="metaid_0000487" reversible="true">
<listOfReactants>
<speciesReference species="Nrg" stoichiometry="1"/>
<speciesReference species="Her4" stoichiometry="1"/>
</listOfReactants>
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<listOfProducts>
<speciesReference species="Her4_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf1 </ci>
      <ci> Nrg </ci>
      <ci> Her4 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr1 </ci>
      <ci> Her4_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R301" metaid="metaid_0000488" reversible="true">
<listOfReactants>
<speciesReference species="Nrg" stoichiometry="1"/>
<speciesReference species="Her4_2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf2 </ci>
      <ci> Nrg </ci>
      <ci> Her4_2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr2 </ci>
      <ci> Her4_2_Nrg </ci>
    </apply>
  </apply>
</math>
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</kineticLaw>
</reaction>
<reaction id="R302" metaid="metaid_0000489" reversible="true">
<listOfReactants>
<speciesReference species="Her4_Nrg" stoichiometry="1"/>
<speciesReference species="Her2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf7 </ci>
      <ci> Her4_Nrg </ci>
      <ci> Her2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7 </ci>
      <ci> Her4_2_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R303" metaid="metaid_0000490" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_Nrg" stoichiometry="1"/>
<speciesReference species="pHer2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf7 </ci>
      <ci> pHer4_Nrg </ci>
      <ci> pHer2 </ci>
    </apply>
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    <apply>
     <times/>
     <ci> kr7 </ci>
     <ci> pHer4_2_Nrg </ci>
    </apply>
   </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R304" metaid="metaid_0000491" reversible="false">
<listOfReactants>
<speciesReference species="pHer4_Nrg" stoichiometry="1"/>
<speciesReference species="Her2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf7 </ci>
    <ci> pHer4_Nrg </ci>
    <ci> Her2 </ci>
  </apply>
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</kineticLaw>
</reaction>
<reaction id="R305" metaid="metaid_0000492" reversible="false">
<listOfReactants>
<speciesReference species="Her4_2_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_2_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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    <ci> kf30 </ci>
    <ci> Her4_2_Nrg </ci>
  </apply>
</math>
</kineticLaw>
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</math>
</kineticLaw>
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<speciesReference species="pHer4_2_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
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      <ci> phtase </ci>
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    <apply>
      <times/>
      <ci> kr38 </ci>
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    </apply>
  </apply>
</math>
</kineticLaw>
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</listOfReactants>

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</listOfProducts>
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    <ci> pHer4_2_Nrg_phtase </ci>
  </apply>
</math>
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<speciesReference species="pHer4_2_Nrg_Pi3k" stoichiometry="1"/>
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      <ci> Pi3k </ci>
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    <apply>
      <times/>
      <ci> kr52 </ci>
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    </apply>
  </apply>
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      <ci> Pip2 </ci>
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<listOfProducts>
<speciesReference species="iHer4_Nrg" stoichiometry="1"/>
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<kineticLaw>

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</math>
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</apply>
<apply>
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</kineticLaw>
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<speciesReference species="iHer4_2_Nrg" stoichiometry="1"/>
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   <ci> Her4_2_Nrg </ci>
  </apply>
  <apply>
   <times/>
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   <ci> iHer4_2_Nrg </ci>
  </apply>
 </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R315" metaid="metaid_0000502" reversible="true">
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<speciesReference species="ipHer4_2_Nrg" stoichiometry="1"/>
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   <ci> pHer4_2_Nrg </ci>
  </apply>
  <apply>
   <times/>
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<listOfProducts>
<speciesReference species="ipHer4_2_Nrg_phtase" stoichiometry="1"/>
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    </apply>
    <apply>
      <times/>
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    </apply>
  </apply>
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</reaction>
<reaction id="R317" metaid="metaid_0000504" reversible="true">
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    </apply>
    <apply>
      <times/>
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    </apply>
  </apply>
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</kineticLaw>

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</reaction>
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<speciesReference species="ipHer4_2_Nrg_Pi3k_Pip2" stoichiometry="1"/>
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    </apply>
    <apply>
      <times/>
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    </apply>
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      <ci> iHer4 </ci>
    </apply>
    <apply>
      <times/>
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      <ci> iHer4_Nrg </ci>
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</kineticLaw>
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      <ci> iHer4_2 </ci>
    </apply>
    <apply>
      <times/>
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    </apply>
  </apply>
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      <times/>
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</math>
</kineticLaw>
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<ci> ipHer2 </ci>
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<speciesReference species="ipHer4_2_Nrg" stoichiometry="1"/>

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</listOfProducts>
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    <ci> iHer2 </ci>
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</kineticLaw>
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<speciesReference species="iHer4_2" stoichiometry="1"/>
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      <ci> iHer2 </ci>
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    </apply>
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      <ci> iHer4 </ci>
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      <times/>
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</kineticLaw>
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  </apply>
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</kineticLaw>
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</kineticLaw>
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</kineticLaw>
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<speciesReference species="dpHer4_2_Nrg" stoichiometry="1"/>
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    <ci> ipHer4_2_Nrg_phtase </ci>
  </apply>
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</kineticLaw>
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<reaction id="R339" metaid="metaid_0000526" reversible="false">

<listOfReactants>
<speciesReference species="ipHer4_2_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer4_2_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer4_2_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R340" metaid="metaid_0000527" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_Nrg" stoichiometry="1"/>
<speciesReference species="Her4" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_4_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf10 </ci>
      <ci> pHer4_Nrg </ci>
      <ci> Her4 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7 </ci>
      <ci> pHer4_4_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R341" metaid="metaid_0000528" reversible="true">
<listOfReactants>
<speciesReference species="Nrg" stoichiometry="1"/>
<speciesReference species="Her4_3" stoichiometry="1"/>

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</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
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    <apply>
      <times/>
      <ci> kf2 </ci>
      <ci> Nrg </ci>
      <ci> Her4_3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr2 </ci>
      <ci> Her4_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R342" metaid="metaid_0000529" reversible="true">
<listOfReactants>
<speciesReference species="Her4_Nrg" stoichiometry="1"/>
<speciesReference species="Her3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf7 </ci>
      <ci> Her4_Nrg </ci>
      <ci> Her3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7 </ci>
      <ci> Her4_3_Nrg </ci>
    </apply>
  </apply>
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</math>
</kineticLaw>
</reaction>
<reaction id="R343" metaid="metaid_0000530" reversible="false">
<listOfReactants>
<speciesReference species="pHer4_Nrg" stoichiometry="1"/>

<speciesReference species="Her3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf7 </ci>
    <ci> pHer4_Nrg </ci>
    <ci> Her3 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R344" metaid="metaid_0000531" reversible="false">
<listOfReactants>
<speciesReference species="Her4_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf30 </ci>
    <ci> Her4_3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R345" metaid="metaid_0000532" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_3_Nrg_phtase" stoichiometry="1"/>
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</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf38 </ci>
      <ci> pHer4_3_Nrg </ci>
      <ci> phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr38 </ci>
      <ci> pHer4_3_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R346" metaid="metaid_0000533" reversible="false">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_3_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf45 </ci>
    <ci> pHer4_3_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R347" metaid="metaid_0000534" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf52 </ci>
<ci> pHer4_3_Nrg </ci>
<ci> Pi3k </ci>
</apply>
<apply>
<times/>
<ci> kr52 </ci>
<ci> pHer4_3_Nrg_Pi3k </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R348" metaid="metaid_0000535" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf59 </ci>
<ci> pHer4_3_Nrg_Pi3k </ci>
<ci> Pip2 </ci>
</apply>
<apply>
<times/>
<ci> kr59 </ci>
<ci> pHer4_3_Nrg_Pi3k_Pip2 </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R349" metaid="metaid_0000536" reversible="false">
<listOfReactants>

<speciesReference species="pHer4_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pHer4_3_Nrg_Pi3k" stoichiometry="1"/>
<speciesReference species="Pip3" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf66 </ci>
    <ci> pHer4_3_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R350" metaid="metaid_0000537" reversible="true">
<listOfReactants>
<speciesReference species="Her4_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> Her4_3_Nrg </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> iHer4_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R351" metaid="metaid_0000538" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer4_3_Nrg" stoichiometry="1"/>

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</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer4_3_Nrg </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer4_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R352" metaid="metaid_0000539" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer4_3_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer4_3_Nrg_phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer4_3_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R353" metaid="metaid_0000540" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg_Pi3k" stoichiometry="1"/>
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer4_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer4_3_Nrg_Pi3k </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer4_3_Nrg_Pi3k </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R354" metaid="metaid_0000541" reversible="true">
<listOfReactants>
<speciesReference species="pHer4_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer4_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf93 </ci>
      <ci> pHer4_3_Nrg_Pi3k_Pip2 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr93 </ci>
      <ci> ipHer4_3_Nrg_Pi3k_Pip2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
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<reaction id="R355" metaid="metaid_0000542" reversible="true">
<listOfReactants>
<speciesReference species="iNrg" stoichiometry="1"/>
<speciesReference species="iHer4_3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf127 </ci>
      <ci> iNrg </ci>
      <ci> iHer4_3 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr1 </ci>
      <ci> iHer4_3_Nrg </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R356" metaid="metaid_0000543" reversible="true">
<listOfReactants>
<speciesReference species="iHer4_Nrg" stoichiometry="1"/>
<speciesReference species="iHer3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf7 </ci>
      <ci> iHer4_Nrg </ci>
      <ci> iHer3 </ci>
    </apply>
    <apply>
      <times/>
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    <ci> kr7 </ci>
    <ci> iHer4_3_Nrg </ci>
   </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R357" metaid="metaid_0000544" reversible="false">
<listOfReactants>
<speciesReference species="ipHer4_Nrg" stoichiometry="1"/>
<speciesReference species="iHer3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf7 </ci>
    <ci> ipHer4_Nrg </ci>
    <ci> iHer3 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R358" metaid="metaid_0000545" reversible="false">
<listOfReactants>
<speciesReference species="iHer4_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf30 </ci>
    <ci> iHer4_3_Nrg </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R359" metaid="metaid_0000546" reversible="true">
<listOfReactants>
<speciesReference species="ipHer4_3_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
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</listOfReactants>
<listOfProducts>
<speciesReference species="ipHer4_3_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf38 </ci>
      <ci> ipHer4_3_Nrg </ci>
      <ci> phtase </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr38 </ci>
      <ci> ipHer4_3_Nrg_phtase </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R360" metaid="metaid_0000547" reversible="false">
<listOfReactants>
<speciesReference species="ipHer4_3_Nrg_phtase" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="iHer4_3_Nrg" stoichiometry="1"/>
<speciesReference species="phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf45 </ci>
    <ci> ipHer4_3_Nrg_phtase </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
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<listOfReactants>
<speciesReference species="ipHer4_3_Nrg" stoichiometry="1"/>
<speciesReference species="Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
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<speciesReference species="ipHer4_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
 <apply>
  <minus/>
  <apply>
   <times/>
   <ci> kf52 </ci>
   <ci> ipHer4_3_Nrg </ci>
   <ci> Pi3k </ci>
  </apply>
  <apply>
   <times/>
   <ci> kr52 </ci>
   <ci> ipHer4_3_Nrg_Pi3k </ci>
  </apply>
 </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R362" metaid="metaid_0000549" reversible="false">
<listOfReactants>
<speciesReference species="iHer4_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
 <apply>
  <times/>
  <ci> kf192 </ci>
  <ci> iHer4_3_Nrg </ci>
 </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R363" metaid="metaid_0000550" reversible="false">
<listOfReactants>
<speciesReference species="ipHer4_3_Nrg" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer4_3_Nrg" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">

<apply>
<times/>
<ci> kf192 </ci>
<ci> ipHer4_3_Nrg </ci>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R364" metaid="metaid_0000551" reversible="false">
<listOfReactants>
<speciesReference species="ipHer4_3_Nrg_phtase"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer4_3_Nrg_phtase" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<times/>
<ci> kf192 </ci>
<ci> ipHer4_3_Nrg_phtase </ci>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R365" metaid="metaid_0000552" reversible="false">
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<speciesReference species="ipHer4_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="dpHer4_3_Nrg_Pi3k" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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<times/>
<ci> kf192 </ci>
<ci> ipHer4_3_Nrg_Pi3k </ci>
</apply>
</math>
</kineticLaw>
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<reaction id="R366" metaid="metaid_0000553" reversible="false">
<listOfReactants>
<speciesReference species="ipHer4_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>

<speciesReference species="dpHer4_3_Nrg_Pi3k_Pip2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf192 </ci>
    <ci> ipHer4_3_Nrg_Pi3k_Pip2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R367" metaid="metaid_0000554" reversible="true">
<listOfReactants>
<speciesReference species="Her4" stoichiometry="2"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_4" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> Her4 </ci>
      <ci> Her4 </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> Her4_4 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R368" metaid="metaid_0000555" reversible="true">
<listOfReactants>
<speciesReference species="Her4" stoichiometry="1"/>
<speciesReference species="Her3" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_3" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>

<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf12 </ci>
<ci> Her4 </ci>
<ci> Her3 </ci>
</apply>
<apply>
<times/>
<ci> kr12 </ci>
<ci> Her4_3 </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R369" metaid="metaid_0000556" reversible="true">
<listOfReactants>
<speciesReference species="Her4" stoichiometry="1"/>
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</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<minus/>
<apply>
<times/>
<ci> kf12 </ci>
<ci> Her4 </ci>
<ci> Her2 </ci>
</apply>
<apply>
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<ci> Her4_2 </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R370" metaid="metaid_0000557" reversible="true">
<listOfReactants>

<speciesReference species="Her4" stoichiometry="1"/>
<speciesReference species="Egfr" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="Her4_1" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf12 </ci>
      <ci> Her4 </ci>
      <ci> Egfr </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr12 </ci>
      <ci> Her4_1 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R371" metaid="metaid_0000558" reversible="true">
<listOfReactants>
<speciesReference species="Her4" stoichiometry="1"/>
<speciesReference species="JAK" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="RJ" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf1_jak </ci>
      <ci> Her4 </ci>
      <ci> JAK </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr1_jak </ci>
      <ci> RJ </ci>

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    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R372" metaid="metaid_0000559" reversible="true">
<listOfReactants>
<speciesReference species="Nrg" stoichiometry="1"/>
<speciesReference species="RJ" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="IFNRJ" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf2_jak </ci>
      <ci> Nrg </ci>
      <ci> RJ </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr2_jak </ci>
      <ci> IFNRJ </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R373" metaid="metaid_0000560" reversible="true">
<listOfReactants>
<speciesReference species="IFNRJ" stoichiometry="2"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="IFNRJ2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf3_jak </ci>
      <ci> IFNRJ </ci>
```

```
      <ci> IFNRJ </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr3_jak </ci>
      <ci> IFNRJ2 </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R374" metaid="metaid_0000561" reversible="false">
<listOfReactants>
<speciesReference species="IFNRJ2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pIFNRJ2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <times/>
    <ci> kf4_jak </ci>
    <ci> IFNRJ2 </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R375" metaid="metaid_0000562" reversible="true">
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<speciesReference species="pIFNRJ2" stoichiometry="1"/>
<speciesReference species="STATc" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pIFNRJ2_STATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf5_jak </ci>
      <ci> pIFNRJ2 </ci>
      <ci> STATc </ci>
    </apply>
    <apply>
```

```
      <times/>
      <ci> kr5_jak </ci>
      <ci> pIFNRJ2_STATc </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R376" metaid="metaid_0000563" reversible="false">
<listOfReactants>
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</listOfReactants>
<listOfProducts>
<speciesReference species="pIFNRJ2" stoichiometry="1"/>
<speciesReference species="pSTATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf6_jak </ci>
    <ci> pIFNRJ2_STATc </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R377" metaid="metaid_0000564" reversible="true">
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<speciesReference species="pSTATc" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pIFNRJ2_pSTATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf7_jak </ci>
      <ci> pIFNRJ2 </ci>
      <ci> pSTATc </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7_jak </ci>
```

```
    <ci> pIFNRJ2_pSTATc </ci>
   </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R378" metaid="metaid_0000565" reversible="true">
<listOfReactants>
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</listOfReactants>
<listOfProducts>
<speciesReference species="pSTATc_pSTATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
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    <apply>
      <times/>
      <ci> kf8_jak </ci>
      <ci> pSTATc </ci>
      <ci> pSTATc </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr8_jak </ci>
      <ci> pSTATc_pSTATc </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R379" metaid="metaid_0000566" reversible="true">
<listOfReactants>
<speciesReference species="pIFNRJ2" stoichiometry="1"/>
<speciesReference species="SHP" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pIFNRJ2_SHP" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf9_jak </ci>
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<ci> pIFNRJ2 </ci>
<ci> SHP </ci>
</apply>
<apply>
<times/>
<ci> kr9_jak </ci>
<ci> pIFNRJ2_SHP </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R380" metaid="metaid_0000567" reversible="false">
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<speciesReference species="pIFNRJ2_SHP" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="SHP" stoichiometry="1"/>
<speciesReference species="IFNRJ2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<times/>
<ci> kf10_jak </ci>
<ci> pIFNRJ2_SHP </ci>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R381" metaid="metaid_0000568" reversible="true">
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<speciesReference species="PPX" stoichiometry="1"/>
<speciesReference species="pSTATc" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="PPX_pSTATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
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<apply>
<times/>
<ci> kf11_jak </ci>
<ci> PPX </ci>
<ci> pSTATc </ci>

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    </apply>
    <apply>
      <times/>
      <ci> kr11_jak </ci>
      <ci> PPX_pSTATc </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R382" metaid="metaid_0000569" reversible="false">
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<listOfProducts>
<speciesReference species="PPX" stoichiometry="1"/>
<speciesReference species="STATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <ci> kf12_jak </ci>
    <ci> PPX_pSTATc </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R383" metaid="metaid_0000570" reversible="true">
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<speciesReference species="PPX" stoichiometry="1"/>
<speciesReference species="pSTATc_pSTATc" stoichiometry="1"/>
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<listOfProducts>
<speciesReference species="PPX_pSTATc_pSTATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
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      <ci> kf11_jak </ci>
      <ci> PPX </ci>
      <ci> pSTATc_pSTATc </ci>
    </apply>
    <apply>
```

```
      <times/>
      <ci> kr11_jak </ci>
      <ci> PPX_pSTATc_pSTATc </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R384" metaid="metaid_0000571" reversible="false">
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<listOfProducts>
<speciesReference species="PPX" stoichiometry="1"/>
<speciesReference species="pSTATc_STATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <ci> kf12_jak </ci>
    <ci> PPX_pSTATc_pSTATc </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R385" metaid="metaid_0000572" reversible="true">
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<speciesReference species="pSTATc" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="pSTATc_STATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf13_jak </ci>
      <ci> STATc </ci>
      <ci> pSTATc </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr13_jak </ci>
```

```
      <ci> pSTATc_STATc </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R386" metaid="metaid_0000573" reversible="false">
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<listOfProducts>
<speciesReference species="pSTATn_pSTATn" stoichiometry="1"/>
</listOfProducts>
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  </apply>
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<reaction id="R387" metaid="metaid_0000574" reversible="true">
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</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf7_jak </ci>
      <ci> pSTATn </ci>
      <ci> pSTATn </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr7_jak </ci>
      <ci> pSTATn_pSTATn </ci>
    </apply>
  </apply>
</math>
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</kineticLaw>
</reaction>
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<listOfProducts>
<speciesReference species="PPN_pSTATn" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <apply>
      <times/>
      <ci> kf15_jak </ci>
      <ci> PPN </ci>
      <ci> pSTATn </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr15_jak </ci>
      <ci> PPN_pSTATn </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R389" metaid="metaid_0000576" reversible="false">
<listOfReactants>
<speciesReference species="PPN_pSTATn" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="PPN" stoichiometry="1"/>
<speciesReference species="STATn" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf16_jak </ci>
    <ci> PPN_pSTATn </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
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<reaction id="R390" metaid="metaid_0000577" reversible="true">
<listOfReactants>
<speciesReference species="PPN" stoichiometry="1"/>
<speciesReference species="pSTATn_pSTATn" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="PPN_pSTATn_pSTATn" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf15_jak </ci>
      <ci> PPN </ci>
      <ci> pSTATn_pSTATn </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr15_jak </ci>
      <ci> PPN_pSTATn_pSTATn </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R391" metaid="metaid_0000578" reversible="false">
<listOfReactants>
<speciesReference species="PPN_pSTATn_pSTATn" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="PPN" stoichiometry="1"/>
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</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <times/>
    <ci> kf16_jak </ci>
    <ci> PPN_pSTATn_pSTATn </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R392" metaid="metaid_0000579" reversible="true">
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<speciesReference species="pSTATn" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="STATn_pSTATn" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <minus/>
    <apply>
      <times/>
      <ci> kf13_jak </ci>
      <ci> STATn </ci>
      <ci> pSTATn </ci>
    </apply>
    <apply>
      <times/>
      <ci> kr13_jak </ci>
      <ci> STATn_pSTATn </ci>
    </apply>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R393" metaid="metaid_0000580" reversible="false">
<listOfReactants>
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</listOfReactants>
<listOfProducts>
<speciesReference species="STATc" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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    <ci> STATn </ci>
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</kineticLaw>
</reaction>
<reaction id="R394" metaid="metaid_0000581" reversible="false">
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<listOfProducts>

<speciesReference species="mRNA_cyt" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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  <ci> mRNA_nuc </ci>
 </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R395" metaid="metaid_0000582" reversible="true">
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<speciesReference species="pIFNRJ2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="SOCS_pIFNRJ2" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
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  <apply>
   <times/>
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   <ci> SOCS </ci>
   <ci> pIFNRJ2 </ci>
  </apply>
  <apply>
   <times/>
   <ci> kr21_jak </ci>
   <ci> SOCS_pIFNRJ2 </ci>
  </apply>
 </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R396" metaid="metaid_0000583" reversible="true">
<listOfReactants>
<speciesReference species="STATc" stoichiometry="1"/>
<speciesReference species="SOCS_pIFNRJ2" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="SOCS_pIFNRJ2_STAT" stoichiometry="1"/>
</listOfProducts>

<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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<times/>
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<ci> STATc </ci>
<ci> SOCS_pIFNRJ2 </ci>
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<ci> SOCS_pIFNRJ2_STAT </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R397" metaid="metaid_0000584" reversible="true">
<listOfReactants>
<speciesReference species="SHP" stoichiometry="1"/>
<speciesReference species="SOCS_pIFNRJ2_STAT" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="SOCS_pIFNRJ2_STAT_SHP" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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<apply>
<times/>
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<ci> SHP </ci>
<ci> SOCS_pIFNRJ2_STAT </ci>
</apply>
<apply>
<times/>
<ci> kr9_jak </ci>
<ci> SOCS_pIFNRJ2_STAT_SHP </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R398" metaid="metaid_0000585" reversible="false">

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</listOfReactants>
<listOfProducts>
<speciesReference species="SHP" stoichiometry="1"/>
<speciesReference species="STATc" stoichiometry="1"/>
<speciesReference species="IFNRJ2" stoichiometry="1"/>
<speciesReference species="SOCS" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <apply>
    <times/>
    <ci> kf10_jak </ci>
    <ci> SOCS_pIFNRJ2_STAT_SHP </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R399" metaid="metaid_0000586" reversible="false">
<listOfReactants>
<speciesReference species="SOCS_pIFNRJ2_STAT_SHP" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="SOCS" stoichiometry="1"/>
<speciesReference species="pIFNRJ2_STATc_SHP" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <times/>
    <ci> kf23_jak </ci>
    <ci> SOCS_pIFNRJ2_STAT_SHP </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R400" metaid="metaid_0000587" reversible="false">

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<speciesReference species="mRNA_nuc" stoichiometry="1"/>
</listOfProducts>
<listOfModifiers>
<modifierSpeciesReference species="pSTATn_pSTATn"/>
</listOfModifiers>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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<apply>
<divide/>
<apply>
<times/>
<ci> k18a_jak </ci>
<ci> pSTATn_pSTATn </ci>
</apply>
<apply>
<plus/>
<ci> k18b_jak </ci>
<ci> pSTATn_pSTATn </ci>
</apply>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R401" metaid="metaid_0000588" reversible="false">
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</listOfReactants>
<listOfProducts>
<speciesReference species="mRNA_cyt" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<times/>
<apply>
<minus/>
<ci> kf22_jak </ci>
</apply>
<ci> mRNA_cyt </ci>
</apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R402" metaid="metaid_0000589" reversible="false">
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<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
<apply>
<times/>

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    <apply>
      <minus/>
      <ci> kf23_jak </ci>
    </apply>
    <ci> SOCS </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
<reaction id="R403" metaid="metaid_0000590" reversible="false">
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<speciesReference species="mRNA_cyt" stoichiometry="1"/>
</listOfReactants>
<listOfProducts>
<speciesReference species="SOCS" stoichiometry="1"/>
</listOfProducts>
<kineticLaw>
<math xmlns="http://www.w3.org/1998/Math/MathML">
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    <ci> mRNA_cyt </ci>
  </apply>
</math>
</kineticLaw>
</reaction>
</listOfReactions>
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