WikiPathways RDF Interactions

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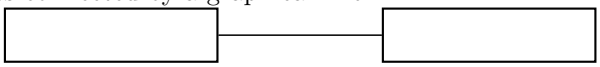
1 External links

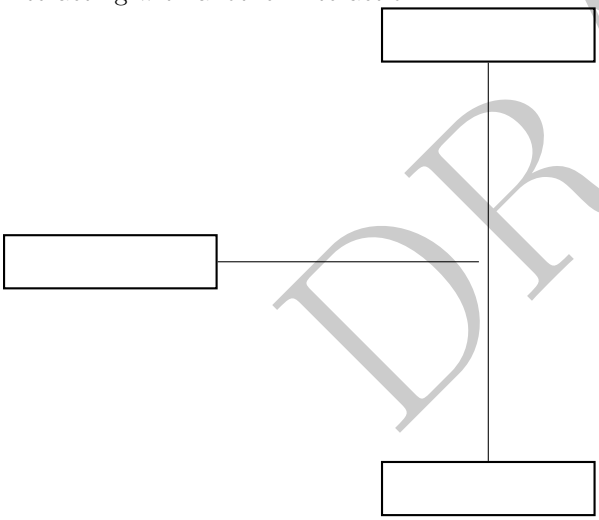
- pathway-template.svg `https://github.com/wikipathways/pathvisio.js/blob/master/src/views/pathway-template.svg`
- Formal mim specs: `http://discover.nci.nih.gov/mim/formal_mim_spec.pdf`

2 Interactions

In WikiPathways/Gpml there are basically two types of interaction templates. The first being two DataNodes connected by a graphical line.



The second being at least three DataNodes interacting with each other, where at least one interaction is interacting with another interaction.



There are 21 different interaction types being recognized. These are Line, Arrow, TBar, Receptor, LigandSquare, ReceptorBound, MimNecessaryStimulation, MimBinding, MimConverstion, MimStimulation, MimModification, MimCatalysis, MimInhibition, MimCleavage, MimiCovalentBond, MimBranchingLeft, MimBranchingRight, MimTranscriptionTranslation, MimGap.

So called markers on the lines indicating an interaction gives both directionality and the type of interaction.

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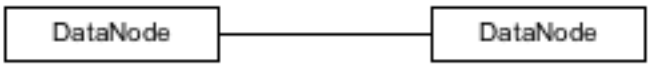
2.1 Line

2.1.1 Pathway snippet

Title: Line



2.1.2 Description

2.1.3 GPML

Listing 2: Line

```
<DataNode TextLabel="DataNode" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="DataNode" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="id1f54355d">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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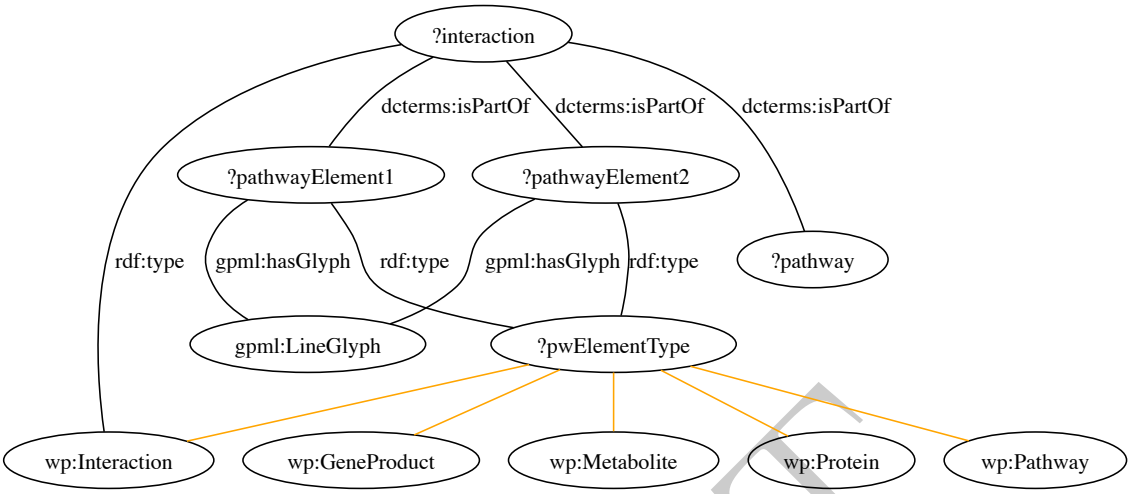
2.1.4 RDFSchema



2.1.5 RDF snippet (turtle)

Listing 3: Line

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.1.6 Example SPARQL query

Listing 4: Line

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
```

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```
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LineGlyph .
}
```

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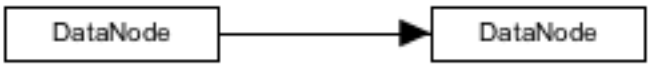
2.2 Arrow

2.2.1 Pathway snippet

Title: Arrow



2.2.2 Description

2.2.3 GPML

Listing 6: Arrow

```
<DataNode TextLabel="DataNode" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="DataNode" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="id94e6d1a4">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="Arrow"
        />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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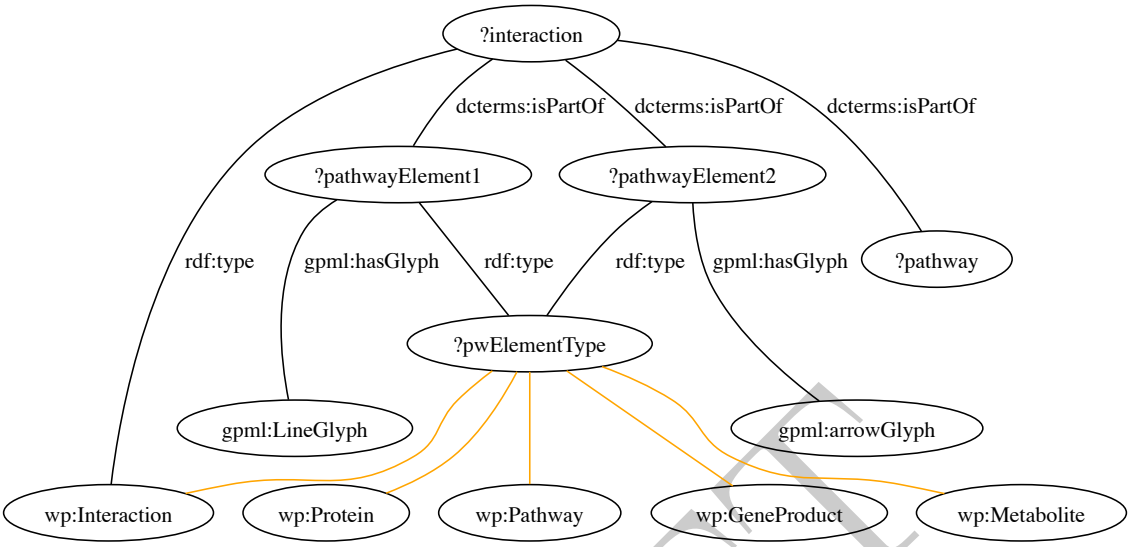
2.2.4 RDFSchema



2.2.5 RDF snippet (turtle)

Listing 7: Arrow

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:ArrowGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.2.6 Example SPARQL query

Listing 8: Arrow

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:ArrowGlyph .
}
```

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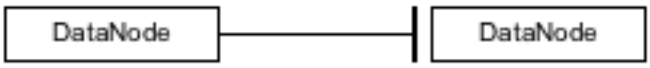
2.3 TBar

2.3.1 Pathway snippet

Title: TBar



2.3.2 Description

2.3.3 GPML

Listing 10: TBar

```
<DataNode TextLabel="DataNode" GraphId="ceece">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="DataNode" GraphId="fbc03">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="id2acfada8">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="TBar" /
        >
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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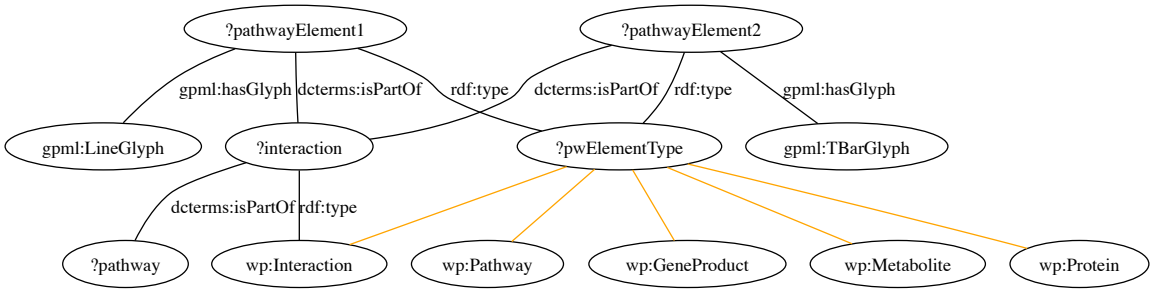
2.3.4 RDFSchema



2.3.5 RDF snippet (turtle)

Listing 11: TBar

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:TBarGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.3.6 Example SPARQL query

Listing 12: TBar

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:TBarGlyph .
}
```

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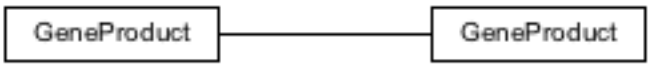
2.4 Receptor

2.4.1 Pathway snippet

Title: Receptor



2.4.2 Description

2.4.3 GPML

Listing 14: Receptor

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="
        Receptor" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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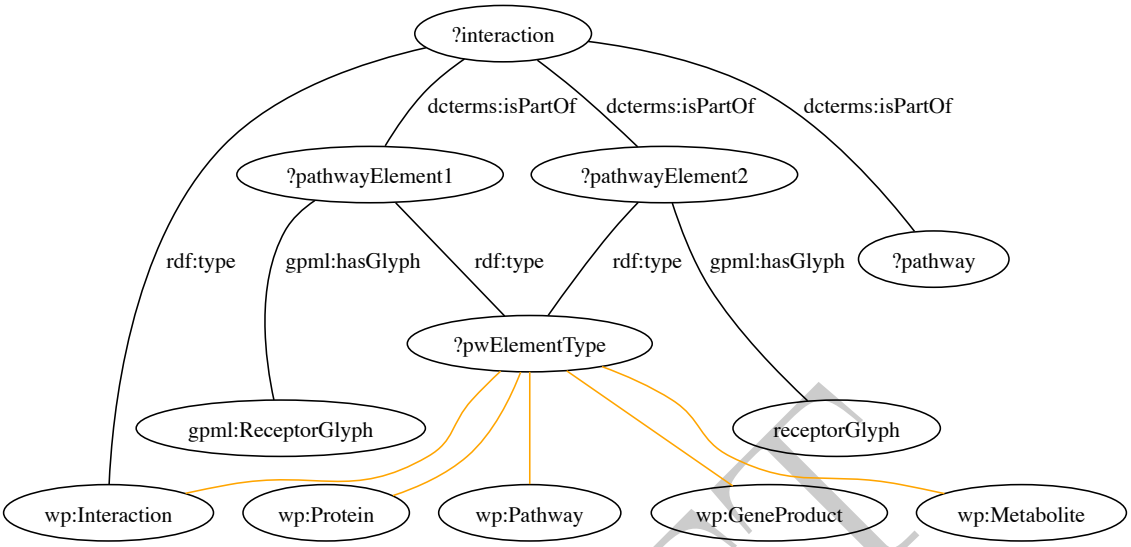
2.4.4 RDFSchema



2.4.5 RDF snippet (turtle)

Listing 15: Receptor

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:ReceptorGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.4.6 Example SPARQL query

Listing 16: Receptor

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LineGlyph .
}
```

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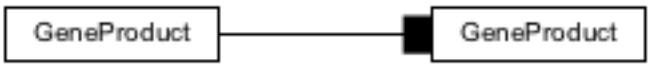
2.5 LigandSquare

2.5.1 Pathway snippet

Title: Ligand Square



2.5.2 Description

2.5.3 GPML

Listing 18: LigandSquare

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="
        LigandSquare" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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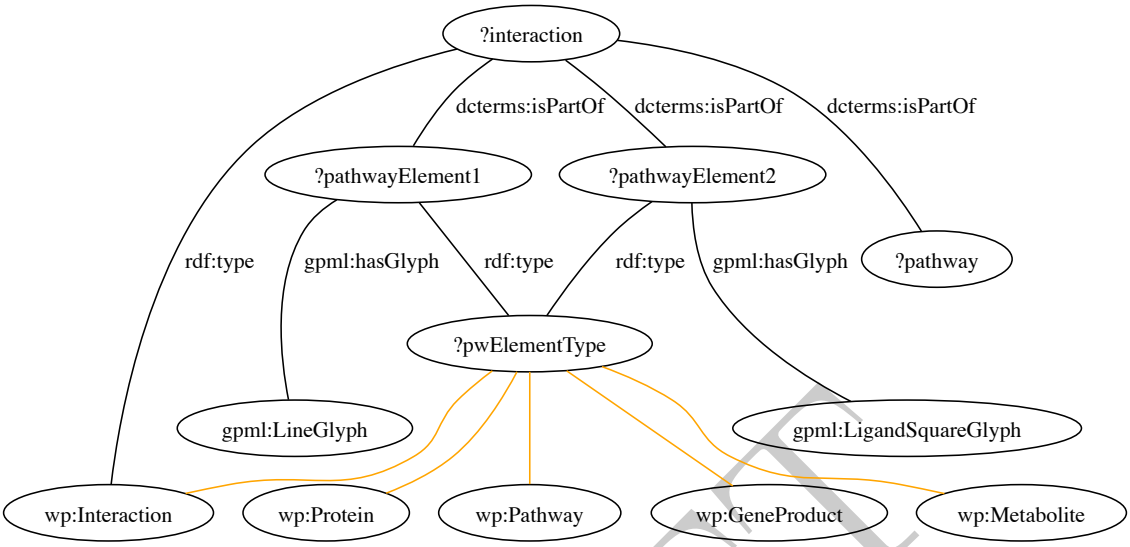
2.5.4 RDFSchema



2.5.5 RDF snippet (turtle)

Listing 19: LigandSquare

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LigandSquareGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.5.6 Example SPARQL query

Listing 20: LigandSquare

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:ligandSquareGlyph .
}
```

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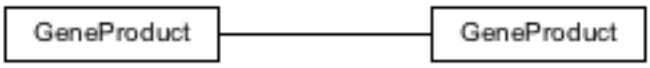
2.6 ReceptorSquare

2.6.1 Pathway snippet

Title: Receptor Square



2.6.2 Description

2.6.3 GPML

Listing 22: ReceptorSquare

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="
        ReceptorSquare" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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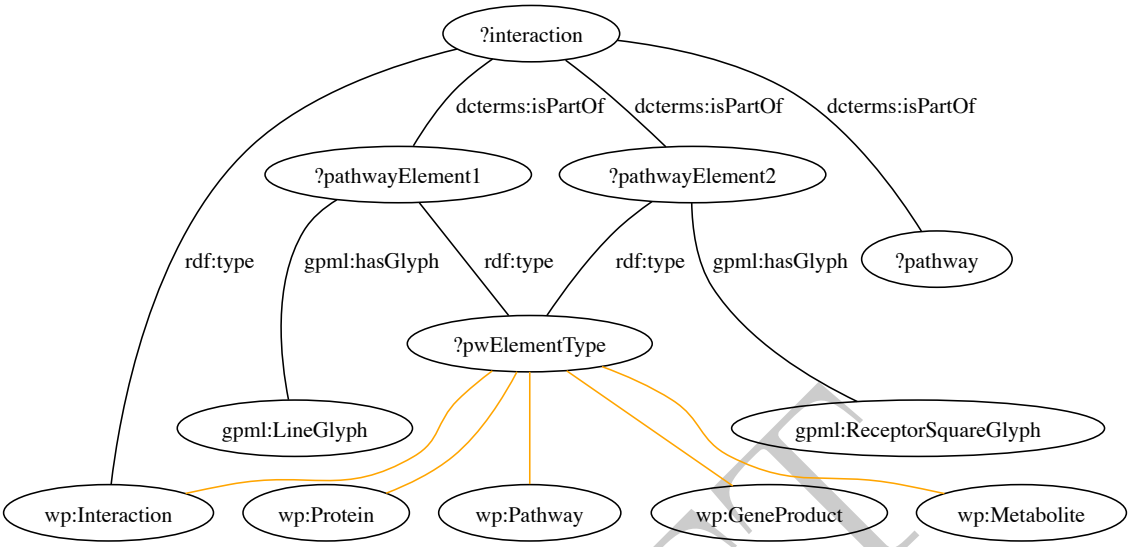
2.6.4 RDFSchema



2.6.5 RDF snippet (turtle)

Listing 23: ReceptorSquare

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:ReceptorSquareGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.6.6 Example SPARQL query

Listing 24: ReceptorSquare

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:ReceptorSquareGlyph .
}
```

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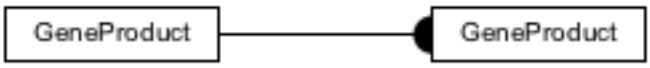
2.7 LigandRound

2.7.1 Pathway snippet

Title: Ligand Round



2.7.2 Description

2.7.3 GPML

Listing 26: LigandRound

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="ide5adf9e2">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="
        LigandRound" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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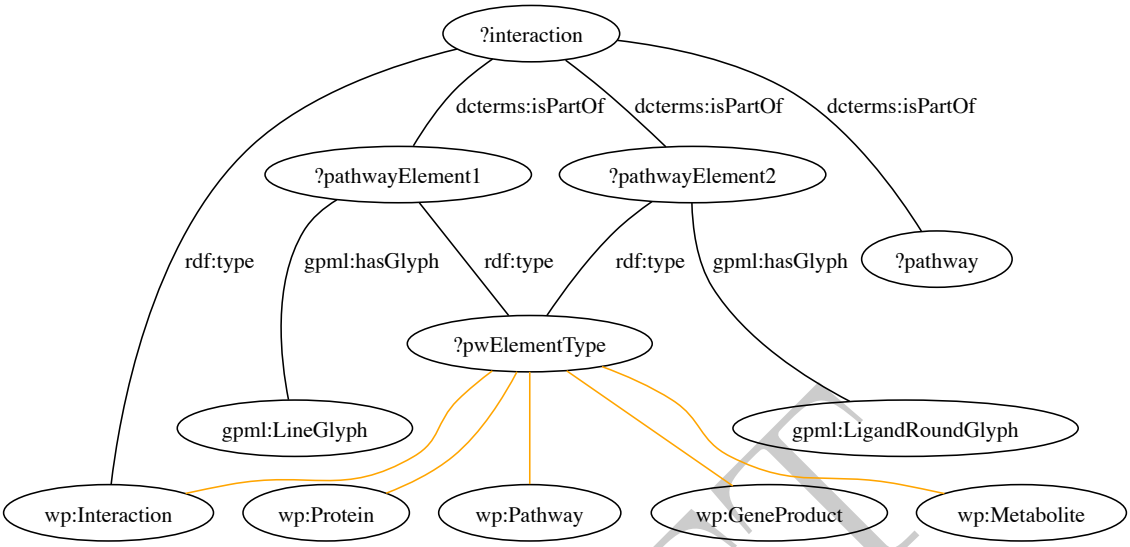
2.7.4 RDFSchema



2.7.5 RDF snippet (turtle)

Listing 27: LigandRound

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LigandRoundGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.7.6 Example SPARQL query

Listing 28: LigandRound

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LigandRoundGlyph .
}
```

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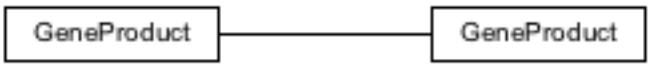
2.8 ReceptorBound

2.8.1 Pathway snippet

Title: Receptor Bound



2.8.2 Description

2.8.3 GPML

Listing 30: ReceptorBound

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="ide5adf9e2">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="
        ReceptorRound" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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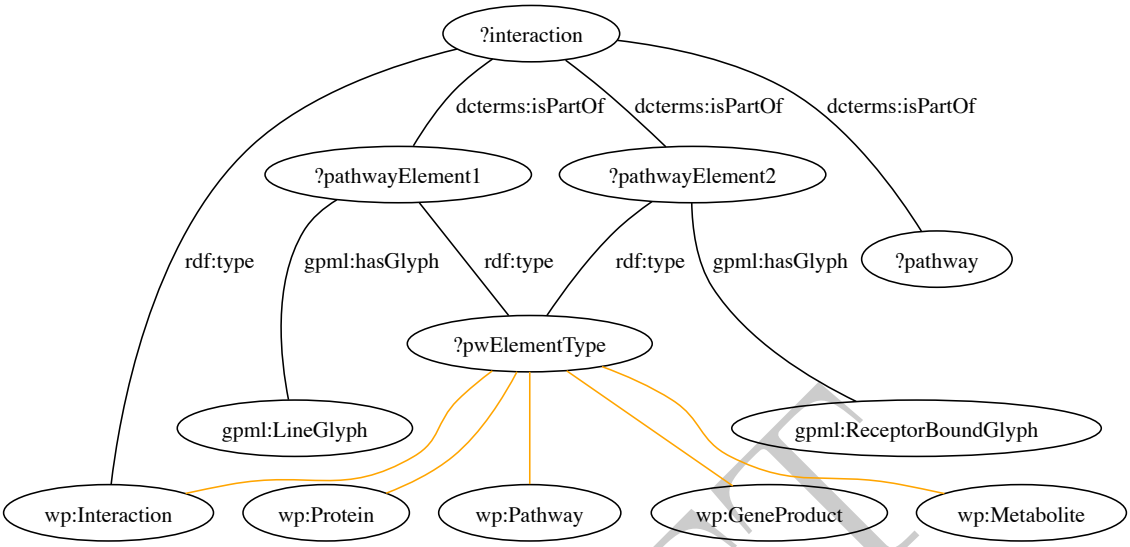
2.8.4 RDFSchema



2.8.5 RDF snippet (turtle)

Listing 31: ReceptorBound

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:ReceptorBoundGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.8.6 Example SPARQL query

Listing 32: ReceptorBound

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:ReceptorBoundGlyph .
}
```

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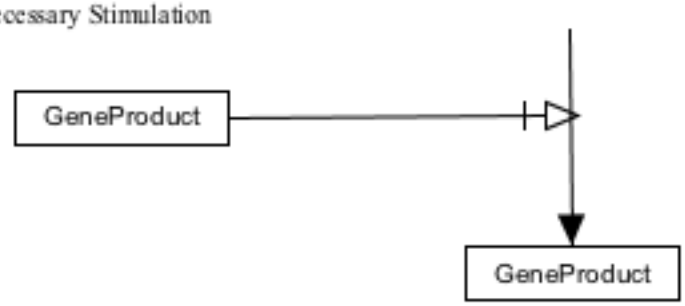
2.9 MimNecessaryStimulation

2.9.1 Pathway snippet

Title: Necessary Stimulation



2.9.2 Description

An interaction where the controller entity is necessary for the controlled interaction to proceed.

2.9.3 GPML

Listing 34: MimNecessaryStimulation

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="257.07899881996894" CenterY="107.10559244780143" Width="80.0"
      Height="20.0" ZOrder="32768" FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="idbd55299a">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="256.44825956186264" Y="48.647555704687065" GraphRef="f8e7c" RelX="0.0"
        RelY="0.0" ArrowHead="mim-necessary-stimulation" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="256.02776672312507" Y="16.34219787594415" />
    <Point X="257.07899881996894" Y="97.10559244780143" GraphRef="fbc03" RelX="0.0" RelY
        ="-1.0" ArrowHead="Arrow" />
    <Anchor Position="0.4" Shape="None" GraphId="f8e7c" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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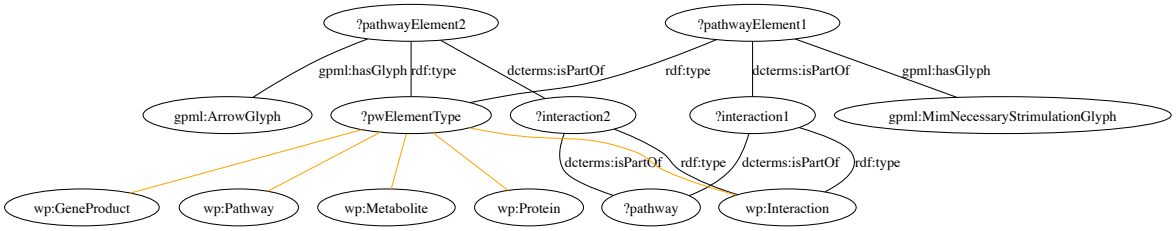
2.9.4 RDFSchema



2.9.5 RDF snippet (turtle)

Listing 35: MimNecessaryStimulation

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction1 rdf:type wp:Interaction .
?interaction1 dcterms:isPartOf ?pathway .
?interaction2 rdf:type wp:Interaction .
?interaction2 dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction1 .
?interaction2 dcterms:isPartOf ?interaction1 .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:MimNecessaryStrimulationGlyph .
?pwElement2 gpml:hasGlyph gpml:ArrowGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

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2.9.6 Example SPARQL query

Listing 36: MimNecessaryStimulation

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction1 rdf:type wp:Interaction .
       ?interaction1 dcterms:isPartOf ?pathway .
       ?interaction2 rdf:type wp:Interaction .
       ?interaction2 dcterms:isPartOf ?pathway .
```

```
        ?pwElement1 dcterms:isPartOf ?interaction1 .
        ?interaction2 dcterms:isPartOf ?interaction1 .
        ?interaction2 gpml:hasGlyph gpml:MinNecessaryStimulationGlyph .
        ?pwElement2 dcterms:isPartOf ?interaction2 .
        ?interaction2 gpml:hasGlyph gpml:ArrowGlyph .
}
```

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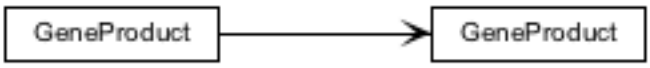
2.10 MimBinding

2.10.1 Pathway snippet

Title: Binding



2.10.2 Description

A complex physical entity created as a result of a binding interaction between two entities (e.g. a protein complex).

Current representation doesnt́ comply with the MIM Binding description see `http://discover.nci.nih.gov/mim/formal_mim_spec.pdf`

2.10.3 GPML

Listing 38: MimBinding

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        binding" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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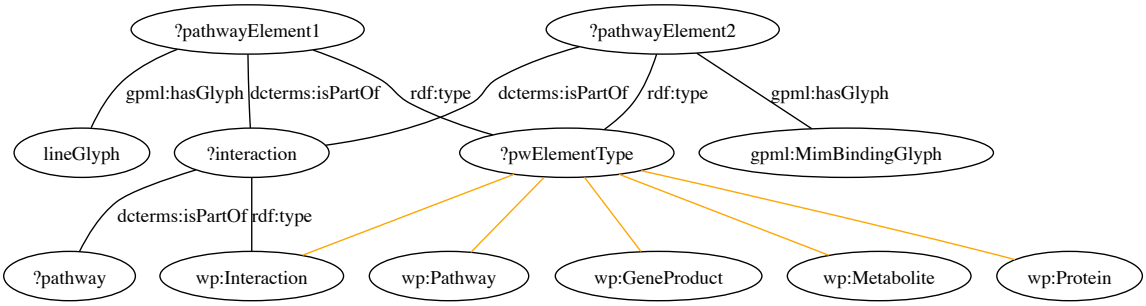
2.10.4 RDFSchema



2.10.5 RDF snippet (turtle)

Listing 39: MimBinding

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasMarker gpml:LineMarker .
?pwElement2 gpml:hasMarker gpml:MimBindingMarker .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

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2.10.6 Example SPARQL query

Listing 40: MimBinding

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
```

```
        ?pwElement2 dcterms:isPartOf ?interaction .
        ?pwElement2 gpml:hasGlyph gpml:MimBindingGlyph .
}
```

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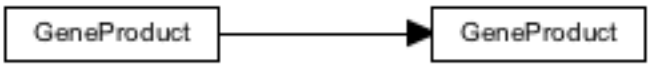
2.11 MimConversion

2.11.1 Pathway snippet

Title: Conversion



2.11.2 Description

An interaction in which one entity is transformed into one or more other entities (e.g. the conversion of ATP to cyclical-AMP).

2.11.3 GPML

Listing 42: MimConversion

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        conversion" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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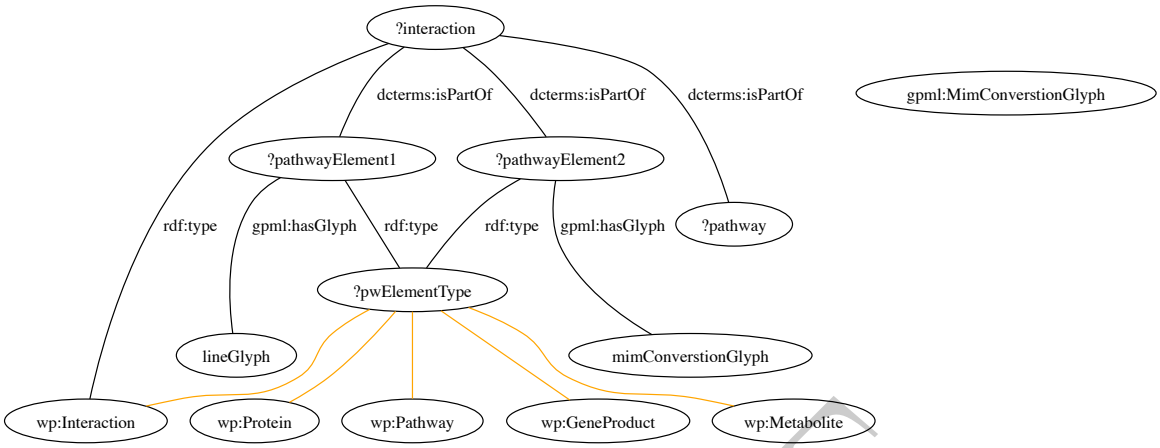
2.11.4 RDFSchema



2.11.5 RDF snippet (turtle)

Listing 43: MimConversion

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.11.6 Example SPARQL query

Listing 44: MimConversion

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .
```

DRAFT

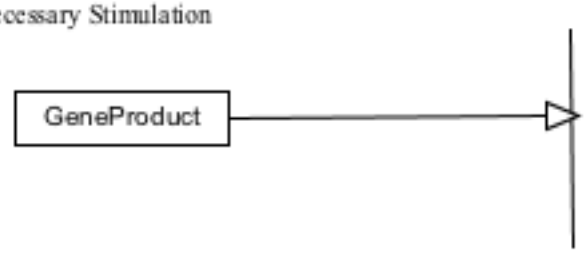
```
SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:MimConversionGlyph .
}
```

DRAFT

2.12 MimStimulation

2.12.1 Pathway snippet

Title: Necessary Stimulation



2.12.2 Description

Enhancement of the velocity or extent of a reaction or contingency by the controller entity.

2.12.3 GPML

Listing 46: MimStimulation

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="idbd55299a">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="256.44825956186264" Y="48.647555704687065" GraphRef="f8e7c" RelX="0.0"
        RelY="0.0" ArrowHead="mim-stimulation" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="256.02776672312507" Y="16.34219787594415" />
    <Point X="257.07899881996894" Y="97.10559244780143" />
    <Anchor Position="0.4" Shape="None" GraphId="f8e7c" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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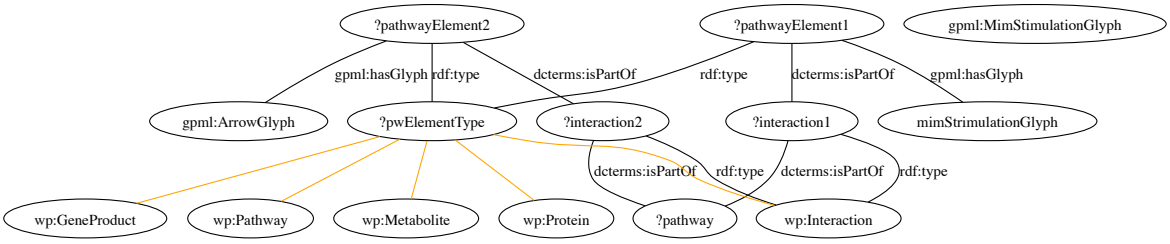
2.12.4 RDFSchema



2.12.5 RDF snippet (turtle)

Listing 47: MimStimulation

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction1 rdf:type wp:Interaction .
?interaction1 dcterms:isPartOf ?pathway .
?interaction2 rdf:type wp:Interaction .
?interaction2 dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction1 .
?interaction2 dcterms:isPartOf ?interaction1 .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:MimStrimulationGlyph .
?pwElement2 gpml:hasGlyph gpml:ArrowGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

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2.12.6 Example SPARQL query

Listing 48: MimStimulation

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction1 rdf:type wp:Interaction .
       ?interaction1 dcterms:isPartOf ?pathway .
       ?interaction2 rdf:type wp:Interaction .
       ?interaction2 dcterms:isPartOf ?pathway .
```

```
        ?pwElement1 dcterms:isPartOf ?interaction1 .
        ?interaction2 dcterms:isPartOf ?interaction1 .
        ?interaction2 gpml:hasGlyph gpml:MinStimulationGlyph .
        ?pwElement2 dcterms:isPartOf ?interaction2 .
        ?interaction2 gpml:hasGlyph gpml:ArrowGlyph .
}
```

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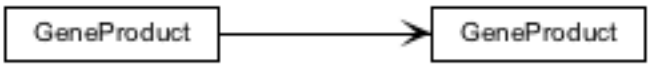
2.13 MimModification

2.13.1 Pathway snippet

Title: Modification



2.13.2 Description

An asymmetric covalent non-reversible binding reaction (e.g. phosphorylation and acetylation) where one of the substrates must be a modifier physical entity.

2.13.3 GPML

Listing 50: MimModification

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        modification" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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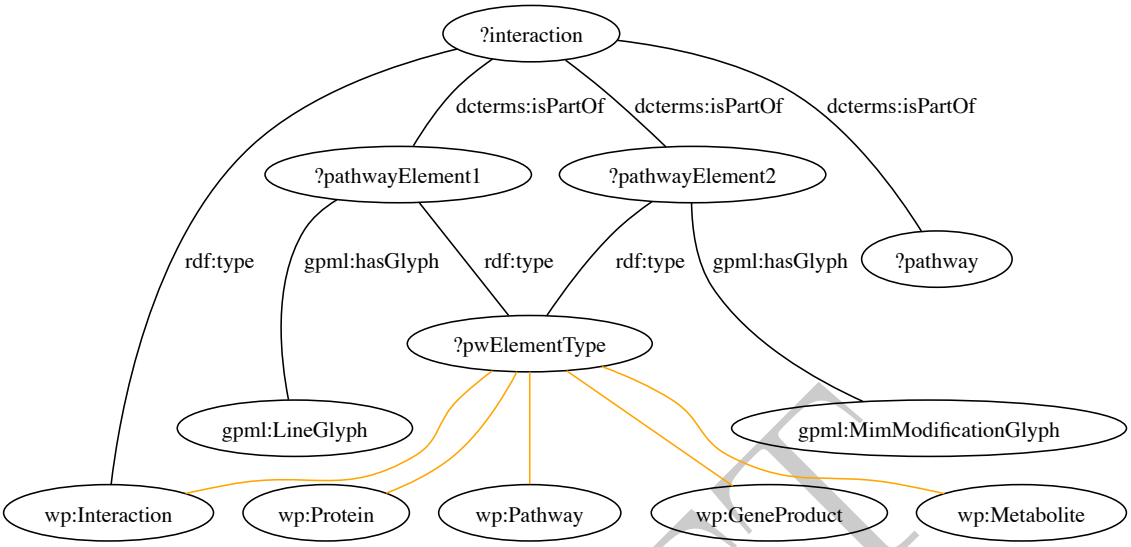
2.13.4 RDFSchema



2.13.5 RDF snippet (turtle)

Listing 51: MimModification

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.13.6 Example SPARQL query

Listing 52: MimModification

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:MimModificationGlyph .
}
```

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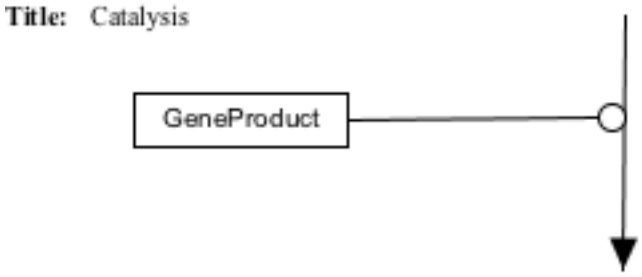
2.14 MimCatalysis

2.14.1 Pathway snippet



2.14.2 Description

An interaction where the controller entity increases the rate of the controlled reaction.

2.14.3 GPML

Listing 54: MimCatalysis

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="id9cfcb804">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="232.11654272434583" Y="48.647555704687065" GraphRef="e00f2" RelX="0.0"
        RelY="0.0" ArrowHead="mim-catalysis" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="232.4223697912057" Y="10.894798583962768" />
    <Point X="231.657802124056" Y="105.2766913857735" ArrowHead="Arrow" />
    <Anchor Position="0.4" Shape="None" GraphId="e00f2" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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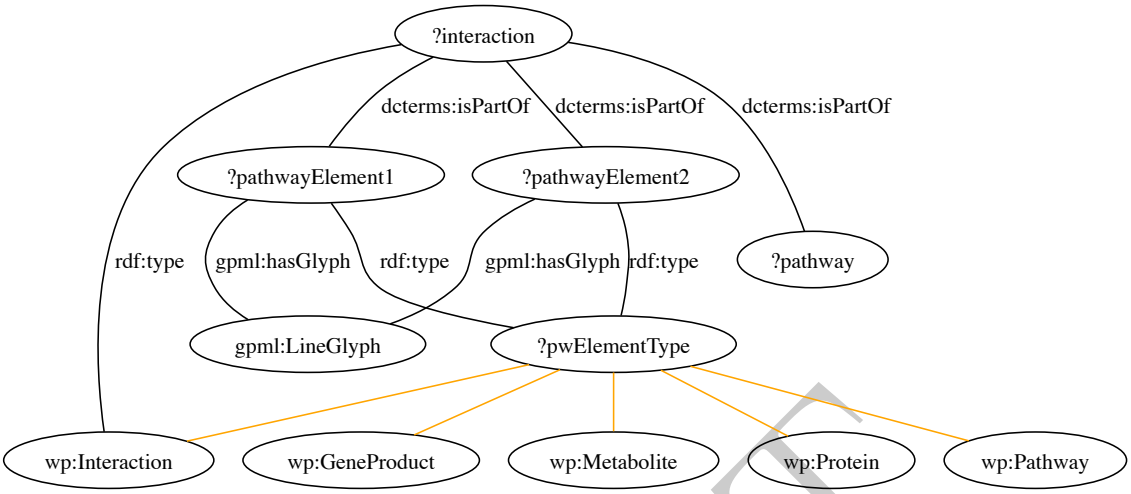
2.14.4 RDFSchema



2.14.5 RDF snippet (turtle)

Listing 55: MimCatalysis

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.14.6 Example SPARQL query

Listing 56: MimCatalysis

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
```

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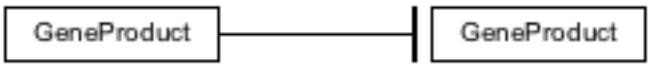
```
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LineGlyph .
}
```

DRAFT

2.15 MimInhibition

2.15.1 Pathway snippet

Title: Inhibition



2.15.2 Description

An interaction where a controller entity causes a decrease in the velocity or extent of controlled reaction or contingency; the probability of the controlled interaction occurring remains greater than 0.

2.15.3 GPML

Listing 58: MimInhibition

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="TBar" /
        >
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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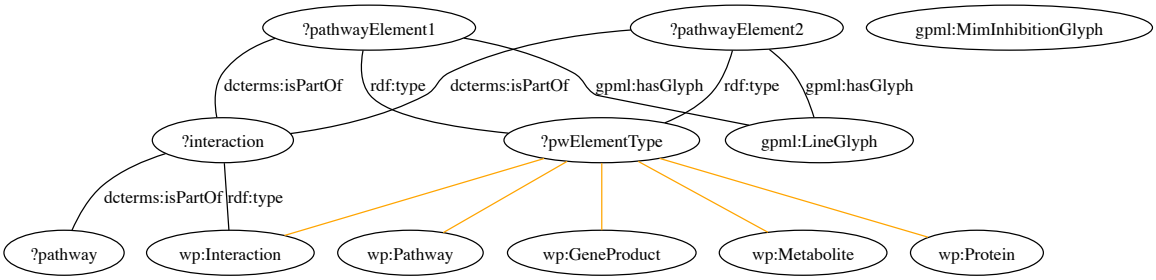
2.15.4 RDFSchema



2.15.5 RDF snippet (turtle)

Listing 59: MimInhibition

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:MimInhibitionGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.15.6 Example SPARQL query

Listing 60: MimInhibition

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
```

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```
        ?pwElement2 gpml:hasGlyph gpml:MimInhibitionGlyph .
}
```

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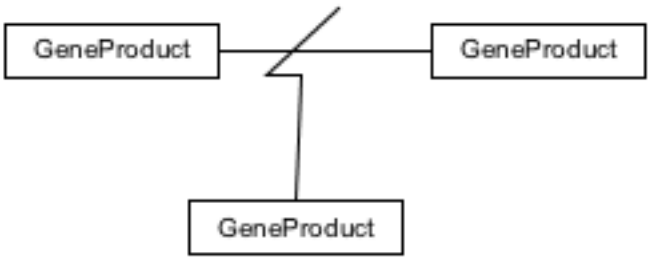
2.16 MimCleavage

2.16.1 Pathway snippet

Title: Cleavage



2.16.2 Description

The scission of a covalent bond or the separation of connections between entity features.

2.16.3 GPML

Listing 62: MimCleavage

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="b4237" Type="GeneProduct">
  <Graphics CenterX="157.06667958546333" CenterY="115.30328501360596" Width="80.0"
      Height="20.0" ZOrder="32768" FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction GraphId="ide9eb61d3">
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        covalent-bond" />
    <Anchor Position="0.4" Shape="None" GraphId="d22c8" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
```

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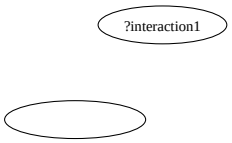
```
    <Point X="157.06667958546333" Y="105.30328501360596" GraphRef="b4237" RelX="0.0"
        RelY="-1.0" />
    <Point X="160.0" Y="49.0" GraphRef="d22c8" RelX="0.0" RelY="0.0" ArrowHead="mim-
        cleavage" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

2.16.4 RDFSchema



2.16.5 RDF snippet (turtle)

Listing 63: MimCleavage

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.16.6 Example SPARQL query

Listing 64: MimCleavage

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
```

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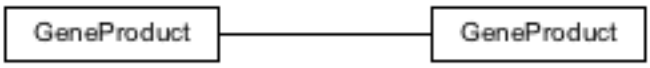
```
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction1 rdf:type wp:Interaction .
       ?interaction1 dcterms:isPartOf ?pathway .
       ?interaction2 rdf:type wp:Interaction .
       ?interaction2 dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction1 .
       ?pwElement2 dcterms:isPartOf ?interaction1 .
       ?pwElement3 dcterms:isPartOf ?interaction2 .
       ?interaction1 dcterms:isPartOf ?interaction2 .
       ?interaction1 gpml:hasGlyph gpml:MimCleavageGlyph .
       pwElement1 gpml:hasGlyph gpml:LineGlyph .
       pwElement2 gpml:hasGlyph gpml:LineGlyph .
       pwElement3 gpml:hasGlyph gpml:LineGlyph .
}
```

DRAFT

2.17 MimCovalentBond

2.17.1 Pathway snippet

Title: Covalent Bond



2.17.2 Description

No description found in the Mim documentation (`http://discover.nci.nih.gov/mim/formal_mim_spec.pdf`)

2.17.3 GPML

Listing 66: MimCovalentBond

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        covalent-bond" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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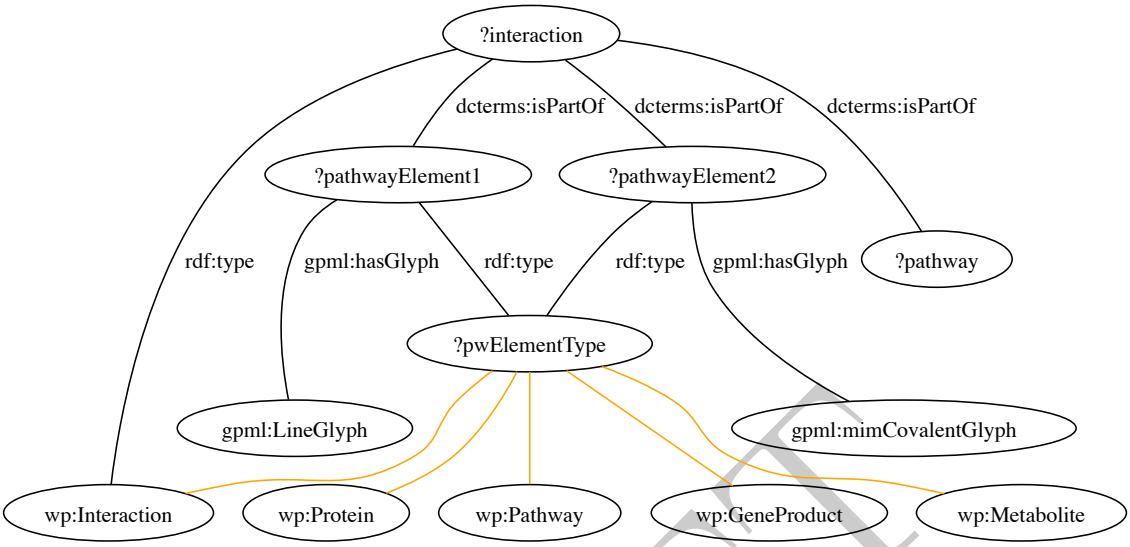
2.17.4 RDFSchema



2.17.5 RDF snippet (turtle)

Listing 67: MimCovalentBond

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:CovalentBondGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.17.6 Example SPARQL query

Listing 68: MimCovalentBond

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

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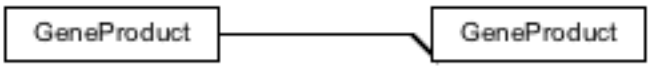
```
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:CovalentBondGlyph .
}
```

DRAFT

2.18 MimBranchingLeft

2.18.1 Pathway snippet

Title: Branching Left



2.18.2 Description

A connection point for two interaction lines [TO DISCUSS]

2.18.3 GPML

Listing 70: MimBranchingLeft

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        branching-left" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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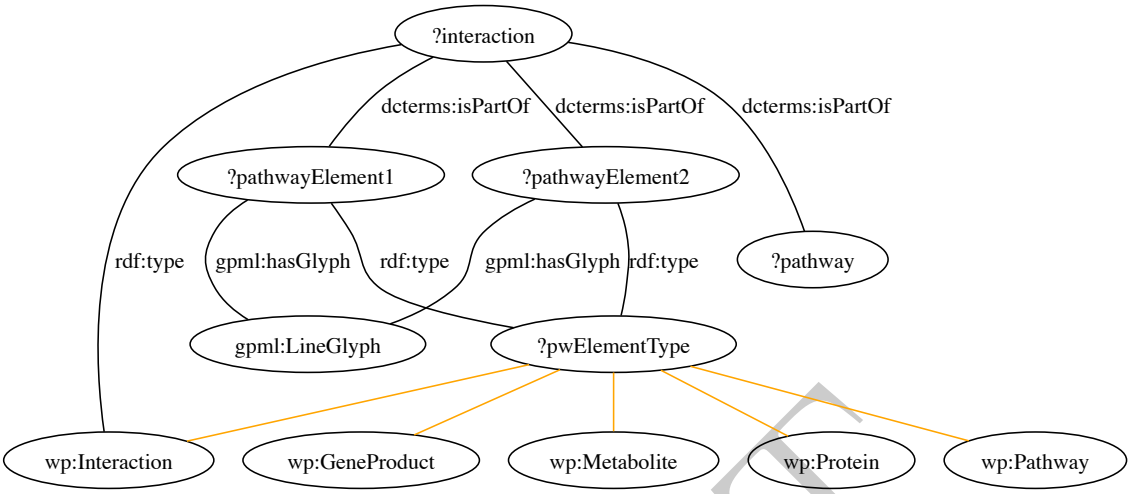
2.18.4 RDFSchema



2.18.5 RDF snippet (turtle)

Listing 71: MimBranchingLeft

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.18.6 Example SPARQL query

Listing 72: MimBranchingLeft

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
```

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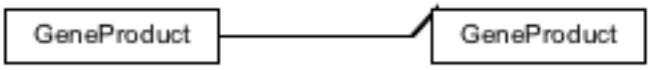
```
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LineGlyph .
}
```

DRAFT

2.19 MimBranchingRight

2.19.1 Pathway snippet

Title: Branching Right



2.19.2 Description

A connection point for two interaction lines [DO DISCUSS]

2.19.3 GPML

Listing 74: MimBranchingRight

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        branching-right" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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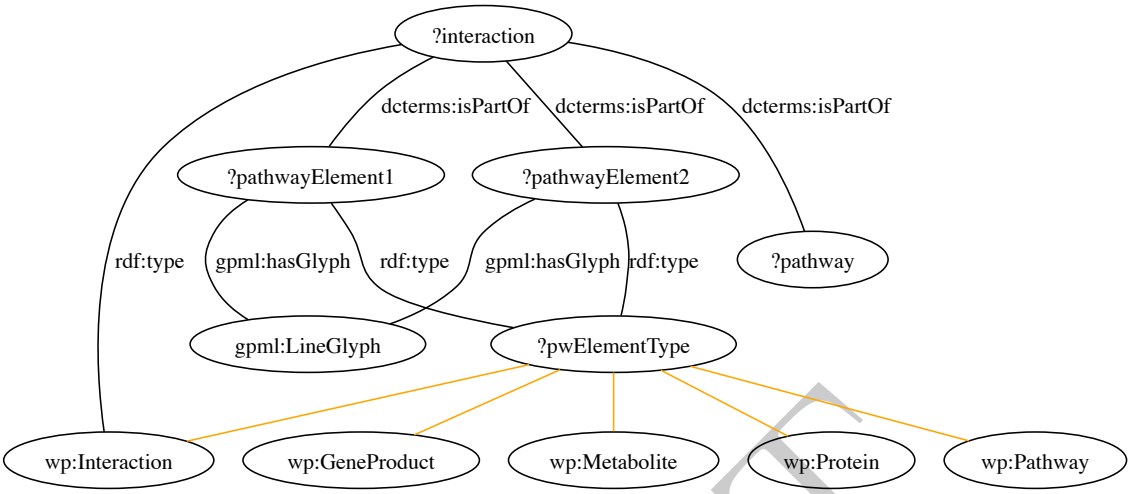
2.19.4 RDFSchema



2.19.5 RDF snippet (turtle)

Listing 75: MimBranchingRight

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.19.6 Example SPARQL query

Listing 76: MimBranchingRight

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
```

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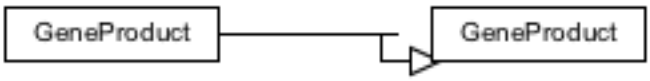
```
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LineGlyph .
}
```

DRAFT

2.20 MimTranscriptionTranslation

2.20.1 Pathway snippet

Title: Transcription Translation



2.20.2 Description

A type of production without loss that involves a template (e.g. the polymerization of a nucleic acid macromolecule from a nucleic acid macromolecule template). The template reaction glyph should be used to describe transcription or translation, but the glyph itself is insufficient to distinguish between the two biological processes.

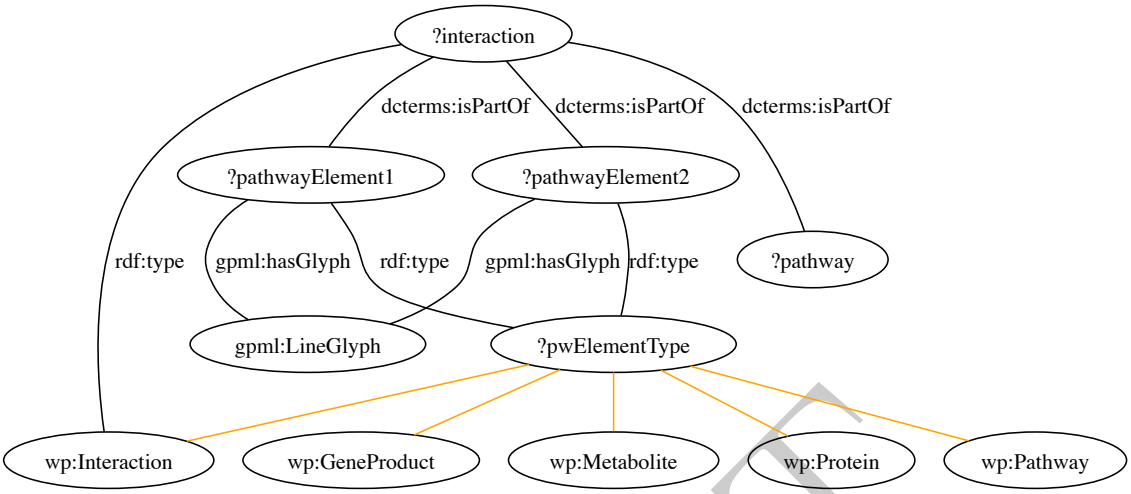
2.20.3 GPML

Listing 78: MimTranscriptionTranslation

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-
        transcription-translation" />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

DRAFT

2.20.4 RDFSchema



2.20.5 RDF snippet (turtle)

Listing 79: MimTranscriptionTranslation

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.20.6 Example SPARQL query

Listing 80: MimTranscriptionTranslation

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
```

DRAFT

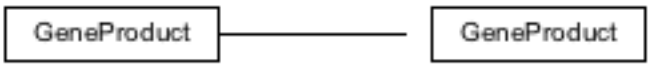
```
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LineGlyph .
}
```

DRAFT

2.21 MimGap

2.21.1 Pathway snippet

Title: Gap



2.21.2 Description

Is not defined in `http://discover.nci.nih.gov/mim/formal_mim_spec.pdf`

2.21.3 GPML

Listing 82: MimGap

```
<DataNode TextLabel="GeneProduct" GraphId="ceece" Type="GeneProduct">
  <Graphics CenterX="88.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<DataNode TextLabel="GeneProduct" GraphId="fbc03" Type="GeneProduct">
  <Graphics CenterX="248.0" CenterY="49.0" Width="80.0" Height="20.0" ZOrder="32768"
      FontSize="10" Valign="Middle" />
  <Xref Database="" ID="" />
</DataNode>
<Interaction>
  <Graphics ZOrder="12288" LineThickness="1.0">
    <Point X="128.0" Y="49.0" GraphRef="ceece" RelX="1.0" RelY="0.0" />
    <Point X="208.0" Y="49.0" GraphRef="fbc03" RelX="-1.0" RelY="0.0" ArrowHead="mim-gap
        " />
  </Graphics>
  <Xref Database="" ID="" />
</Interaction>
```

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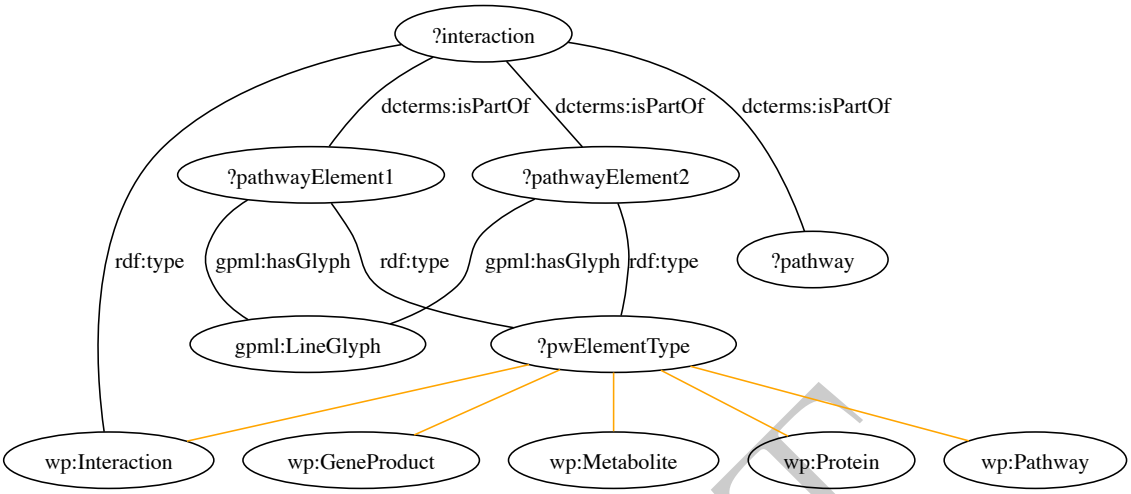
2.21.4 RDFSchema



2.21.5 RDF snippet (turtle)

Listing 83: MimGap

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix wp: <http://vocabularies.wikipathways.org/wp#> .
@prefix gpml: <http://vocabularies.wikipathways.org/gpml#> .

?interaction rdf:type wp:Interaction .
?interaction dcterms:isPartOf ?pathway .
?pwElement1 dcterms:isPartOf ?interaction .
?pwElement2 dcterms:isPartOf ?interaction .
?pwElement1 rdf:type ?pwElementType .
?pwElement2 rdf:type ?pwElementType .
?pwElement1 gpml:hasGlyph gpml:LineGlyph .
?pwElement2 gpml:hasGlyph gpml:LineGlyph .
FILTER (?pwElementType == wp:GeneProduct ||
       ?pwElementType == wp:Metabolite ||
       ?pwElementType == wp:Interaction ||
       ?pwElementType == wp:Pathway ||
       ?pwElementType == wp:Protein) .
```

2.21.6 Example SPARQL query

Listing 84: MimGap

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
PREFIX dcterms: <http://purl.org/dc/terms/> .
PREFIX wp: <http://vocabularies.wikipathways.org/wp#> .
```

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```
PREFIX gpml: <http://vocabularies.wikipathways.org/gpml#> .

SELECT DISTINCT * WHERE {
       ?interaction rdf:type wp:Interaction .
       ?interaction dcterms:isPartOf ?pathway .
       ?pwElement1 dcterms:isPartOf ?interaction .
       ?pwElement2 dcterms:isPartOf ?interaction .
       ?pwElement2 gpml:hasGlyph gpml:LineGlyph .
}
```

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