Systems Biology Ontology

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7th April 2009, Waiheke

- What it is

- Tree and term structure

- Features : Browse & Search (Edit)

- Obsolete terms

- History

- Downloads

- Examples

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- Provide a strictly defined relational vocabulary of terms for use in Systems Biology

- A navigable taxonomic structure of terms that has 'parents', 'children'

6 orthogonal vocabularies:

- entity (macromolecule)

- interaction (transport, reactions)

- mathematical expressions (mass action rate law)

- modeling framework (discrete)

- participant roles (S, P, M)

- quantitative parameters (Hill coefficient)

Orthogonal branches

EBI › SBO › Browsing

Systems Biology Ontology

⊞ ⊟

⊟ **SBO:0000000 – sbo term**

⊞ ⓘ SBO:0000236 - entity

⊞ ⓘ SBO:0000231 - interaction

⊞ ⓘ SBO:0000064 - mathematical expression

⊞ ⓘ SBO:0000004 - modelling framework

⊞ ⓘ SBO:0000003 - participant role

⊞ ⓘ SBO:0000002 - quantitative parameter

Legend

ⓘ "is a" relationship

Each term has:

- Name

- Definition

- Unique identifier

- Synonyms

- Comments

- Equation (mathematical expression branch)

- Linked via relationship (is_a)

http://www.ebi.ac.uk/sbo/

- Browse

- Search

- Edit

- Export (OBO flat file, XML and OWL)

- Web Services

http://sourceforge.net/projects/sbo/

- Term request (via tracker)

- Source code

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[Toggle ID display] [Refresh tree]

SBO:0000000 - sbo term

- SBO:0000236 - entity
- SBO:0000231 - interaction
  - SBO:0000375 - process
    - SBO:0000167 - biochemical or transport reaction
      - SBO:0000176 - biochemical reaction
      - SBO:0000185 - transport reaction
    - SBO:0000357 - biological effect of a perturbation
    - SBO:0000205 - composite biochemical process
    - SBO:0000395 - encapsulating process
    - SBO:0000342 - molecular or genetic interaction
    - SBO:0000397 - omitted process
    - SBO:0000358 - process that affects an observable
    - SBO:0000396 - uncertain process
  - SBO:0000374 - relationship
- SBO:0000064 - mathematical expression
- SBO:0000004 - modelling framework
- SBO:0000003 - participant role
- SBO:0000002 - quantitative parameter

http://www.ebi.ac.uk/sbo/

Legend

🛈 "is a" relationship

- Identifier can never be destroyed

- Terms get refined, branches can be re-organised

- Terms can be made obsolete :

  - Discourage the use of obsolete terms (view)

  - Maintain a record for obsolete terms (reference)

- If possible suggest an alternative term

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Search

Search for: vmax

[Search] [Reset]

The search for **vmax** returned the following result(s):

Results found in *name*:

Accession	Name	
SBO:0000187	Henri-Michaelis-Menten equation, Vmax form (obsolete term)	[Entry view]

Results found in *definition, comment, mathML*:

Accession	Name	
SBO:0000324	forward maximal velocity	[Tree view] [Entry view]
SBO:0000187	Henri-Michaelis-Menten equation, Vmax form (obsolete term)	[Entry view]
SBO:0000192	Hill-type rate law, generalised form	[Tree view] [Entry view]
SBO:0000195	Hill-type rate law, microscopic form	[Tree view] [Entry view]
SBO:0000198	Hill-type rate law, reduced form	[Tree view] [Entry view]
SBO:0000186	maximal velocity	[Tree view] [Entry view]
SBO:0000325	reverse maximal velocity	[Tree view] [Entry view]
SBO:0000301	total catalytic efficiency	[Tree view] [Entry view]

Results found in *synonyms*:

Accession	Name	
SBO:0000186	maximal velocity	[Tree view] [Entry view]
SBO:0000324	forward maximal velocity	[Tree view] [Entry view]
SBO:0000325	reverse maximal velocity	[Tree view] [Entry view]

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⊞ ⊟

☐ SBO:0000000 · sbo term

⊞ ⓘ SBO:0000236 · entity

⊟ ⓘ SBO:0000231 · interaction

   ⊟ ⓘ SBO:0000375 · process

      ⊟ ⓘ SBO:0000167 · biochemical or transport reaction

         ⊞ ⓘ SBO:0000176 · biochemical reaction

         ⓘ SBO:0000185 · transport reaction

      ⓘ SBO:0000357 · biological effect of a perturbation

      ⊞ ⓘ SBO:0000205 · composite biochemical process

      ⓘ SBO:0000395 · encapsulating process

      ⊞ ⓘ SBO:0000342 · molecular or genetic interaction

      ⓘ SBO:0000397 · omitted process

      ⓘ SBO:0000358 · process that affects an observable

      ⓘ SBO:0000398 · uncertain process

   ⊞ ⓘ SBO:0000374 · relationship

⊞ ⓘ SBO:0000084 · mathematical expression

⊞ ⓘ SBO:0000004 · modelling framework

⊞ ⓘ SBO:0000003 · participant role

⊟ ⓘ SBO:0000002 · quantitative parameter

   ⊟ ⓘ SBO:0000258 · biochemical parameter

      ⊟ ⓘ SBO:0000380 · biochemical coefficient

         ⊟ ⓘ SBO:0000382 · biochemical exponential coefficient

            ⓘ **SBO:0000190 · Hill coefficient**

         ⊞ ⓘ SBO:0000381 · biochemical proportionality coefficient

   ⊞ ⓘ SBO:0000308 · equilibrium or steady-state characteristic

⇦ Previous

Hill coefficient

1/1

Next ⇨

Tree View

Entry view

SBO:0000190

Name

Hill coefficient

Definition

Empirical parameter created by Archibald Vivian Hill to describe the cooperative binding of oxygen on hemoglobine (Hill (1910). The possible effects of the aggregation of the molecules of haemoglobin on its dissociation curves. J Physiol 40: iv-vii).

Comment

Determined from a "Hill plot", it is sometimes assumed to be the number of binding or catalytic sites in a polymer, but it is incorrect. In some mechanistic model, the Hill coefficient gives a lower limit for the number of sites.

Miscellaneous

Date of creation:

    03 August 2008, 18:35

Date of last modification:

    25 November 2008, 16:09

Parent(s)

SBO:0000382 *biochemical exponential coefficient* (is a)

Children

    This term has no child.

History [+]

Date	Action	Details

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SBO:0000195

Name

Hill-type rate law, microscopic form

Definition

Hill equation rewritten by creating a pseudo-microscopic constant, equal to the Hill constant powered to the opposite of the Hill coefficient.

MathML

```
<math xmlns="http://www.w3.org/1998/Math/MathML">
<semantics definitionURL="http://biomodels.net/SBO/#SBO:0000062">
    <lambda>
        <bvar><ci definitionURL="http://biomodels.net/SBO/#SBO:0000186">Vmax</ci></bvar>
        <bvar><ci definitionURL="http://biomodels.net/SBO/#SBO:0000010">R</ci></bvar>
        <bvar><ci definitionURL="http://biomodels.net/SBO/#SBO:0000194">K</ci></bvar>
        <bvar><ci definitionURL="http://biomodels.net/SBO/#SBO:0000190">h</ci></bvar>
        <apply>
```

Rendered equation

$$\lambda (Vmax, R, K, h) = \frac{Vmax \times R^h}{K^h + R^h}$$

Comment

The symbol Vmax and the names maximum rate and maximum velocity are in widespread use although under normal circumstances there is no finite substrate concentration at which v = V and hence no maximum in the mathematical sense (Eur. J. Biochem. 128:281-291).

Miscellaneous

Date of creation:

03 August 2008, 18:57

Date of last modification:

25 November 2008, 16:15

Parent(s)

SBO:0000192 *Hill-type rate law, generalised form* (is a)

Children

This term has no child.

History [+]

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EBI › SBO › History

Systems Biology Ontology

BIOMODELS.NET

History

Here are the latest modifications of the ontology.

Date	Term	Action	Details
26/03/2009	SBO:0000410	term created	This term has been newly created, it is a child of SBO:0000290
26/03/2009	SBO:0000290	relationship created	This term is now the parent of the newly created term SBO:0000410
13/03/2009	SBO:0000387	term updated	The information about this term has been updated (name, definition, MathML or comment)
05/03/2009	SBO:0000409	term created	This term has been newly created, it is a child of SBO:0000238
05/03/2009	SBO:0000238	relationship created	This term is now the parent of the newly created term SBO:0000409
05/03/2009	SBO:0000408	term updated	The information about this term has been updated (name, definition, MathML or comment)
05/03/2009	SBO:0000408	term created	This term has been newly created, it is a child of SBO:0000003
05/03/2009	SBO:0000003	relationship created	This term is now the parent of the newly created term SBO:0000408
05/03/2009	SBO:0000171	term updated	The information about this term has been updated (name, definition, MathML or comment)
05/03/2009	SBO:0000170	term updated	The information about this term has been updated (name, definition, MathML or comment)

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SBO:0000198 Hill-type rate law, reduced form

Name
Hill-type rate law, reduced form

Definition
Hill equation rewritten by replacing the concentration of reactant with its reduced form, that is the concentration divide by a pseudo-microscopic constant, equal to the Hill constant powered to the opposite of the Hill coefficient.

MathML
```
<math xmlns="http://www.w3.org/1998/Math/MathML">
<semantics definitionURL="http://biomodels.net/SBO/#SBO:0000062">
    <lambda>
        <bvar><ci definitionURL="http://biomodels.net/SBO/#SBO:0000186">Vmax</ci></bvar>
        <bvar><ci definitionURL="http://biomodels.net/SBO/#SBO:0000010">R*</ci></bvar>
        <bvar><ci definitionURL="http://biomodels.net/SBO/#SBO:0000190">h</ci>
```

Rendered equation

$$\lambda\,(Vmax, R^*, h) = \frac{Vmax \times R^{*^h}}{1 + R^{*^h}}$$

Comment
The symbol Vmax and the names maximum rate and maximum velocity are in widespread use although under normal circumstances there is no finite substrate concentration at which v = V and hence no maximum in the mathematical sense (Eur. J. Biochem. 128:281-291).

Parent(s)
SBO:0000192 Hill-type rate law, generalised form (is a)

Children
This term has no child.

Log message

Add a synonym
Enter a new synonym: new synonym
Add this new synonym

Add a child
Choose an existing term: SBO:0000012 mass action rate law
Add this child

Add a new child
Add a new child

EBI ˃ SBO ˃ Download

Systems Biology Ontology

juty | My Account | Sign Out

Access to the OBO, OWL and XML exports of the ontology.

Instant exports

These exports are automatically generated daily at 7am UK time, therefore you can quickly download them without waiting.

- OBO file
- OWL file
- XML file

Generate exports

You can also generate up-to-date files, based on the current version of the database. Your export will be generated on demand: this will take a few seconds to complete.

- OBO file
- OWL file
- XML file

SBO Statistics

- Nb terms: 397 (410)
- Last updated: Mar 28, 2009

OBO

```
format-version: 1.2
date: 28:03:2009 07:00
data-version: 26:03:2009 12:18
saved-by: SBO community
auto-generated-by: SBO Browser (http://www.ebi.ac.uk/sbo/)
default-namespace: sbo
```

OWL

```
<owl:Ontology rdf:about="">
  <rdfs:comment xml:lang="EN">Systems Biology Ontology, OWL export generated by
  <owl:versionInfo>26:03:2009 12:18</owl:versionInfo>
  <rdfs:label xml:lang="EN">Generated: 28:03:2009 07:00</rdfs:label>
</owl:Ontology>
```

XML

```
<?xml version="1.0" encoding="UTF-8"?>
<sbo xmlns="http://www.biomodels.net/sbo"
    date="2009-03-28T07:00:31.105Z" data-version="2009-03-26T12:18:33.000Z">
    <Term>
        <id>SBO:0000000</id>
```

message getTermsByIdsRequest

parts	parameters	
		element	impl:getTermsByIds
used by	Operation getTermsByIds in PortType SBOProvider	

source	`<wsdl:message name="getTermsByIdsRequest">`
	 `<wsdl:part name="parameters" element="impl:getTermsByIds"/>`
	`</wsdl:message>`	

message getStringTermByIdResponse

parts	parameters	
		element	impl:getStringTermByIdResponse
used by	Operation getStringTermById in PortType SBOProvider	

source	`<wsdl:message name="getStringTermByIdResponse">`
	 `<wsdl:part name="parameters" element="impl:getStringTermByIdResponse"/>`
	`</wsdl:message>`	

message searchTermMathRequest

parts	parameters	
		element	impl:searchTermMath
used by	Operation searchTermMath in PortType SBOProvider	

source	`<wsdl:message name="searchTermMathRequest">`
	 `<wsdl:part name="parameters" element="impl:searchTermMath"/>`
	`</wsdl:message>`	

Semantic layer:

- link between models encoded in SBML and graphical notations (such as SBGN)

- conversion to semantically enriched computing formats (such as BioPAX)

- translation of models between *continuous deterministic frameworks* and *discrete stochastic framework*

- merging/integration of models

```xml
<reaction sboTerm="SBO:0000172">
   <listOfReactants>
     <speciesReference species="S" sboTerm="SBO:0000015"/>
   </listOfReactants>
   <listOfProducts>
     <speciesReference species="P" sboTerm="SBO:0000011"/>
   </listOfProducts>
   <listOfModifiers>
     <speciesReference species="E" sboTerm="SBO:0000014"/>
   </listOfModifiers>
   <kineticLaw sboTerm="SBO:0000031">
     <listOfParameters>
       <parameter id="K1" sboTerm="SBO:0000008"/>
       <parameter id="kp" sboTerm="SBO:0000025"/>
     </listOfParameters>
     <math xmlns="http://www.w3.org/1998/Math/MathML">
       <apply>
         <divide/><apply>
                   <times/><ci>E</ci>
                           <ci>kp</ci>
                           <ci>S</ci>
                 </apply>
                 <apply>
                   <plus/><ci>K1</ci>
                          <ci>S</ci>
                 </apply>
       </apply>
     </math>
   </kineticLaw>
 </reaction>
```
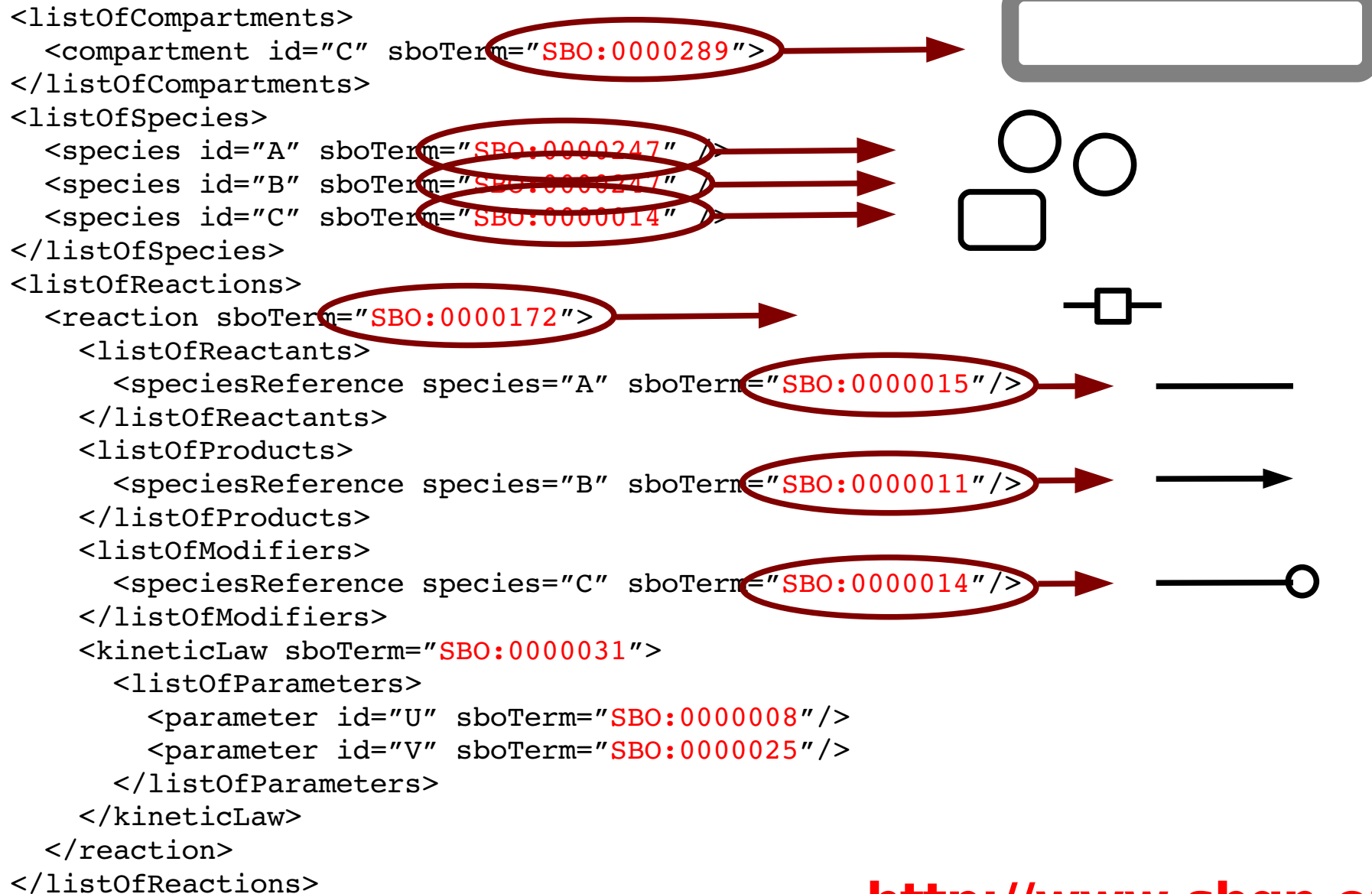
```
<reaction sboTerm="SBO:0000172">                              catalysis
  <listOfReactants>
    <speciesReference species="S" sboTerm="SBO:0000015"/>     substrate
  </listOfReactants>
  <listOfProducts>
    <speciesReference species="P" sboTerm="SBO:0000011"/>     product
  </listOfProducts>
  <listOfModifiers>
    <speciesReference species="E" sboTerm="SBO:0000013"/>     catalyst
  </listOfModifiers>
  <kineticLaw sboTerm="SBO:0000031">                          Briggs-Haldane equation
    <listOfParameters>
      <parameter id="K1" sboTerm="SBO:0000008"/>              Km
      <parameter id="kp" sboTerm="SBO:0000025"/>              kcat
    </listOfParameters>
    <math xmlns="http://www.w3.org/1998/Math/MathML">
      <apply>
        <divide/><apply>
                    <times/><ci>E</ci>
                            <ci>kp</ci>
                            <ci>S</ci>
                  </apply>
                  <apply>
                    <plus/><ci>K1</ci>
                           <ci>S</ci>
                  </apply>
      </apply>
    </math>
  </kineticLaw>
</reaction>
```

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```
<listOfCompartments>
  <compartment id="C" sboTerm="SBO:0000289">
</listOfCompartments>
<listOfSpecies>
  <species id="A" sboTerm="SBO:0000247" />
  <species id="B" sboTerm="SBO:0000247" />
  <species id="C" sboTerm="SBO:0000014" />
</listOfSpecies>
<listOfReactions>
  <reaction sboTerm="SBO:0000172">
    <listOfReactants>
      <speciesReference species="A" sboTerm="SBO:0000015"/>
    </listOfReactants>
    <listOfProducts>
      <speciesReference species="B" sboTerm="SBO:0000011"/>
    </listOfProducts>
    <listOfModifiers>
      <speciesReference species="C" sboTerm="SBO:0000014"/>
    </listOfModifiers>
    <kineticLaw sboTerm="SBO:0000031">
      <listOfParameters>
        <parameter id="U" sboTerm="SBO:0000008"/>
        <parameter id="V" sboTerm="SBO:0000025"/>
      </listOfParameters>
    </kineticLaw>
  </reaction>
</listOfReactions>
```

http://www.sbgn.org/

https://sourceforge.net/projects/sbo

- **EBI**

  - Mélanie Courtot
  - Camille Laibe
  - Nicolas Le Novère
  - Lukas Endler

- **SBML team**

  - Michael Hucka

- **BioModels Database developers and curators**

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- **EBI**

  - Mélanie Courtot
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  - Nicolas Le Novère
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- **SBML team**

  - Michael Hucka

- **BioModels Database developers and curators**

The community of Systems Biology for their contributions, their software support and their comments.

https://sourceforge.net/projects/sbo

bbsrc
biotechnology and biological
sciences research council

EMBL

NIGMS

ELIXIR

The End