

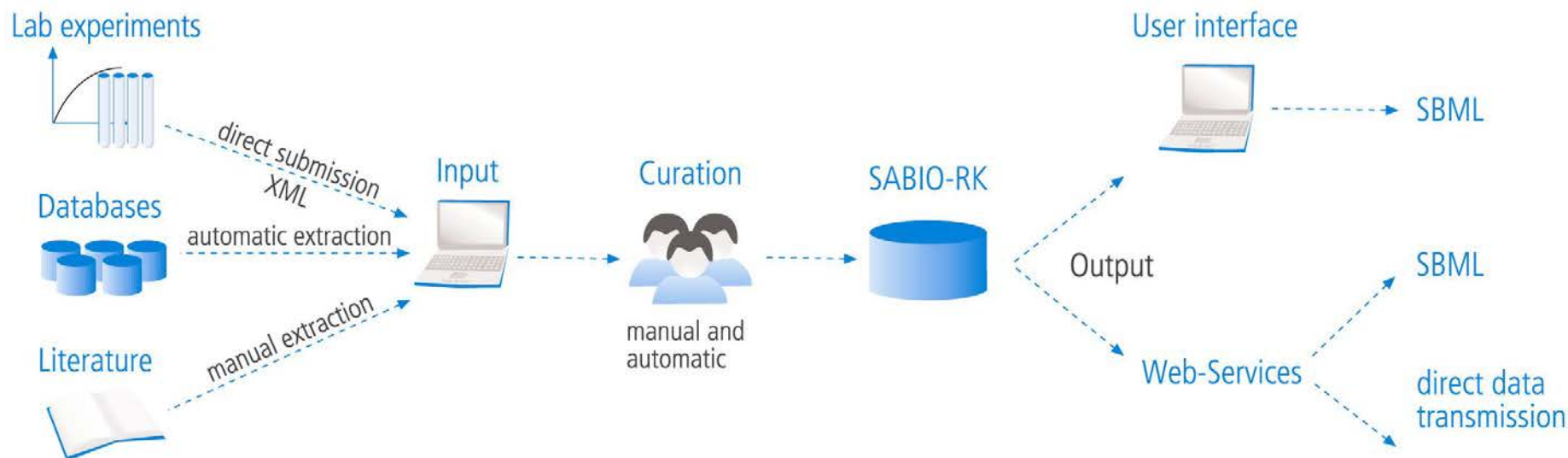
Bridging Experiments and Modelling: SABIO-RK - Reaction Kinetics Database

Martin Golebiewski & Andreas Weidemann
Heidelberg Institute for Theoretical Studies
HITS gGmbH, Germany

ICSB/COMBINE 2013, Copenhagen, September 4

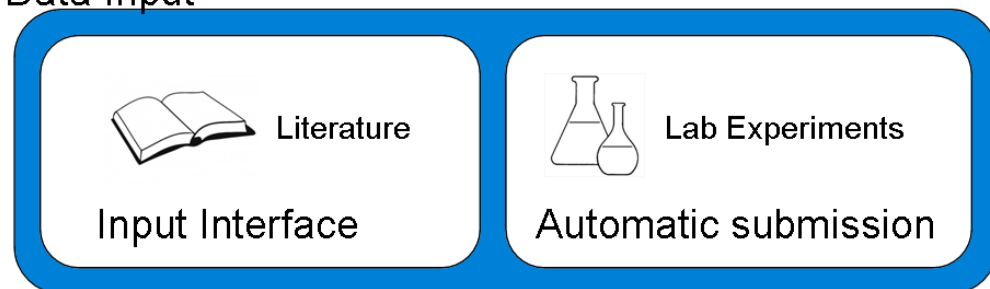
SABIO-RK

Database Population and Access

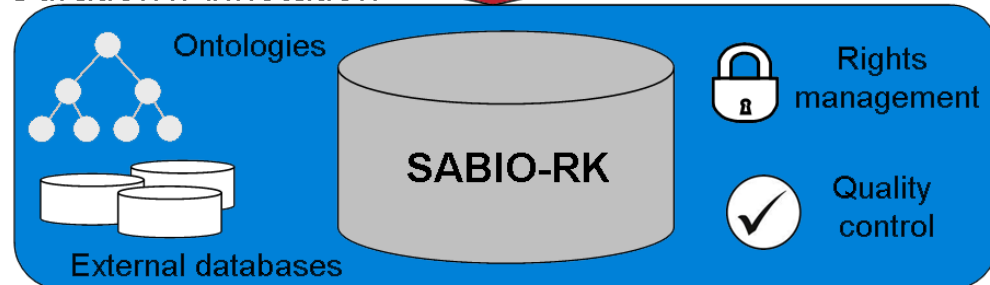


- Kinetic data from **literature** and directly from **experiments** merged with data describing biochemical reactions and pathways from **other resources**
- Data about **metabolic** and **signalling** reactions, as well as reaction mechanisms
- Data is unified, structured, normalized, interrelated and annotated
- Access through a web-based **user interface** and through **web-services (API)**
- **Proprietary levels** can be defined to restrict access to sensitive data
- **Data export** possible in standard formats (e.g. SBML and BIOPAX)

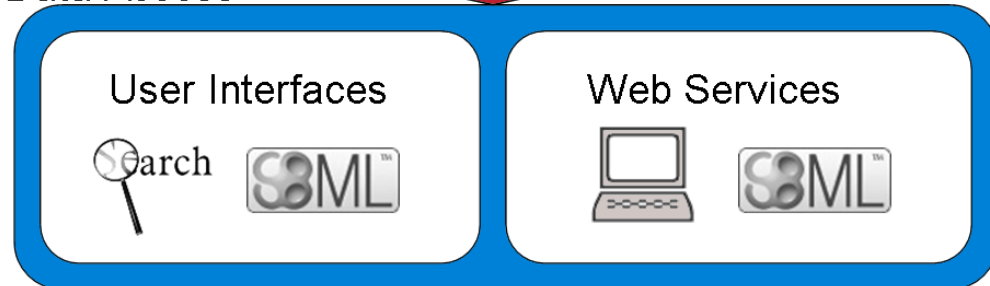
Data Input



Curation / Annotation



Data Access



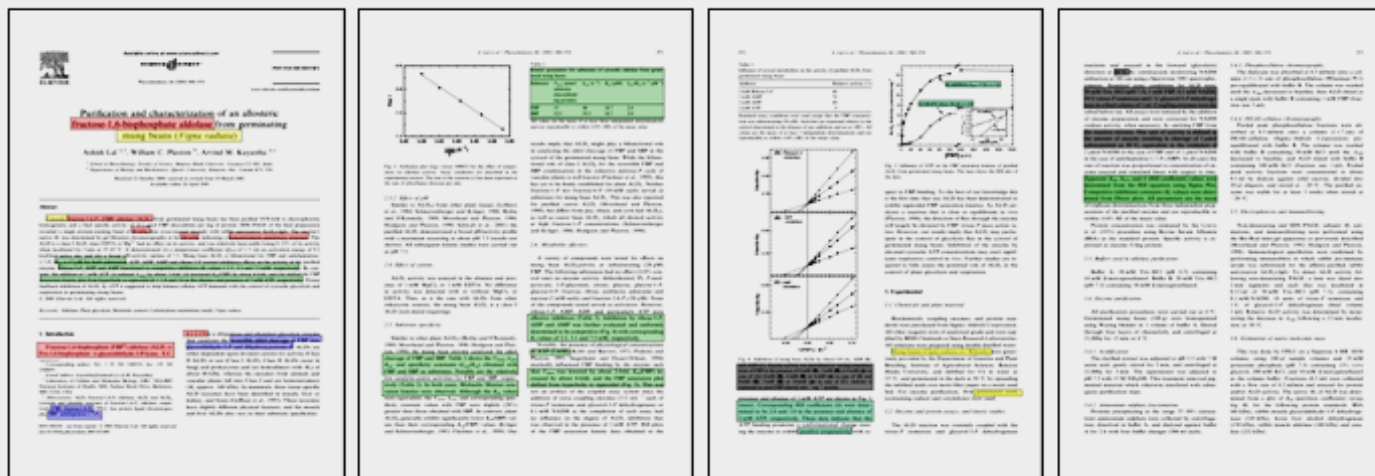
<http://sabiork.h-its.org>

Biochemical reaction kinetics

Data is

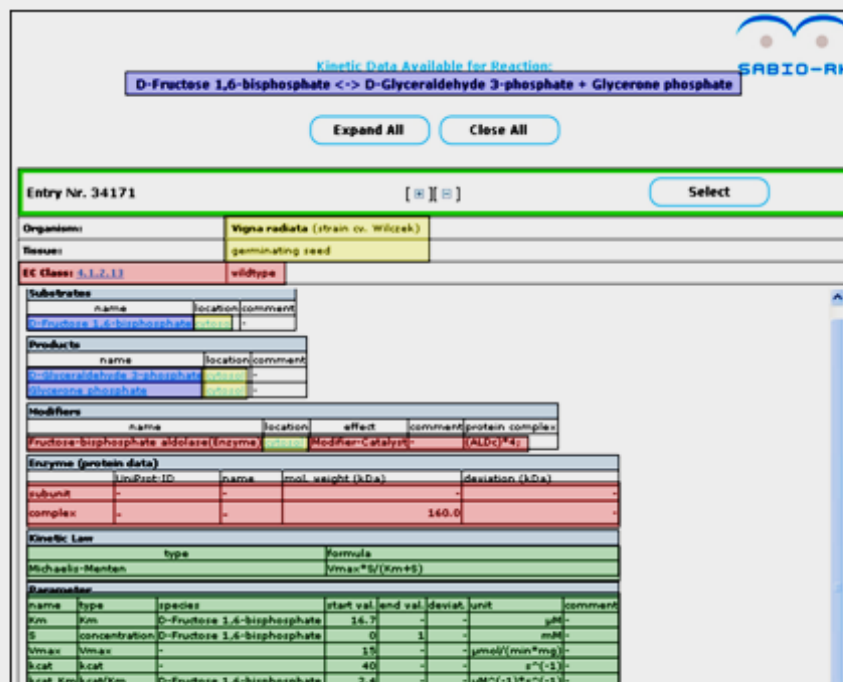
- Unified
- Structured
- Curated
- Normalized
- Interrelated
- Annotated

A



Four panels showing original scientific publications. The first panel is a text-heavy abstract. The second panel contains a line graph showing a linear relationship. The third panel features multiple small graphs and a table. The fourth panel is a text-heavy abstract with some highlighted sections.

B



Screenshot of the SABIO-RK database entry for D-Fructose 1,6-bisphosphate conversion. The entry includes organism (Vigna radiata), tissue (germinating seed), EC class (1.1.1.11), and a detailed table of kinetic data (Michaelis-Menten parameters) for the enzyme Fructose-bisphosphate aldolase (ALDO14).

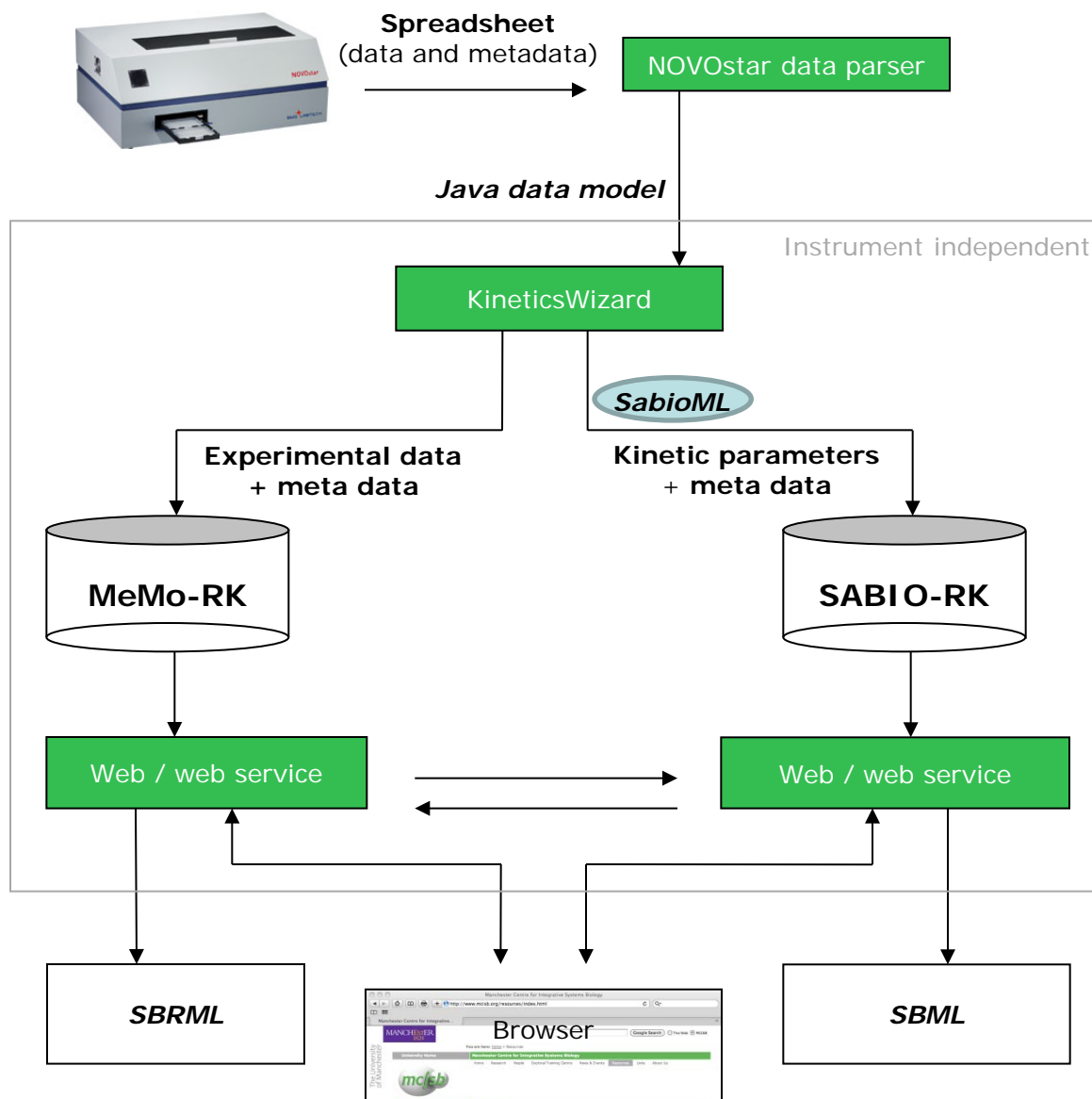
name	type	species	start val.	end val.	deviat.	unit	comment
Km	Km	D-Fructose 1,6-bisphosphate	14.7	-	-	μM	
concentration		D-Fructose 1,6-bisphosphate	0	1	-	μmol/(min*mg)	
Vmax	Vmax	-	3.5	-	-	μmol/(min*mg)	
Kcat	Kcat	-	40	-	-	s ⁻¹	
Kcat Km/Km	Kcat Km/Km	D-Fructose 1,6-bisphosphate	2.6	-	-	μmol/(min*mg)	

Added Value:

- Clean
- Standardized
- Coherent
- Interlinked

→ High quality data

- Protein- bzw. Enzymdaten
- Reaktionen und chemische Verbindungen
- kinetische Daten
- experimentelle Bedingungen
- biologische Quelle (Organismus, Gewebe, Zelltyp)



the **FEBS**
Journal



Enzyme kinetics informatics: from instrument to browser



Neil Swainston^{1,†}, Martin Golebiewski^{2,†},
Hanan L. Messiha¹, Naglis Malys¹, Renate
Kania², Sylvestre Kengne², Olga Krebs²,
Saqib Mir², Heidrun Sauer-Danwitz²,
Kieran Smallbone¹, Andreas Weidemann²,
Ulrike Wittig², Douglas B. Kell¹, Pedro
Mendes^{1,3}, Wolfgang Müller², Norman W.
Paton¹, Isabel Rojas²

Article first published online: 3 AUG 2010

DOI: 10.1111/j.1742-4658.2010.07778.x

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FEBS

Issue



FEBS Journal

Volume 277, Issue 18, pages
3769–3779, September 2010

Additional Information [\(Show All\)](#)

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Author Information

- ¹ Manchester Centre for Integrative Systems Biology, University of Manchester, UK
- ² Heidelberg Institute for Theoretical Studies, Germany
- ³ Virginia Bioinformatics Institute, Virginia Tech, Blacksburg, VA, USA

*Correspondence: N. Swainston, Manchester Centre for Integrative Systems Biology, University of Manchester, Manchester M1 7DN, UK Fax: +44 161 306 8918 Tel:  +44 161 306 5146  E-mail: neil.swainston@manchester.ac.uk Website: <http://www.mcisb.org>

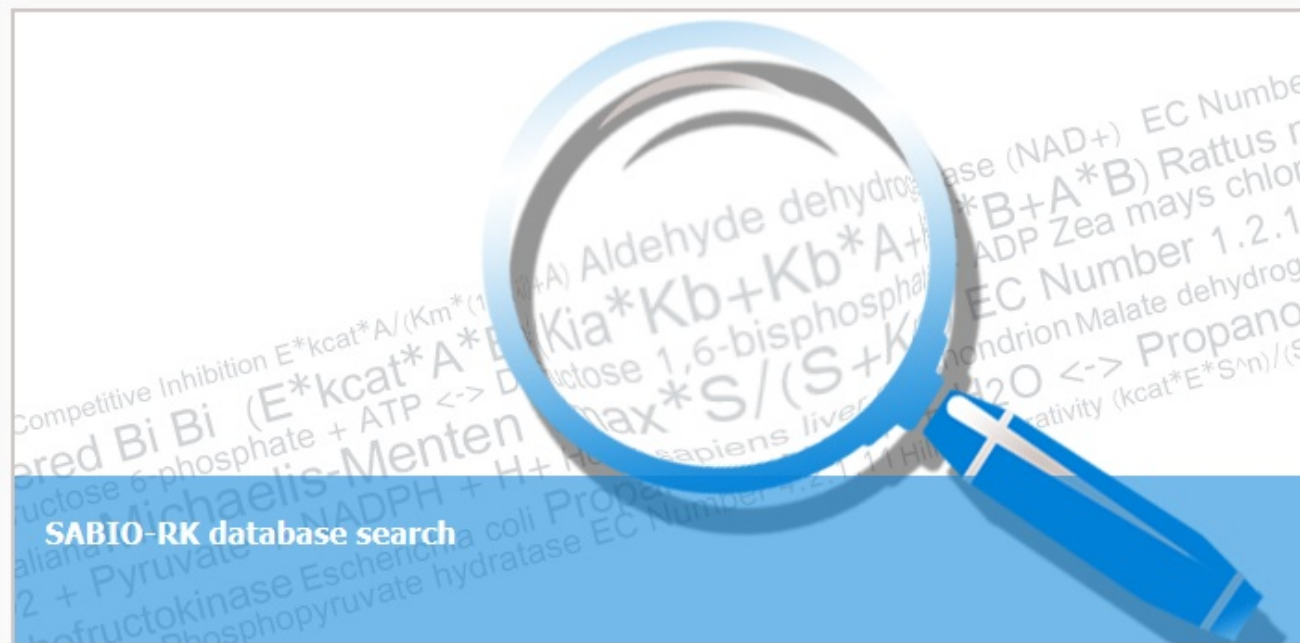
†*

These authors contributed equally to this work



Welcome!

SABIO-RK is a curated database that contains information about biochemical reactions, their kinetic rate equations with parameters and experimental conditions.



News

[Signalling data in SABIO-RK](#)

15-08-2013

With the release 2013_08 it is now possible to search SABIO-RK for kinetic data related to signalling reactions [more>>](#)

[SABIO-RK tutorial at ICSB 2013](#)

10-06-2013

A SABIO-RK tutorial will be presented as part of a full-day tutorial workshop on September 4, 2013 following the ICSB conference in Copenhagen (Denmark). [more>>](#)



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Search

Organism:"mammalia (NCBI)" AND Tissue:"liver (BTO)" NOT
UniprotID:P00637 AND Substrate:"D-Fructose 1,6-bisphosphate"

[Reset](#)

Advanced Search

AND d-fructo [Add & Search](#)

d-fructose, 6-(dihydrogen phosphate) (0)
d-fructose 6-phosphoric acid(0)
d-fructose 2,6-bisphosphate (0)
d-fructose 6-phosphate (0)
d-fructose (0)

[Entry View](#) [Reaction View](#)

Filter Options

Enzyme

☒ Wildtype ☒ Mutant ☐ Recombinant

Kinetic Data

☒ Rate Equation

Environmental Conditions

pH: 0 - 14

Temperature: -10 C° - 115 C°

Source

☒ Direct Submission

☐ Entries inserted since:

☒ Journal

15/10/2008





Total number of kinetic law entries found: 40

1 2 3 Next

display 15 entries per page

Kinetic data	Reaction	Enzyme			Tissue	Organism	Parameter (besides concentration)	Environment		Add to export cart?
		ECNumber	Protein	Variant				° C	pH	
	D-Fructose 1,6-bisphosphate + H ₂ O = D-Fructose 6-phosphate + Orthophosphate	3.1.3.11	Q9N0J6	wildtype	liver	Oryctolagus cuniculus	Kd Km Vmax	25.0	9.5	<input type="checkbox"/>
	H ₂ O + D-Fructose 1,6-bisphosphate =	3.1.3.11	Q3SZB7	wildtype	liver	Bos taurus	Km Vmax	28.0	6.5	<input type="checkbox"/>

	D-Fructose 1,6-bisphosphate = Glycerone phosphate + D-Glyceraldehyde 3-phosphate	4.1.2.13	P05062 ↗	wildtype aldolase B	liver ↗	Homo sapiens	Vmax Km	22.0	7.6	
--	--	----------	--------------------------	------------------------	-------------------------	-----------------	------------	------	-----	--

Entry ID: 2175

General information

Organism	Homo sapiens
Tissue	liver ↗
EC Class	4.1.2.13
SABIO reaction id	1338
Variant	wildtype aldolase B
Recombinant	expressed in Escherichia coli BL21(DE3)

Substrates

name	location	comment
D-Fructose 1,6-bisphosphate	-	-

Products

name	location	comment
Glycerone phosphate	-	-
D-Glyceraldehyde 3-phosphate	-	-

Modifiers

name	location	effect	comment	protein complex
fructose-bisphosphate aldolase(Enzyme)	-	Modifier-Catalyst	-	(P05062 ↗)*4;

Enzyme (protein data)

	UniProt-ID	name	mol. weight (kDa)	deviation (kDa)
subunit	P05062	-	-	-
complex	-	-	-	-

Kinetic Law

type	formula
Michaelis-Menten	$V_{max} * S / (K_m + S)$

Parameter

name	type	species	start val.	end val.	deviat.	unit	comment
S	concentration	D-Fructose 1,6-bisphosphate	-	-	-	-	-
Km	Km	D-Fructose 1,6-bisphosphate	4.0	-	0.6	μM	-

Substrates							
name		location		comment			
D-Fructose 1,6-bisphosphate		-		-			
Products							
name		location		comment			
Glycerone phosphate		-		-			
D-Glyceraldehyde 3-phosphate		-		-			
Modifiers							
name		location	effect	comment	protein complex		
fructose-bisphosphate aldolase(Enzyme)		-	Modifier-Catalyst	-	(P05062 ↗)*4;		
Enzyme (protein data)							
	UniProt-ID	name	mol. weight (kDa)		deviation (kDa)		
subunit	P05062	-	-		-		
complex	-	-	-		-		
Kinetic Law							
type			formula				
Michaelis-Menten			$V_{max} \cdot S / (K_m + S)$				
Parameter							
name	type	species	start val.	end val.	deviat.	unit	comment
S	concentration	D-Fructose 1,6-bisphosphate	-	-	-	-	-
Km	Km	D-Fructose 1,6-bisphosphate	4.0	-	0.6	μM	-
Vmax	Vmax	-	4.787	-	-	μmol/(min*mg)	-
Experimental conditions							
	start value		end value		unit		
temperature	22.0		-		°C		
pH	7.6		-		-		
buffer	50 mM Tris-acetate, 0.15 mM NADH, 10 mM EDTA, 100 mg/ml bovine serum albumin, 2 mg/ml alpha-glycerophosphate dehydrogenase/triose phosphate isomerase						
comment	-						
Reference							
title		author	year	journal	volume	pages	PubMed
Expression, purification, and characterization of natural mutants of human aldolase B. Role of quaternary structure in catalysis.		Rellos P, Sygusch J, Cox TM.	2000	J Biol Chem	275	1145-51	10625657 ↗



Save Model

Enter name of model:

Export parameters normalized to SI base units

Save Model on Disk as SBML

Save Model on Disk as PDF

Bioinformatics. 2009 June 1; 25(11): 1455–1456.
Published online 2009 March 23. doi: [10.1093/bioinformatics/btp170](https://doi.org/10.1093/bioinformatics/btp170).

PMCID: PMC2682517

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SBML2L^AT_EX: Conversion of SBML files into human-readable reports

Andreas Dräger,^{1*} Hannes Planatscher,¹ Dieudonné Motsou Wouamba,¹
Adrian Schröder,¹ Michael Hucka,² Lukas Endler,³ Martin Golebiewski,⁴
Wolfgang Müller,⁴ and Andreas Zell¹



- Currently up to **SBML Level 3 Version 1**
- **Reaction Kinetics Warehouse:**
Reactions, kinetic equations and parameters (with corresponding units) from different database entries can be exported in one SBML file
- Data is annotated (RDF and SBOterms) according to **MIRIAM**
- Annotations include **SABIO-RK Ids** (reaction and kineticlaw) for tracking
- Export with **experimental conditions** (SABIO-RK specific namespace)
- Optional **normalization of kinetic parameters** to SI base units
- Export also as human readable PDF (only SBML level 2) → **SBML2LaTeX**

```
<?xml version='1.0' encoding='UTF-8' standalone='no'?>
<sbml xmlns="http://www.sbml.org/sbml/level3/version1/core" level="3" version="1">
  <model name="SABIOmdl16Aug2012604">
    <notes><body xmlns="http://www.w3.org/1999/xhtml">
      <p>
        This model has been created with the help of the SABIO-RK Database
        (http://sabio.h-its.org/)
        (c) 2005-2012 HITS gGmbH http://www.h-its.org
      </p><br/>
      To cite SABIO-RK Database, please use
      "http://www.ncbi.nlm.nih.gov/pubmed/22102587"
    </body></notes>
    <listOfFunctionDefinitions>
      <functionDefinition id="KL_2175" sboTerm="SBO:0000028">
        <math xmlns="http://www.w3.org/1998/Math/MathML">
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            <bvar>
              <ci> Km </ci>
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            <bvar>
              <ci> S </ci>
            </bvar>
            <bvar>
              <ci> Vmax </ci>
            </bvar>
            <apply>
              <divide/>
              <apply>
                <times/>
                <ci> Vmax </ci>
                <ci> S </ci>
              </apply>
            </apply>
            <plus/>
            <ci> Km </ci>
            <ci> S </ci>
          </apply>
        </lambda>
      </math>
    </functionDefinition>
  </listOfFunctionDefinitions>
  <listOfUnitDefinitions>
    <unitDefinition id="M" name="M">
      <listOfUnits>
```

SABIO-RK - database for biochemical reaction kinetics. Wittig U, Kania R, Golebiewski M, Rey M, Shi L, Jong L, Algaa E, Weidemann A, Sauer-Danzwith H, Mir S, Krebs O, Bittkowski M, Wetsch E, Rojas I, Mueller W. Nucleic Acids Res. 2012;40(Database issue)790-6

```
</body></notes>
    <listOfFunctionDefinitions>
      <functionDefinition id="KL_2175" sboTerm="SBO:0000028">
        <math xmlns="http://www.w3.org/1998/Math/MathML">
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            </bvar>
            <bvar>
              <ci> S </ci>
            </bvar>
            <bvar>
              <ci> Vmax </ci>
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            <plus/>
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            <ci> S </ci>
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        </lambda>
      </math>
    </functionDefinition>
  </listOfFunctionDefinitions>
  <listOfUnitDefinitions>
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```

Kinetic Rate Equations


```

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  <unitDefinition id="molswedgeonegwedgedone" name="mol*s^(-1)*g^(-1)">
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      <unit scale="0" exponent="-1" multiplier="1" kind="gram"/>
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  </unitDefinition>
</listOfUnitDefinitions>
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</listOfCompartments>
<listOfSpecies>
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  metaid="META_SPC_1465_Cell" boundaryCondition="false" compartment="compartment_Cell">
    <annotation>
      <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:bqbiol="http://biomodels.net/biology-qualifiers/"
      xmlns:bqmodel="http://biomodels.net/model-qualifiers/">
        <rdf:Description rdf:about="#META_SPC_1465_Cell">
          <bqbiol:is>
            <rdf:Bag>
              <rdf:li rdf:resource="urn:miriam:obo.chebi:16905"/>
              <rdf:li rdf:resource="urn:miriam:obo.chebi:37736"/>
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  </species>
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```

Parameter Units

**Reactants
(+ Annotations)**

```

<species id="ENZ_140280_Cell" initialConcentration="1" constant="false" hasOnlySubstanceUnits="false" name="fructose-bisphosphate
aldolase(Enzyme) wildtype aldolase B" metaid="META_ENZ_140280_Cell" boundaryCondition="false" compartment="compart_Cell">
  <annotation bqbiol="http://biomodels.net/biology-qualifiers/" rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#/">
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qualifiers/" xmlns:bqmodel="http://biomodels.net/model-qualifiers/">
    <rdf:Description rdf:about="#META_ENZ_140280_Cell">
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        <rdf:Bag>
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        </rdf:Bag>
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  </rdf:RDF>
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xmlns:bqmodel="http://biomodels.net/model-qualifiers/">
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          <bqbiol:isVersionOf>
            <rdf:Bag>
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            </rdf:Bag>
          </bqbiol:isVersionOf>
          <bqbiol:is>
            <rdf:Bag>
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            </rdf:Bag>
          </bqbiol:is>
          <bqbiol:occursIn>
            <rdf:Bag>
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            </rdf:Bag>
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          <bqbiol:is>
            <rdf:Bag>
              <rdf:li rdf:resource="urn:miriam:sabiork.reaction:1338"/>
            </rdf:Bag>
          </bqbiol:is>
        </rdf:Description>
      </annotation>
    </reaction>
  </listOfReactions>

```

**Catalyzing Enzymes
(+ Annotations)**

**Reactions
(+ Annotations)**

**SABIO-RK
Annotations**

```

    <speciesReference constant="true" species="SPC_28_Cell" sboTerm="SBO:0000011" stoichiometry="1"/>
  </listOfProducts>
  <listOfModifiers>
    <modifierSpeciesReference species="ENZ_140280_Cell" sboTerm="SBO:0000460"/>
  </listOfModifiers>
  <kineticLaw metaid="META_KL_2175" sboTerm="SBO:0000028">
    <annotation sbrk="http://sabiork.h-its.org" bqbiol="http://biomodels.net/biology-qualifiers/" rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#/">
      <sbrk:sabiork xmlns:sbrk="http://sabiork.h-its.org">
        <sbrk:kineticLawID>2175</sbrk:kineticLawID>
        <sbrk:experimentalConditions>
          <sbrk:temperature>
            <sbrk:startValueTemperature>22.0</sbrk:startValueTemperature>
            <sbrk:temperatureUnit>°C</sbrk:temperatureUnit>
          </sbrk:temperature>
          <sbrk:pH>
            <sbrk:startValuepH>7.6</sbrk:startValuepH>
          </sbrk:pH>
          <sbrk:buffer> 50 mM Tris-acetate, 0.15 mM NADH, 10 mM EDTA, 100 mg/ml bovine serum albumin, 2 mg/ml alpha-glycerophosphate dehydrogenase/triose phosphate isomerase
        </sbrk:buffer>
        </sbrk:experimentalConditions>
      </sbrk:sabiork>
      <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:bqbiol="http://biomodels.net/biology-qualifiers/"
        xmlns:bqmodel="http://biomodels.net/model-qualifiers/">
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            </rdf:Bag>
          </bqbiol:isDescribedBy>
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            <rdf:Bag>
              <rdf:li rdf:resource="urn:miriam:sabiork.kineticrecord:2175"/>
            </rdf:Bag>
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        </rdf:Description>
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    </annotation>
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        <ci> Km_SPC_1465_Cell </ci>
        <ci> SPC_1465_Cell </ci>
        <ci> Vmax </ci>
      </apply>
    </math>
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      <localParameter id="Vmax" name="Vmax" value="7.97833E-5" sboTerm="SBO:0000186" units="molswedgeneonedgewedgene"/>
    </listOfLocalParameters>
  </kineticLaw>

```

**Experimental Conditions
(SABIO-RK namespace)**

**Data Sources:
Primary source and
SABIO-RK entry ID**

**Kinetic Parameters
(+ SBO Annotations)**

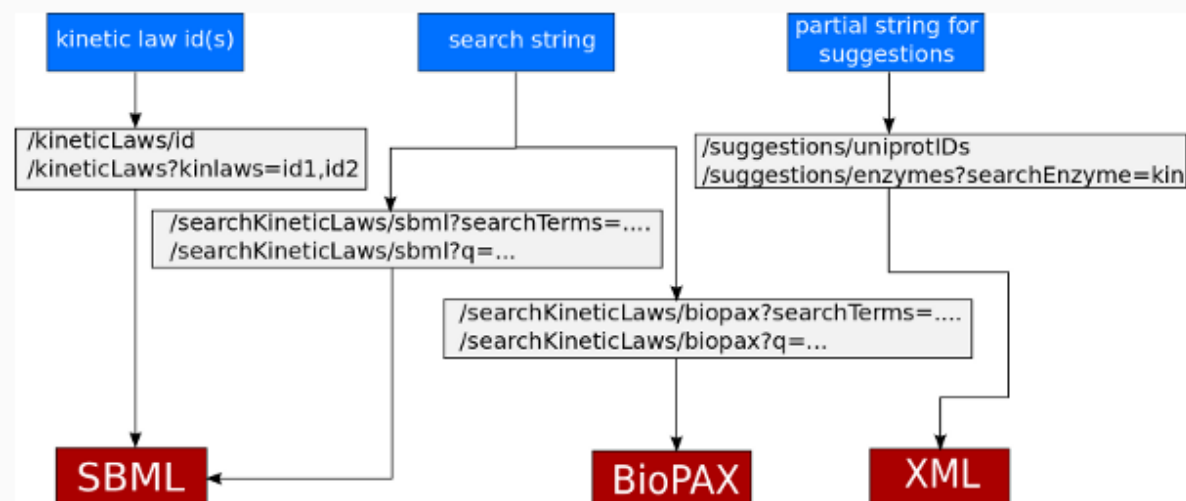
- **Reaction Kinetics Warehouse:**
Reactions, kinetic equations and parameters (with corresponding units) from different database entries can be exported in one BioPAX file
- Data is annotated according to **MIRIAM**
- **SBPAX3** (Systems Biology Pathway Exchange) is used to represent the reaction kinetics data and experimental conditions (<http://www.sbpax.org>)
- Parameter units are described via the **UOME** (Units of Measurement Expressions) extension to BioPax (<http://www.sbpax.org/uome/>)
- BioPAX export is available in both web search interface and web services (<http://sabio.h-its.org/sabioRestWebServices/searchKineticLaws/biopax> endpoint)

```
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  xmlns:bp3="http://www.biopax.org/release/biopax-level3.owl#"
  xmlns:sbx3="http://vcell.org/sbpax3#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:uome-core="http://www.sbpax.org/uome/core.owl#"
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    <owl:imports rdf:resource="http://www.sbpax.org/uome/core.owl"/>
    <owl:imports rdf:resource="http://www.sbpax.org/uome/list.owl"/>
  </owl:Ontology>
  <bp3:UnificationXref rdf:about="http://sabio.h-its.org/biopax#Brenda_Tissue_Ontology:BT0:0000424">
    <bp3:db rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Brenda Tissue Ontology</bp3:db>
    <bp3:id rdf:datatype="http://www.w3.org/2001/XMLSchema#string">BT0:0000424</bp3:id>
  </bp3:UnificationXref>
  <bp3:SmallMolecule>
    <bp3:name rdf:datatype="http://www.w3.org/2001/XMLSchema#string">D-Glucose</bp3:name>
  </bp3:SmallMolecule>
  <sbx3:SBMeasurable rdf:about="http://sabio.h-its.org/biopax#temperature714">
    <sbx3:SBVocabulary rdf:resource="http://sabio.h-its.org/biopax#SBO:0000147"/>
    <sbx3:hasNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#double">37.0</sbx3:hasNumber>
    <sbx3:hasUnit rdf:resource="http://www.sbpax.org/uome/list.owl#DegreeCelsius"/>
    <sbx3:sbTerm rdf:resource="http://sabio.h-its.org/biopax#SBO:0000147"/>
  </sbx3:SBMeasurable>
  <bp3:TissueVocabulary rdf:about="http://sabio.h-its.org/biopax#tissue_erythrocyte">
    <bp3:term rdf:datatype="http://www.w3.org/2001/XMLSchema#string">erythrocyte</bp3:term>
    <bp3:xref rdf:resource="http://sabio.h-its.org/biopax#Brenda_Tissue_Ontology:BT0:0000424"/>
  </bp3:TissueVocabulary>
  <uome-core:UnitOfMeasurement rdf:nodeID="node16t8bg47mx420">
    <uome-core:unitSymbol rdf:datatype="http://www.w3.org/2001/XMLSchema#string">M</uome-core:unitSymbol>
  </uome-core:UnitOfMeasurement>
</rdf:RDF>
```




RESTful Web Services Introduction


RESTful Web Services are implemented offering data access via HTTP requests following a Representational State Transfer (REST) approach. Data can be accessed using simple http GET requests to either retrieve a complete SBML model, or a BioPAX/SBPAX3 representation of the requested entries, or pieces of information in a tailored format (in plain text or XML). Entries can be requested directly by using the database entry ID or can be searched for using the same format query built in user interface advanced search.



RESTFUL

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- Manual - including request examples
- Search Keyword Vocabulary

SOAP

- Manual
- Sample Client Code
- WSDL 



SABIO-RK RESTful Web Services Manual

API methods

[check API status](#)
[get a single kinetic law entry by ID](#)
[get kinetic law entries by IDs](#)
[get fields available for use in query strings for searching](#)
[search for kinetic law entries \(sbml\)](#)
[search for kinetic law entries and return a list of the entry IDs](#)
[search for kinetic law entries \(bioPAX\)](#)
[search for kinetic law entries and return the only the number of entries found](#)
[search for SabioReactionIDs](#)
[get fields available for suggestion lists](#)
[get suggestion list for the supplied field and term](#)
[get number of suggestions for the supplied field and term](#)

Error codes and their meaning

HTTP Response Code	Description
200	OK. The request to the web service completed successfully.
400	Bad request. The parameters passed to the API endpoint were invalid.
404	Not found. The resource corresponding to the supplied parameters does not exist.
500	Service unavailable. An internal problem prevented us from fulfilling your request.

SABIO REST api methods


Methods returning models of entries

Description: Get a single kinetic law entry by SABIO entry ID

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SABIO REST api methods

Methods returning models of entries

Description: Get a single kinetic law entry by SABIO entry ID

Input: N.A.

Output: SBML model

Example URL: <http://sabiork.h-its.org/sabioRestWebServices/kineticLaws/123>

Optional Parameters:

level - SBML level, default value:3

version - SBML version, default value:1

normalized - Export parameters with normalized units, default:true

Description: Get kinetic law entries by SABIO entry IDs

Input: list of SABIO entry IDs

Output: SBML model

Example URL: <http://sabiork.h-its.org/sabioRestWebServices/kineticLaws?kinlawids=123,234>

Optional Parameters:

level - SBML level, default value:3

version - SBML version, default value:1

normalized - Export parameters with normalized units, default:true

Description: Search for kinetic law entries by SABIO entry by a query string

Input: query string, see [Search Keyword Vocabulary](#) for how to form a query

Output: SBML model

Example URL: <http://sabiork.h-its.org/sabioRestWebServices/searchKineticLaws/sbml?q=Tissue:liver AND Organism:Homo sapiens>

Optional Parameters:

level - SBML level, default:3

version - SBML version, default:1

normalized - Export parameters with normalized units, default:true

Description: Search for kinetic law entries by SABIO entry by a query string

Input: query string, see [Search Keyword Vocabulary](#) for how to form a query

Output: BioPAX model

Example URL: <http://sabiork.h-its.org/sabioRestWebServices/biopax?q=Tissue:liver AND Organism:Homo sapiens>

Description: Search for kinetic law entries by SABIO entry by a query string, return only the number of the matching entries

Input: query string, see [Search Keyword Vocabulary](#) for how to form a query

Output: XML or plain text

Example URL: <http://sabiork.h-its.org/sabioRestWebServices/count?q=Tissue:liver AND Organism:Homo sapiens>

Optional Parameters:

format - format for export "xml" or "txt", default:xml



RESTful Web Services Search Keyword Vocabulary

The following vocabulary may be used to form queries to search for entries. These terms are identical to those used in the web interface for forming queries. An xml document containing all possible search fields is also accessible at <http://sabiork.h-its.org/sabioRestWebServices/searchKineticLaws>. Queries are formed using one or more of the fields below and should be passed as a request parameter named "q". Fields may be combined using the boolean AND operator to form complex queries.

Entry

EntryID - SABIO-RK entry ID (eg EntryID:123)

Reaction/Pathway

Pathway - The name of the reaction pathway (eg, Pathway:urea Cycle)

KeggReactionID - KEGG ID for the reaction (eg KeggReactionID:R00782)

SabioReactionID- SABIO-RK ID for the reaction (eg SabioReactionID:14)

Compound

AnyRole - Compound found in any role in a reaction eg (AnyRole:oxygen)

Substrate - Compound acting as a substrate in a reaction eg (Substrate:ATP)

Product - Compound acting as a product in a reaction

Inhibitor - Compound acting as an inhibitor modifier in a reaction

Catalyst - Compound acting as a catalyst modifier in a reaction

Cofactor - Compound acting as a cofactor in a reaction

Activator - Compound acting as an activator in a reaction

OtherModifier - Compound acting as a modifier not specified above, in a reaction

PubChemID - PubChem ID number of a compound

KeggID - KEGG ID number of a compound


ChebiID - Chebi ID number of a compound

SabioCompoundID

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Example requests:

Entries may be requested directly if the database entry ID is known

<http://sabio.h-its.org/sabioRestWebServices/kineticLaws/20147>

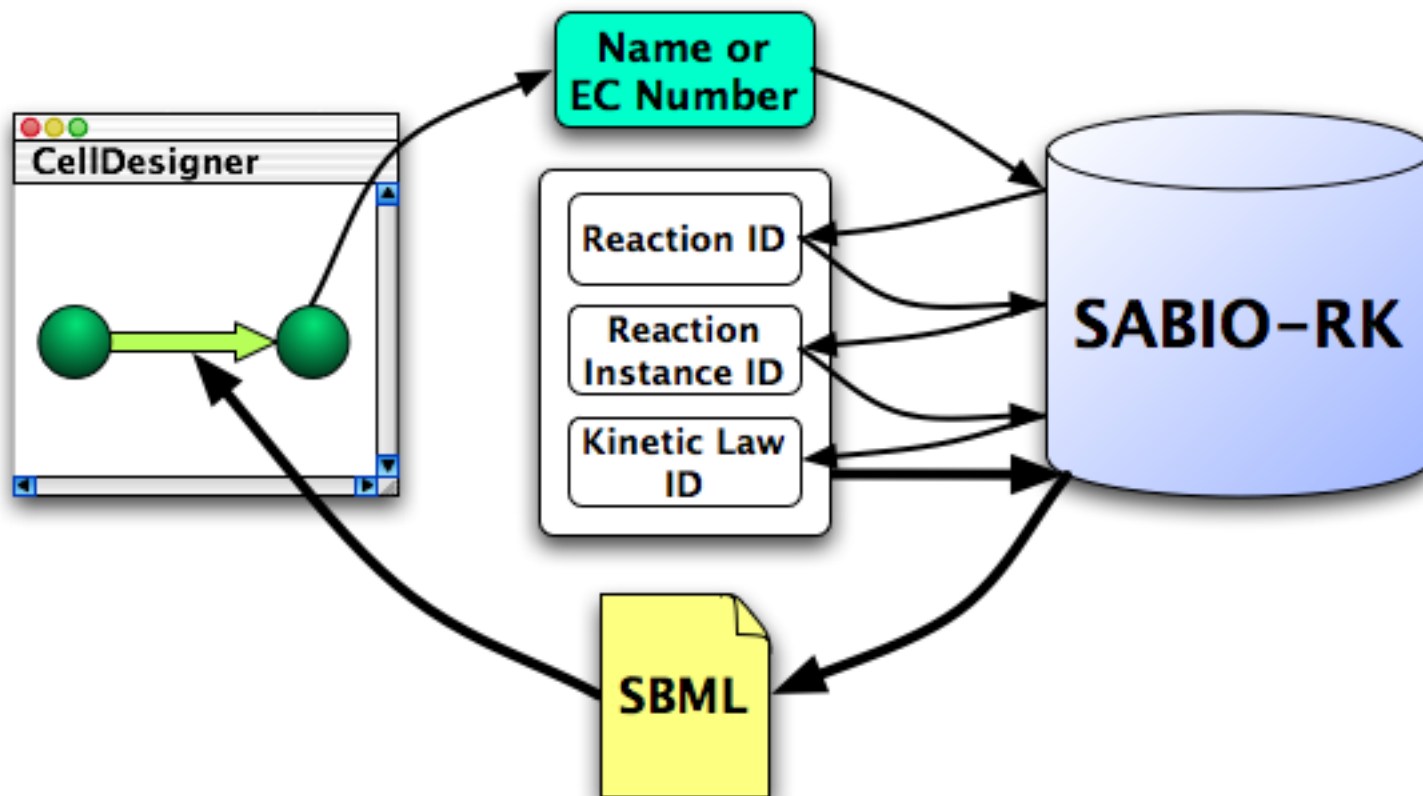
Entries may be searched for using the same search options available in the browser search interface

<http://sabio.h-its.org/sabioRestWebServices/searchKineticLaws/sbml?searchTerms=ORGANISM=Homo sapiens;TISSUE=liver>

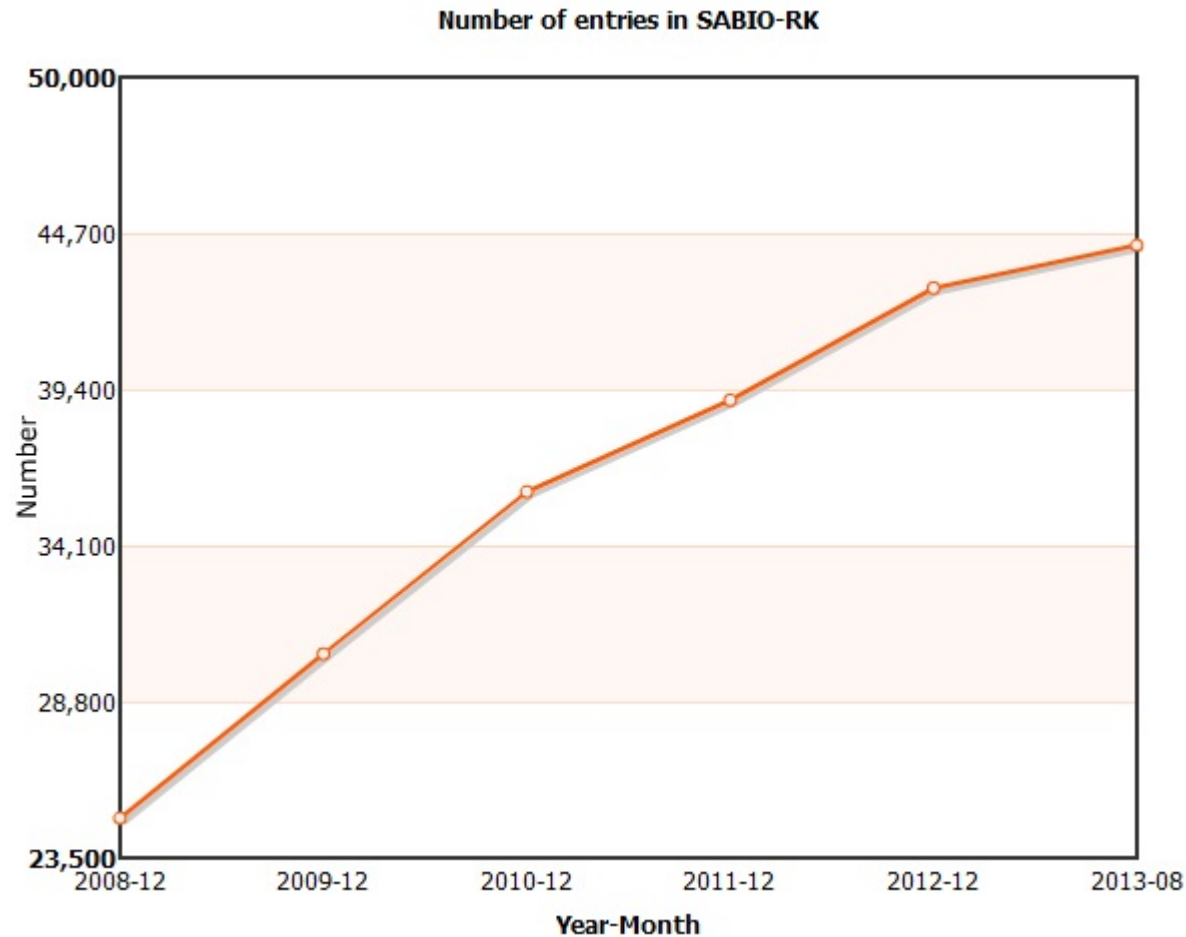
Suggestions for search terms can be done

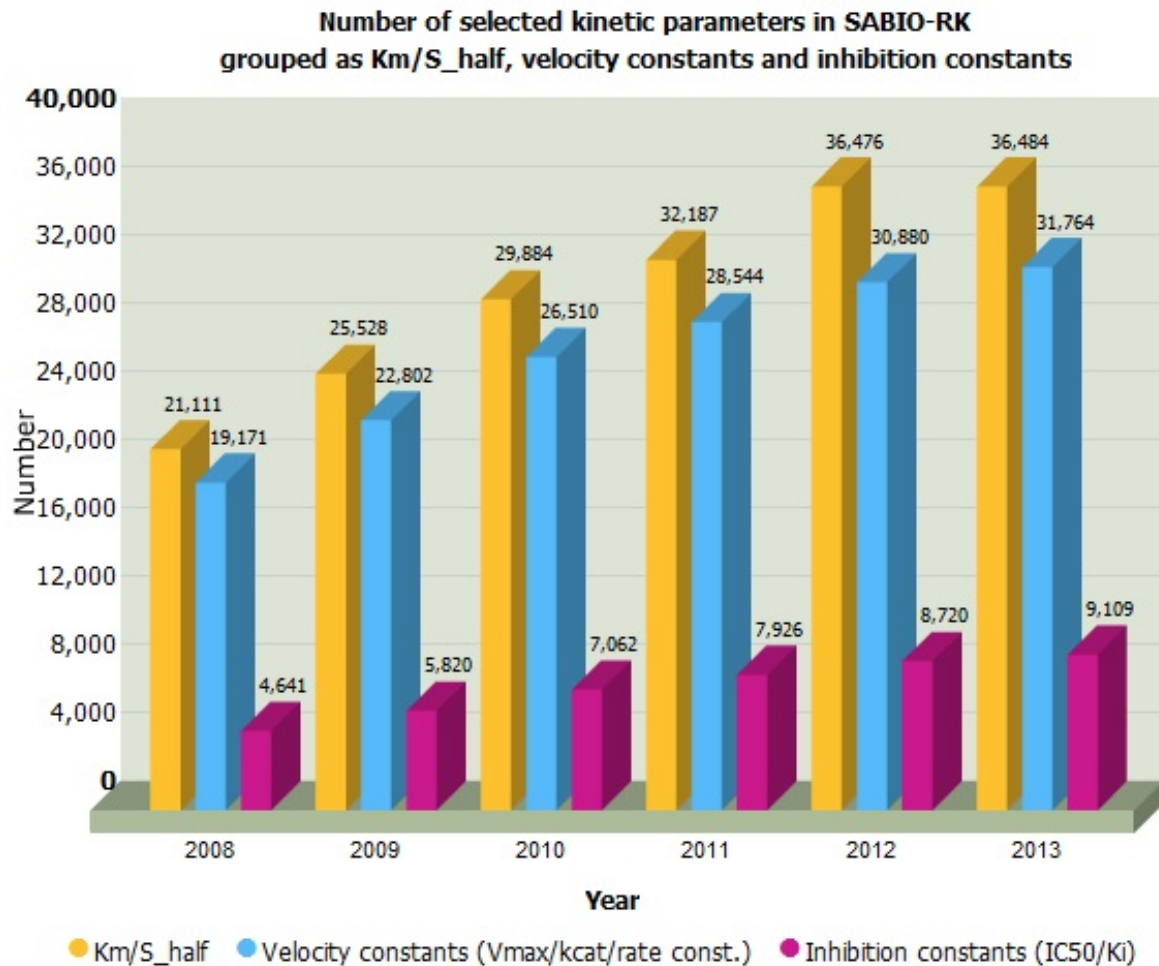
<http://sabio.h-its.org/sabioRestWebServices/suggestions/compounds?searchCompounds=glycoch>

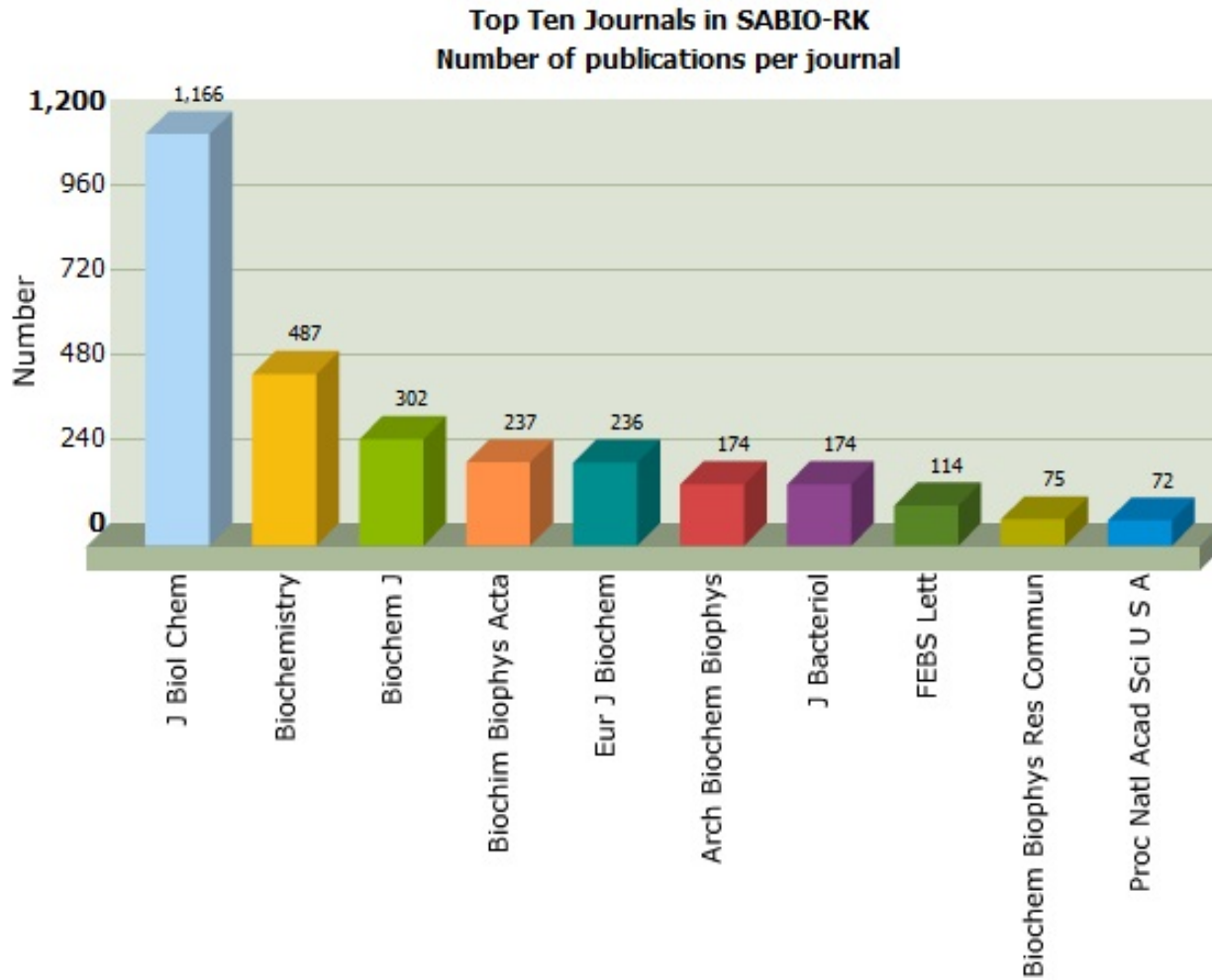
SABIO-RK API Access Integration into Modeling Tools



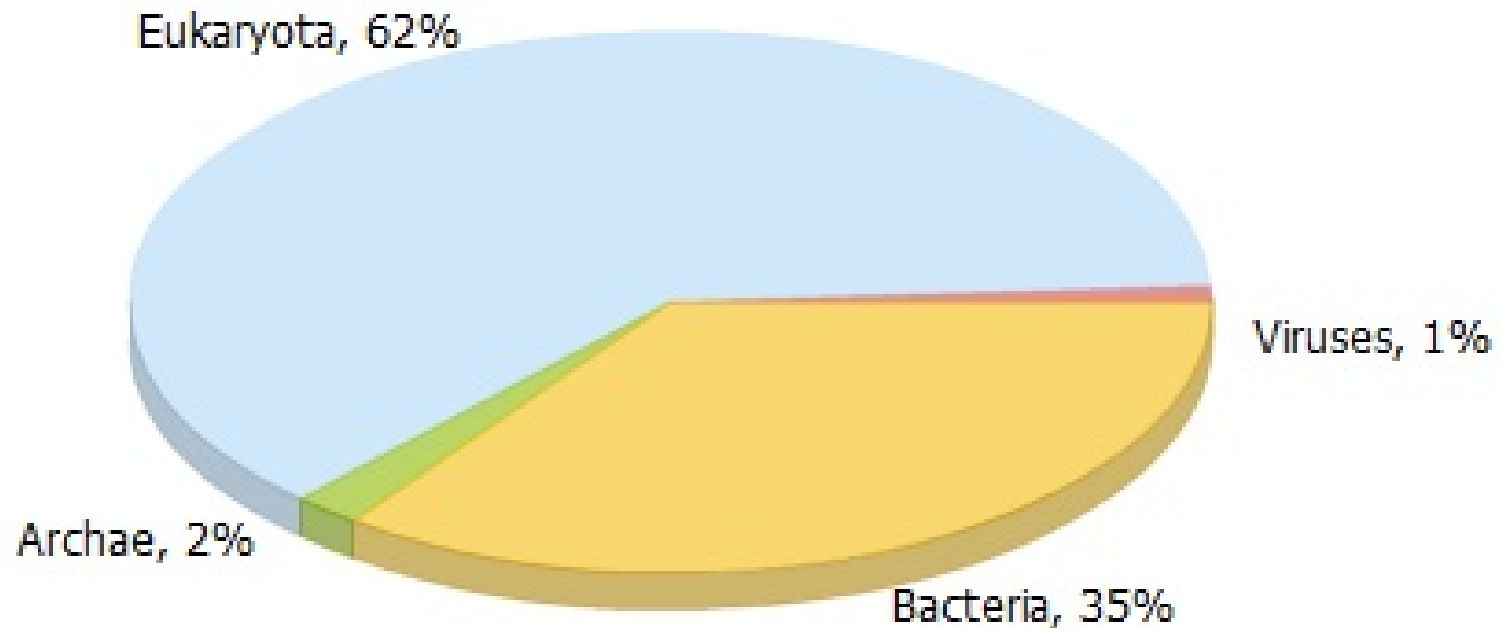
<http://www.celldesigner.org>







Taxonomic distribution of organisms in SABIO-RK





<http://sabio.h-its.org>



<http://sabiork.h-its.org>

Wittig U, Kania R, Golebiewski M, Rey M, Shi L, Jong L, Alga E, Weidemann A, Sauer-Danzwith H, Mir S, Krebs O, Bittkowski M, Wetsch E, Rojas I, Müller W

Nucleic Acids Research (2012) 40 (D1): D790-D796 (doi: 10.1093/nar/gkr1046)

Tutorial video: <http://sabio.h-its.org/redesign/files/SABIORKtutorial.mp4>

