

Collaborative Ontology Development and Evolution with WebProtégé and BioPortal

Natasha Noy
Stanford University

and the WebProtégé and BioPortal teams

Download Tutorial Slides

- Download:
 - <http://tinyurl.com/ICBO2011-WP-BP>
- Pages with the following icon are for the record only. We will switch to the demo for these pages:



By the end of the tutorial you will..

- **understand** how you can develop ontologies collaboratively
- **participate** in a collaborative ontology development
- know how to **custom-tailor** WebProtégé user interface for specific projects
- understand when to use **WebProtégé** and **BioPortal** in the life-cycle of ontology development
- know how to integrate WebProtégé and BioPortal in a single workflow
- know how to **collect feedback** on your published ontology from the user community and to provide feedback
-

Tutorial Outline

- **Lifecycle** of collaborative ontology development
- The **Stanford ontology tools**
- Collaborative development in **WebProtégé**
 - with hands-on exercises
- Soliciting feedback in **BioPortal**
 - with hands-on exercises
- **Bringing it all together**: viewing contributions from BioPortal in WebProtégé and vice versa

Collaborative Ontology Development

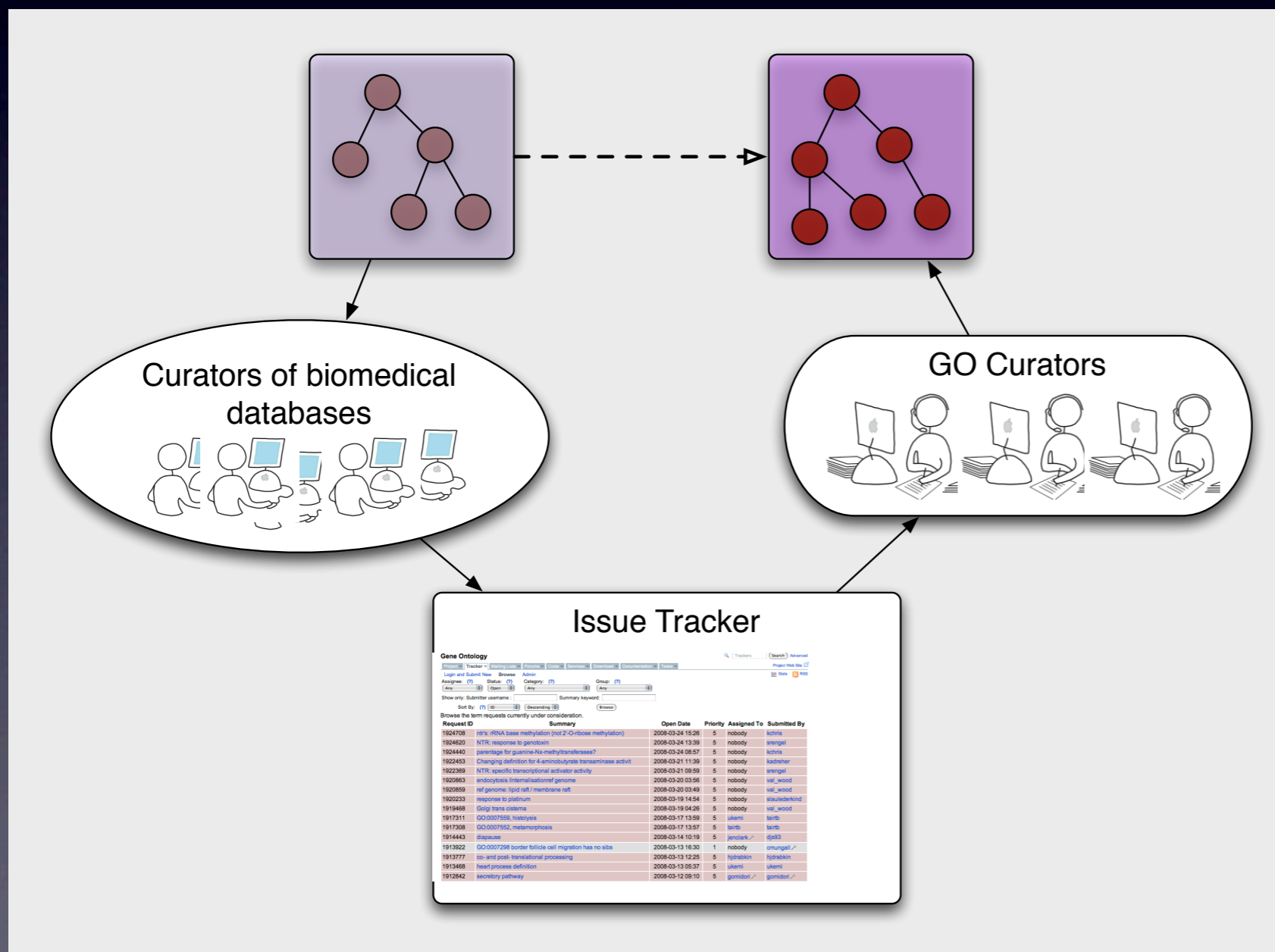
- **Collaborative**
 - Several users contribute to a single developing ontology
 - There are mechanisms to carry out discussions and to reach consensus
- **Ontologies**
 - From simple taxonomies
 - To expressive OWL ontologies

Use Cases in Biomedical Domain

- Gene Ontology (GO)
- NCI Thesaurus
- OBI, RadLex

The Gene Ontology

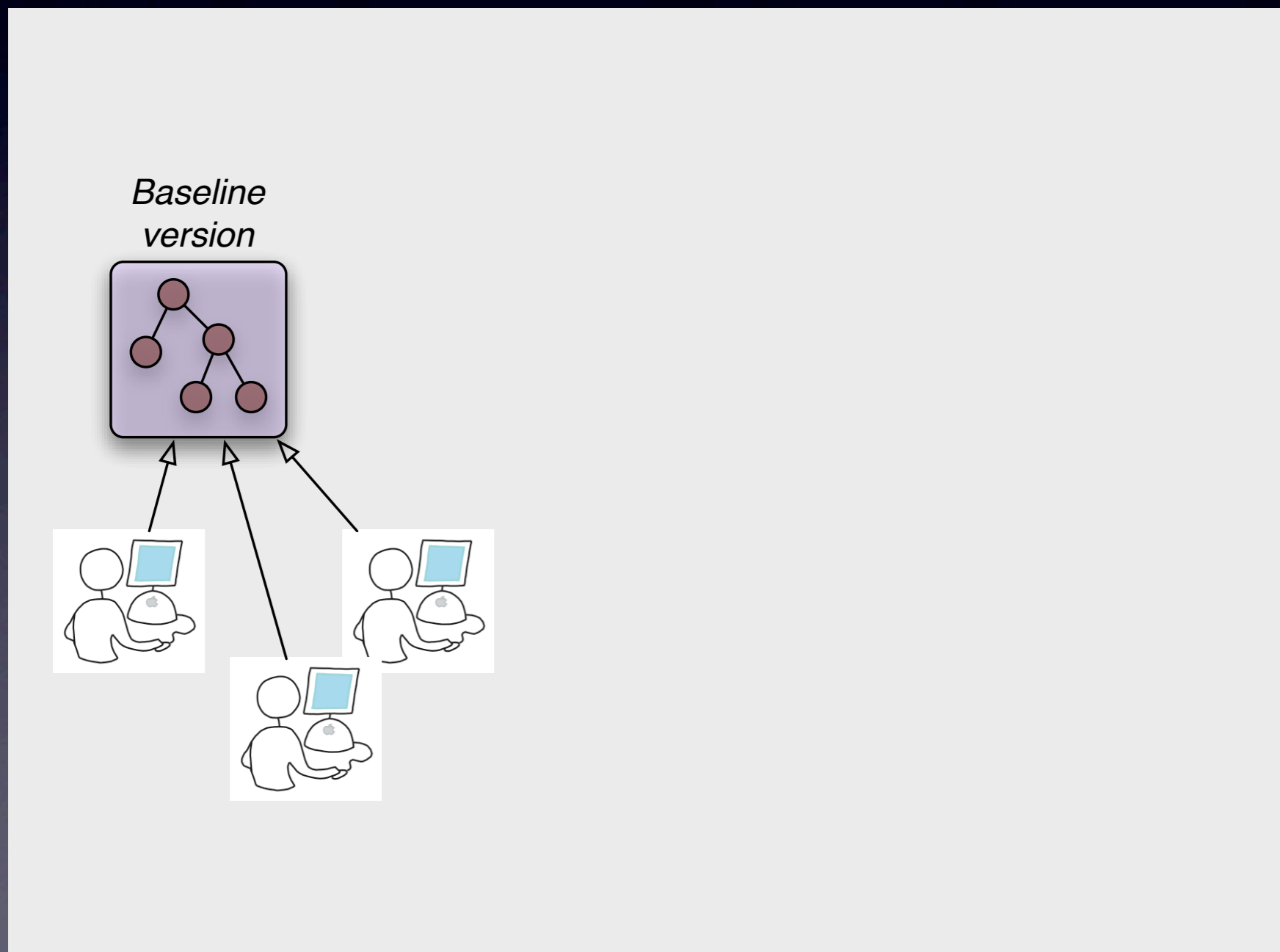
Terminology for consistent description of gene products



- *Small number of full-time curators have access to edit GO*
- *Anyone in the community can submit an issue or request*

The NCI Thesaurus

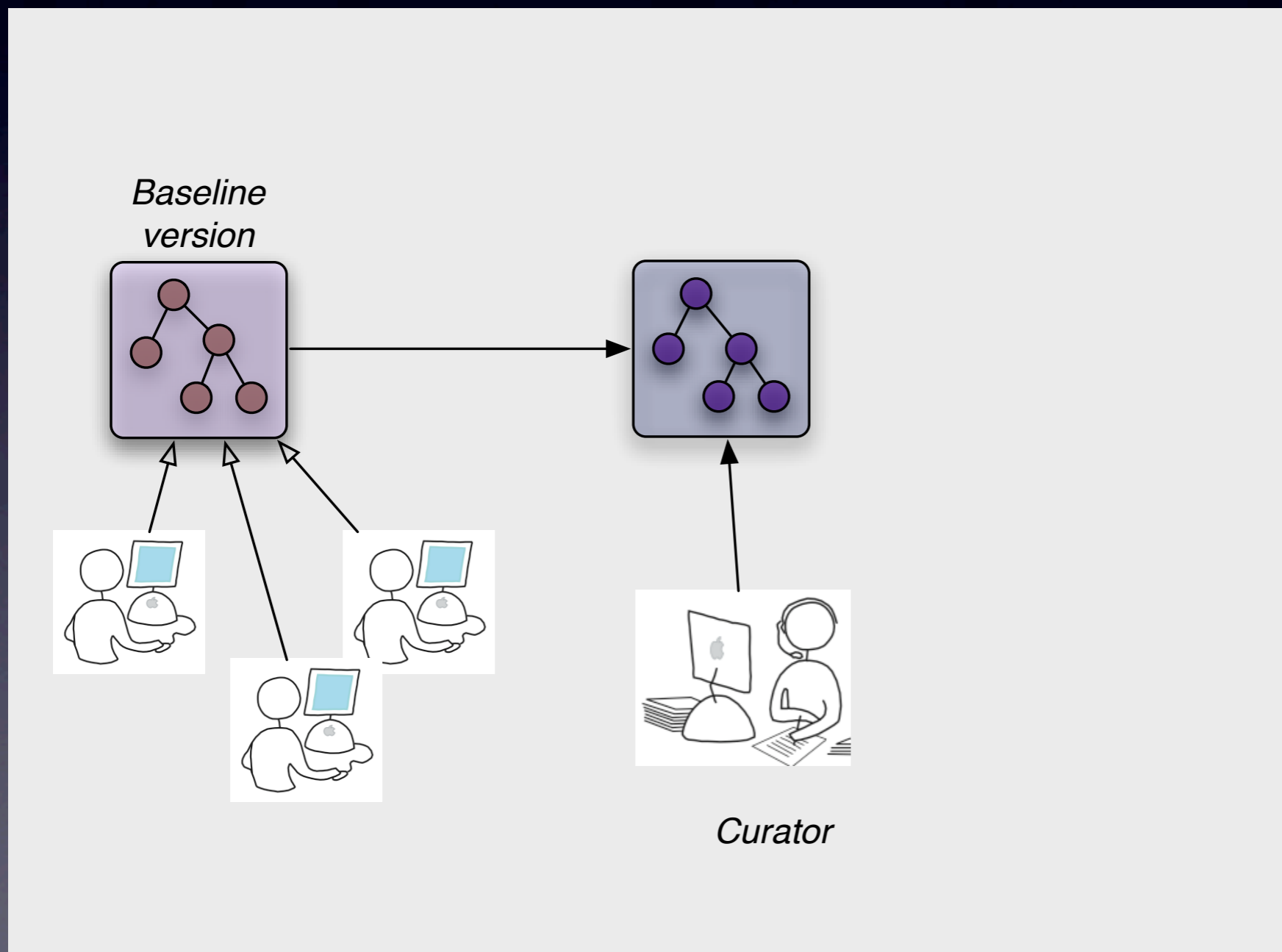
Reference ontology for cancer biology, translational science, and clinical oncology



- *~20 full-time editors making changes*
- *Changes are not immediately visible*
- *1 “lead editor” who approves the changes, and assigns new tasks*

The NCI Thesaurus

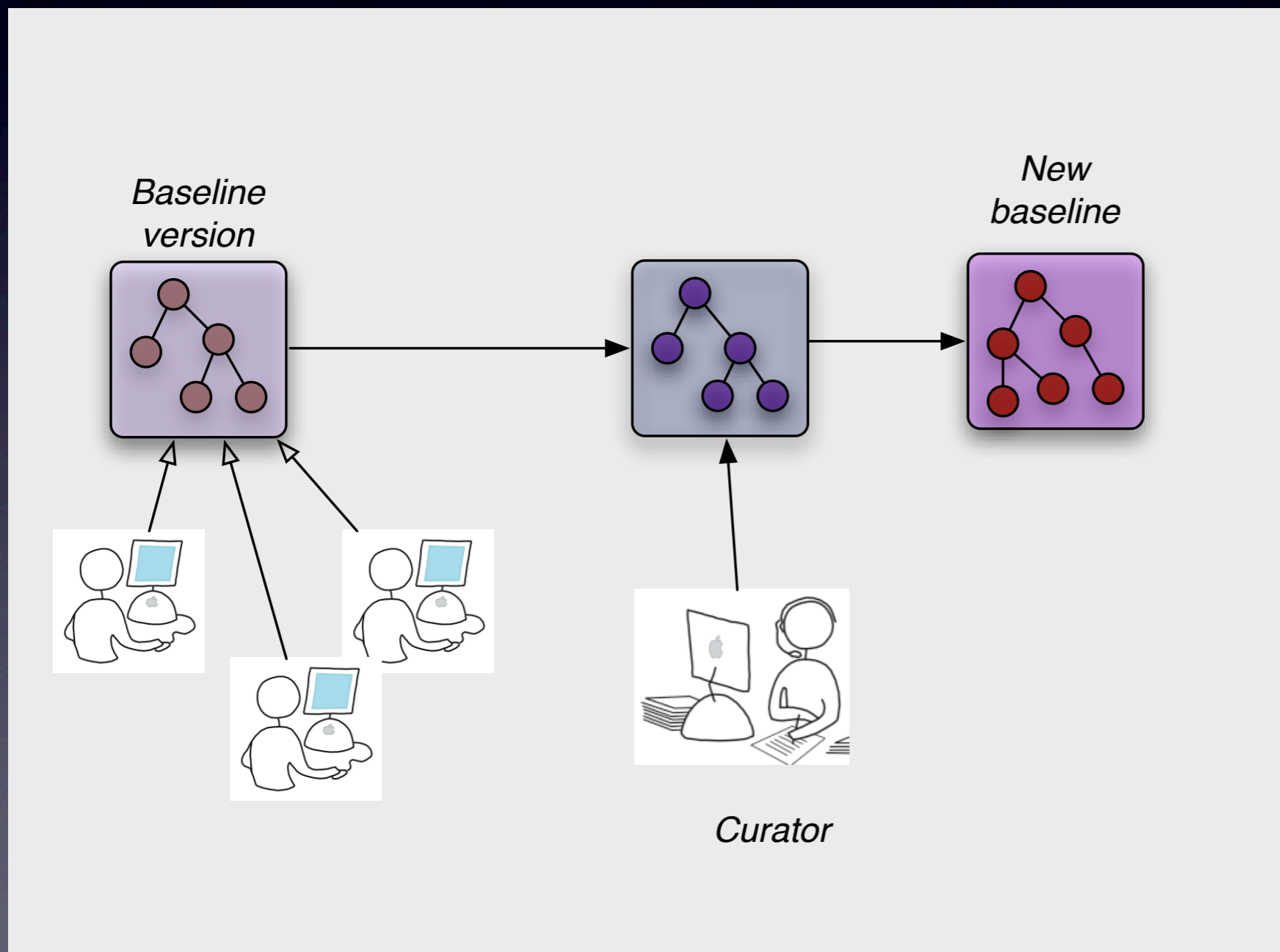
Reference ontology for cancer biology, translational science, and clinical oncology



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The NCI Thesaurus

Reference ontology for cancer biology, translational science, and clinical oncology



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Other Biomedical Projects

- OBI, RadLex
 - tightly-knit community of developers (20-30)
 - most actively participate in discussions
 - Small number of editors make changes to the ontology

Dimensions of Collaborative Workflows

- **Ontology size**
 - *from 100s to 10,000s of concepts*
- **Size of the community**
 - Contributors (in some form): *from 2-3 to dozens*
 - Editors: *from 1-2 to 20*
- **Control mechanisms**
 - Variety of roles
 - Gatekeepers, etc.
 - Client-server editing
- **Discussion tools**
 - mailing lists, message boards
 - face-to-face meetings, telecons
- **Synchronization and editing mechanisms**
 - CVS, SVN
 - Integrated ontology environments (WebProtégé, BioPortal)

Brief Introduction to Stanford Ontology Tools

- **WebProtégé**: a web-based collaborative ontology editor
- **BioPortal**: a community-based ontology repository



What Is Protégé?

- Protégé is an **open-source ontology editor**
 - developed at Stanford, in collaboration with University of Manchester
 - has more than 175,000 registered users
 - has dozens of plugins for
 - visualization
 - inference
 - import and export
 - natural-language processing
 - ... (things we don't know exist)

WebProtégé

- **WebProtégé** is an open source light-weight ontology editor for the Web
 - It is a Protégé client
- Main features of WebProtégé:
 - Browsing of ontologies
 - **Lightweight** ontology editing
 - **Customizable** user interface
 - **Extensible**: Developers may easily implement their own tabs and portlets

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Welcome to WebProtégé Demo!

You are signed out. | [Sign In](#) | [Send feedback!](#)

My WebProtégé

OPL

Classes

Edit Class Metadata

Properties

Notes and Discussions

Change History

Search Bioportal

Add content to this tab Add tab

Classes

Create Delete Watch Branch

- 9
- 9
- inuant 6
- ependent_continuant
- ndependent_continuant 6
- material_entity 6
 - anatomical structure 2
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 - cell
 - erythrocyte
 - Homo sapiens erythrocyte
 - hepatocyte
 - macrophage
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 - hepatopancreas
 - hindgut
 - intestine
 - liver
 - lung

Properties for Homo sapiens erythrocyte

Add property value Delete property value

Property	Value	Lang
definition	red blood cells of human	
oboInOwl:hasDbXref	FMA:62845	
rdfs:label	Homo sapiens erythrocyte	

Asserted Conditions for Homo sapiens erythrocyte

NECESSARY & SUFFICIENT

- erythrocyte
- part_of *some* 'Homo sapiens'

NECESSARY

INHERITED

- continuant *or* occurrent [from entity]
- dependent_continuant *or* independent_continuant *or* spatial_region [from continuant]
- fiat_object_part *or* object *or* object_aggregate [from material_entity]
- material_entity *or* object_boundary *or* site [from independent_continuant]

NCBO BioPortal

- Web accessible **repository** of ontologies for the biomedical community:
 - <http://bioportal.bioontology.org>
- Online support for ontology
 - Peer review
 - Notes (comments and discussion)
 - Versioning
 - Mapping
 - Search
 - Resources



Browse

Search

Projects

Annotate

All Mappings

All Resources

Access all ontologies that are available in BioPortal: You can filter this list by category to display ontologies relevant for a certain domain (try selecting "Anatomy category" menu below). You can also filter ontologies that belong to a certain group such as ontologies from the [OBO Foundry](#), or ontologies from the [Cancer Bi](#). [the BioPortal RSS feed](#) to receive alerts for submissions of new ontologies, new versions of ontologies, new notes, and new projects. You can subscribe to feeds for this page. Add a new biomedical ontology to BioPortal using the Submit New Ontology link.

FILTER BY CATEGORY	<input type="text" value="All Categories"/>
FILTER BY GROUP	<input type="text" value="All Groups"/>
FILTER BY TEXT	<input type="text"/>

[Submit New Ontology](#)

ONTOLOGY NAME ▲	VISIBILITY	TERMS	NOTES	REVIEWS	PROJECTS	UPLOADED
ABA Adult Mouse Brain (ABA)	Public	913	0	0	2	08/08/2009
Adverse Event Ontology (AEO)	Public	431	0	0	0	04/13/2011
Adverse Event Reporting ontology (AERO)	Public	252	0	0	1	07/22/2011
African Traditional Medicine (ATMO)	Public	223	2	2	2	06/28/2009
AI/RHEUM (AIR)	Public	681	0	0	0	02/05/2010
Amino Acid (amino-acid)	Public	46	0	0	3	07/02/2010
Amphibian gross anatomy (AAO)	Public	1,603	0	0	3	07/22/2011
Amphibian taxonomy (ATO)	Public	6,135	0	0	1	11/02/2009
Anatomical Entity Ontology (AEO)	Public	137	0	0	0	02/15/2011
Animal natural history and life history (ADW)	Public	360	0	0	0	08/31/2010

BioPortal Library

- 250+ ontologies in OWL, RDFS, Protégé frames, OBO, and RRF
- 5,300,000 terms in the ontologies
- 2,000,000 term-to-term mappings

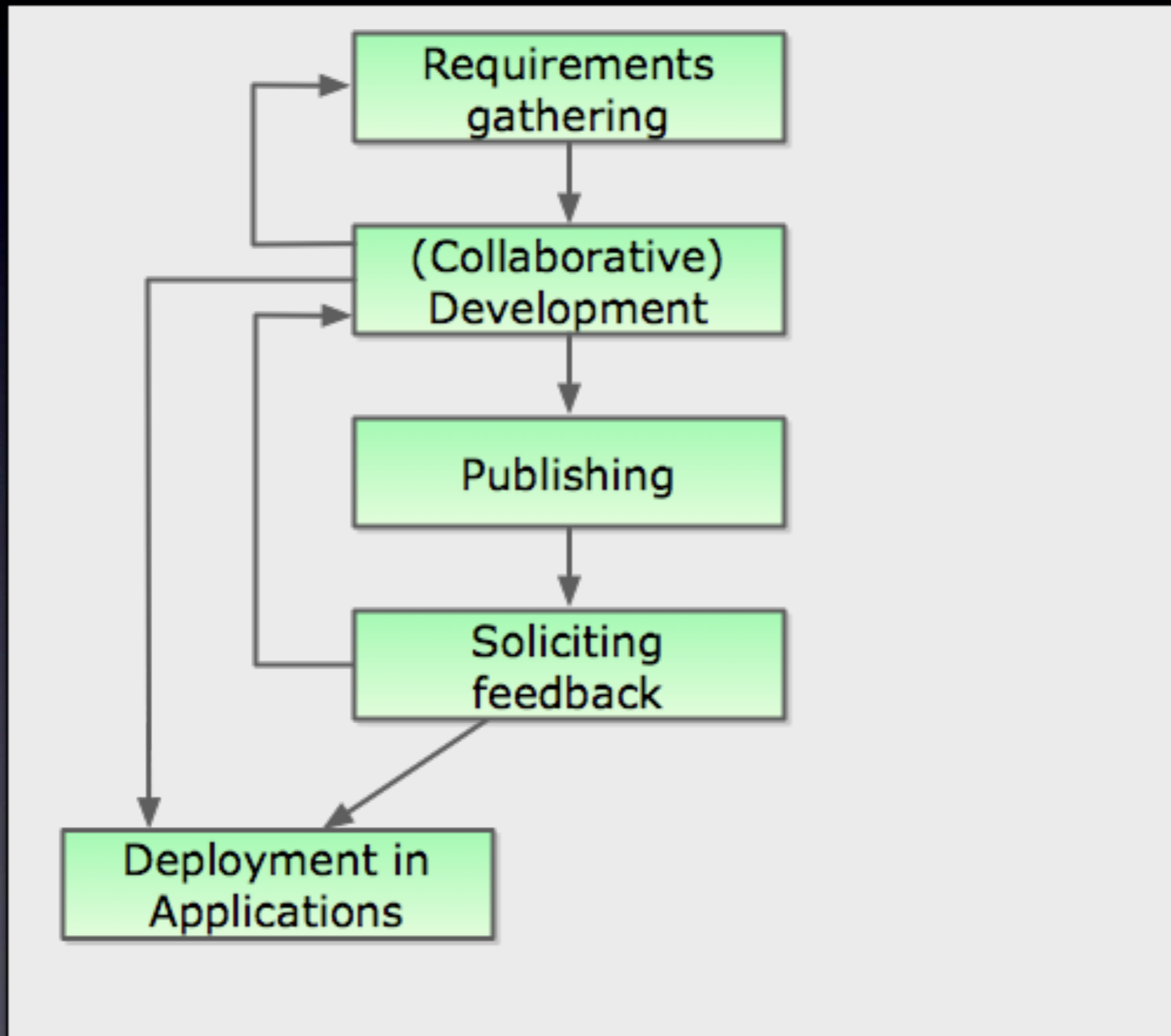
So, you want to develop an ontology....

- ... and have your friends help you
- ... and have the broader user community contribute to your work

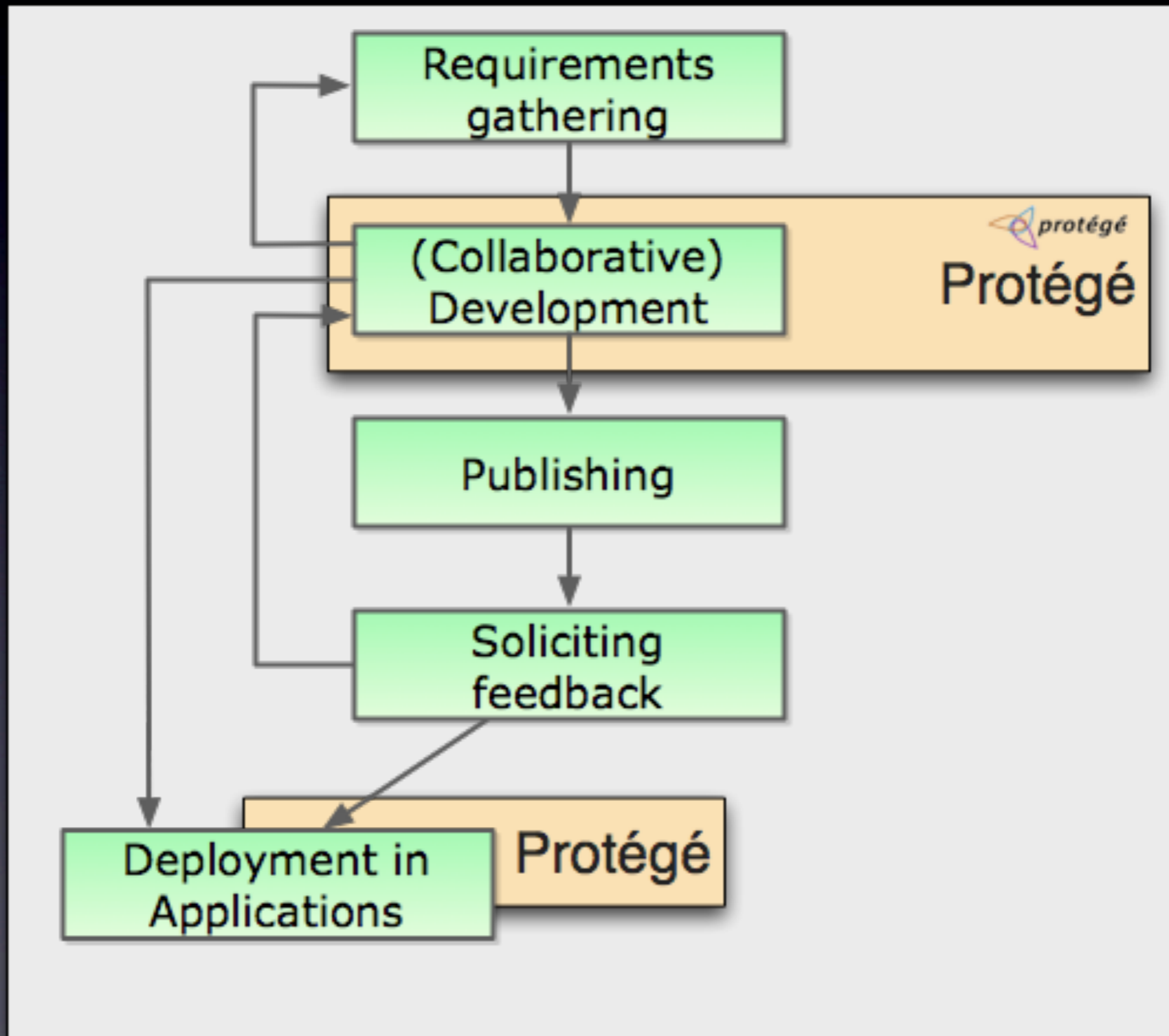
Lifecycle of Collaborative Ontology Development

- Develop an ontology collaboratively
 - with several editors contributing to the ontology
 - discussing the ontology internally within the group
- Publish ontology to collect feedback from the user community
- Evolve the ontology based on the feedback

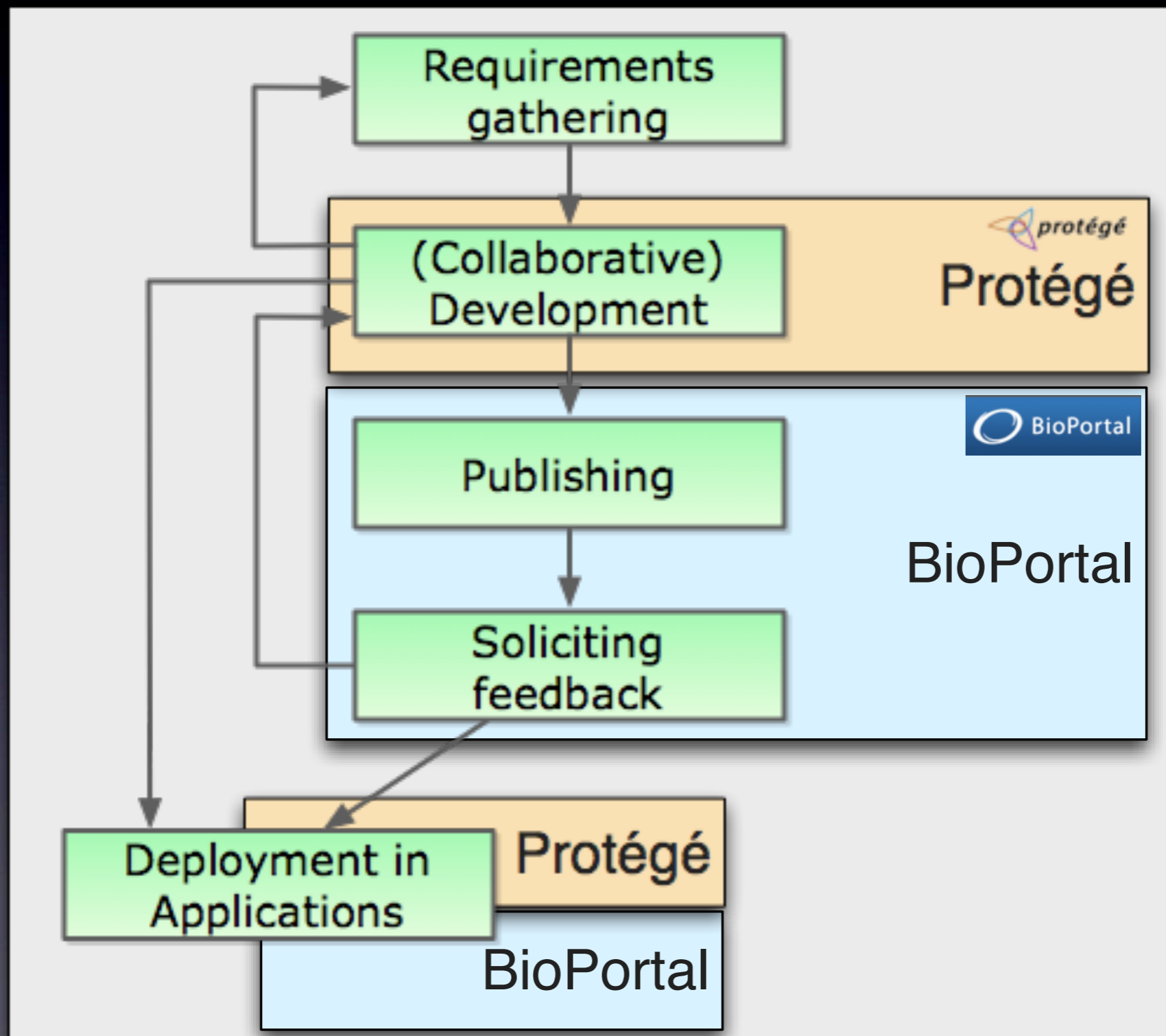
An (Over-Simplified) Ontology Lifecycle



An (Over-Simplified) Ontology Lifecycle



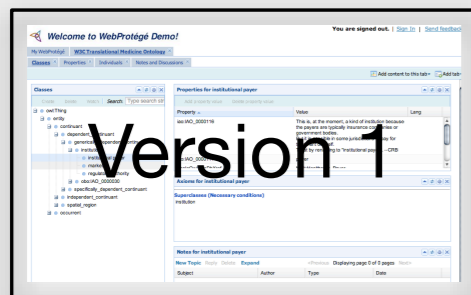
An (Over-Simplified) Ontology Lifecycle



Use Case Scenario

Use Case Scenario

Develop

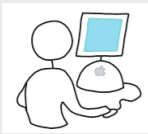
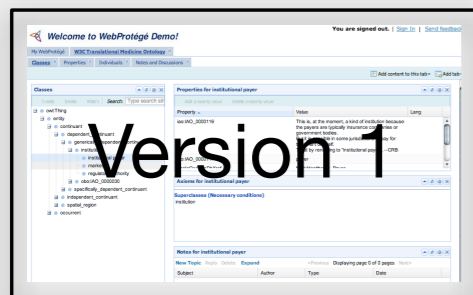


Version 1

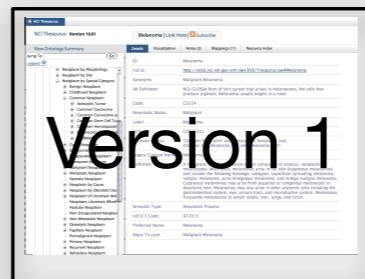


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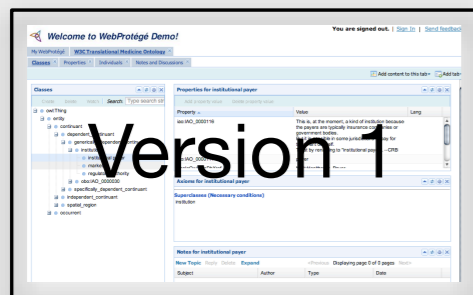


Publish

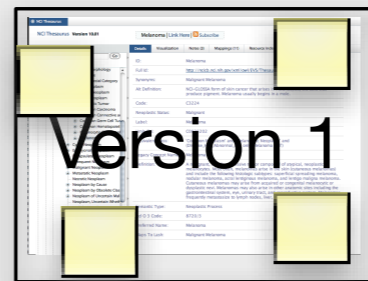


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Develop

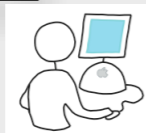
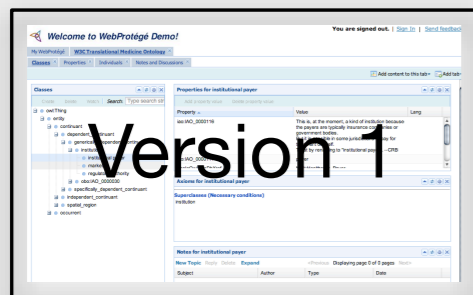


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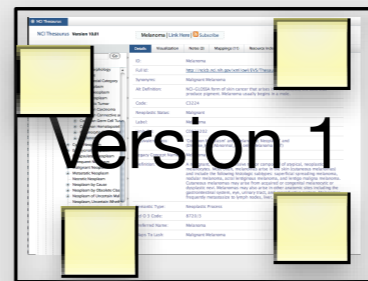


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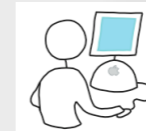
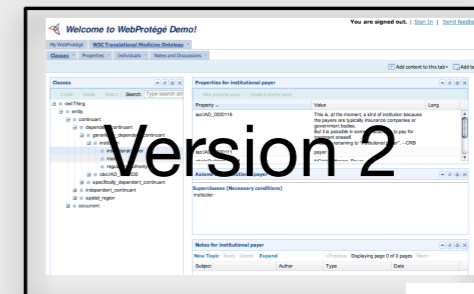
Develop



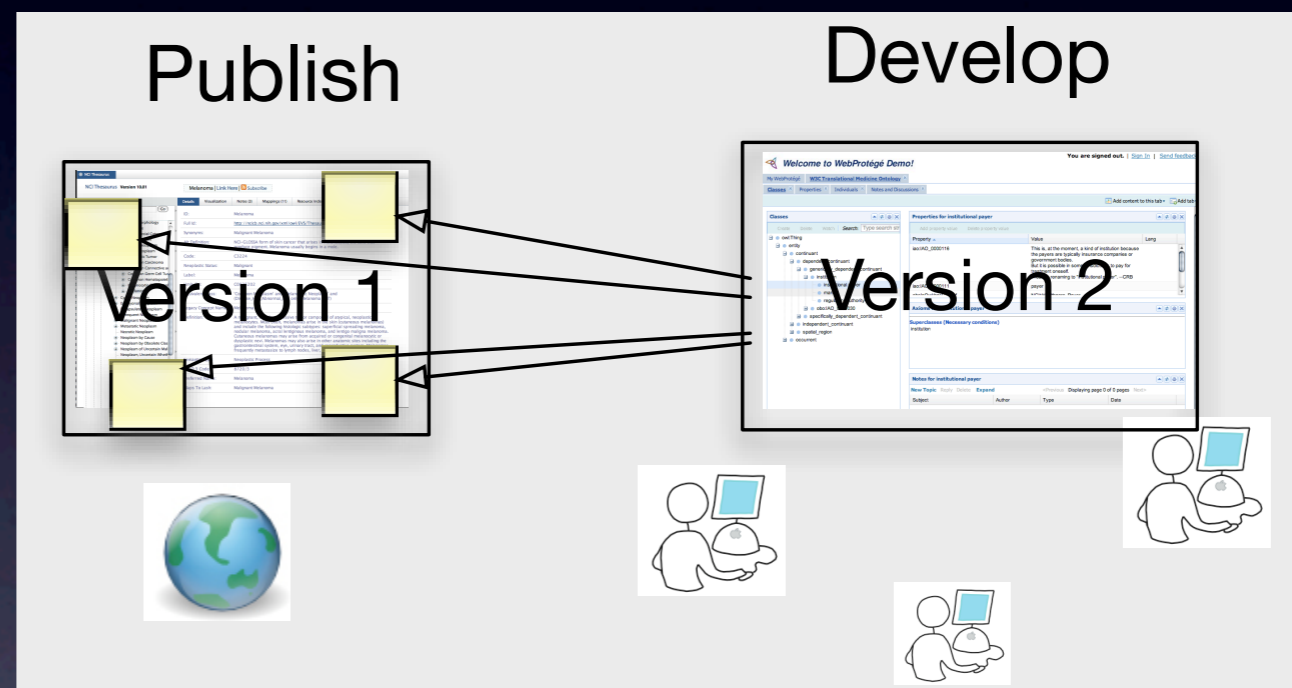
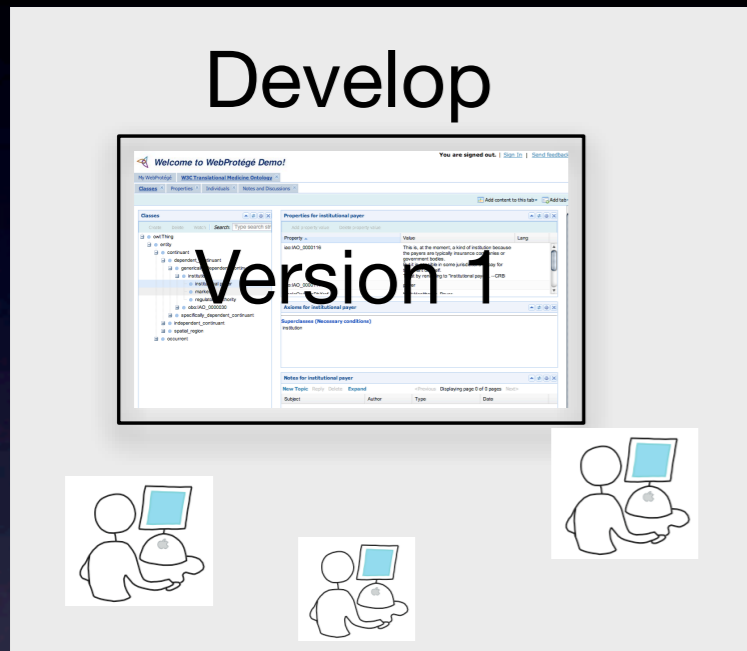
Publish



Develop

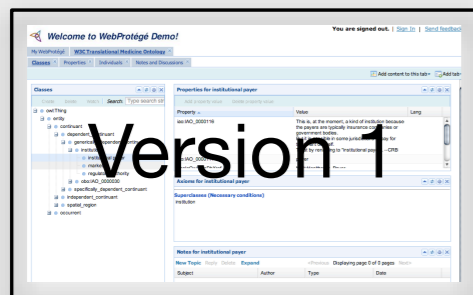


Use Case Scenario

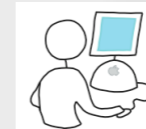
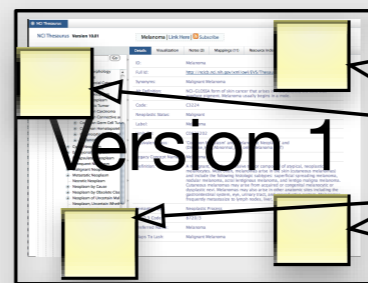


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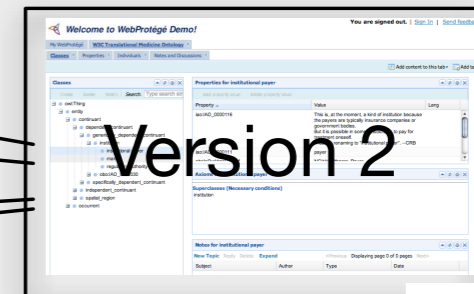
Develop



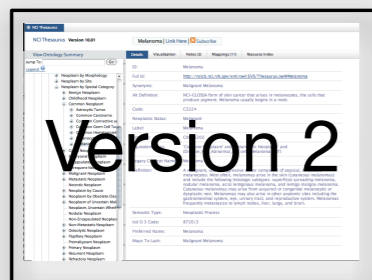
Publish



Develop



Publish



WebProtégé

WebProtégé versus “The Good Old Protégé

- WebProtégé is another client that you can use to access the Protégé server



Welcome to WebProtégé Demo!

You are signed out. | [Sign In](#) | [Send feedback!](#)

My WebProtégé

OPL

Classes

Edit Class Metadata

Properties

Notes and Discussions

Change History

Search Bioportal

Add content to this tab Add tab

Classes

Create Delete Watch Branch

- 9
- 9
- inuant 6
- ependent_continuant
- ndependent_continuant 6
- material_entity 6
 - anatomical structure 2
 - blood 2
 - cell
 - erythrocyte
 - Homo sapiens erythrocyte**
 - hepatocyte
 - macrophage
 - cerebrospinal fluid
 - hepatopancreas
 - hindgut
 - intestine
 - liver
 - lung

Properties for Homo sapiens erythrocyte

Add property value Delete property value

Property	Value	Lang
definition	red blood cells of human	
ob	Λ:62845	
rdf	no sapiens erythrocyte	

Asserted Conditions for Homo sapiens erythrocyte

NECESSARY & SUFFICIENT

- erythrocyte
- part_of *some* 'Homo sapiens'

NECESSARY

INHERITED

- continuant *or* occurrent [from entity]
- dependent_continuant *or* independent_continuant *or* spatial_region [from continuant]
- fiat_object_part *or* object *or* object_aggregate [from material_entity]
- material_entity *or* object_boundary *or* site [from independent_continuant]

WebProtégé

Welcome to WebProtégé Demo! You are signed out. | [Sign In](#) | [Send feedback](#)

My WebProtégé OPL

Classes Edit Class Metadata Properties Notes and Discussions Change History Search Biportal

Add content to this tab Add tab

WebProtégé

Classes

- erthocyte
- Homo sapiens erthocyte
- hepatocyte
- macrophage
- cerebrospinal fluid
- hepatopancreas
- hindgut
- intestine
- liver
- lung

Properties for Homo sapiens erthocyte

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erthocyte

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flat_object_part or object or object_aggregate [from material_entity]

material_entity or object_boundary or site [from independent_continuant]

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My WebProtégé OPL

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Classes

Properties for Homo sapiens erythrocyte

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WebProtégé

- doap:SVNRepository
- doap:Version
- ▼ entity
 - ▼ ● continuant
 - ▶ ● dependent_continuant
 - ▼ ● independent_continuant
 - ▼ ● material_entity
 - allergen
 - ▶ ● anatomical entity
 - antigen
 - capsule shell
 - ▶ ● cell
 - ▶ ● cellular_component
 - ▶ ● chemical solution
 - chimera
 - ▶ ● cloning vector
 - decapitated organism
 - dissolved material entity
 - ▶ ● enzyme
 - epitope
 - fiat_object_part

Protégé 3.4.6 (file:/Users/natasha/Work/Ontologies/merged-obi-comments_v2011-04-20.pprj, OWL / RDF Files)

Tools Window BioPortal Collaboration Help

owl) ● OWLClasses ■ Properties ◆ Individuals ■ Forms

CLASS EDITOR for material_entity (instance of owl:Class)

For Class: .ifomis.org/bfo/1.1/snap#MaterialEntity Inferred View

Property	Value
■ rdfs:comment	Definition: An independent continuant [snap:IndependentContinuant] that is spatially extended whose identity is independent of that of other entities and can be maintained through time.

Desktop Protégé

Asserted Co

NECESSAR

ct or object_aggregate

t

● continuant or occurrent [from e

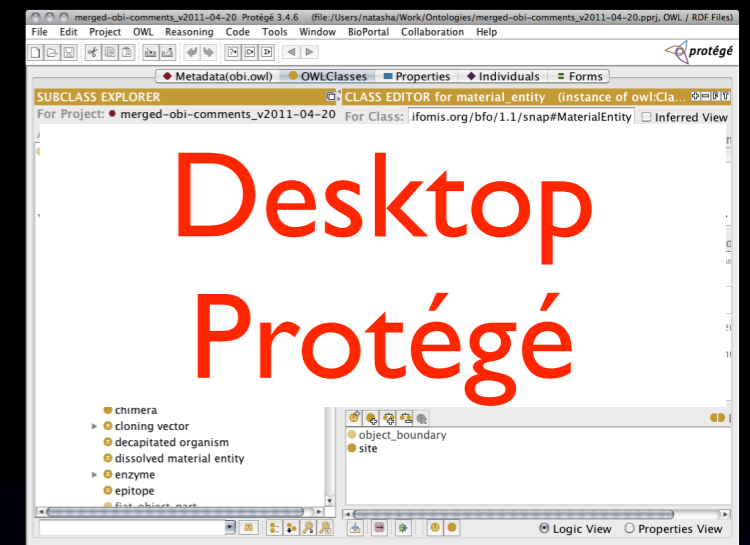
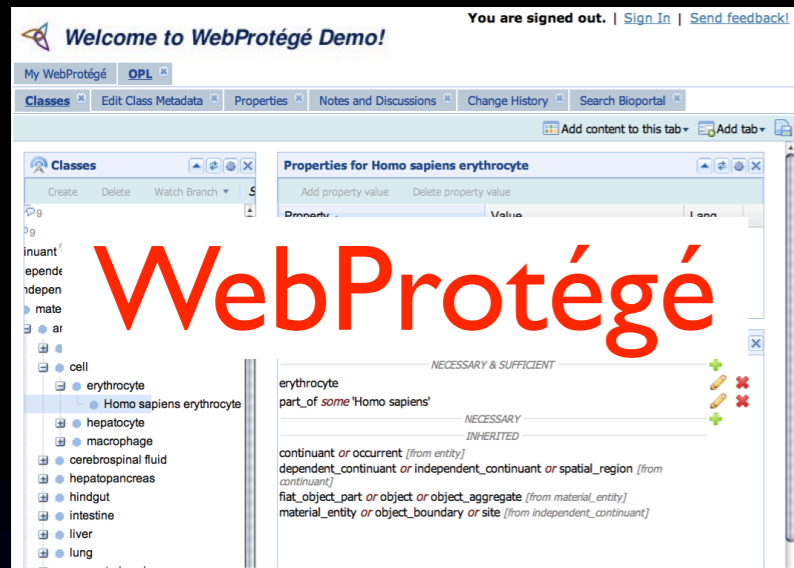
● dependent_continuant or independent_continuant or spatial_region

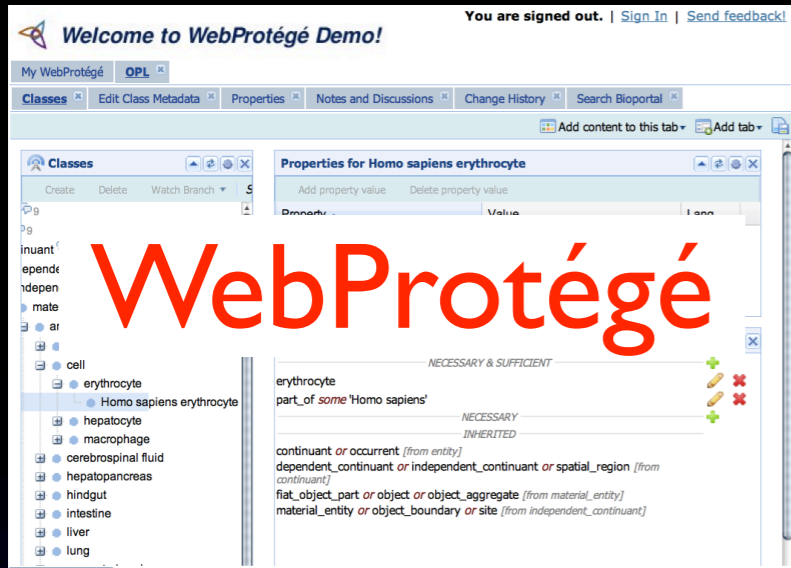
● material_entity or object_boundary or site [from independent_conti

● object_boundary

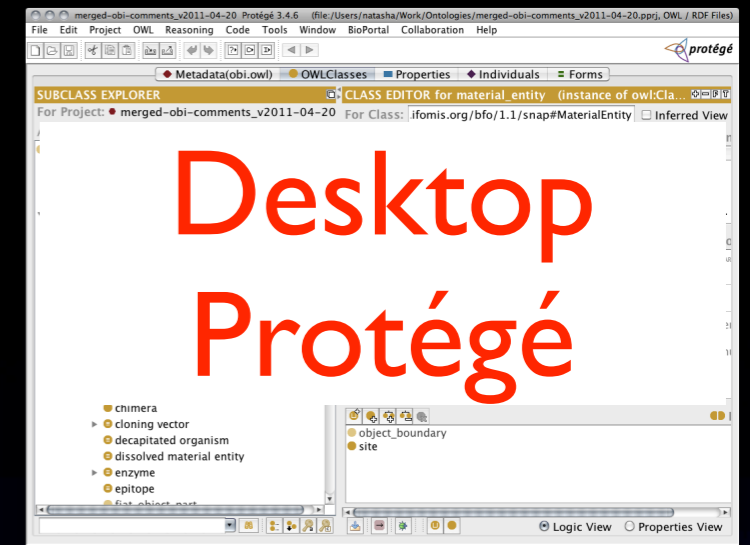
● site

Logic View Properties View

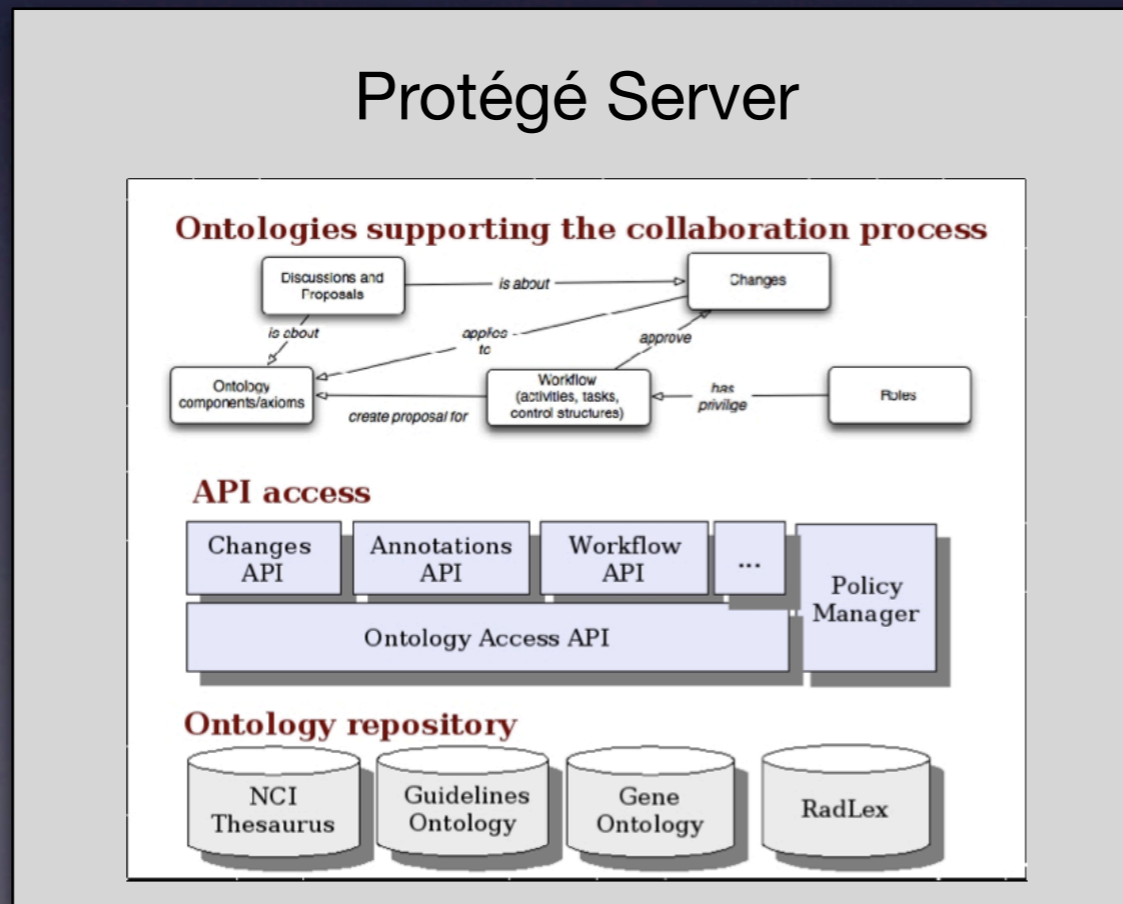




WebProtégé



Desktop Protégé



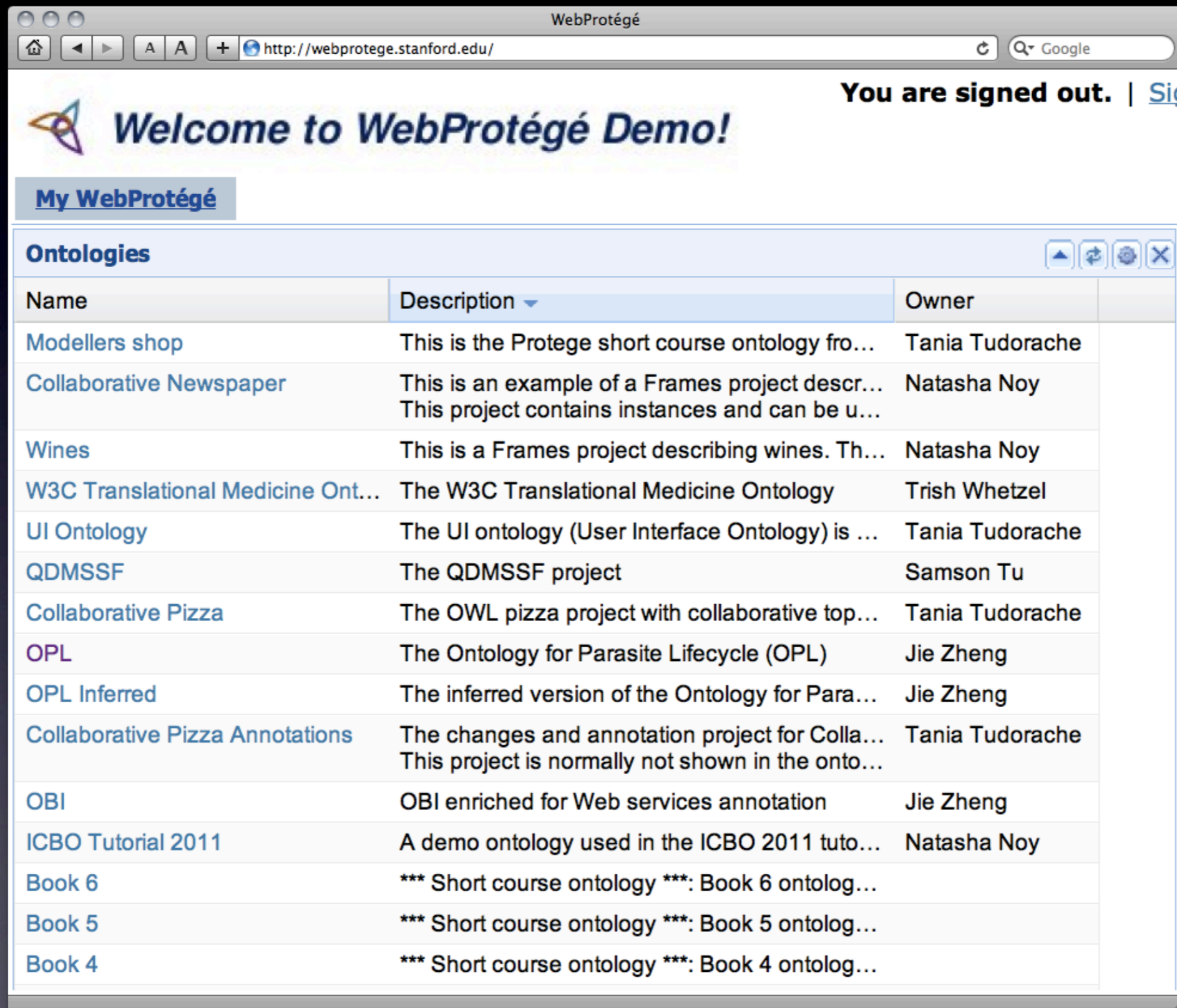
WebProtégé demo

<http://webprotege.stanford.edu>

Let's say....

- A friend has invited you to help her develop an ontology
- And she has set it up in WebProtégé
- <http://webprotege.stanford.edu>

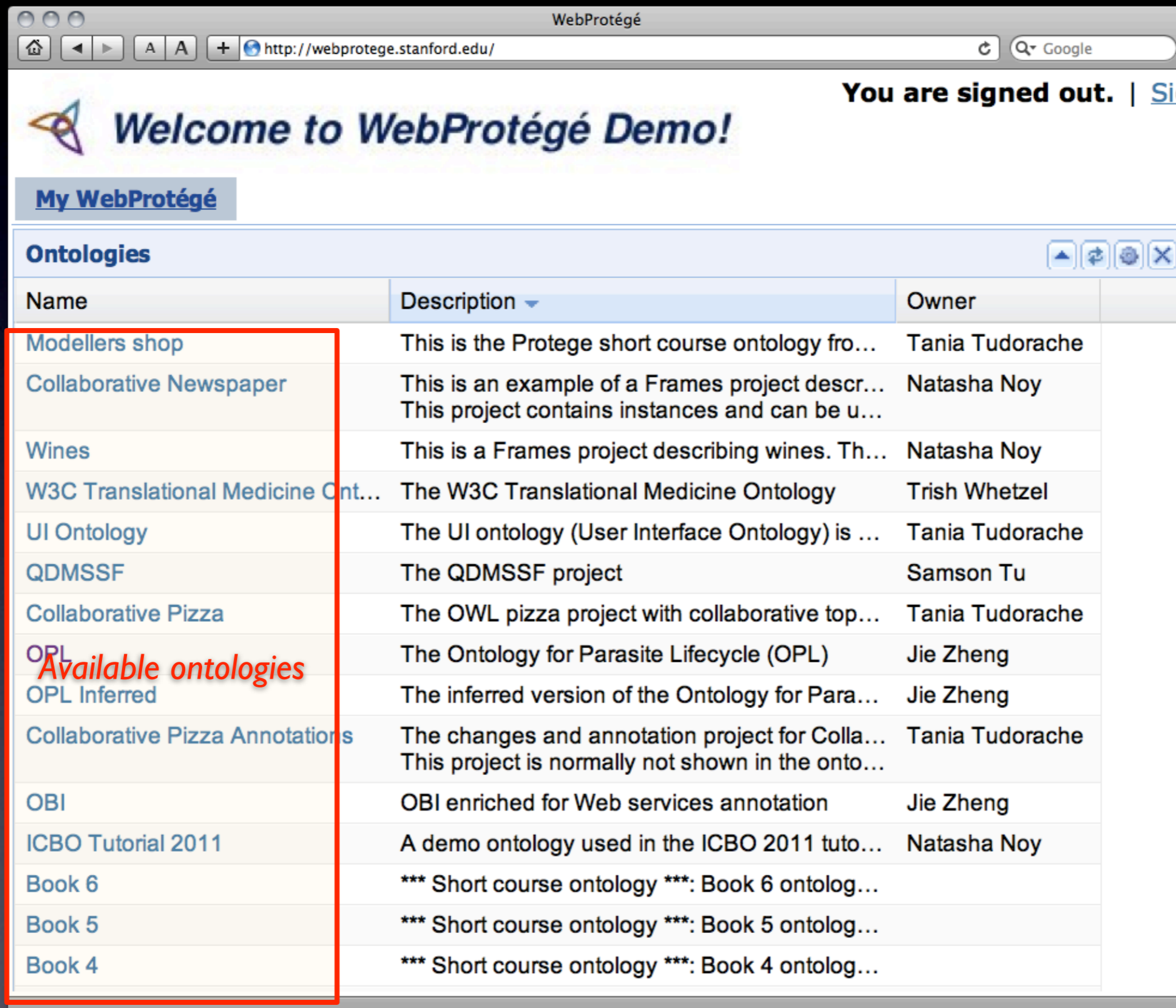
WebProtégé home screen



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Name	Description	Owner
Modellers shop	This is the Protege short course ontology fro...	Tania Tudorache
Collaborative Newspaper	This is an example of a Frames project descr... This project contains instances and can be u...	Natasha Noy
Wines	This is a Frames project describing wines. Th...	Natasha Noy
W3C Translational Medicine Ont...	The W3C Translational Medicine Ontology	Trish Whetzel
UI Ontology	The UI ontology (User Interface Ontology) is ...	Tania Tudorache
QDMSSF	The QDMSSF project	Samson Tu
Collaborative Pizza	The OWL pizza project with collaborative top...	Tania Tudorache
OPL	The Ontology for Parasite Lifecycle (OPL)	Jie Zheng
OPL Inferred	The inferred version of the Ontology for Para...	Jie Zheng
Collaborative Pizza Annotations	The changes and annotation project for Colla... This project is normally not shown in the onto...	Tania Tudorache
OBI	OBI enriched for Web services annotation	Jie Zheng
ICBO Tutorial 2011	A demo ontology used in the ICBO 2011 tuto...	Natasha Noy
Book 6	*** Short course ontology ***: Book 6 ontolog...	
Book 5	*** Short course ontology ***: Book 5 ontolog...	
Book 4	*** Short course ontology ***: Book 4 ontolog...	

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You are signed out. | [Sign out](#)

Welcome to WebProtégé Demo!

[My WebProtégé](#)

Ontologies

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Book 5	*** Short course ontology ***: Book 5 ontolog...	
Book 4	*** Short course ontology ***: Book 4 ontolog...	

WebProtégé home screen

The screenshot shows the WebProtégé home screen in a browser window. The browser address bar shows <http://webprotege.stanford.edu/>. The page title is "WebProtégé". The main heading is "Welcome to WebProtégé Demo!". In the top right corner, it says "You are signed out." with a "Sign in" link. Below the heading is a "My WebProtégé" button. The main content is a table titled "Ontologies" with columns for Name, Description, and Owner. A red box highlights the first 15 rows of the table, with the text "Available ontologies" written in red. Another red box highlights the description and owner columns of the "W3C Translational Medicine Ontology" row, with the text "Information about each ontology" written in red. A red arrow points to the "Sign in" link.

Name	Description	Owner
Modellers shop	This is the Protege short course ontology fro...	Tania Tudorache
Collaborative Newspaper	This is an example of a Frames project descr... This project contains instances and can be u...	Natasha Noy
Wines	This is a Frames project describing wines. Th...	Natasha Noy
W3C Translational Medicine Ontology	The W3C Translational Medicine Ontology	Fish Wheeler
UI Ontology	The UI ontology (User Interface Ontology) is ...	Tania Tudorache
QDMSSF	The QDMSSF project	Samson Tu
Collaborative Pizza	The OWL pizza project with collaborative top...	Tania Tudorache
OPL	The Ontology for Parasite Lifecycle (OPL)	Jie Zheng
OPL Inferred	The inferred version of the Ontology for Para...	Jie Zheng
Collaborative Pizza Annotations	The changes and annotation project for Colla... This project is normally not shown in the onto...	Tania Tudorache
OBI	OBI enriched for Web services annotation	Jie Zheng
ICBO Tutorial 2011	A demo ontology used in the ICBO 2011 tuto...	Natasha Noy
Book 6	*** Short course ontology ***: Book 6 ontolog...	
Book 5	*** Short course ontology ***: Book 5 ontolog...	
Book 4	*** Short course ontology ***: Book 4 ontolog...	

WebProtégé home screen

The screenshot shows the WebProtégé home screen in a browser window. The browser address bar shows <http://webprotege.stanford.edu/>. The page title is "WebProtégé". The main heading is "Welcome to WebProtégé Demo!". In the top right corner, it says "You are signed out." with a "Sign in" link. A red arrow points to the "Sign in" link with the label "Login". Below the heading is a "My WebProtégé" button. The main content is a table titled "Ontologies" with columns for Name, Description, and Owner. A red box highlights the first three rows of the table, with the text "Available ontologies" written in red. Another red box highlights the "W3C Translational Medicine Ontology" row, with the text "Information about each ontology" written in red.

Name	Description	Owner
Modellers shop	This is the Protege short course ontology fro...	Tania Tudorache
Collaborative Newspaper	This is an example of a Frames project descr... This project contains instances and can be u...	Natasha Noy
Wines	This is a Frames project describing wines. Th...	Natasha Noy
W3C Translational Medicine Ontology	The W3C Translational Medicine Ontology	Fish Wheeler
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ICBO Tutorial 2011	A demo ontology used in the ICBO 2011 tuto...	Natasha Noy
Book 6	*** Short course ontology ***: Book 6 ontolog...	
Book 5	*** Short course ontology ***: Book 5 ontolog...	
Book 4	*** Short course ontology ***: Book 4 ontolog...	



Signing In

WebProtégé

http://webprotege.stanford.edu/

You are signed out. | [Sign In](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

[My WebProtégé](#)

Ontologies

Name	Description	Owner
Book 1	Short course ontology ***: Book 1 ontology (submitted by SE)	
Book 2		
Book 3		
Book 4		
Book 5		
Book 6		
Collaborative Newspaper		Natasha Noy
Collaborative Pizza		Tania Tudorache
Collaborative Pizza Annotations		Tania Tudorache
Math Ontology (Frames)		Doug Skuce
Math Ontology (OWL)		Doug Skuce
Modellers shop		Tania Tudorache
OBI		Jie Zheng
OPL		Jie Zheng
OPL Inferred	The inferred version of the Ontology for Parasite Lifecycle projects (OPL)	Jie Zheng
QDMSSF	The QDMSSF project	Samson Tu
UI Ontology	The UI ontology (User Interface Ontology) is used to model declaratively the user interfaces ...	Tania Tudorache
W3C Translational Medicine Ontology	The W3C Translational Medicine Ontology	Trish Whetzel
Wines	This is a Frames project describing wines. This project does not have the notes and change...	Natasha Noy




Welcome! Please enter your username and password:

User name:

Password:

[Forgot username or password](#)

Login with your OpenId [?](#)

   [More...](#)

Signing in

Sign in

Welcome! Please enter your username and password:

User name: First name Last name

Password: First name

Sign In

[Forgot username or password](#)

Login with your OpenId ?

   [More...](#)

- If you don't have an account, use "Guest" (Guest1/guest1, Guest2/guest2, ... Guest9/guest9 will work)
- After you sign in, the list of ontologies may change to include the private ontologies

Using WebProtégé to Edit Ontologies

- Setting up a **WebProtégé server**
 - WebProtégé Administrator's Guide:
<http://protegewiki.stanford.edu/wiki/WebProtegeAdminGuide>
 - Will not cover in today's tutorial
- When installing the server, the administrator defines:
 - **ontologies** that will be available for editing
 - **privileges** for users with editing rights (read, write, display in project list, admin, etc.)
 - **configuration** for the user interface

Ontology visibility options

- Each installation of WebProtege is a **private ontology library**
 - <http://webprotege.stanford.edu>
- Some ontologies are visible to everyone with a link
 - Could be none, all ontologies may be private
- Server administrator **configures** which users and groups of users can access non-public ontologies
 - Each user may have read and/or write permission

Configuring Permissions

Administer Protege Server (Logged in as Natasha Noy)

Projects Sessions Metaproject Server Control

CLASS BROWSER For Project: ●

Class Hierarchy

- :THING
- ▶ ● :SYSTEM-CLASS
 - GroupOperation (34)
 - ▶ ● Operation
 - PolicyControlledObject
 - Group (16)
 - Project (52)
 - Server (1)
 - PropertyValue (129)
 - User (149)

INSTANCE BROWSER For Class: ● Project

name

- ◆ Math Ontology (Frames) Annotation
- ◆ Math Ontology (OWL)
- ◆ Math Ontology (OWL) Annotation
- ◆ Modellers shop
- ◆ Modellers shop annotation
- ◆ NCI Thesaurus
- ◆ NCI Thesaurus Annotations
- ◆ Newspaper Annotation
- ◆ OBI
- ◆ OBI annotation
- ◆ OPL
- ◆ OPL Annotation
- ◆ OPL Inferred
- ◆ Orthosurgery
- ◆ Orthosurgery Annotation

INSTANCE EDITOR For Instance: ◆ OPL (instance of Project, internal name is KB_45223...)

Name: OPL Owner: ◆ Jie Zheng

Description: The Ontology for Parasite Lifecycle (OPL)

Location: /usr/local/icat-files/projects/opl/opl_db.pprj

Allowed Group Operations (Policies)

allowedGroup	allowedOperation
AdminGroup	DisplayInProjectList, Read, Write
OPL group	DisplayInProjectList, Read, Write
World	DisplayInProjectList, Read

Additional Properties

name	value
scheduler.last.run.time.Daily	1311483138935
scheduler.last.run.time.Immediately	1311532578368
scheduler.last.run.time.Hourly	1311532638358

Superclasses: ● PolicyControlledObject

Types: ● Project

Configuring Permissions

The screenshot displays the Protege Admin interface for configuring permissions. The main window is titled "Administer Protege Server (Logged in as Natasha Noy)" and has tabs for "Projects", "Sessions", "Metaproject", and "Server Control".

The interface is divided into several panes:

- CLASS BROWSER:** Shows a class hierarchy for the project. The selected class is "Project (52)".
- INSTANCE BROWSER:** Shows a list of instances for the "Project" class. The selected instance is "OPL".
- INSTANCE EDITOR:** Shows the configuration for the "OPL" instance. The name is "OPL", the description is "The Ontology for Parasite Life", and the location is "/usr/local/icat-files/project".
- OPL group (instance...):** A dialog box for configuring the "OPL" group. It shows the name "OPL group" and a list of members: flora, phismith, priti, satya, topalis, louis, Natasha Noy, Tania Tudorache, and Jie Zheng. The "Allowed Group Operations" section shows "allowedGroup" and "World".

Class Details

The screenshot shows the WebProtégé web application interface. At the top, there is a navigation bar with the user's name 'Natasha Noy' and links for 'Sign Out', 'Options', and 'Send feedback!'. Below this is a 'Welcome to WebProtégé Demo!' message. The main interface is divided into several panes. On the left is a 'Classes' tree view showing a hierarchy from 'owl:Thing' down to 'Homo sapiens blood'. The right pane is titled 'Properties for Homo sapiens blood' and contains a table of properties. Below this is a section for 'Asserted Conditions for Homo sapiens blood' which lists various logical conditions and their status.

WebProtégé

http://webprotege.stanford.edu/#OPL

Natasha Noy | [Sign Out](#) | [Options](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

My WebProtégé OPL

Classes Edit Class Metadata Properties Notes and Discussions Change History Search Biportal

Add content to this tab Add tab

Classes

Create Delete Watch Branch

- owl:Thing (9)
- entity (9)
 - continuant (6)
 - dependent_continuant
 - independent_continuant
 - material_entity (6)
 - anatomical structure
 - blood (2)
 - Homo sapiens blood

Properties for Homo sapiens blood

Add property value Delete property value

Property	Value	Lang
definition	blood of human	
obolOwl:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	

Asserted Conditions for Homo sapiens blood

NECESSARY & SUFFICIENT

- blood
- part_of *some* 'Homo sapiens'

NECESSARY

INHERITED

- continuant *or* occurrent [from entity]
- dependent_continuant *or* independent_continuant *or* spatial_region [from continuant]
- fiat_object_part *or* object *or* object_aggregate [from material_entity]
- material_entity *or* object_boundary *or* site [from independent_continuant]

Class Details

The screenshot shows the WebProtégé web application interface. At the top, there is a navigation bar with the user's name 'Natasha Noy' and links for 'Sign Out', 'Options', and 'Send feedback!'. Below this is a 'Welcome to WebProtégé Demo!' message. The main interface is divided into several panes. On the left, a 'Classes' pane shows a hierarchical tree of classes, with 'Homo sapiens blood' selected. A red box highlights this tree, and the text 'Class hierarchy' is written in red next to it. The right pane is titled 'Properties for Homo sapiens blood' and contains a table with columns for 'Property', 'Value', and 'Lang'. Below this table is a section for 'Asserted Conditions for Homo sapiens blood', which lists various conditions and their logical relationships.

WebProtégé

http://webprotege.stanford.edu/#OPL

Natasha Noy | [Sign Out](#) | [Options](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

My WebProtégé OPL

Classes Edit Class Metadata Properties Notes and Discussions Change History Search Bioportal

Add content to this tab Add tab

Classes

Create Delete Watch Branch

- owl:Thing (9)
- entity (9)
 - continuant (6)
 - dependent_continuant
 - independent_continuant
 - material_entity (6)
 - anatomical structure
 - blood (2)
 - Homo sapiens blood

Class hierarchy

Properties for Homo sapiens blood

Add property value Delete property value

Property	Value	Lang
definition	blood of human	
obol:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	

Asserted Conditions for Homo sapiens blood

NECESSARY & SUFFICIENT

blood

part_of *some* 'Homo sapiens'

NECESSARY

INHERITED

continuant *or* occurrent [from entity]

dependent_continuant *or* independent_continuant *or* spatial_region [from continuant]

fiat_object_part *or* object *or* object_aggregate [from material_entity]

material_entity *or* object_boundary *or* site [from independent_continuant]

Class Details

The screenshot shows the WebProtégé web application interface. At the top, there is a navigation bar with the user's name 'Natasha Noy' and links for 'Sign Out', 'Options', and 'Send feedback!'. Below this is a 'Welcome to WebProtégé Demo!' message. The main interface is divided into several panes. On the left, the 'Classes' pane shows a hierarchical tree of classes, with 'Homo sapiens blood' selected. A red box highlights this tree, and the text 'Class hierarchy' is written in red next to it. The right pane is titled 'Properties for Homo sapiens blood' and contains a table of properties. A red box highlights this table, and the text 'Annotation Properties' is written in red next to it. Below the table is a section for 'Asserted Conditions for Homo sapiens blood'.

WebProtégé

http://webprotege.stanford.edu/#OPL

Natasha Noy | [Sign Out](#) | [Options](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

My WebProtégé OPL

Classes Edit Class Metadata Properties Notes and Discussions Change History Search Biportal

Add content to this tab Add tab

Classes

- owl:Thing (9)
- entity (9)
 - continuant (6)
 - dependent_continuant
 - independent_continuant
 - material_entity (6)
 - anatomical structure
 - blood (2)
 - Homo sapiens blood

Class hierarchy

Properties for Homo sapiens blood

Property	Value	Lang
definition	blood of human	
oboInOwl:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	

Annotation Properties

Asserted Conditions for Homo sapiens blood

NECESSARY & SUFFICIENT

blood

part_of *some* 'Homo sapiens'

NECESSARY

INHERITED

continuant *or* occurrent [from entity]

dependent_continuant *or* independent_continuant *or* spatial_region [from continuant]

fiat_object_part *or* object *or* object_aggregate [from material_entity]

material_entity *or* object_boundary *or* site [from independent_continuant]

Class Details

The screenshot shows the WebProtégé interface with the following components:

- Classes Panel (left):** A tree view showing a class hierarchy. The path is: owl:Thing > entity > continuant > material_entity > anatomical structure > blood > Homo sapiens blood. A red box highlights this entire tree, with the text "Class hierarchy" written in red next to it.
- Properties for Homo sapiens blood (top right):** A table listing properties for the selected class. A red box highlights this table, with the text "Annotation Properties" written in red next to it.

Property	Value	Lang
definition	blood of human	
oboInOwl:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	
- Asserted Conditions for Homo sapiens blood (bottom right):** A list of logical conditions for the class. A red box highlights this list, with the text "Restrictions" written in red next to it.

NECESSARY & SUFFICIENT

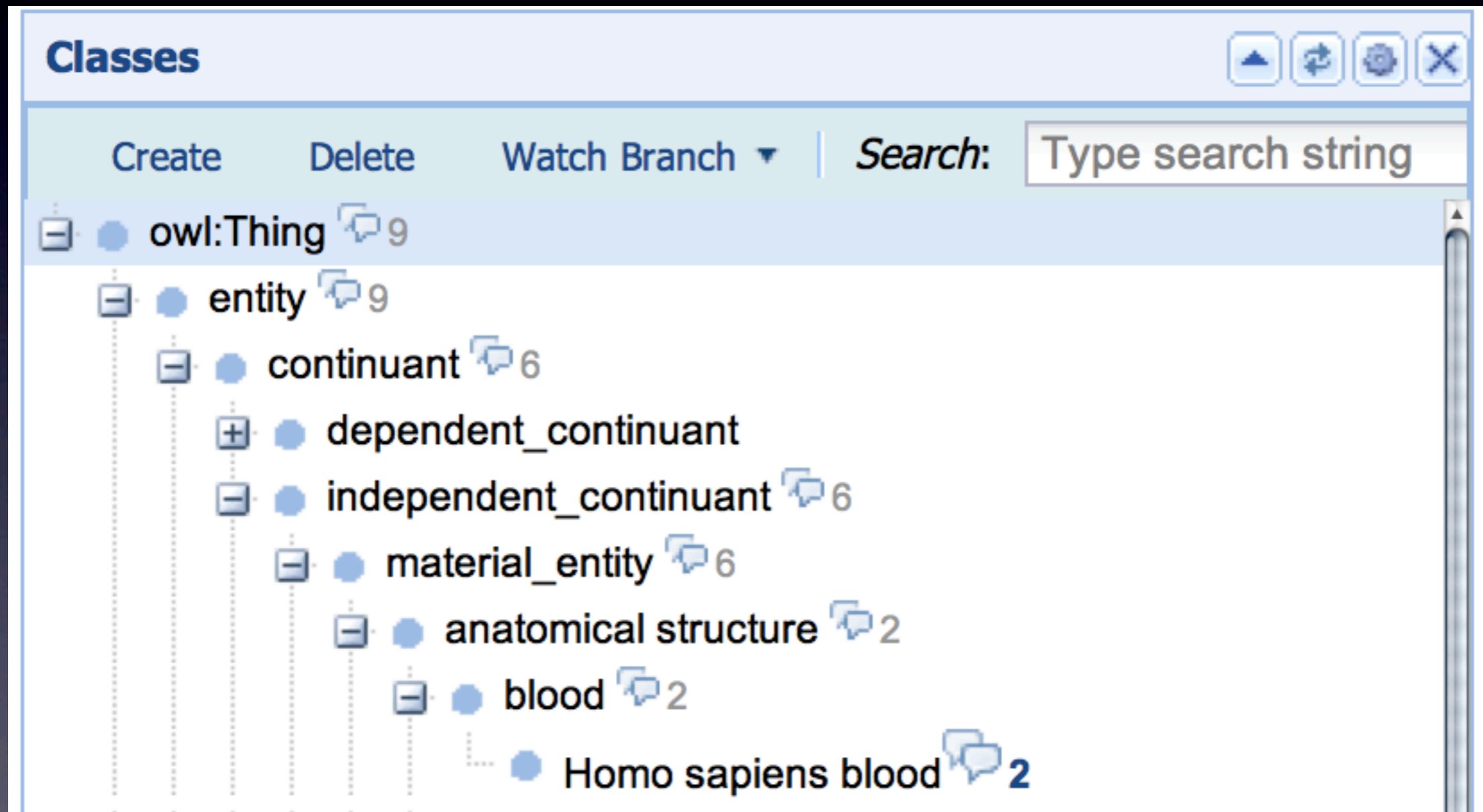
 - blood
 - part_of *some* 'Homo sapiens'

NECESSARY

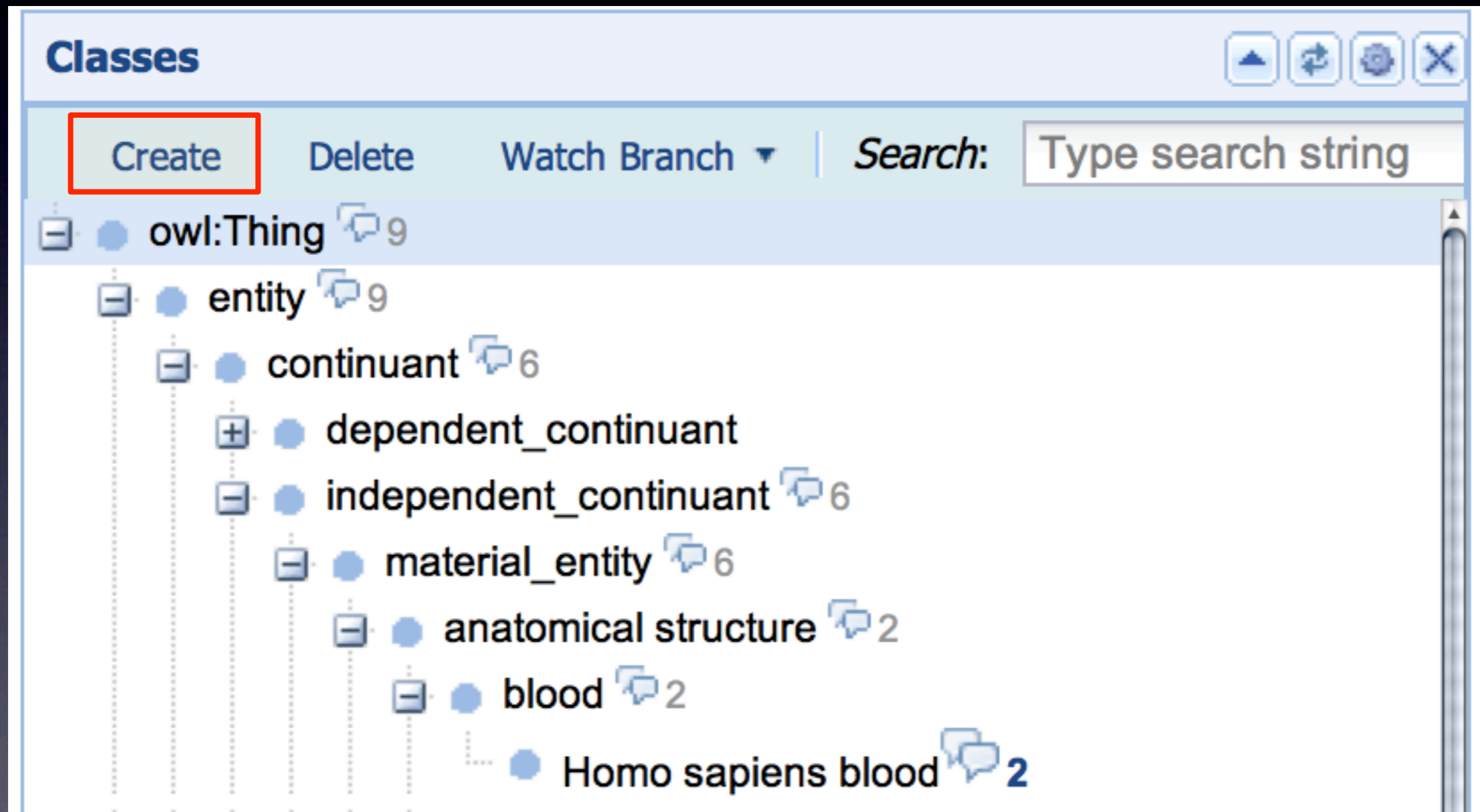
INHERITED

 - continuant *or* occurrent [from entity]
 - dependent_continuant *or* independent_continuant *or* spatial_region [from continuant]
 - fiat_object_part *or* object *or* object_aggregate [from material_entity]
 - material_entity *or* object_boundary *or* site [from independent_continuant]

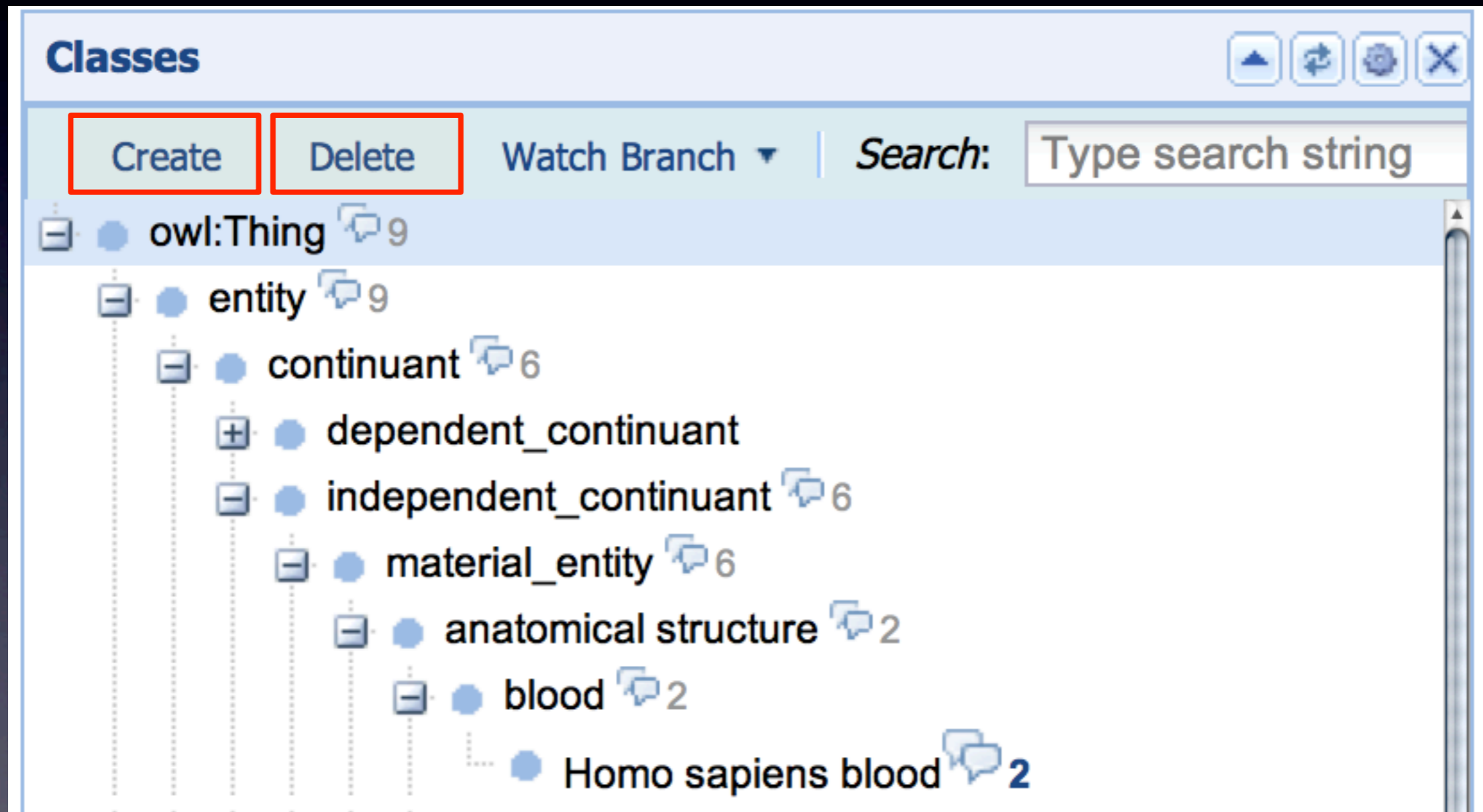
Class Hierarchy (More Details)



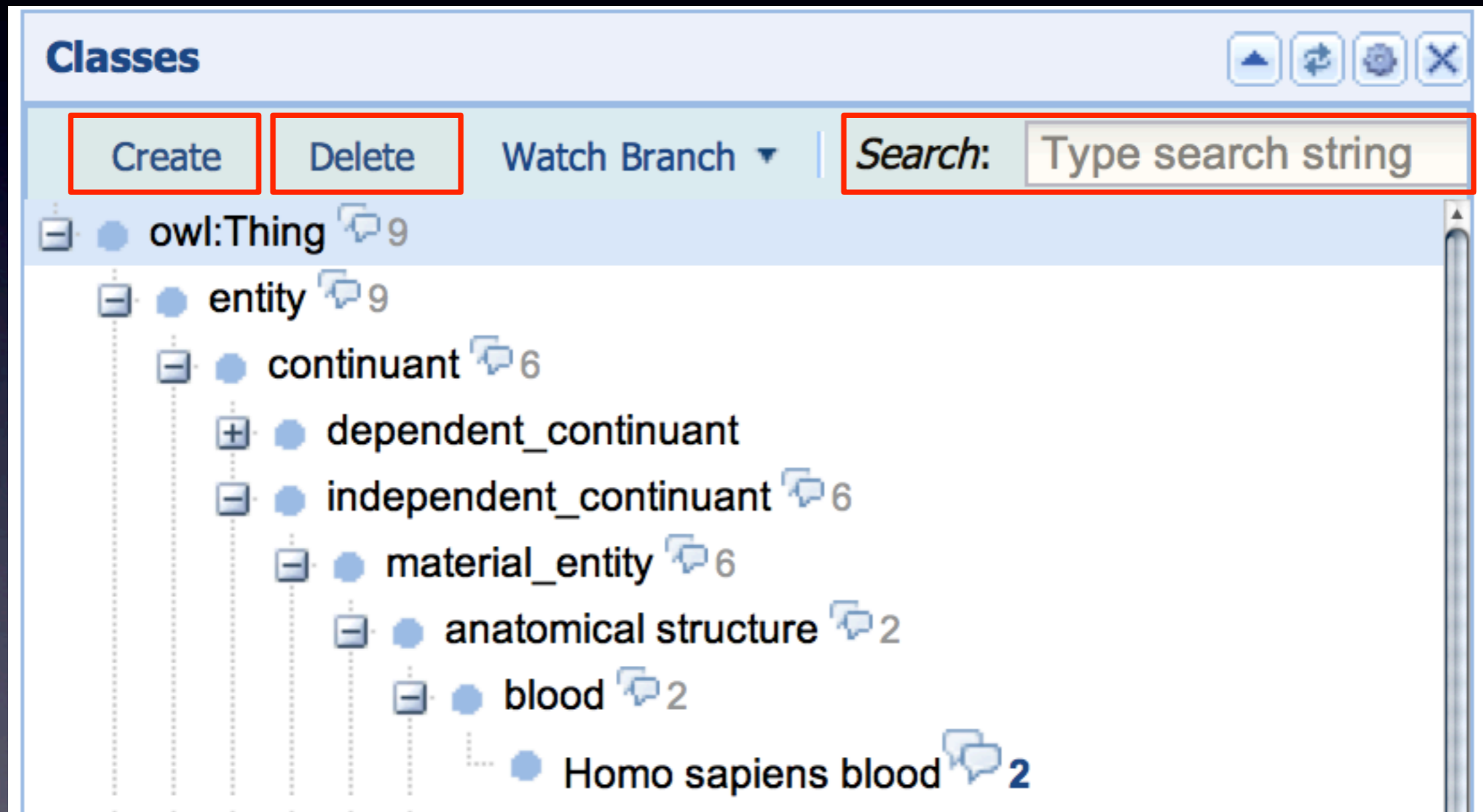
Class Hierarchy (More Details)



Class Hierarchy (More Details)



Class Hierarchy (More Details)





Annotation Properties

Properties for Homo sapiens blood		
Add property value		Delete property value
Property ▲	Value	Lang
definition	blood of human	
obolInOwl:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	



Annotation Properties

Properties for Homo sapiens blood		
Add property value	Delete property value	
Property ▲	Value	Lang
definition	blood of human	
obolnOwl:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	



Annotation Properties

Properties for Homo sapiens blood ▲ ↺ ⚙ ✕

Add property value Delete property value

Property ▲	Value	Lang
definition	blood of human	
obolInOwl:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	

Annotation Properties (another way to look at them)

The screenshot shows the BioPortal interface for editing class metadata. The top navigation bar includes tabs for 'Classes', 'Edit Class Metadata', 'Properties', 'Notes and Discussions', 'Change History', and 'Search Bioportal'. The main content area is split into two panes. The left pane, titled 'Classes', shows a hierarchical tree of classes with 'Homo sapiens blood' selected. The right pane, titled 'Details for Homo sapiens blood', shows the 'Metadata' tab with various properties and their values.

Property	Value	Actions
rdfs:label	Homo sapiens blood	✖
Alternative term		✖
Editor Preferred Term		✖
Definition	blood of human	✖
Definition Source		✖
Definition Editor		✖
Editor Note		✖

Annotation Properties (another way to look at them)

The screenshot displays the Bioportal interface with the 'Edit Class Metadata' tab selected. The left sidebar shows a tree view of classes, with 'Homo sapiens blood' highlighted. The main panel shows the 'Details for Homo sapiens blood' with the 'Metadata' tab active. The metadata fields are as follows:

Property	Value	Actions
rdfs:label	Homo sapiens blood	✖
Alternative term		✖
Editor Preferred Term		✖
Definition	blood of human	✖
Definition Source		✖
Definition Editor		✖
Editor Note		✖

Annotation Properties (another way to look at them)

The screenshot displays the BioPortal interface for editing class metadata. The top navigation bar includes tabs for 'Classes', 'Edit Class Metadata', 'Properties', 'Notes and Discussions', 'Change History', and 'Search Bioportal'. The 'Edit Class Metadata' tab is highlighted with a red box. Below the navigation bar, there are two main panels. The left panel, titled 'Classes', shows a hierarchical tree of classes. The right panel, titled 'Details for Homo sapiens blood', shows the metadata for the selected class. The 'Metadata' tab is highlighted with a red box. The metadata fields are as follows:

Property	Value	Actions
rdfs:label	Homo sapiens blood	✖
Alternative term		✖
Editor Preferred Term		✖
Definition	blood of human	✖
Definition Source		✖
Definition Editor		✖
Editor Note		✖

Annotation Properties (another way to look at them)

The screenshot displays the BioPortal interface for editing class metadata. The top navigation bar includes tabs for 'Classes', 'Edit Class Metadata', 'Properties', 'Notes and Discussions', 'Change History', and 'Search Bioportal'. The 'Edit Class Metadata' tab is active and highlighted with a red box. Below the navigation bar, there are options to 'Add content to this tab' and 'Add tab'. The main content area is divided into two panes. The left pane, titled 'Classes', shows a hierarchical tree of classes. The 'Homo sapiens blood' class is selected and highlighted. The right pane, titled 'Details for Homo sapiens blood', shows the metadata for this class. The 'Metadata' and 'Curation Status' tabs are highlighted with red boxes. The metadata fields include:

- rdfs:label**: Homo sapiens blood
- Alternative term**: (empty field)
- Editor Preferred Term**: (empty field)
- Definition**: blood of human
- Definition Source**: (empty field)
- Definition Editor**: (empty field)
- Editor Note**: (empty field)

Each field has a red 'X' icon and a speech bubble icon to its right. There are also green plus icons and the text 'Add new value' between the 'Alternative term' and 'Definition Source' fields, and between the 'Definition Editor' and 'Editor Note' fields.



Curation Status

Details for Homo sapiens blood

Metadata **Curation Status**

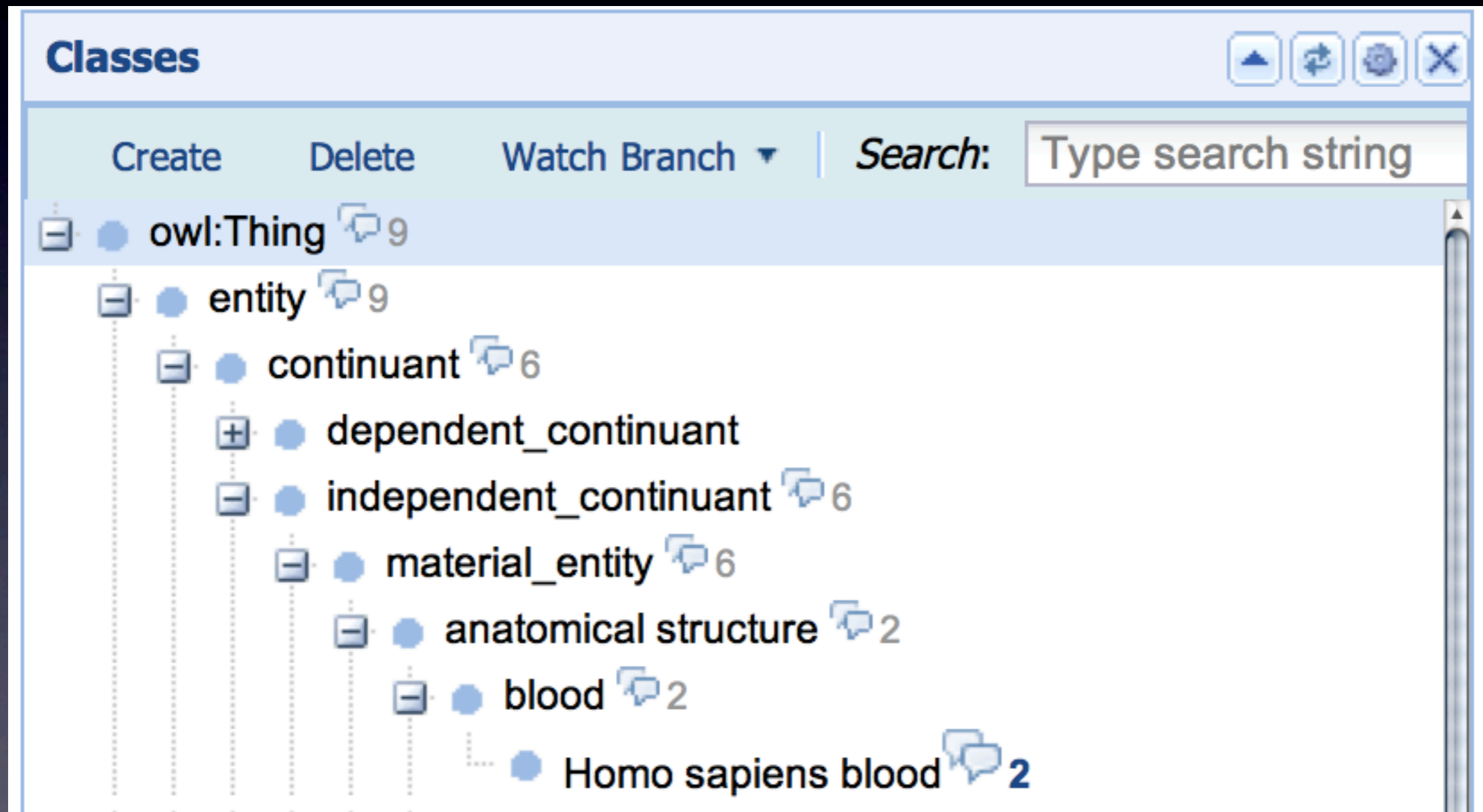
Curation Status

- uncurated
- requires discussion
- metadata complete
- metadata incomplete
- organizational term
- example to be eventually removed
- to be replaced with external ontology term
- ready for release

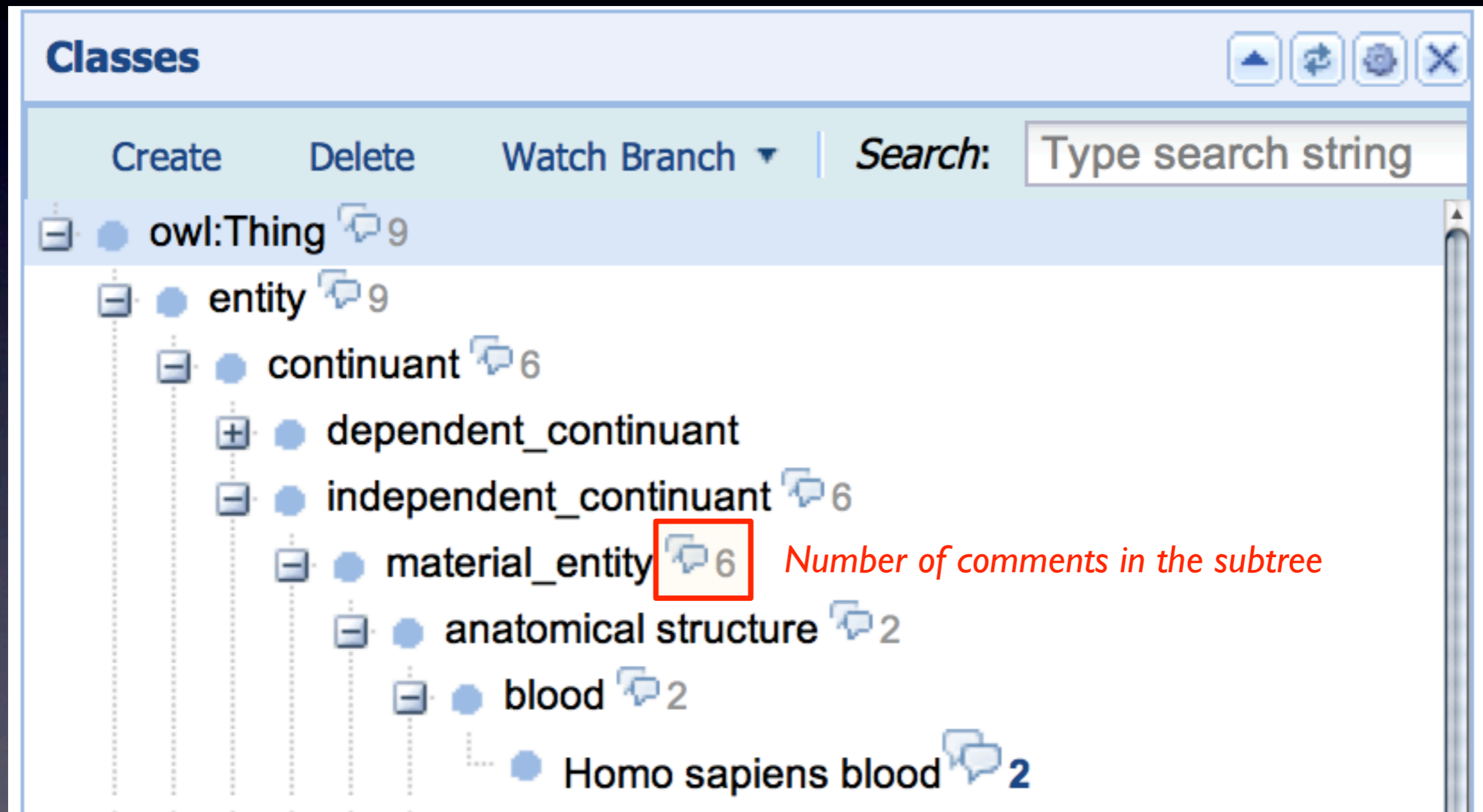
It's not just about editing...

- You can **comment** on classes and carry out discussions
- **Archive** notes and requests that you have responded to
- See the **change history** for a class
- Set up a list of “**watched entities**”
 - get notified when someone else changes a class
 - get notified when there are any changes in the hierarchy branch that you care about

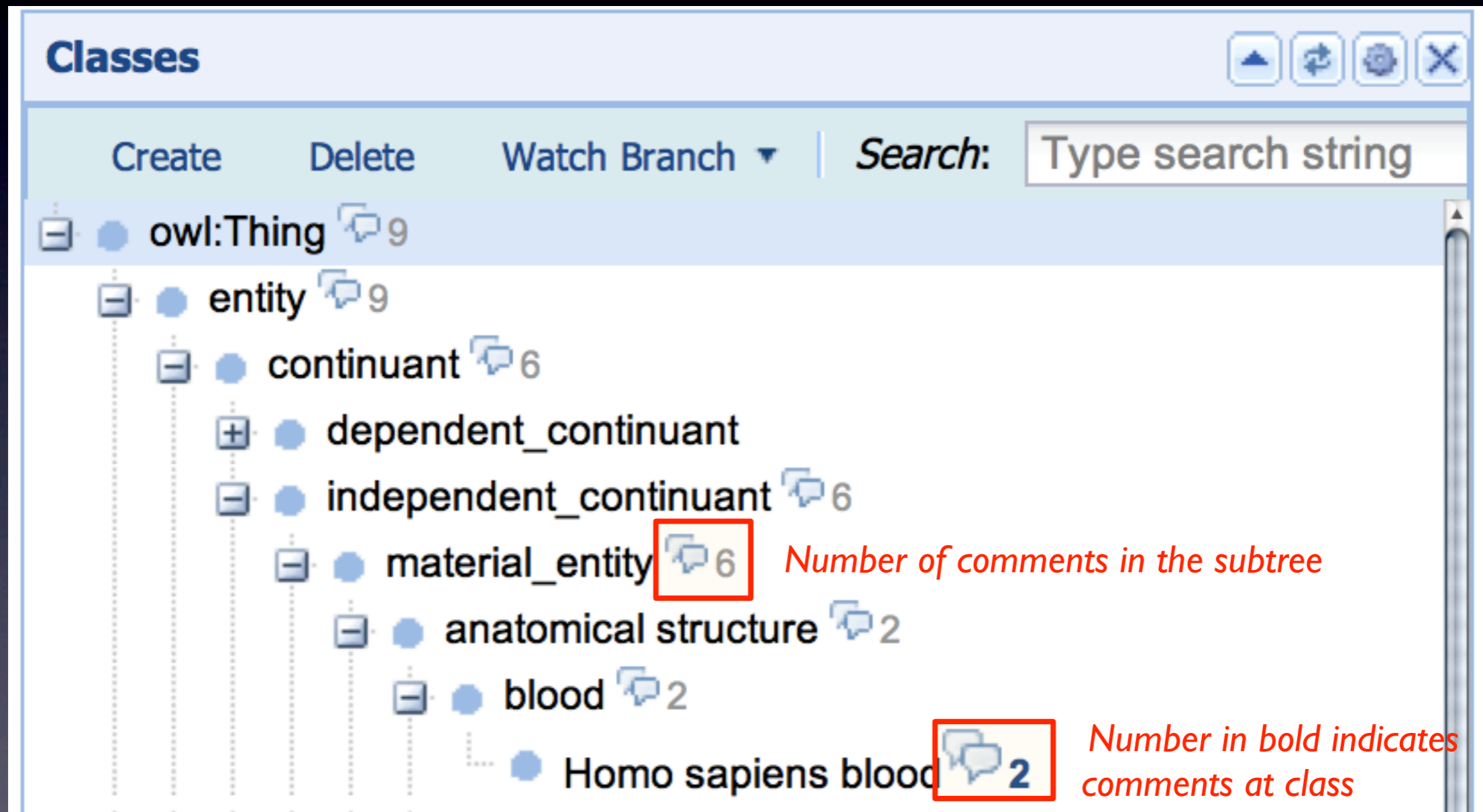
Class Hierarchy (More Details)



Class Hierarchy (More Details)



Class Hierarchy (More Details)





Notes And Discussion

The screenshot shows the WebProtégé web application interface. At the top, the browser address bar displays `http://webprotege.stanford.edu/`. The page header includes the user name **Natasha Noy** and links for [Sign Out](#), [Options](#), and [Send feedback!](#). Below the header, there is a navigation bar with tabs for **Classes**, **Edit Class Metadata**, **Properties**, **Notes and Discussions** (which is active), **Change History**, and **Search Bioportal**. The main content area is split into two panels. The left panel, titled **Classes**, shows a hierarchical tree of classes. The **Homo sapiens blood** class is selected and highlighted in blue, with a red box around its comment icon (a speech bubble with the number 2) and a red arrow pointing to it. The right panel, titled **Notes Tree for Homo sapiens blood**, displays a discussion thread. The first topic is **Do we need species specific terms?** by user **jiezheng**. Below it is a reply titled **Re: Do we need species specific terms?** by user **stoeckrt**. The text of the reply discusses the use of species-specific terms for human blood and mentions a previous post by jiezheng from 06/03/2011.

Bring up comments



Change History

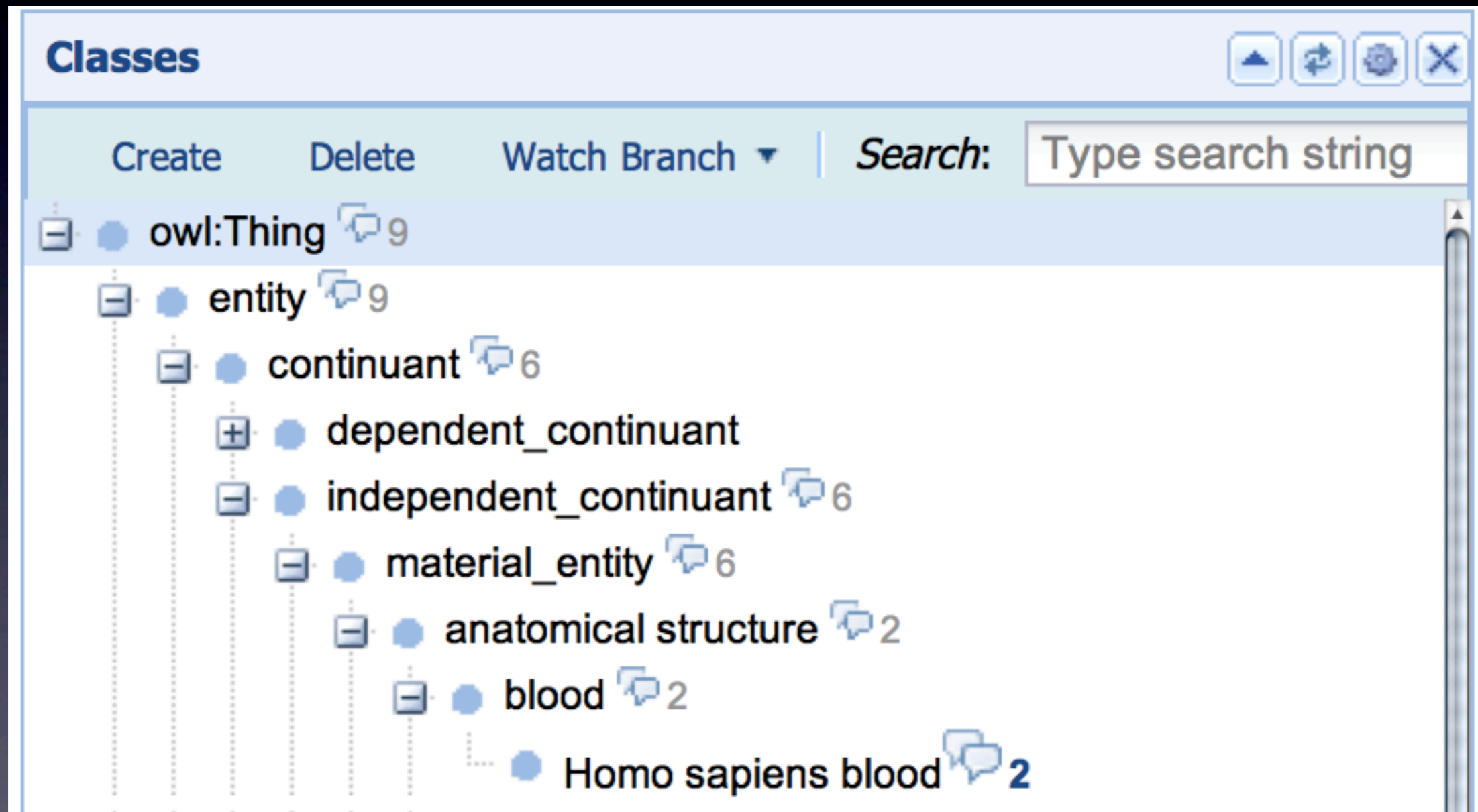
Change history for Homo sapiens blood		
Description	Author	Timestamp
Annotation change for obo:OPL_0000117, property: r...	jiezheng	Thu Jun 09 201...
Delete condition has_part only cell from 'Homo sapie...	jiezheng	Thu Jun 09 201...
Set condition at 'Homo sapiens blood' to has_part onl...	jiezheng	Thu Jun 09 201...
Set condition at 'Homo sapiens blood' to has_part so...	jiezheng	Thu Jun 09 201...

Page 1 of 1 | Displaying records 1 - 4 of 4

Change Summary for OPL		
Recent Activity		
Today: (refresh the widget to get the count)		
Yesterday: (refresh the widget to get the count)		
Change History		
Description	Author	Timestamp
Deleted class http://purl.obolibrary.org/obo/opl.owl#probe	Natasha Noy	Fri Jul 22 2011 00:59:20 GMT-0700 (PDT)
Created class probe	Natasha Noy	Fri Jul 22 2011 00:58:48 GMT-0700 (PDT)

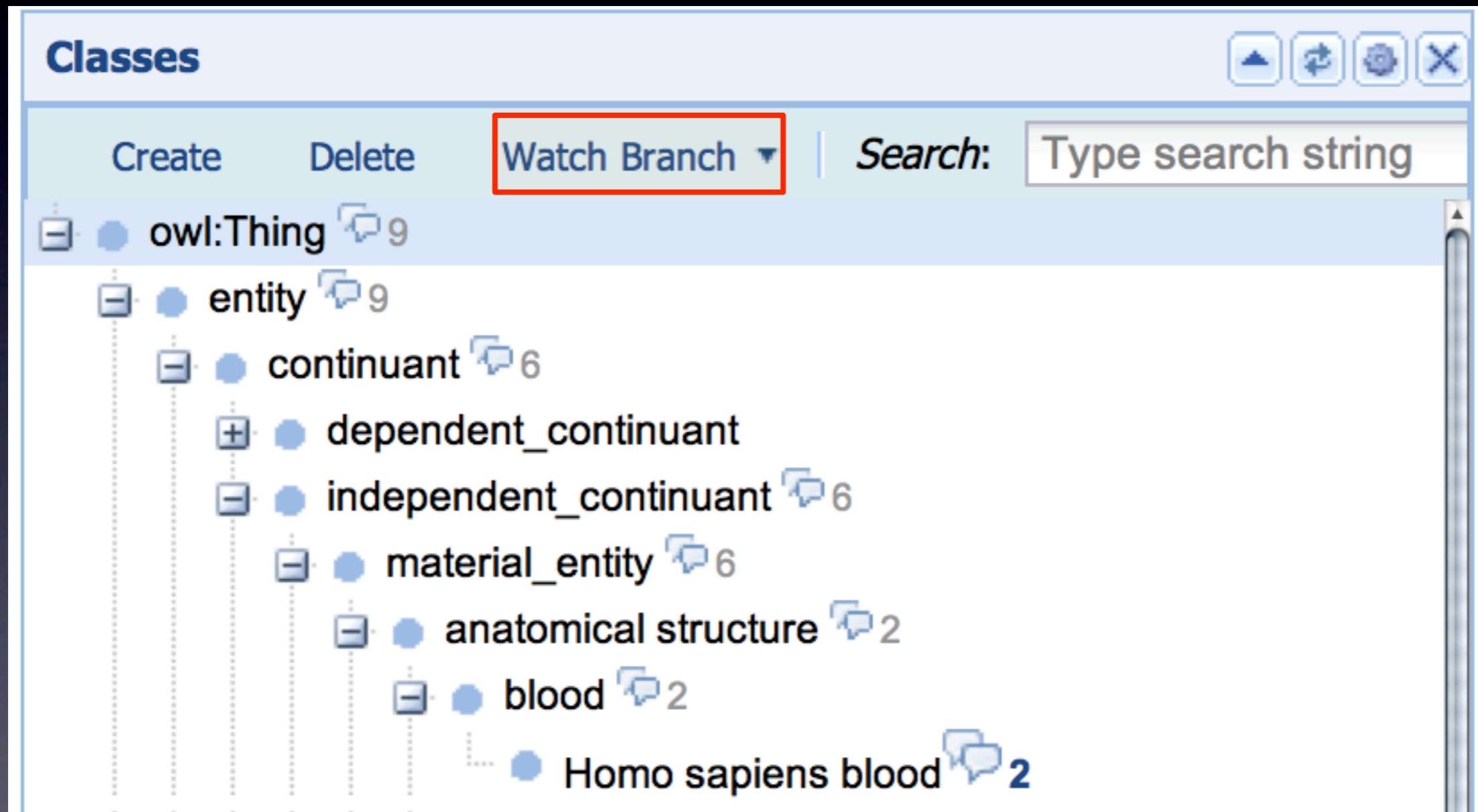


Class Hierarchy (More Details)





Class Hierarchy (More Details)





Watched entities

WebProtégé

http://webprotege.stanford.edu/#ICBO%20Tutorial%202011

Natasha Noy | [Sign Out](#) | [Options](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

My WebProtégé **ICBO Tutorial 2011**

Classes | Claims Metadata | Specific Claim Form | Properties | Individuals | Notes and Discussions | **Change History** | Watched E

Add content to this tab | Add tab

Classes

Create Delete Remove Watch Search

- owl:Thing 1
- Claim 1
 - External Reference
 - Provider

Change history for Claim

Description	Author	Timestamp
Replaced Definition of Claim. Old value: Demand for p...	Tania Tudorache	Mon Jul 25 201...
Replaced Definition of Claim. Old value: Demand for p...	Tania Tudorache	Mon Jul 25 201...
Added a new Definition to Claim. Added value: Deman...	Tania Tudorache	Mon Jul 25 201...
Deleted Disease Code (ICD-10) from Claim. Deleted v...	Tania Tudorache	Mon Jul 25 201...
Deleted Disease Code (ICD-10) from Claim. Deleted v...	Tania Tudorache	Mon Jul 25 201...
Imported reference for Claim and property Disease Co...	Tania Tudorache	Mon Jul 25 201...
Imported reference for Claim and property Disease Co...	Tania Tudorache	Mon Jul 25 201...
Imported reference for Claim and property Disease Co...	Tania Tudorache	Mon Jul 25 201...
Added a new Label to Claim. Added value: Claim	Tania Tudorache	Mon Jul 25 201...



Creating Individuals: Just Like in the Desktop Client

WebProtégé

http://webprotege.stanford.edu/#ICBO%20Tutorial%202011

Natasha Noy | [Sign Out](#) | [Options](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

My WebProtégé **ICBO Tutorial 2011**

Classes | Claims Metadata | Specific Claim Form | Properties | **Individuals** | Notes and Discussions | Change History

Add content to this tab | Add tab

Classes

Create Delete Watch Branch Search:

- owl:Thing 1
- Claim 1
 - Malaria Related Claim
 - External Reference
 - Provider

Individuals for Malaria Related Claim

Create Delete Watch Search: Type sea

Name
Claim for Joe Doe

Properties for Claim for Joe Doe

Add property value Delete property value

Property	Value	L...
definition	This is the claim made for Joe	
disease_code	Malaria due to simian plasmodia from ICD10	
rdfs:comment	Joe went in the mighty jungle and got malaria there.	
rdfs:label	Claim for Joe	

Notes Tree for Claim for Joe Doe

[New Topic](#) [Expand All](#) [Collapse](#)



Creating Individuals: Just Like in the Desktop Client

WebProtégé

http://webprotege.stanford.edu/#ICBO%20Tutorial%202011

Natasha Noy | [Sign Out](#) | [Options](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

My WebProtégé **ICBO Tutorial 2011**

Classes | Claims Metadata | Specific Claim Form | Properties | **Individuals** | Notes and Discussions | Change History

Add content to this tab | Add tab

Classes

Create Delete Watch Branch Search:

- owl:Thing 1
- Claim 1
 - Malaria Related Claim
 - External Reference
 - Provider

Individuals for Malaria Related Claim

Create Delete Watch Search: Type sea

Name
Claim for Joe Doe

Properties for Claim for Joe Doe

Add property value Delete property value

Property	Value	L...
definition	This is the claim made for Joe	
disease_code	Malaria due to simian plasmodia from ICD10	
rdfs:comment	Joe went in the mighty jungle and got malaria there.	
rdfs:label	Claim for Joe	

Notes Tree for Claim for Joe Doe

New Topic Expand All Collapse

Browsing ontologies in WebProtégé

- View and edit the class **hierarchy**
- View and edit ontology **metadata**
- View and edit class **definitions**
- View and edit **comments**
- View and edit **individuals**

Let's Develop an Ontology!

- <http://webprotege.stanford.edu>

Hands-on exercise

- We will create a simple ontology collaboratively
- Topic: Health insurance

Select an ontology to edit

[Send us feedback!](#) [Documentation](#) | [Protégé Web site](#) | [Protégé Wiki](#) | [About](#)

My WebProtégé

Logged-in as **Natasha Noy** [Logout](#)

Name	Description	Owner
BioPortal Metadata Ontology	The ontology used by BioPortal _staging_ server to store the metadata about BioPortal ontologies.	Natasha Noy
Biomedical Resource Ontology	The Biomedical Resource Ontology version 2.7	Daniel Rubin
CA ADI 2003	The CA ADI 2003 project	Samson Tu
Collaborative Newspaper	A frames example project about Newspapers. The project supports the collaborative features.	Ray Ferguson
Collaborative Pizza	The OWL pizza project with collaborative toppings..	Jennifer Vendetti
Human Studies	The Human Studies ontology	Herb Hagler
ICBO tutorial	The project to be used by participants in the ICBO tutorial	Tania Tudorache
ICD 11	A demo version of ICD11	Natasha Noy
ICD 11 P3F Exp 15	A test version of ICD	Natasha Noy
OBI (demo version)	Ontology for Biomedical Investigations Link to home page	Daniel Schober
OCReStart Here	the OCR Start Here ontology	Samson Tu
OMV_2_4	Ontology Metadata Vocabulary. Link: http://omv.ontoware.org/	Amir Ghazvinian
RadLex	A Lexicon for Uniform Indexing and Retrieval of Radiology Information Resources External Link	Daniel Rubin
Wines	A Frames project for wine lovers (no collaboration support). This project is configured as <u>read-only</u> .	Natasha Noy
ckc_challenge	An ontology about research with collaborative support. The ontology was used in the CKC Challenge at WWW07.	Natasha Noy

Select "ICBO Tutorial"

To open the same copy of an ontology in the Protégé rich client, click [here](#) .

Let's develop a simple ontology

- Goal:
 - Develop a simple ontology to represent **health insurance** information

Initial Terms

- Provider

- Individual doctor
- Hospital
- Clinical practice

- Services

- Emergency visit
- Urgent care

- Claim
- Diagnosis
- *disease from ICD9*

-
- Hands-on exercise
 - Create classes
 - Edit classes
 - Comment on what others are doing

Custom-Tailoring the Interface

- You can custom-tailor the interface **per project** and **per user of the project**
- If you are custom-tailoring in your own browser, WebProtégé saves the configuration as as your preferences for the current ontology
- You can customize
 - the number of tabs
 - the layout and content of each tab
 - the size of each tab component
 - the types of the components on the tab

Class Details

The screenshot shows the WebProtégé web application interface. At the top, there is a navigation bar with the user's name 'Natasha Noy' and links for 'Sign Out', 'Options', and 'Send feedback!'. Below this is a 'Welcome to WebProtégé Demo!' message. The main interface is divided into several panes. On the left, the 'Classes' pane shows a hierarchical tree of classes, with 'Homo sapiens blood' selected. The right pane is titled 'Properties for Homo sapiens blood' and contains a table of properties. Below this, there is a section for 'Asserted Conditions for Homo sapiens blood' which lists various logical conditions and their status.

WebProtégé

http://webprotege.stanford.edu/#OPL

Natasha Noy | [Sign Out](#) | [Options](#) | [Send feedback!](#)

Welcome to WebProtégé Demo!

My WebProtégé OPL

Classes Edit Class Metadata Properties Notes and Discussions Change History Search Bioportal

Add content to this tab Add tab

Classes

Create Delete Watch Branch

- owl:Thing (9)
- entity (9)
 - continuant (6)
 - dependent_continuant
 - independent_continuant
 - material_entity (6)
 - anatomical structure
 - blood (2)
 - Homo sapiens blood

Properties for Homo sapiens blood

Add property value Delete property value

Property	Value	Lang
definition	blood of human	
obol:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	

Asserted Conditions for Homo sapiens blood

NECESSARY & SUFFICIENT

- blood
- part_of *some* 'Homo sapiens'

NECESSARY

INHERITED

- continuant *or* occurrent [from entity]
- dependent_continuant *or* independent_continuant *or* spatial_region [from continuant]
- fiat_object_part *or* object *or* object_aggregate [from material_entity]
- material_entity *or* object_boundary *or* site [from independent_continuant]

Class Details

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- Classes Pane:** A tree view on the left showing the class hierarchy. 'owl:Thing' is the root, followed by 'entity', 'continuant', and 'material_entity'. Under 'material_entity', 'anatomical structure' is expanded to show 'blood', which is further expanded to show 'Homo sapiens blood'.
- Properties for Homo sapiens blood:** A table with columns 'Property', 'Value', and 'Lang'. It lists 'definition' (blood of human), 'obolOwl:hasDbXref' (FMA:9670), and 'rdfs:label' (Homo sapiens blood).
- Asserted Conditions for Homo sapiens blood:** A section showing logical conditions for the class, such as 'blood part_of some 'Homo sapiens'', categorized by 'NECESSARY & SUFFICIENT', 'NECESSARY', and 'INHERITED'.

Two red boxes highlight specific UI elements: one around the 'Add content to this tab' and 'Add tab' buttons, and another around a vertical scrollbar with the word 'Resize' written in red next to it.

Class Details

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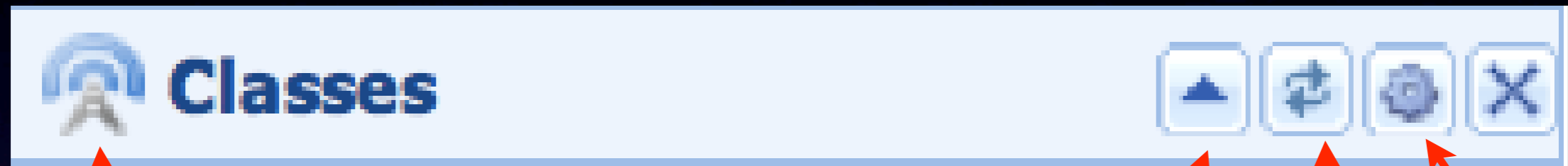
- Classes:** A tree view on the left showing a hierarchy of classes. 'owl:Thing' is the root, followed by 'entity', 'continuant', and 'material_entity'. Under 'material_entity', 'anatomical structure' is expanded to show 'blood', which is further expanded to show 'Homo sapiens blood'.
- Properties for Homo sapiens blood:** A table with columns for 'Property', 'Value', and 'Lang'.

Property	Value	Lang
definition	blood of human	
obolInOwl:hasDbXref	FMA:9670	
rdfs:label	Homo sapiens blood	
- Asserted Conditions for Homo sapiens blood:** A list of conditions with their logical status and edit/delete icons.
 - NECESSARY & SUFFICIENT:** 'blood part_of some 'Homo sapiens'' (with edit and delete icons).
 - NECESSARY:** (empty row).
 - INHERITED:** (empty row).

Red annotations highlight specific UI elements:

- 'Save Configuration!!!' with an arrow pointing to the 'Add tab' button.
- 'Resize' with an arrow pointing to the vertical scrollbar of the 'Properties' table.

Portlet Toolbar



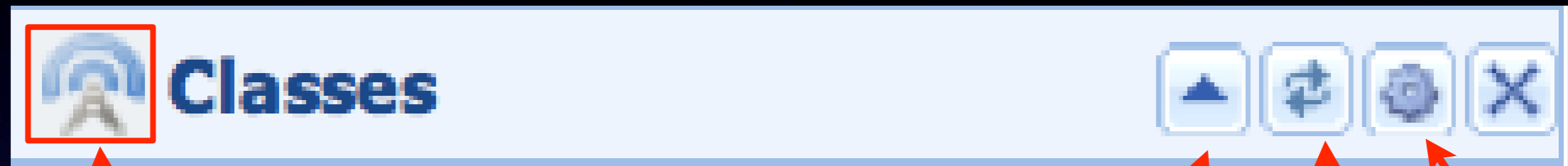
*Controlling Portlet
(controls selection
for the whole tab)*

*Hide
portlet*

*Refresh
portlet
(VERY
useful)*

*Set
controlling
portlet*

Portlet Toolbar



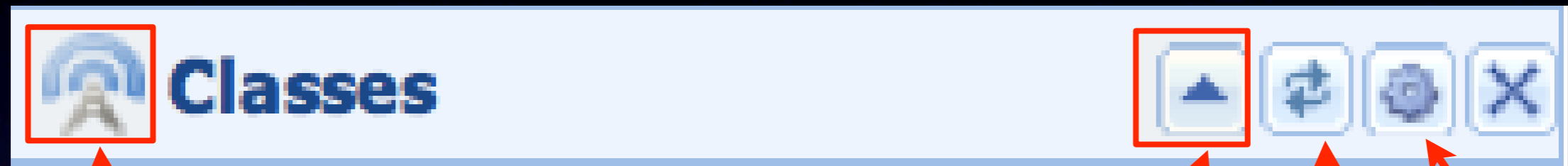
*Controlling Portlet
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*Hide
portlet*

*Refresh
portlet
(VERY
useful)*

*Set
controlling
portlet*

Portlet Toolbar



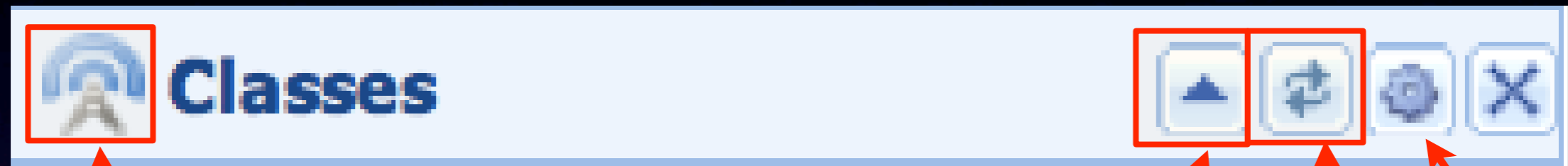
*Controlling Portlet
(controls selection
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Portlet Toolbar



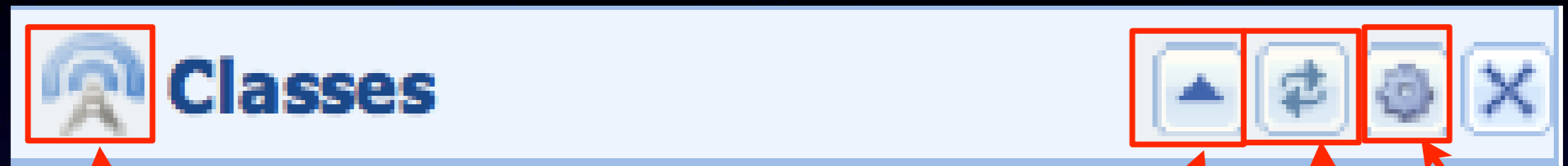
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*Hide
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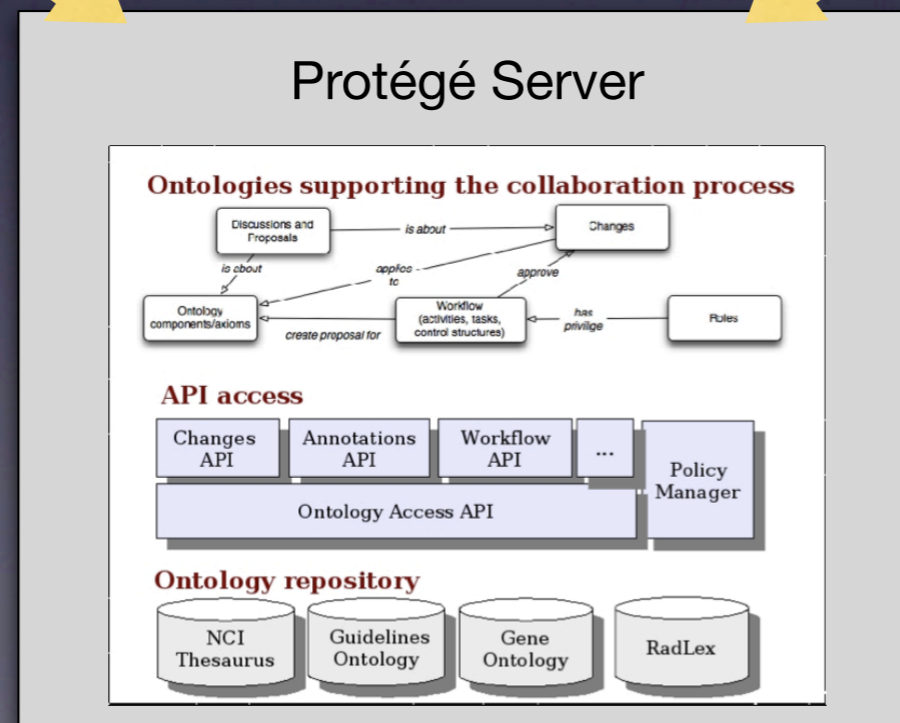
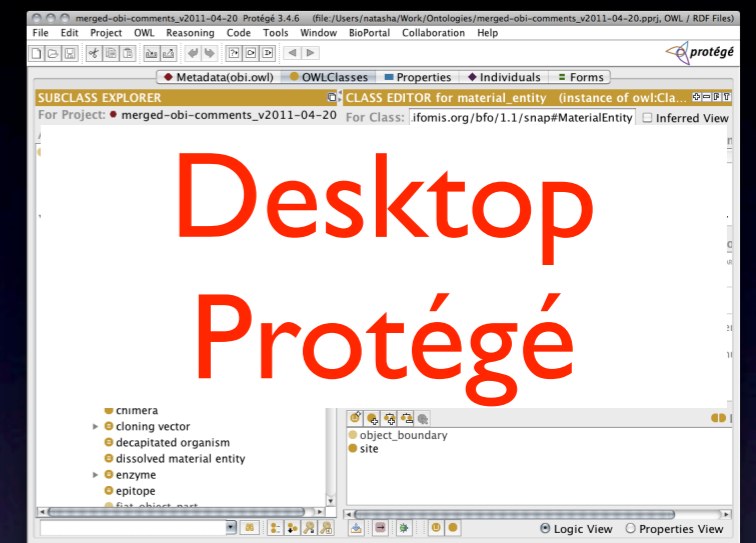
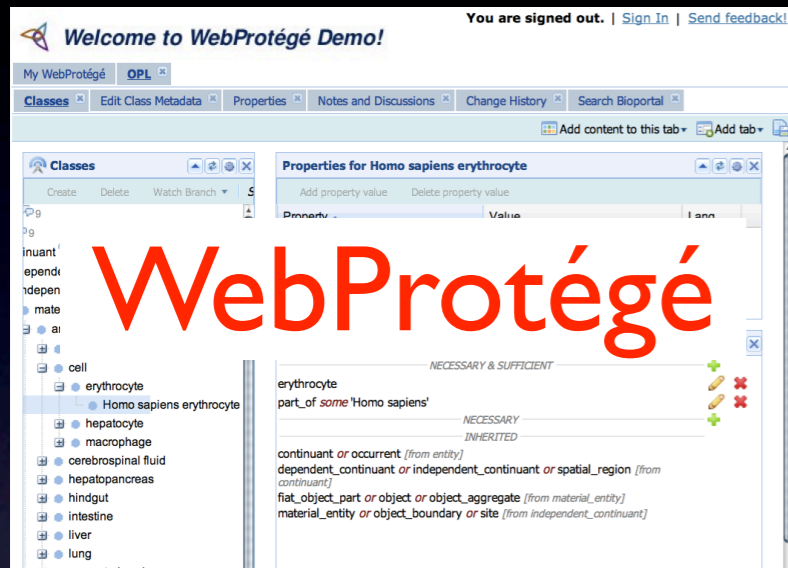
*Refresh
portlet
(VERY
useful)*

*Set
controlling
portlet*

Configurations

- More detailed configurations are stored as an XML file on the server
 - Need to edit it directly to fine-tune the project configuration
- Saving the configuration over-writes the project-wide configuration

Accessing the Ontologies From a Desktop Client





Same Projects On The Server

Project	Current Users
Book 1	webprotege_prd (127.0.0.1)
Book 2	webprotege_prd (127.0.0.1)
Book 3	
Book 4	webprotege_prd (127.0.0.1)
Book 5	webprotege_prd (127.0.0.1)
Book 6	
CELDAC Ortho-Spine	
CELDAC Ortho-Spine Annotation	
Collaborative Newspaper	webprotege_prd (127.0.0.1)
Collaborative Pizza	webprotege_prd (127.0.0.1)
Collaborative Pizza Annotations	webprotege_prd (127.0.0.1), webprotege_pr...
Disposition Ontology	
Disposition Ontology Annotation	
Energy_Vocabulary	
Energy_Vocabulary_Annotation	
HOM Demographics Ontology	
HOM Demographics Ontology Annotation	
ICBO Tutorial 2011	webprotege_prd (127.0.0.1)
Math Ontology (Frames)	webprotege_prd (127.0.0.1)
Math Ontology (Frames) Annotation	webprotege_prd (127.0.0.1)
Math Ontology (OWL)	webprotege_prd (127.0.0.1)
Math Ontology (OWL) Annotation	webprotege_prd (127.0.0.1)
Modellers shop	webprotege_prd (127.0.0.1)
NCI Thesaurus	
NCI Thesaurus Annotations	
OBI	webprotege_prd (127.0.0.1)
OBI annotation	webprotege_prd (127.0.0.1)
OPL	webprotege_prd (127.0.0.1)
OPL Annotation	webprotege_prd (127.0.0.1), webprotege_pr...
OPL Inferred	webprotege_prd (127.0.0.1)
Orthosurgery	

OK Cancel



Class Details in Desktop Client

OPL Protégé 3.4.6 (rmi://bmir-webprotege1/OPL)

File Edit Project OWL Reasoning Code Tools Window BioPortal Change Collaboration Help

Metadata(opl.owl) OWLClasses Properties Individuals

SUBCLASS EXPLORER CLASS EDITOR for 'Homo sapiens blood' (... + = F T)

For Project: For Class: `ary.org/obo/OPL_0000117` Inferred View

Asserted hierarchy

- owl:Thing (9)
 - entity (9)
 - continuant (6)
 - dependent_continuant
 - independent_continuant (6)
 - material_entity (6)
 - anatomical structure (6)
 - blood (2)
 - Homo sapiens blood**
 - cell
 - cerebrospinal fluid
 - hepatopancreas
 - hindgut
 - intestine
 - liver
 - lung
 - mesenteric vein
 - midgut
 - proboscis
 - salivary gland
 - skin of body
 - ureter
 - urinary bladder

Same class hierarchy

Property	Value
rdfs:comment	
definition	blood of human
oboInOwl:hasD...	FMA:9670

blood
part_of some 'Homo sapiens'

continuant or occurrent
dependent_continuant or independent_continuant or spat
fiat_object_part or object or object_aggregate
material_entity or object_boundary or site [fr

Logic View Properties View

Collaboration

Entity notes Changes

Notes for 'Homo sapiens blood'

Filter <None> Go

or Reply using a Comment

jiezheng (06/03/11 11:07): Do we need species speci
stoectkr (06/15/11 06:32): Re: Do we need specie



Class Details in Desktop Client

OPL Protégé 3.4.6 (rmi://bmir-webprotege1/OPL)

File Edit Project OWL Reasoning Code Tools Window BioPortal Change Collaboration Help

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- intestine
- liver
- lung
- mesenteric vein
- midgut
- proboscis
- salivary gland
- skin of body
- ureter
- urinary bladder

Property	Value
rdfs:comment	
definition	blood of a human
oboInOwl:hasDefinition	

blood

part_of some 'Homo sapiens'

continuant or occurrent

dependent_continuant or independent_continuant or spatial

fiat_object_part or object or object_aggregate

material_entity or object_boundary or site

Logic View Properties View

Collaboration

Entity notes Changes

Notes for 'Homo sapiens blood'

Filter <None> Go

or Reply using a Comment

jiezhen (06/03/11 11:07): Do we need species spec

stoectrt (06/15/11 06:32): Re: Do we need specie

Same class hierarchy

Same Annotation Properties

Same Restrictions

Same Comments

Why Use The Desktop Client?

- Richer user interface
 - some OWL experts may prefer it
- Familiar user interface
- You can invoke a classifier only from the desktop client

WebProtégé: Take-Aways

- (Hopefully) easier to use than “good old Protégé”
- Supports collaborations
 - Synchronous editing
 - Notes and discussion
 - Watched entities
 - Change history
- Configurable user interface

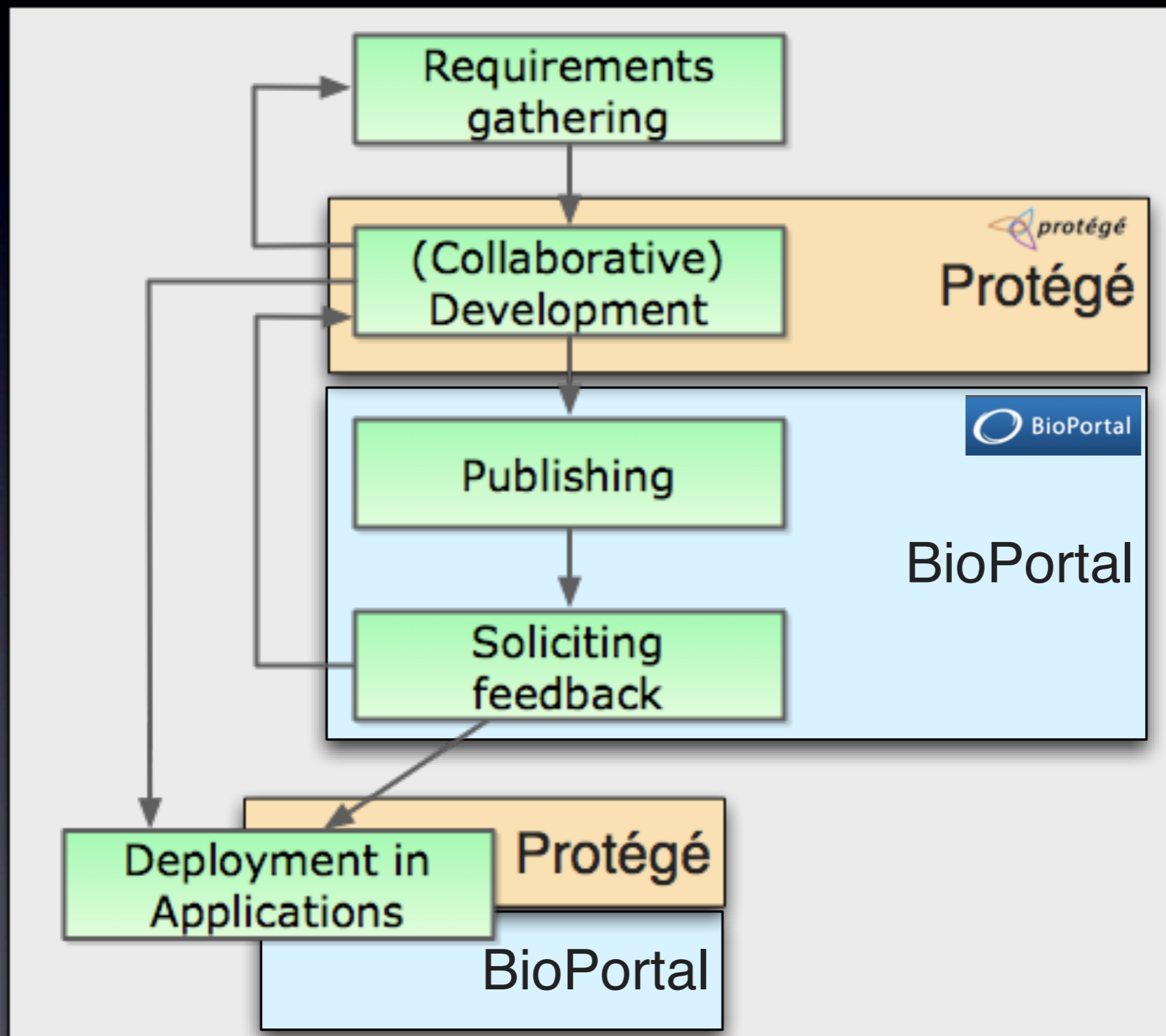
Collaboration Support

- Complete change history
- Discussions **in the context** of definitions
- Discussions stored and accessible after the ontology is developed to provide provenance information, design rationale, etc.
 - *in the context of the class definitions*
- Support for social mechanisms to reach consensus

You have developed an ontology.....

- Now what?
- **Publish** your ontology:
 - to enable others to use it
 - to have a Web link to your ontology
 - or any concept in it
 - to collect feedback from your users
 - to make it accessible to applications via a web service API
- **BioPortal**: an open community-based repository of biomedical ontologies

An (Over-Simplified) Ontology Lifecycle



BioPortal Ontology Library

Ontology Listing | NCBO BioPortal

http://bioportal.bioontology.org/ontologies

BioPortal Browse Search Projects Annotate All Mappings All Resources

Access all ontologies that are available in BioPortal: You can filter this list by category to display ontologies relevant for a certain domain (try selecting "Anatomical Entity Ontology" menu below). You can also filter ontologies that belong to a certain group such as ontologies from the [OBO Foundry](#), or ontologies from the [Cancer Biomedical Research Ontology](#). [the BioPortal RSS feed](#) to receive alerts for submissions of new ontologies, new versions of ontologies, new notes, and new projects. You can subscribe to feeds for this page. Add a new biomedical ontology to BioPortal using the [Submit New Ontology](#) link.

FILTER BY CATEGORY: All Categories

FILTER BY GROUP: All Groups

FILTER BY TEXT:

[Submit New Ontology](#)

ONTOLOGY NAME	VISIBILITY	TERMS	NOTES	REVIEWS	PROJECTS	UPLOADED
ABA Adult Mouse Brain (ABA)	Public	913	0	0	2	08/08/2009
Adverse Event Ontology (AEO)	Public	431	0	0	0	04/13/2011
Adverse Event Reporting ontology (AERO)	Public	252	0	0	1	07/22/2011
African Traditional Medicine (ATMO)	Public	223	2	2	2	06/28/2009
AI/RHEUM (AIR)	Public	681	0	0	0	02/05/2010
Amino Acid (amino-acid)	Public	46	0	0	3	07/02/2010
Amphibian gross anatomy (AAO)	Public	1,603	0	0	3	07/22/2011
Amphibian taxonomy (ATO)	Public	6,135	0	0	1	11/02/2009
Anatomical Entity Ontology (AEO)	Public	137	0	0	0	02/15/2011
Animal natural history and life history (ADW)	Public	360	0	0	0	08/31/2010

BioPortal Ontology Library

Browse
the
BioPortal
ontology
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Ontology Listing | NCBO BioPortal

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African Traditional Medicine (ATMO)	Public	223	2	2	2	06/28/2009
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FILTER BY TEXT:

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Adverse Event Ontology (AEO)	Public	431	0	0	0	04/13/2011
Adverse Event Reporting ontology (AERO)	Public	252	0	0	1	07/22/2011
African Traditional Medicine (ATMO)	Public	223	2	2	2	06/28/2009
Amino Acid (amino-acid)	Public	46	0	0	3	07/02/2010
Amphibian gross anatomy (AAO)	Public	1,603	0	0	3	07/22/2011
Amphibian taxonomy (ATO)	Public	6,135	0	0	1	11/02/2009
Anatomical Entity Ontology (AEO)	Public	137	0	0	0	02/15/2011
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Ontologies in the library

BioPortal Ontology Library

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Ontologies in the library

Details about an ontology

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Submit New Ontology

FILTER BY CATEGORY: All Categories

FILTER BY GROUP: All Groups *Library filters*

FILTER BY TEXT:

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Explore the BioPortal Library

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http://bioportal.bioontology.org/ontologies

BioPortal Browse Search Projects Annotate All Mappings All Resources

Access all ontologies that are available in BioPortal: You can filter this list by category to display ontologies relevant for a certain domain (try selecting "Anatomical Entity Ontology" menu below). You can also filter ontologies that belong to a certain group such as ontologies from the [OBO Foundry](#), or ontologies from the [Cancer Biomedical Research Ontology](#). You can also [subscribe to the BioPortal RSS feed](#) to receive alerts for submissions of new ontologies, new versions of ontologies, new notes, and new projects. You can subscribe to feeds for individual ontologies. Add a new biomedical ontology to BioPortal using the [Submit New Ontology](#) link.

FILTER BY CATEGORY: All Categories

FILTER BY GROUP: All Groups

FILTER BY TEXT:

[Submit New Ontology](#)

ONTOLOGY NAME	VISIBILITY	TERMS	NOTES	REVIEWS	PROJECTS	UPLOADED
ABA Adult Mouse Brain (ABA)	Public	913	0	0	2	08/08/2009
Adverse Event Ontology (AEO)	Public	431	0	0	0	04/13/2011
Adverse Event Reporting ontology (AERO)	Public	252	0	0	1	07/22/2011
African Traditional Medicine (ATMO)	Public	223	2	2	2	06/28/2009
AI/RHEUM (AIR)	Public	681	0	0	0	02/05/2010
Amino Acid (amino-acid)	Public	46	0	0	3	07/02/2010
Amphibian gross anatomy (AAO)	Public	1,603	0	0	3	07/22/2011
Amphibian taxonomy (ATO)	Public	6,135	0	0	1	11/02/2009
Anatomical Entity Ontology (AEO)	Public	137	0	0	0	02/15/2011
Animal natural history and life history (ADW)	Public	360	0	0	0	08/31/2010

The Ontology Catalog

- Find **metadata** about the ontologies
 - authors, versions, dates, documentation
- **Filter** ontologies
 - by category (e.g., anatomy)
 - by group (such as OBO Foundry ontologies)
 - by (part of the) name, type

Hands on exercise

- Explore the BioPortal ontology library:
<http://bioportal.bioontology.org>

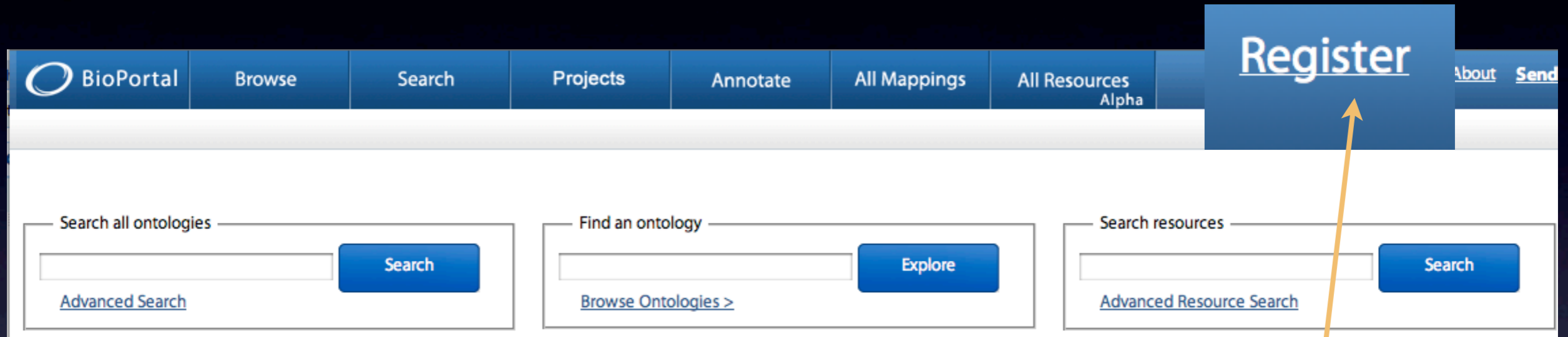
Now you want your ontology to appear in the list

- **Log in** to BioPortal
- **Upload** your ontology
- Get a link to send to your collaborators or to publish on your web site

Now you want your ontology to appear in the list


- **Log in** to BioPortal
- **Upload** your ontology
- Get a link to send to your collaborators or to publish on your web site

Create a BioPortal account



Click on the “Register” link

New user registration form

 BioPortal	Browse	Search	Projects	Annotate	All Mappings	All Resources
New BioPortal Account						
FIRST NAME:	<input type="text"/>					
LAST NAME:	<input type="text"/>					
EMAIL ADDRESS:*	<input type="text"/>					
RE-ENTER EMAIL ADDRESS:*	<input type="text"/>					
ACCOUNT NAME:*	<input type="text"/>					
PASSWORD:*	<input type="text"/>					
RE-ENTER PASSWORD:*	<input type="text"/>					
ORGANIZATION	<input type="text"/>					
PROJECT NAME	<input type="text"/>					
PROJECT URL	<input type="text"/>					
PROJECT DESCRIPTION	<input type="text"/>					
EXPECTED USES	<p>Web Interface</p> <ul style="list-style-type: none"><input type="checkbox"/> Browse ontologies, notes, mappings, and reviews<input type="checkbox"/> Create notes<input type="checkbox"/> Create mappings<input type="checkbox"/> Annotate text with ontology terms<input type="checkbox"/> Search resources with ontology terms <p>API (REST) Access</p> <ul style="list-style-type: none"><input type="checkbox"/> List and retrieve information about ontologies, notes, mappings, and reviews<input type="checkbox"/> Create, edit, and delete notes<input type="checkbox"/> Create, edit, and delete mappings<input type="checkbox"/> Annotate text with ontology terms<input type="checkbox"/> Search resources with ontology terms					
	<p>Select ontologies of interest (search using textbox)</p> <input type="text"/> <ul style="list-style-type: none"><input type="checkbox"/> ABA Adult Mouse Brain (ABA)<input type="checkbox"/> Adverse Event Ontology (AEO)<input type="checkbox"/> Adverse Event Reporting ontology (AFRO)					

New user registration form

BioPortal Browse Search Projects Annotate All Mappings All Resources

New BioPortal Account

FIRST NAME:	<input type="text"/>
LAST NAME:	<input type="text"/>
EMAIL ADDRESS:*	<input type="text"/>
RE-ENTER EMAIL ADDRESS:*	<input type="text"/>
ACCOUNT NAME:*	<input type="text"/>
PASSWORD:*	<input type="text"/>
RE-ENTER PASSWORD:*	<input type="text"/>
ORGANIZATION	<input type="text"/>
PROJECT NAME	<input type="text"/>
PROJECT URL	<input type="text"/>
PROJECT DESCRIPTION	<input type="text"/>
EXPECTED USES	<p>Web Interface</p> <ul style="list-style-type: none"><input type="checkbox"/> Browse ontologies, notes, mappings, and reviews<input type="checkbox"/> Create notes<input type="checkbox"/> Create mappings<input type="checkbox"/> Annotate text with ontology terms<input type="checkbox"/> Search resources with ontology terms <p>API (REST) Access</p> <ul style="list-style-type: none"><input type="checkbox"/> List and retrieve information about ontologies, notes, mappings, and reviews<input type="checkbox"/> Create, edit, and delete notes<input type="checkbox"/> Create, edit, and delete mappings<input type="checkbox"/> Annotate text with ontology terms<input type="checkbox"/> Search resources with ontology terms
	<p>Select ontologies of interest (search using textbox)</p> <input type="text"/> <ul style="list-style-type: none"><input type="checkbox"/> ABA Adult Mouse Brain (ABA)<input type="checkbox"/> Adverse Event Ontology (AEO)<input type="checkbox"/> Adverse Event Reporting ontology (AFRO)

We would really like to know what you are using BioPortal for (our funders, too!)

Creating an Account in BioPortal

- When you create an account
 - you can **submit** new ontologies
 - you can **comment** on existing ontologies
 - you can **create mappings**
 - you get an **API key** to use for **REST service** calls

Log in to BioPortal

The screenshot shows the BioPortal website interface. At the top, there is a navigation bar with links for 'Browse', 'Search', 'Projects', 'Annotate', 'All Mappings', and 'All Resources'. Below this is a welcome message for 'natasha'. A paragraph of text explains how to filter ontologies and provides links for the 'OBO Foundry', 'Cancer Biomedical Informatics', and 'BioPortal RSS feed'. A 'Submit New Ontology' button is highlighted with a red box. Below the filters, there is a table listing various ontologies with columns for name, visibility, terms, notes, reviews, projects, upload date, and author.

Ontology Listing | NCBO BioPortal

http://bioportal.bioontology.org/ontologies

Welcome natasha.

Access all ontologies that are available in BioPortal: You can filter this list by category to display ontologies relevant for a certain domain (try selecting "Anatomy or Experimental Medicine" category" menu below). You can also filter ontologies that belong to a certain group such as ontologies from the [OBO Foundry](#), or ontologies from the [Cancer Biomedical Informatics](#). [the BioPortal RSS feed](#) to receive alerts for submissions of new ontologies, new versions of ontologies, new notes, and new projects. You can subscribe to feeds for a specific page. Add a new biomedical ontology to BioPortal using the Submit New Ontology link.

FILTER BY CATEGORY All Categories

FILTER BY GROUP All Groups

FILTER BY TEXT

Submit New Ontology

ONTOLOGY NAME	VISIBILITY	TERMS	NOTES	REVIEWS	PROJECTS	UPLOADED	AUTHOR
ABA Adult Mouse Brain (ABA)	Public	913	0	0	2	08/08/2009	Aller
Adverse Event Ontology (AEO)	Public	431	0	0	0	04/13/2011	Yong
Adverse Event Reporting ontology (AERO)	Public	252	0	0	1	07/22/2011	Mela
African Traditional Medicine (ATMO)	Public	223	2	2	2	06/28/2009	Ghis
AI/RHEUM (AIR)	Public	681	0	0	0	02/05/2010	May
Amino Acid (amino-acid)	Public	46	0	0	3	07/02/2010	Nick Stev
Amphibian gross anatomy (AAO)	Public	1,603	0	0	3	07/22/2011	Davi
Amphibian taxonomy (ATO)	Public	6,135	0	0	1	11/02/2009	Amp
Anatomical Entity Ontology (AEO)	Public	137	0	0	0	02/15/2011	EMA

What Ontologies Should/Can Be Submitted?

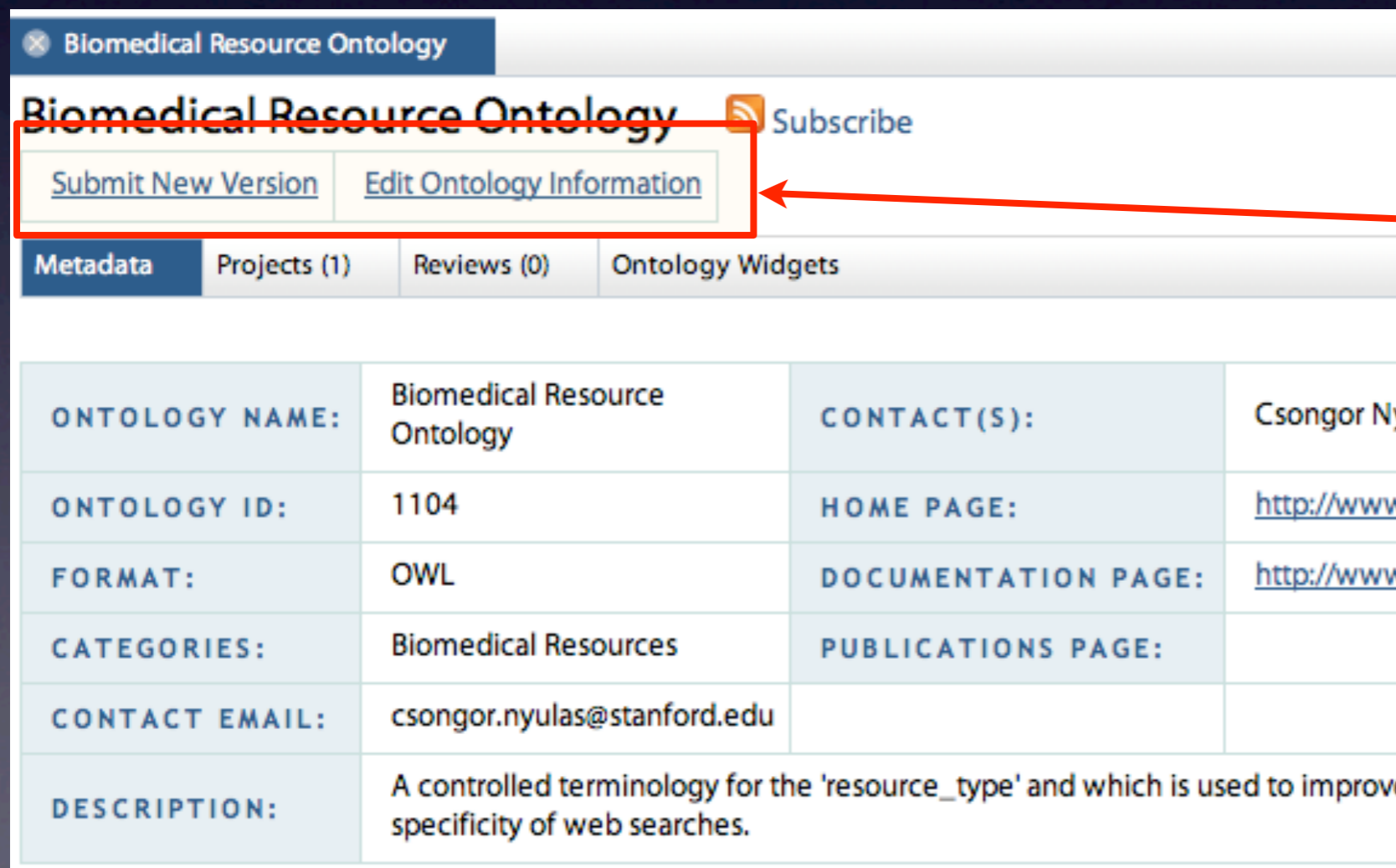
- The ontology needs to be ready for the wider community to see
 - **Anyone** can browse BioPortal and see your ontology
 - Don't publish "toy ontologies"
- Your published ontology can (and often is) "**work in progress**"
 - You can publish early versions to collect feedback or to inform community about your work
- Always indicate the maturity status of the ontology in the metadata

What happens next?

- BioPortal **parses and indexes** your ontology
- While the ontology is parsing, its metadata is available, but the ontology itself is not available for browsing
- Usually takes 1-2 hours before the ontology is fully loaded and indexed

Evolving Your Ontology

- Now you have a **new version** of your ontology
- If you are the ontology administrator, you can upload the new version



Biomedical Resource Ontology

Biomedical Resource Ontology [Subscribe](#)

[Submit New Version](#) [Edit Ontology Information](#)

Metadata Projects (1) Reviews (0) Ontology Widgets

ONTOLOGY NAME:	Biomedical Resource Ontology	CONTACT(S):	Csongor Ny
ONTOLOGY ID:	1104	HOME PAGE:	http://www
FORMAT:	OWL	DOCUMENTATION PAGE:	http://www
CATEGORIES:	Biomedical Resources	PUBLICATIONS PAGE:	
CONTACT EMAIL:	csongor.nyulas@stanford.edu		
DESCRIPTION:	A controlled terminology for the 'resource_type' and which is used to improve specificity of web searches.		

You see these buttons if you are the ontology administrator

What can you do now?

- Tell your friends where your ontology is
 - and ask them to provide feedback
 - give them a link to download your ontology for their use
- Send links to specific classes
- Use REST web service API to access your ontology and any of its components
- Subscribe to updates to your ontology

When you are on the metadata page for your ontology ...

BioPortal Browse Search Projects Annotate All Mappings

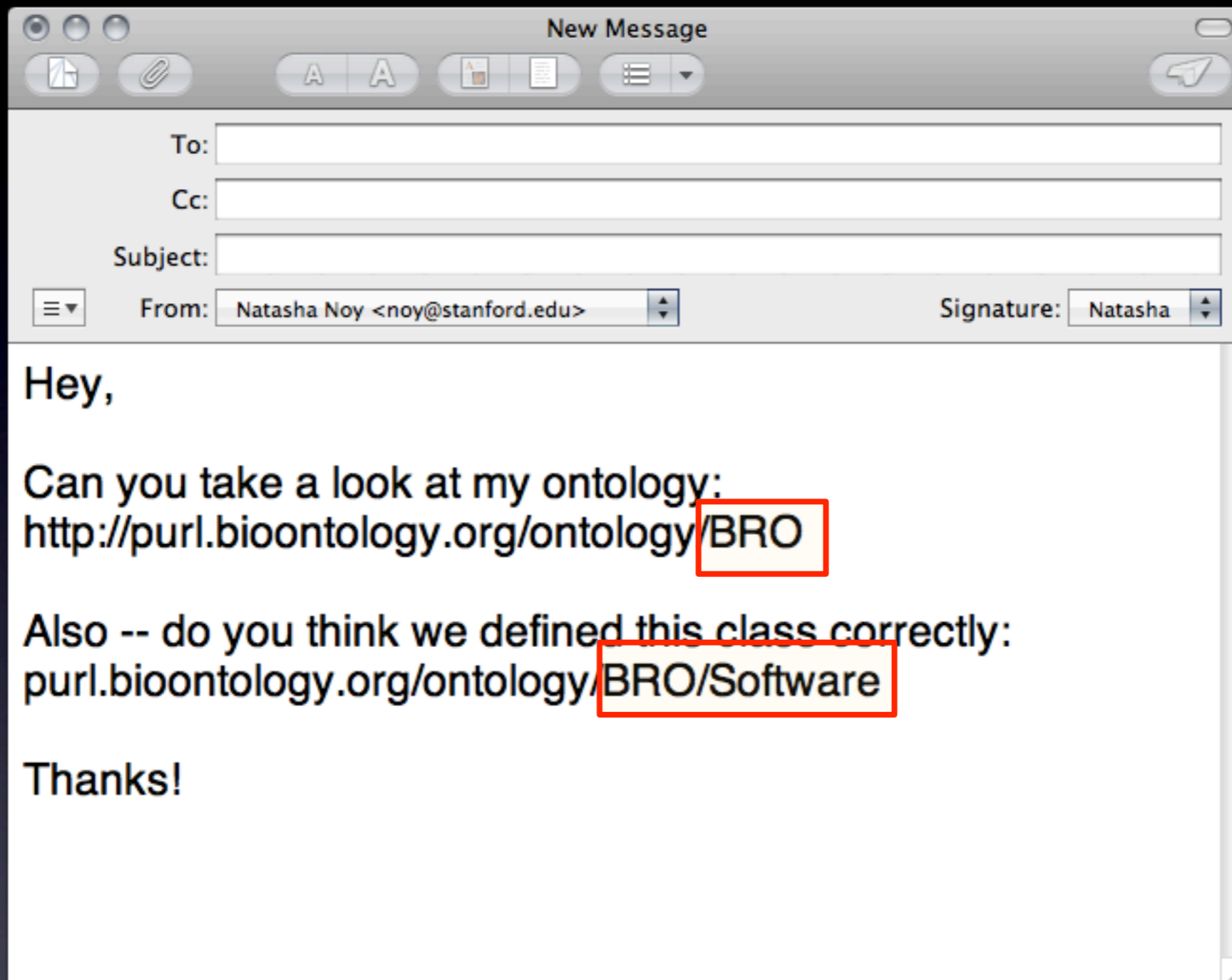
Biomedical Resource Ontology

Summary Administer

Details

ONTOLOGY ID:	1104
BIOPORTAL PURL:	http://purl.bioontology.org/ontology/BRO
STATUS:	
FORMAT:	OWL
CATEGORIES:	Biomedical Resources
GROUPS:	Clinical and Translational Science Awards
CONTACT:	Trish Whetzel, Csongor Nyulas, Natasha Noy, bro-discuss@googlegroups.com
HOME PAGE:	http://www.ncbcs.org/biositemaps/
PUBLICATIONS PAGE:	
DOCUMENTATION PAGE:	http://www.ncbcs.org/biositemaps/
DESCRIPTION:	A controlled terminology of resources, which is used to improve the sensitivity and specificity of web searches.

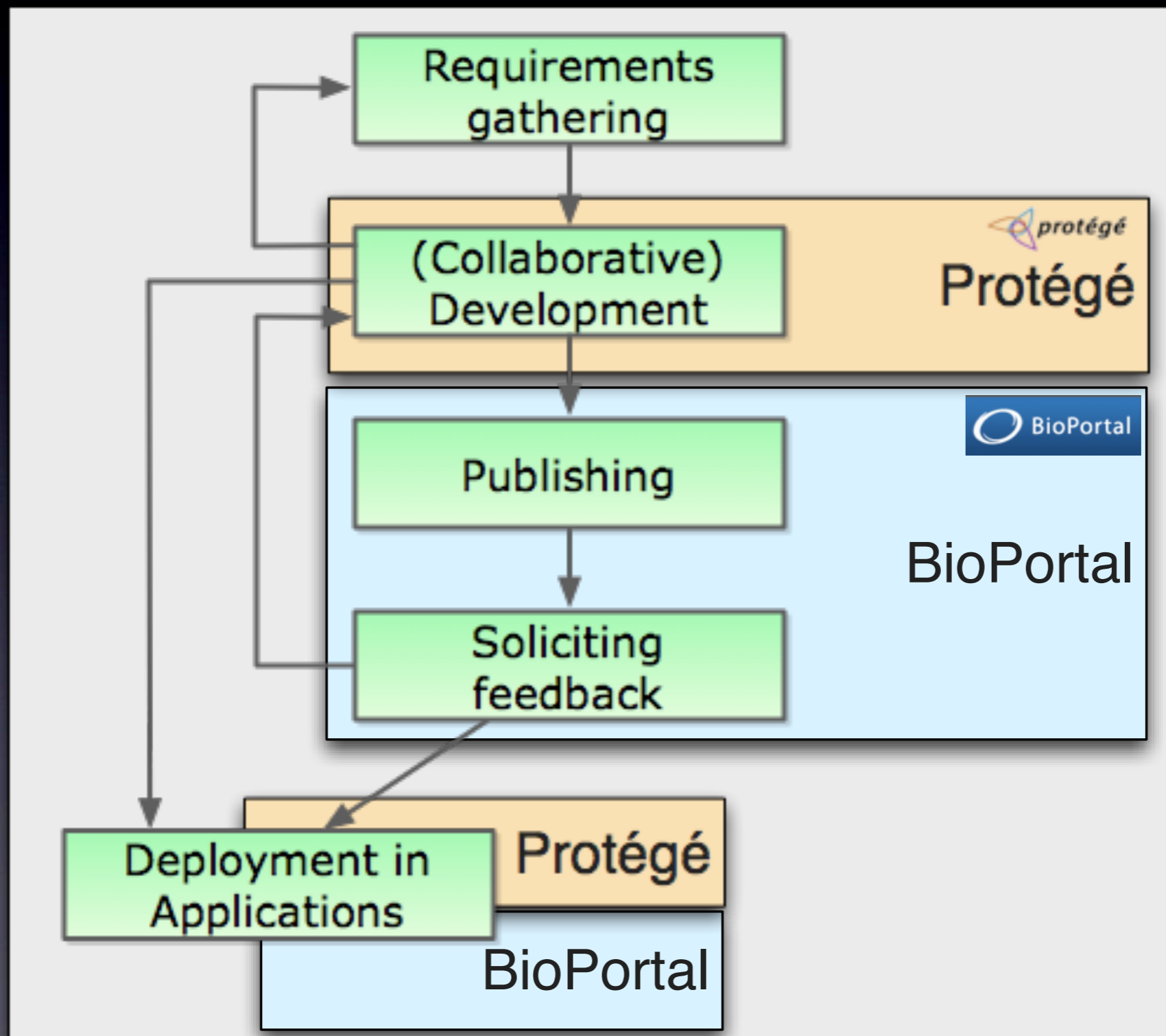
You get a link to share



Do you need to send a new link to everyone now?

- The purl.bioontology.org URL resolves to the latest version of the ontology
- You can add a class name to the URL to access the page for the class

An (Over-Simplified) Ontology Lifecycle



Ontology Evaluation

- Ontologies are not like journal articles:
 - It is difficult to judge methodological soundness simply by inspection
 - We may wish to use an ontology even though some portions
 - Are not well designed
 - Make distinctions that are different from those that we might want

Computable ontology metrics

- Logical consistency checking
 - e.g., use a reasoner to determine if an ontology is consistent
- Structural consistency based on meta-properties
- Rules of thumbs and heuristics
- Statistical information
 - number of classes and properties
 - connectedness, fan-out, etc.
 - cycles

Some Ontology Metrics are Subjective

Some Ontology Metrics are Subjective

What is a “good” feature in some setting, can be a “bad” feature in another setting

Some Ontology Metrics are Subjective

What is a “good” feature in some setting, can be a “bad” feature in another setting

Some Ontology Metrics are Subjective

What is a “good” feature in some setting, can be a “bad” feature in another setting

- High level of **axiomatization**:
 - **good** if you want to perform reasoning
 - can be **bad** because of the high computational and cognitive cost if you don't need the axioms

Some Ontology Metrics are Subjective

What is a “good” feature in some setting, can be a “bad” feature in another setting

- High level of **axiomatization**:
 - **good** if you want to perform reasoning
 - can be **bad** because of the high computational and cognitive cost if you don't need the axioms
- **Organizing** anatomy concepts based primarily on their structure rather than function
 - can be **good** if you need to understand which organs a wound goes through
 - **not appropriate** if you need to understand spread of disease

Community-Based Evaluation



Which ontology from the library is appropriate for my task?

Community-Based Evaluation



Which ontology from the library is appropriate for my task?

- The only people who know the answer to these question are
 - (maybe) ontology authors
 - other users of the ontology

Community-Based Evaluation



Which ontology from the library is appropriate for my task?

- The only people who know the answer to these question are
 - (maybe) ontology authors
 - other users of the ontology
- Allow users to provide ratings for ontologies

An Experiment: Community-Based Annotation as Peer Review

- Potentially makes ontology evaluation a democratic process
- Assumes users' application of ontologies will lead to insights not achievable by inspection alone
- Assumes end-users will be motivated to comment on and engage in dialog about ontologies in the repository

Types Of User Feedback

- **Projects** that use the ontologies
- Ontology **reviews**
- **Notes** on ontologies and **term requests**

Projects in BioPortal

- Users can describe their **ontology-based projects** in BioPortal
- Projects are linked to ontologies they are using
- Ontology reviews can be done in the context of projects



Projects appear as part of the ontology metadata

Biomedical Resource Ontology - Summary | NCBO BioPortal

http://bioportal.bioontology.org/ontologies/1104

- ▶ **Biomedical Resource Ontology - Area of Research View**
- ▶ **Biomedical Resource Ontology - Resource View**
- ▶ **Biomedical Resource Ontology with Simplified Chinese annotations.**
- ▶ **Biositemap Information Model**

Projects Using This Ontology [Create new project](#)

PROJECT	DESCRIPTION	PEOPLE	INSTITUTION
Biositemaps	The Biositemaps Working Group of the NIH Roadmap National Cente...		
CTSA Inventory Resource Web Presence (CIRWP)	The CTSA Inventory Resource Web Presence (CIRWP) is a federated...		
eagle-i	The eagle-i project is building a searchable network of researc...	Melissa Haendel, Carlo Torniai	Consortium
NCBO Annotator	A Web service that tags free text with ontology concepts. NCBO ...	NCBO	Stanford University
NCBO Resource Index	The NCBO Resource Web service is a system for ontology based a...	NCBO	Stanford University

The National Center for Biomedical Ontology is one of the [National Centers for Biomedical Computing](#) supported by the National Institutes of Health.
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Biomedical Resource Ontology

[Add Project](#)

Projects

[Protege](#) [Edit Project](#) [Delete Project](#)

Protégé is a free, open source ontology editor and knowledge-base framework

PEOPLE:	
INSTITUTION:	
HOMEPAGE:	http://protege.stanford.edu

[RadLex](#) [Edit Project](#) [Delete Project](#)

RadLex is a controlled terminology for radiology.

PEOPLE:	
INSTITUTION:	RSNA
HOMEPAGE:	http://radlex.org

[OBR](#) [Edit Project](#) [Delete Project](#)

OBR service is a system for ontology based annotation and indexing of biomedical data; the key functionality of this system is to enable users to locate biomedical data resources related to particular concepts. A set of annotations is generated automatically and presented through integration with BioPortal, enabling researchers to search for biomedical resources associated (annotated) with specific ontology terms. OBR service uses a concept recognizer (currently provided by the National Center for Integrative Biomedical Informatics, University of Michigan) to produce a set of annotations and expand them using ontology is-a relations. The system's indexing workflow processes the text metadata of diverse resource elements such as gene expression data sets, descriptions of radiology images, clinical-trial reports, and PubMed article abstracts to annotate and index them with concepts from appropriate ontologies. Researchers can then search biomedical data sources using ontology concepts.

PEOPLE:	Clement Jonquet
INSTITUTION:	Stanford University



Biomedical Resource Ontology

[Add Project](#)

Projects

[Protege](#) [Edit Project](#) [Delete Project](#)

Protégé is a free, open source ontology editor and knowledge-base framework

PEOPLE:

INSTITUTION:

HOME PAGE: <http://protege.stanford.edu>

[RadLex](#) [Edit Project](#) [Delete Project](#)

RadLex is a controlled terminology for radiology.

PEOPLE:

INSTITUTION: RSNA

HOME PAGE: <http://radlex.org>

[OBR](#) [Edit Project](#) [Delete Project](#)

OBR service is a system for ontology based annotation and indexing of biomedical data; the key functionality of this system is to enable users to locate biomedical data resources related to particular concepts. A set of annotations is generated automatically and presented through integration with BioPortal, enabling researchers to search for biomedical resources associated (annotated) with specific ontology terms. OBR service uses a concept recognizer (currently provided by the National Center for Integrative Biomedical Informatics, University of Michigan) to produce a set of annotations and expand them using ontology is-a relations. The system's indexing workflow processes the text metadata of diverse resource elements such as gene expression data sets, descriptions of radiology images, clinical-trial reports, and PubMed article abstracts to annotate and index them with concepts from appropriate ontologies. Researchers can then search biomedical data sources using ontology concepts.

PEOPLE: Clement Jonquet

INSTITUTION: Stanford University



Biomedical Resource Ontology

[Add Project](#)

Projects

[Protege](#) [Edit Project](#) [Delete Project](#)

Protégé is a free, open source ontology editor and knowledge-base framework

PEOPLE:	
INSTITUTION:	
HOMEPAGE:	http://protege.stanford.edu

Use this page to create a new project

[RadLex](#) [Edit Project](#) [Delete Project](#)

RadLex is a controlled terminology for radiology.

PEOPLE:	
INSTITUTION:	RSNA
HOMEPAGE:	http://radlex.org

[OBR](#) [Edit Project](#) [Delete Project](#)

OBR service is a system for ontology based annotation and indexing of biomedical data; the key functionality of this system is to enable users to locate biomedical data resources related to particular concepts. A set of annotations is generated automatically and presented through integration with BioPortal, enabling researchers to search for biomedical resources associated (annotated) with specific ontology terms. OBR service uses a concept recognizer (currently provided by the National Center for Integrative Biomedical Informatics, University of Michigan) to produce a set of annotations and expand them using ontology is-a relations. The system's indexing workflow processes the text metadata of diverse resource elements such as gene expression data sets, descriptions of radiology images, clinical-trial reports, and PubMed article abstracts to annotate and index them with concepts from appropriate ontologies. Researchers can then search biomedical data sources using ontology concepts.

PEOPLE:	Clement Jonquet
INSTITUTION:	Stanford University



Describe Your Project

New project

PROJECT NAME:*	<input type="text"/>
INSTITUTION:	<input type="text"/>
PEOPLE:	<input type="text"/>
HOMEPAGE:*	<input type="text"/>
DESCRIPTION:*	<input type="text"/>

Select Ontologies Used

Selected (0) Unselected

ABA Adult Mouse Brain	African Traditional Medicine	Amino Acid	Amino Acid with Simplified Chinese annotations
Amphibian gross anatomy	Animal natural history and life history	Ascomycete phenotype ontology	Basic Vertebrate Anatomy
Bilateria anatomy	Biological imaging methods	Biomedical Resource Ontology	BioPortal Metadata
BioTop	BIRNLex	Bleeding History Phenotype	Breast Cancer Grading Ontology
BRENDA tissue / enzyme source	C. elegans development	C. elegans gross anatomy	C. elegans phenotype



Describe Your Project

New project

PROJECT NAME:*	<input type="text"/>
INSTITUTION:	<input type="text"/>
PEOPLE:	<input type="text"/>
HOME PAGE:*	<input type="text"/>
DESCRIPTION:*	<input type="text"/>

Project description

Select Ontologies Used

View All	Selected (0)	Unselected	
ABA Adult Mouse Brain	African Traditional Medicine	Amino Acid	Amino Acid with Simplified Chinese annotations
Amphibian gross anatomy	Animal natural history and life history	Ascomycete phenotype ontology	Basic Vertebrate Anatomy
Bilateria anatomy	Biological imaging methods	Biomedical Resource Ontology	BioPortal Metadata
BioTop	BIRNLex	Bleeding History Phenotype	Breast Cancer Grading Ontology
BRENDA tissue / enzyme source	C. elegans development	C. elegans gross anatomy	C. elegans phenotype

Create



Describe Your Project

New project

PROJECT NAME:*	<input type="text"/>
INSTITUTION:	<input type="text"/>
PEOPLE:	<input type="text"/>
HOMEPAGE:*	<input type="text"/>
DESCRIPTION:*	<input type="text"/>

Project description

Select Ontologies Used

View All	Selected (0)	Unselected	
ABA Adult Mouse Brain	African Traditional Medicine	Amino Acid	Amino Acid with Simplified Chinese annotations
Amphibian gross anatomy	Animal natural history and life history	Ascomycete phenotype ontology	Basic Vertebrate Anatomy
Bilateria anatomy	Biological imaging methods	Biomedical Resource Ontology	BioPortal Metadata
BioTop	BIRNLex	Bleeding History Phenotype	Breast Cancer Grading Ontology
BRENDA tissue / enzyme source	C. elegans development	C. elegans gross anatomy	C. elegans phenotype

Ontologies that the project uses

Create

As A Reviewer, You Can Provide:

- General review and rating
- **Usage** information
 - Which applications have successfully used the ontology?
 - What problems were encountered?
- **Coverage**
 - Does it cover the domain properly?
 - Are there major gaps?
 - Are some parts developed better than others?
- **Concept-specific comments**
 - Are there problems with specific concepts?
 - What alternative definitions should be used?



Creating a review

- On the ontology metadata page:

The screenshot shows a web browser window with the URL <http://bioportal.bioontology.org/ontologies/1104>. The page displays metadata for the 'Biomedical Resource Ontology' and a review section.

STATUS:	
FORMAT:	OWL
CATEGORIES:	Biomedical Resources
GROUPS:	Clinical and Translational Science Awards
CONTACT:	Trish Whetzel, Csongor Nyulas, Natasha Noy, bro-discuss@googlegroups.com
HOME PAGE:	http://www.ncbcs.org/biositemaps/
PUBLICATIONS PAGE:	
DOCUMENTATION PAGE:	http://www.ncbcs.org/biositemaps/
DESCRIPTION:	A controlled terminology of resources, which is used to improve the sensitivity and specificity of web searches.

Reviews [Add your review](#)

REVIEW BY ALANRUTTENBERG

★★★★★ Usability	The ontology does not validate as OWL DL, for reasons that are easily fixed.
★★★★★ Domain Coverage	
★★★★★ Correctness	
★★★★★ Quality Of Content	
★★★★★ Degree Of Formality	
★★★★★ Documentation And Support	

Creating Notes

- discuss class definitions
- suggest changes and corrections
- request new items
- provide additional information about a class (e.g., references, supporting documentation)

Notes on Classes

The screenshot shows a web application interface with a sidebar on the left containing a tree view of classes. The main content area is titled 'Notes (1)' and displays a table of notes. The table has columns for SUBJECT, AUTHOR, TYPE, and CREATED. The first entry is 'does not fit to taxonomy' by 'daumkep' of type 'Comment' created on '03/08/2011'. Below the table, there is a detailed view of this note, including the text of the comment and a response from 'beverlycollins'.

aggressiveness modifier
composition modifier
destruction pattern
disease origin modifier
distribution pattern
imaging observation location modifier
modality-related characteristic
morphologic characteristic
motion characteristic
pathophysiologic process observation modifier
aortic dissection modifier
arthritis modifier
bone pathophysiologic process modifier
cardiomyopathy descriptor
disc composition
cartilaginous
collagenous
dessicated
gaseous
liquefied
nuclear
osseous
disc location modifier
effusion modifier
fracture modifier
head pathophysiologic process observation modifier
hernia modifier
hormonal pathophysiologic process modifier
mass modifier
polyp morphology
renal ectopia modifier
varices modifier
radiopacity

Details Visualization **Notes (1)** Mappings (6) Resource Index

Show 50 entries Filtering Options:

SUBJECT	AUTHOR	TYPE	CREATED
does not fit to taxonomy	daumkep	Comment	03/08/2011

does not fit to taxonomy Archive Note

Comment submitted by **daumkep** 5 months ago on [osseous](#) in [RadLex](#)

Hi all, to my view, "osseus" does not really fit as a child of "disc composition" as it can appear in many other contexts. A good terminology practice would be to name the preferred terms in a unique way, e.g. "osseus disc composition" and put the term "osseous" on a place such as Qualifier "value->Appearance->osseous". What do you think? All the best Philipp

Responses [hide all](#) | [show all](#)

Agree by beverlycollins 5 months ago

Thanks, Philipp, we agree that the terms in this category more correctly belong in the "composition" class. We will move them there and move the class "disc composition" to Obsolete Radlex terms, since this term does not seem necessary. Beverly

[reply](#)

Add Reply

Showing 1 to 1 of 1 entries
[First](#) [Previous](#) **1** [Next](#) [Last](#)

Types of Notes

- Comment
- Change proposal
 - New term proposal
 - New relationship proposal
 - New attribute value



All Proposal Are Structured

Comment	Propose New Term	Propose Relationship Change	Propose Property Value Change
-------------------------	----------------------------------	---	---

New Term

Reason for change *

Preferred name *

Synonyms (comma-separated list)

Definition *

Parent (start typing to autocomplete) *

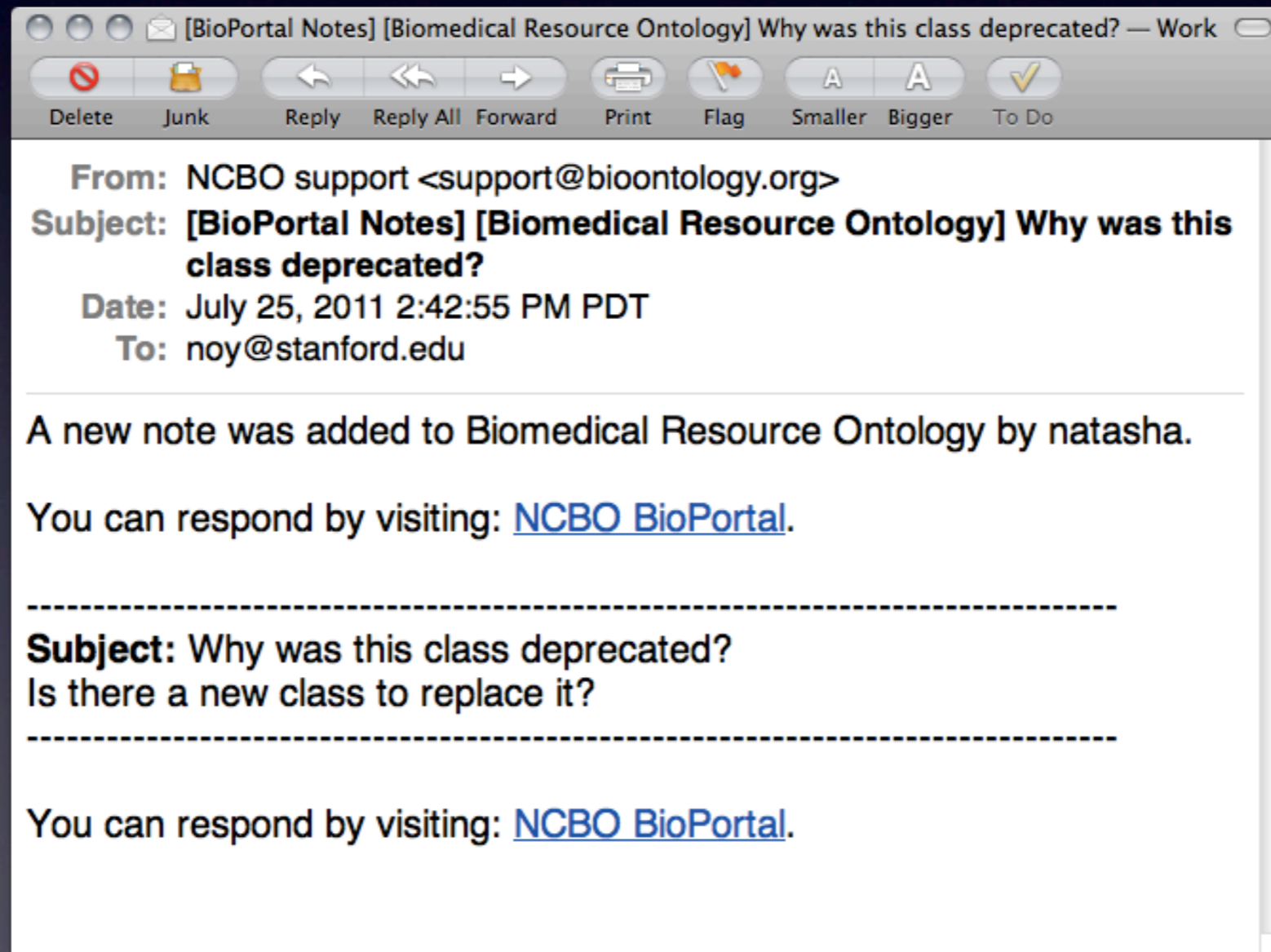
Contact information (publically visible)

* required

submit

Email Notification

- You can subscribe to be notified when a new note appears for any class in your ontology of interest



How BioPortal And WebProtégé Talk to Each Other

- View BioPortal **Notes** in WebProtégé
 - View notes created in BioPortal as you are editing the ontology in WebProtégé
- Add references to BioPortal classes using BioPortal **reference widget** in WebProtégé
 - Search BioPortal
 - Create a reference to BioPortal in your ontology
- **Post notes** from WebProtégé to BioPortal
 - The notes will appear on the classes in BioPortal
- **Archive notes** in WebProtégé to hide them in BioPortal display

BioPortal Notes in WebProtégé

Biomedical Resource Ontology - Terms | NCBO BioPortal

http://bioportal.bioontology.org/ontologies/44450/?p=terms&conceptid=BRO:Funding_Resource

BioPortal Browse Search Projects Annotate All Mappings All Res

Biomedical Resource Ontology

Terms

Jump To:

- Activity
- Area of Research
- Biositemaps Information Model
- core:Collection
- core:Concept
- core:ConceptScheme
- Deprecated Area of Research
- Resource
 - Funding Resource**
 - Information Resource
 - Material Resource
 - People Resource
 - Service Resource
 - Software
 - Training Resource
- Deprecated Resource
- Deprecated Activity

Details Visualization **Notes (2)** Mappings (4) Resource Index

Show 50 entries Filtering Options Search:

SUBJECT	AUTHOR	TYPE
Proposed Subclass	whetzel	Comm

Proposed Subclass
Comment submitted by **whetzel** over 1 year ago on [Funding Resource](#) in Bio

Term: Foreign_Funding_Resource

Please [login](#) to submit notes

Proposed Subclass	whetzel	Comm
-----------------------------------	---------	------

Showing 1 to 2 of 2 entries
[First](#) [Previous](#) **1** [Next](#) [Last](#)

Please [login](#) to submit notes

Go to "http://bioportal.bioontology.org/"

BRO in BioPortal

The Same Class In WebProtégé

The screenshot shows the WebProtégé web interface. At the top, the browser address bar displays `http://webprotege.stanford.edu/#BRO`. The user is identified as **Natasha Noy**, with links for [Sign Out](#), [Options](#), and [Send feedback!](#). The main heading reads "Welcome to WebProtégé Demo!".

Below the heading, there are tabs for "My WebProtégé" (with a sub-tab for "BRO") and a row of application tabs: "Edit BRO Class Metadata", "Classes and Properties", "WebProtege Notes and Discussions", "BioPortal Notes", and "Change History".

The interface is split into two main panels:

- Classes Panel (Left):** A tree view showing a hierarchy of classes. The root is `owl:Thing`. Under it are `Activity`, `Area of Research`, `Biositemaps Information Model`, `core:Collection`, `core:Concept`, `core:ConceptScheme`, `Deprecated Activity`, `Deprecated Area of Research`, `Deprecated Resource`, and `Resource`. Under `Resource` are `Funding Resource`, `Information Resource`, `Material Resource`, `People Resource`, `Service Resource`, `Software`, and `Training Resource`. The `Funding Resource` class is currently selected.
- BioPortal notes and proposals for Funding Resource Panel (Right):** A table with columns for Subject, Author, and Date. It contains two entries:

Subject	Author	Date
Proposed Subclass	whetzel	Fri Mar 12 18:51:30 GMT-800 2010
Proposed Subclass	whetzel	Fri Mar 12 18:50:45 GMT-800 2010

Below the table is a section for "Add new note" and a detailed view of the selected note:

Proposed Subclass whetzel Comment Fri Mar 12 18:50:45 GMT-800 2010

Term: Foreign_Funding_Resource

Reply Status **Not set**

The same notes in WebProtégé

Sets Of Notes in WebProtégé

BioPortal

Access all ontologies that are available in BioPortal: You can filter this list by category to display ontologies relevant for a certain domain (try selecting "Anatomy or Experimental Conditions" in the "Filter by category" menu below). You can also filter ontologies that belong to a certain group such as ontologies from the OBO Foundry, or ontologies from the Cancer Biomedical Informatics Grid (caBIG). Subscribe to the BioPortal RSS feed to receive alerts for submissions of new ontologies, new versions of ontologies, new notes, and new projects. You can subscribe to feeds for a specific ontology at the individual ontology page. Add a new biomedical ontology to BioPortal using the Submit New Ontology link.

SUBMIT ONTOLOGY [Submit New Ontology](#)

FILTER BY CATEGORY:

FILTER BY GROUP:

FILTER BY TEXT:

ONTOLOGY NAME	FORMAT	VERSION	AUTHOR	UPLOADED ON	GROUP	STATUS
ABA Adult Mouse Brain (ABA)	OWL	1.0	Allen Institute for Brain Science	08/08/2009		Explore
Adverse Event Ontology (AEO)	OWL	1.0.11	Yongqun "Oliver" He	04/20/2010		Explore
African Traditional Medicine (ATMO)	OBO Format	1.101	Ghislain Atezmezing	06/28/2009		Explore
AIR (AIR)	RRF	1993	May Cheh	02/05/2010	UMLS	Explore
Amino Acid (amino-acid)	OWL	1.2 (inferred)	Nick Drummond, Georgina Moulton, Robert Stevens, Phil Lord	07/02/2010		Explore

Protégé server

merged-obi-comments_v2011-04-20 Protégé 3.4.6 (file:///Users/natasha/Work/Ontologies/merged-obi-comments_v2011-04-20.pptj_owl_/RDF Files)

File Edit Project OWL Reasoning Code Tools Window BioPortal Collaboration Help

Metadata(obi.owl) OWLClasses Properties Individuals Forms

SUBCLASS EXPLORER CLASS EDITOR for material_entity (instance of owl:Class)

For Project: merged-obi-comments_v2011-04-20 For Class: ifomis.org/bfo/1.1/snap#MaterialEntity Inferred View

Asserted Hierarchy

- owl:Thing
 - doap:Project
 - doap:SVNRepository
 - doap:Version
 - entity
 - continuant
 - dependent_continuant
 - independent_continuant
 - material_entity
 - allergen
 - anatomical entity
 - antigen
 - capsule shell
 - cell
 - cellular_component
 - chemical solution
 - chimera
 - cloning vector
 - decapitated organism
 - dissolved material entity
 - enzyme
 - epitope
 - flat object part

Property Value

rdfs:comment Definition: An independent continuant [snap:IndependentContinuant] that is spatially extended whose identity is independent of that of other entities and can be maintained through time.

Asserted Cc

fiat_object_part_of object_aggregate

independent_continuant

continuant or occurrent

dependent_continuant or independent_continuant or spatial_region

material_entity or object_boundary or site [from independent_conti

object_boundary

site

Logic View Properties View

WebProtégé

BioPortal Proposal Portlet

BioPortal notes and proposals for Funding Resource

Subject	Date
Proposed Subclass whetzel	Fri Mar 12 18:50:45 GMT-800
Proposed Subclass whetzel	Fri Mar 12 18:50:45 GMT-800

Add new note

Proposed Subclass whetzel

Notes Tree Portlet

Welcome to WebProtégé Demo! Natasha Noy | Sign Out | Options | Send Feedback

Classes Edit Class Hierarchy Properties Notes and Discussions Change history Search Request

- owl:Thing
 - independent_continuant
 - material_entity
 - antigen
 - capsule shell
 - cell
 - cellular_component
 - chemical solution
 - chimera
 - cloning vector
 - decapitated organism
 - dissolved material entity
 - enzyme
 - epitope
 - flat object part

BioPortal Proposal Portlet in WebProtégé

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The central area is divided into two main sections. On the left, the "Classes" panel shows a hierarchical tree of ontology classes. The "Funding Resource" class is currently selected and highlighted. On the right, a dropdown menu titled "Add content to this tab" is open, listing various portlets. The "BioPortalProposalsPortlet" is highlighted with a red rectangular box, indicating it is the selected option for addition to the current tab.

Classes

- owl:Thing
 - Activity
 - Area of Research
 - Biositemaps Information Model
 - core:Collection
 - core:Concept
 - core:ConceptScheme
 - Deprecated Activity
 - Deprecated Area of Research
 - Deprecated Resource
 - Resource
 - Funding Resource
 - Information Resource
 - Material Resource
 - People Resource
 - Service Resource
 - Software
 - Training Resource

BioPortal Proposal Portlet in WebProtégé

The screenshot shows the WebProtégé web application interface. At the top, the browser address bar displays `http://webprotege.stanford.edu/#BRO`. The user is identified as **Natasha Noy**, with links for [Sign Out](#), [Options](#), and [Send feedback!](#). The main heading reads "Welcome to WebProtégé Demo!".

A "Configure" dialog box is open, with the "BioPortal" tab selected. It contains the following fields:

- BioPortal REST Base:** `http://rest.bioontology.org`
- Linked BioPortal Ontology Id:** `44450` (highlighted with a red box)

A red annotation next to the "44450" field reads: *Version id in BioPortal*.

At the bottom of the dialog are "OK" and "Cancel" buttons. Below the dialog, a list of resource types is visible on the left, including Information Resource, Material Resource, People Resource, Service Resource, Software, and Training Resource. On the right, a list of portlets is visible, including PropertiesTreePortlet, PropertiesViewPortlet, RestrictionsPortlet, SuperclassesPortlet, and WatchedEntitiesPortlet.

Actions On BioPortal Notes

- **View** a note
- **Reply** to a note
 - The reply will be from “WebProtege”
- **Create** a new note
 - Try creating a note for a deprecated class
 - A note will be from “WebProtege”
- Change the **status** of the note
 - BioPortal user interface doesn't reflect the new status at the moment, but the REST services do



Replying to a Note

New note on EDAWebProtégé Demo! Noy

Subject:
What was this class replaced with?

Body:

B *I* U | A[^] A^v | A^v ab^v | [List Icons]

This class is deprecated? What is the new version for this class in the main branch?

License and Terms for Use
Matrix
Modular Component

Send Cancel



Reply in BioPortal

Show entries [Filtering Options](#) Search:

SUBJECT	AUTHOR	TYPE	CREATED
Why was this class deprecated?	natasha	Comment	07/25/2011

Why was this class deprecated? Archive Note
Comment submitted by natasha 14 minutes ago on [Anatomic Atlas](#) in [Biomedical Resource Ontology](#)

Is there a new class to replace it?

Responses [hide all](#) | [show all](#)

Re: Why was this class deprecated? by webprotege 2 minutes ago

deprecated because it was too specific or overlapped with definition of Atlas.

On Mon Jul 25 14:42:55 GMT-700 2011, natasha wrote:

Is there a new class to replace it?

[reply](#)

BioPortal Reference Widget


- Allows references to classes in BioPortal
- A property can be configured to link to classes from a specific ontology

Find the Property Value in BioPortal

Details for Claim for Joe Doe

Claim Title Claim for Joe Doe

Disease Code (ICD-10)

label	Term ID	Link
Malaria due to simian plasmodia	B53.1	

+ Find term
+ Add term


Description of the Claim Joe went in the mighty jungle and got malaria there.

Find the Property Value in BioPortal

Details for Claim for Joe Doe

Claim Title Claim for Joe Doe

Disease Code (ICD-10)

label	Term ID	Link
Malaria due to simian plasmodia	B53.1	

+ Find term

+ Add term

Description of the Claim Joe went in the mighty jungle and got malaria there.

Find the value in BioPortal

Search BioPortal

BioPortal Search for property Disease Code (ICD-10) [Individuals](#) [Notes and Discussions](#) [Change History](#)

Search for concept: [Search in BioPortal](#)

Id	Preferred Name	Found in	Matched content	Ontology			
B54	Unspecified malaria		Unspecified malaria	ICD10			Import
B52	Plasmodium malariae malaria		Plasmodium malariae malaria	ICD10			Import
B52.0	Plasmodium malariae malaria with nephropathy		Plasmodium malariae malaria with nephropathy	ICD10			Import
P37.3	Congenital falciparum malaria		Congenital falciparum malaria	ICD10			Import
B53.1	Malaria due to simian plasmodia		Malaria due to simian plasmodia	ICD10			Import
P37.4	Other congenital malaria		Other congenital malaria	ICD10			Import
B53	Other parasitologically confirmed malaria		Other parasitologically confirmed malaria	ICD10			Import
B50	Plasmodium falciparum malaria		Plasmodium falciparum malaria	ICD10			Import
B50.9	Plasmodium falciparum malaria,		Plasmodium	ICD10			Import

10 / 19 results shown. [Show all search results](#) [Did not find it. Leave a comment](#)

Search BioPortal

BioPortal Search for property Disease Code **(ICD-10)** Individuals Notes and Discussions Change History

Search for concept: [Search in BioPortal](#)

Id	Preferred Name	Found in	Matched content	Ontology			
B54	Unspecified malaria		Unspecified malaria	ICD10			Import
B52	Plasmodium malariae malaria		Plasmodium malariae malaria	ICD10			Import
B52.0	Plasmodium malariae malaria with nephropathy		Plasmodium malariae malaria with nephropathy	ICD10			Import
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Search term

Search BioPortal

BioPortal Search for property Disease Code (ICD-10) Individuals Notes and Discussions Change History

Search for concept: [Search in BioPortal](#)

Id	Preferred Name	Found in	Matched content	Ontology			
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Search for concept: [Search in BioPortal](#)

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10 / 19 results shown. [Show all search results](#)

[Did not find it. Leave a comment](#)

Search term

Going Back to The Insurance Ontology

- The `disease_code` is configured to link to the ICD-9 ontology in BioPortal
- Exercise
 - Create instances of claims
 - Add disease codes

Under The Hood of WebProtégé

- Administering the WebProtégé server
- Changes and Annotation Ontology

Administering The WebProtégé Server

- An Administrator can
 - Add new projects
 - Set permissions for projects
 - Create new users and add them to groups
 - Temporarily stop access to the project so that you can run a classifier



Log In As Admin

Open Project

File Host Machine Name
webprotege.stanford.edu:5200

URL User Name
Natasha Noy

Server Password
.....

New user

Administer server (requires privileges)

OK Cancel



Admin Screen

Administer Protege Server (Logged in as Natasha Noy)

Projects Sessions Metaproject Server Control

Remote projects

Project	Status	Sessions
Book 1	READY	[Session(id=15, user=webprotege_prd)]
Book 2	READY	[Session(id=42, user=webprotege_prd)]
Book 3	READY	[]
Book 4	READY	[Session(id=45, user=webprotege_prd)]
Book 5	READY	[Session(id=24, user=webprotege_prd)]
Book 6	READY	[]
Book1 ann	READY	[Session(id=16, user=webprotege_prd)]
Book2 ann	READY	[Session(id=43, user=webprotege_prd)]
Book3 ann	READY	[]
Book4 Ann	READY	[Session(id=46, user=webprotege_prd)]
Book5 Ann	READY	[Session(id=25, user=webprotege_prd)]
Book6 ann	READY	[]
CELDAC Ortho-Spine	READY	[]
CELDAC Ortho-Spine Annotation	READY	[]
Collaborative Newspaper	READY	[Session(id=21, user=webprotege_prd)]
Collaborative Pizza	READY	[Session(id=1, user=webprotege_prd)]
Collaborative Pizza Annotations	READY	[Session(id=2, user=webprotege_prd), Sessi...
Disposition Ontology	READY	[]
Disposition Ontology Annotation	READY	[]

Details (no project selected)

Statistics

Estimated round trip time for this admin client (ms):

Milliseconds to calculate frame cache:

Transaction Isolation Level:

Users

Session ID	User	IP Adress	In Transaction?	Server Backlog
------------	------	-----------	-----------------	----------------

Refresh



The Metaproject: Configuring Permissions

Administer Protege Server (Logged in as Natasha Noy)

Projects Sessions Metaproject Server Control

CLASS BROWSER

For Project: ●

Class Hierarchy

- :THING
- ▶ ● :SYSTEM-CLASS
 - GroupOperation (35)
 - ▼ ● Operation
 - GroupAppliedOperation (1)
 - ProjectAppliedOperation (3)
 - ServerAppliedOperation (7)
 - ▼ ● PolicyControlledObject
 - Group (17)
 - Project (52)
 - Server (1)
 - PropertyValue (129)
 - User (185)

Superclasses

- PolicyControlledObject

INSTANCE BROWSER

For Class: ● Project

name

- ◆ HOM Demographics Ontology Annotation
- ◆ ICBO Tutorial 2011
- ◆ ICBO Tutorial 2011 Annotation
- ◆ Math Ontology (Frames)
- ◆ Math Ontology (Frames) Annotation
- ◆ Math Ontology (OWL)
- ◆ Math Ontology (OWL) Annotation
- ◆ Modellers shop
- ◆ Modellers shop annotation
- ◆ NCI Thesaurus
- ◆ NCI Thesaurus Annotations
- ◆ Newspaper Annotation
- ◆ OBI
- ◆ OBI annotation
- ◆ OPL

Types

- Project

INSTANCE EDITOR

For Instance: ◆ ICBO Tutorial 2011 (instan...)

Name: ICBO Tutorial 2011

Owner: ◆ Natasha Noy

Description: A demo ontology used in the ICBO 2011 tutorial on collabor development

Location: /usr/local/icat-files/projects/icbo2011/icbo2011.pprj

Allowed Group Operations (Policies)

allowedGroup	allowedOperation
World	Read
World	DisplayInProjectList
ICBO2011	Read, Write

Additional Properties

name	value
scheduler.last.run.time.Daily	1311569538929
scheduler.last.run.time.Hourly	1311583038357
scheduler.last.run.time.Immedia...	1311583458368

AnnotationProject

- ◆ ICBO Tutorial 2011 Annotation

What Have We Learned Today

- **Workflow** for collaborative ontology development
- **WebProtégé**
 - Ontology editing
 - Collaboration: comments, discussion
 - User interface configuration
- **BioPortal**
 - Publishing ontologies
 - Commenting on ontologies
 - Requesting new terms
- **Cross-talk** between BioPortal and WebProtégé:
 - Components of a single collaborative workflow

Thanks!

- **The Protégé Team**

- Tania Tudorache
- Csongor Nyulas
- Timothy Redmond
- Jennifer Vendetti

- **The BioPortal Team**

- Paul Alexander
- Michael Dorf
- Ray Ferguson
- Trish Whetzel
- Pradip Kanjamala

- Mark Musen

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