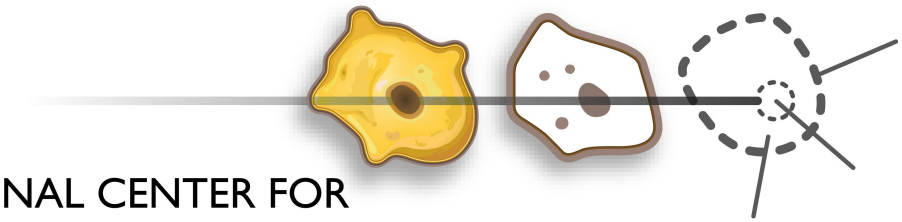
If we build it, will they come?

Social engineering of new technology to disseminate biomedical ontologies

Mark A. Musen and the BioPortal Team

Stanford University



NATIONAL CENTER FOR
BIOMEDICAL ONTOLOGY

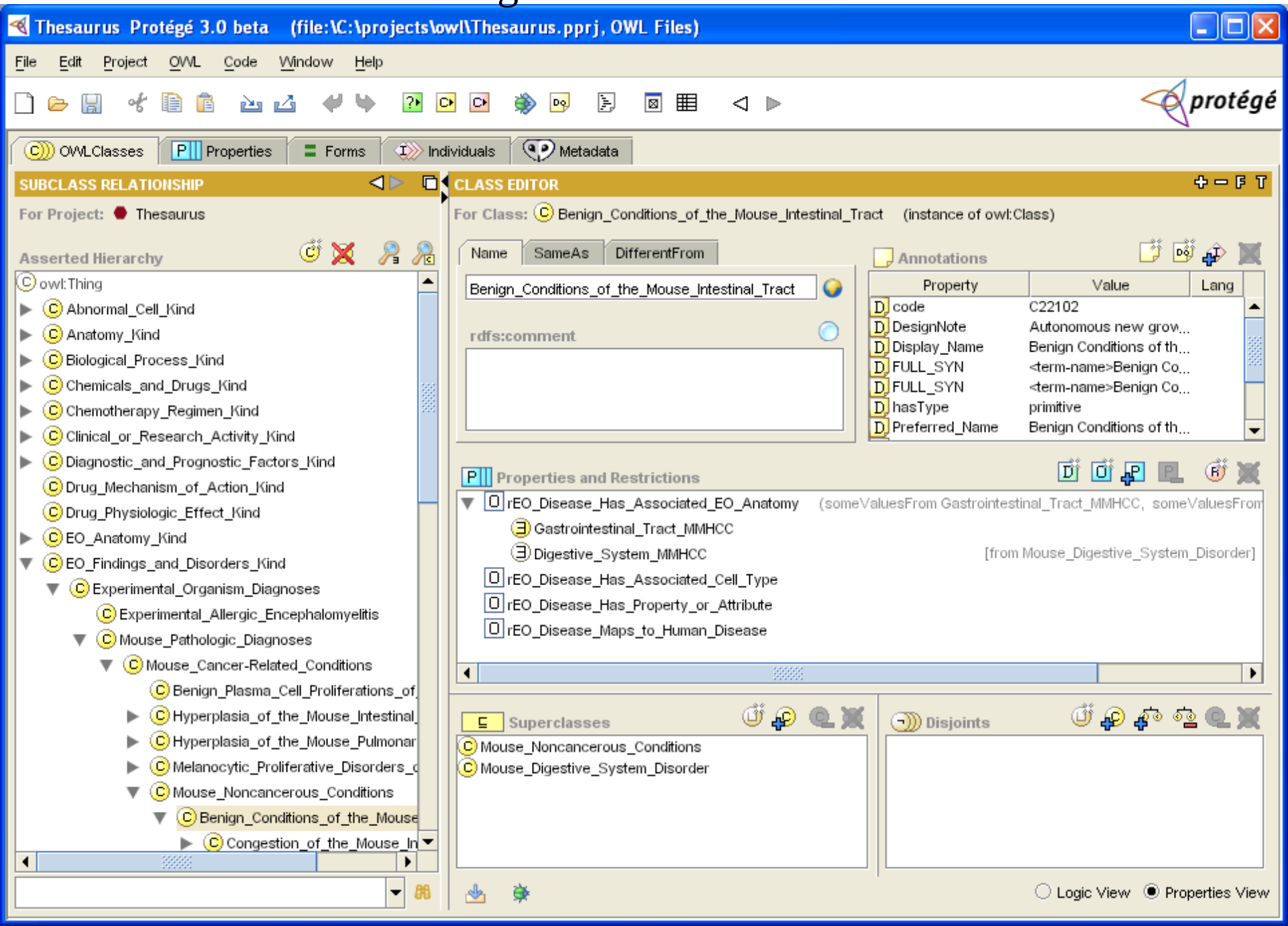
Thanks to a ton of people!

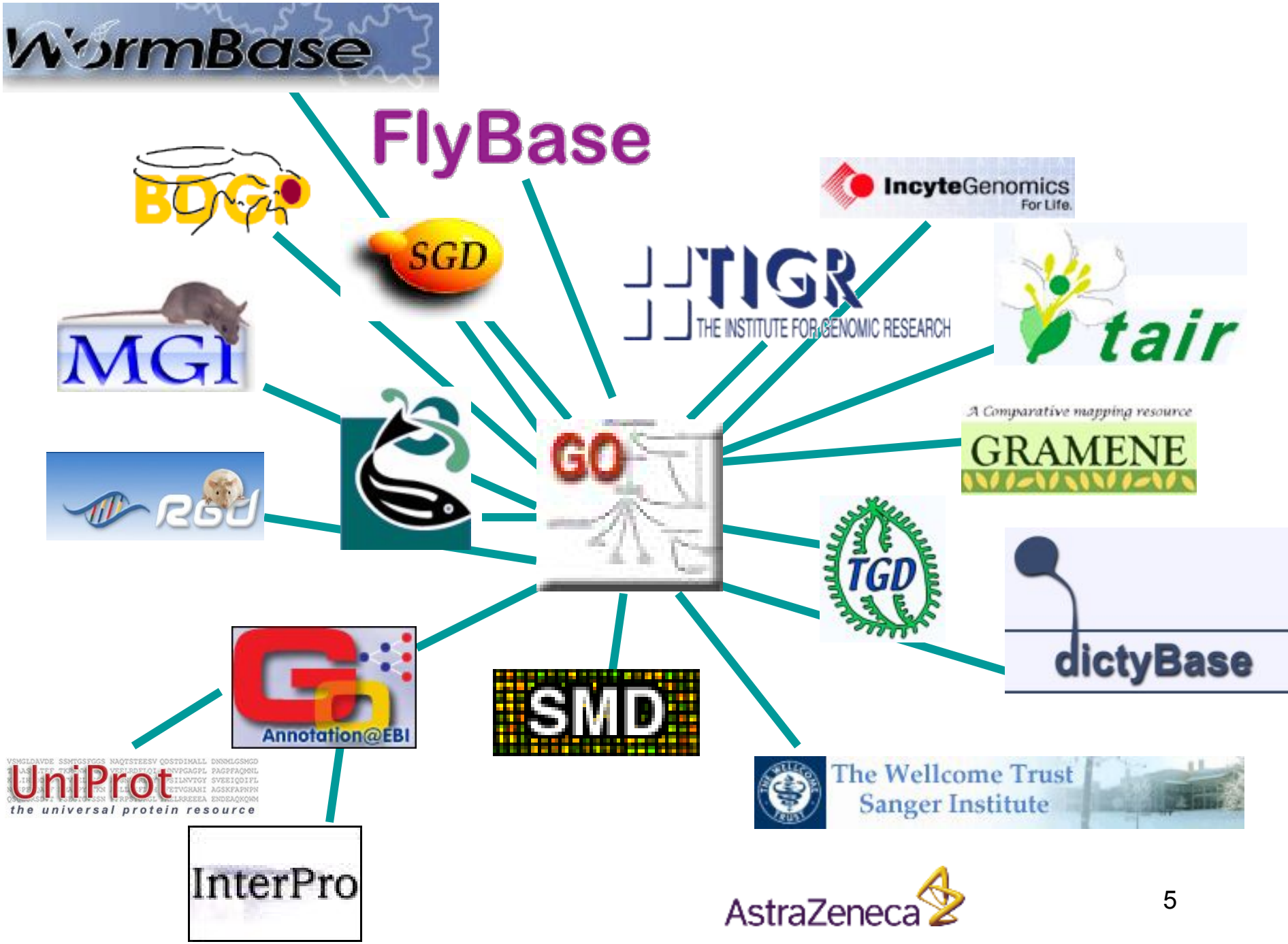
- Benjamin Dai
- Misha Dorf
- Nick Griffith
- Suzanna Lewis
- Dilvan Moreira
- Michael Montegut
- Chris Mungall
- Natasha Noy
- Kaustubh Supekar
- Nicole Washington
- Daniel Rubin
- Nigam Shah

A Small Portion of ICD9-CM

724	Unspecified disorders of the back
724.0	Spinal stenosis, other than cervical
724.00	Spinal stenosis, unspecified region
724.01	Spinal stenosis, thoracic region
724.02	Spinal stenosis, lumbar region
724.09	Spinal stenosis, other
724.1	Pain in thoracic spine
724.2	Lumbago
724.3	Sciatica
724.4	Thoracic or lumbosacral neuritis
724.5	Backache, unspecified
724.6	Disorders of sacrum
724.7	Disorders of coccyx
724.70	Unspecified disorder of coccyx
724.71	Hypermobility of coccyx
724.71	Coccygodynia
724.8	Other symptoms referable to back
724.9	Other unspecified back disorders

The NCI Thesaurus in Protégé-OWL




WormBase
FlyBase
BDGP
SGD
IncyteGenomics
For Life.
TIGR
THE INSTITUTE FOR GENOMIC RESEARCH
tair
MGI
A Comparative mapping resource
GRAMENE
RGD
GO
TGD
dictyBase
Annotation@EBI
SMD
UniProt
the universal protein resource
The Wellcome Trust
Sanger Institute
InterPro
AstraZeneca

Search GO:

Terms Gene Products

Top Docs Gene Ontology GO Links GO Summary

- **GO:0003673 : Gene_Ontology (92932)**
  - **GO:0008150 : biological_process (56952)**
    - GO:0007610 : behavior (566)
    - GO:0000004 : biological_process unknown (6152)
    - **GO:0007154 : cell communication (11916)**
      - GO:0007155 : cell adhesion (830)
      - GO:0030260 : cell invasion (0)
      - GO:0008037 : cell recognition (210)
      - **GO:0007267 : cell-cell signaling (1318)**
        - GO:0045168 : cell-cell signaling involved in cell fate commitment (0)
        - **GO:0030072 : peptide hormone secretion (6)**
          - GO:0030252 : growth hormone secretion (2)
          - GO:0030073 : insulin secretion (4)
          - GO:0030103 : vasopressin secretion (2)
        - GO:0019226 : transmission of nerve impulse (688)
      - GO:0030383 : host-pathogen interaction (12)

Goals of Biomedical Ontologies

- To provide a classification of biomedical entities
- To annotate data to enable summarization and comparison across databases
- To provide for semantic data integration
- To drive NLP systems
- To simplify the engineering of complex software systems
- To provide a formal specification of biomedical knowledge

Open Biomedical Ontologies library

Domain	Prefix	Ontology	Defs file
Arabidopsis gross anatomy	TAIR	arabidopsis anatomy.ontology	arabidopsis anatomy.definitions
Arabidopsis development	TAIR	arabidopsis development.ontology	arabidopsis development.definitions
Cell type	CL	cell.obo	included in cell.obo
Cereal plant gross anatomy	GRO	anatomy gr ont	anatomy gr def
Cereal plant development	GRO	temporal gr ont	temporal gr def
Cereal plant trait ontology	TO	trait ontology	trait definitions
Chemical entities of biological interest	CHEBI	ontology.obo	included in ontology.obo
Protein covalent bond	CV	[none]	[none]
Protein-protein interaction	MI	psi-mi.dag	psi-mi.def
Maize gross anatomy	ZEA	Zea mays anatomy ontology.txt	Zea mays anatomy ontology definitions.txt
Dictyostelium anatomy	DDANAT	anatomy.ontology	anatomy.definitions
Drosophila gross anatomy	FBbt	fly anatomy.ontology	fly anatomy.definitions
Habronattus courtship		protege source	included in protege source
Loggerhead nesting		protege source	included in protege source
Human anatomy and development	EV	ontologies	[none]
Microarray experimental conditions		MGEDOntology.daml	included in MGEDOntology.daml
Physical-chemical methods and properties	FIX	fix.ontology	[none]
Fungal gross anatomy	FAO	fungal anatomy.ontology	fungal anatomy.definitions
Molecular function	GO	gene_ontology.obo	included in gene_ontology.obo
Biological process	GO	gene_ontology.obo	included in gene_ontology.obo
Cellular component	GO	gene_ontology.obo	included in gene_ontology.obo

- OLS Home
- Documentation
  - Project
  - Publications
- Developer Resources
  - Download
  - Implementation Overview
  - Javadoc
  - Webservice documentation
- Contact Us
  - Acknowledgements

News

June 2007: Maintenance Release

Implementation documentation has been updated to include more recent dependencies. Please note that unless stated otherwise in specific instances, newer versions of given depencies should work without issue.

OLS - Ontology Lookup Service

Enter Ontology Term

Search Ontology: Arabidopsis Development [TAIR] **Browse**

Term Name: (Include obselete terms ☑)

stem

Term ID:

Additional Information:

Enter a partial search term. As you are typing, you will see suggested terms that match what are entering in the form. If you select one from the pull-down list, its corresponding ID will be displayed in the form. If you see "... and more" in the list of suggested values, you can select this value to be redirected to a page where all possible values are listed. As an example, enter *mitoc* in the Term Name box while the *Gene Ontology* ontology is selected.

For better search results, do not type punctuation or symbols. For example, if you are looking for 4'-(L-tryptophan), try typing *4 L tryp*.

You can browse an ontology by clicking on the "browse" button next to the ontology selector. To view the complete ontology, do not select a term name. If a term name has been selected, it will be the root from which the ontology will be browsed.

Simple Term ID Search:

Term ID: **Search**

Enter a complete term ID (example: GO:0008150) and click on the 'Search' button to quickly obtain all pertinent information for this term. Searches are case-sensitive, so ensure that the proper ontology prefix is used (GO:, rather than go: or Go:).

OLS - Ontology Lookup Service

TAIR Ontology Browser

News

June 2007: Maintenance Release

Implementation documentation has been updated to include more recent dependencies. Please note that unless stated otherwise in specific instances, newer versions

- Arabidopsis ontology
  - Arabidopsis growth
    - plant growth stages
      - post-reproductive
      - silique ripening
      - senescence
      - rosette growth
      - vegetative
      - reproductive
      - embryonic
    - body part developmental stages
      - flower development
        - stage 1 flower
        - stage 2 flower
        - stage 3 flower
        - stage 4 flower
        - stage 5 flower
        - stage 6 flower
        - stage 7 flower
        - stage 8 flower
        - stage 9 flower
        - stage 10 flower

In biology, lots of ontology developers are almost hobbyists

- Nearly always, ontologies are created to address pressing practical needs
- The people who have the most insight into professional knowledge of a given biomedical domain may have little appreciation for metaphysics, principles of knowledge representation, or computational logic
- There simply aren't enough good ontologists to go around

Issues in assuring ontology quality

- Unlike the case with journal submissions, it makes no sense for ontologies to be peer-reviewed by just a handful of experts
- Open, community-based review of ontologies may be haphazard and chaotic
- Top–down solutions may offer rigid review critieria at the expense of scalability
- There is a pressing need for empirical evaluation of methods for ontology evaluation

A Curated Approach for Quality Assurance

- A proposal to create a family of interoperable “gold standard” biomedical reference ontologies
- Formulated by Barry Smith and members of the GO Consortium
- A *Good Housekeeping* Seal of Approval for biomedical ontologies

Home
Principles
Ontology Table
Ontology Index
Mappings
Project
Repository
Downloads
Subscribe
Contact
Tools

Please submit any updates or corrections to the OBO webmaster

OBO Foundry Principles

For an ontology to be accepted as one of the Open Biomedical Ontologies in the Foundry, the following criteria must be met (further principles will be added over time):

Version as of 24 April 2006

1. The ontology must be *open* and available to be used by all without any constraint other than (a) its origin must be acknowledged and (b) it is not to be altered and subsequently redistributed under the original name or with the same identifiers.

   The OBO ontologies are for sharing and are resources for the entire community. For this reason, they must be available to all without any constraint or license on their use or redistribution. However, it is proper that their original source is always credited and that after any external alterations, they must never be redistributed under the same name or with the same identifiers.

2. The ontology is in, or can be expressed in, a *common shared syntax*. This may be either the OBO syntax, extensions of this syntax, or OWL.

   The reason for this is that the same tools can then be usefully applied. This facilitates shared software implementations. This criterion is not met in all of the ontologies currently listed, but we are working with the ontology developers to have them available in a common OBO syntax.

3. The ontologies possesses a *unique identifier space* within the OBO Foundry.

   The source of concepts from any ontology can be immediately identified by the prefix of the identifier of each concept. It is, therefore, important that this prefix be unique.

4. The ontology provider has procedures for identifying distinct successive *versions*.

5. The ontology has a clearly specified and clearly *delineated content*.

   The ontology must be orthogonal to other ontologies already lodged within OBO.

   The major reason for this principle is to allow two different ontologies, for example anatomy and process, to be combined through additional relationships. These relationships could then be used to constrain when terms could be jointly applied to describe complementary (but distinguishable) perspectives on the same biological or medical entity.

   As a corollary to this, we would strive for community acceptance of a single ontology for one domain, rather than encouraging rivalry between ontologies.

6. The ontologies include textual *definitions* for all terms.

   Many biological and medical terms may be ambiguous, so concepts should be defined so that their precise meaning within the context of a particular ontology is clear to a human reader.

7. The ontology uses relations which are unambiguously defined following the pattern of definitions laid down in the *OBO Relation Ontology*.

8. The ontology is *well documented*.

9. The ontology has a plurality of independent *users*.

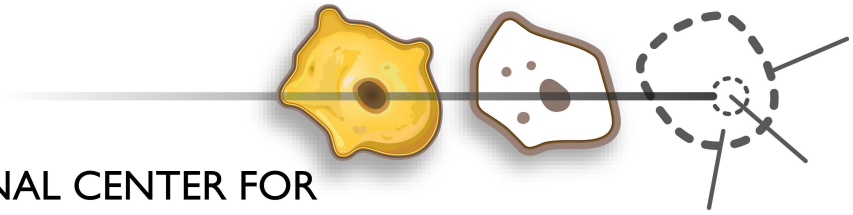
10. The ontology will be developed *collaboratively* with other OBO Foundry members.

OBO Foundry must address lots of questions

- Can the top–down approach scale? How many ontologies can be managed by a small panel of curators?
- Who gets to reject an ontology on the basis of form or content? What is the appeals process? How do we know whom to believe?
- Who will curate the curators?

The National Center for Biomedical Ontology

- One of three National Centers for Biomedical Computing launched by NIH in 2005
- Collaboration of Stanford, Berkeley, Mayo, Buffalo, Victoria, UCSF, Oregon, and Cambridge
- Primary goal is to make ontologies accessible and usable
- Research will develop technologies for ontology dissemination, indexing, alignment, and peer review



NATIONAL CENTER FOR
BIOMEDICAL ONTOLOGY

NIH Roadmap

ACCELERATING MEDICAL DISCOVERY TO IMPROVE HEALTH

New Pathways to Discovery

Research Teams of the Future

Re-engineering the Clinical Research Enterprise

What's New

NIH Roadmap

National Centers for Biomedical Computing

Home | NCBC Summary | SDIWG | Tools and Applications | Ontology Working Group | DBP Interactions

ATTENTION: Final Report from National Centers for Biomedical Computing 2006 All Hands Meeting

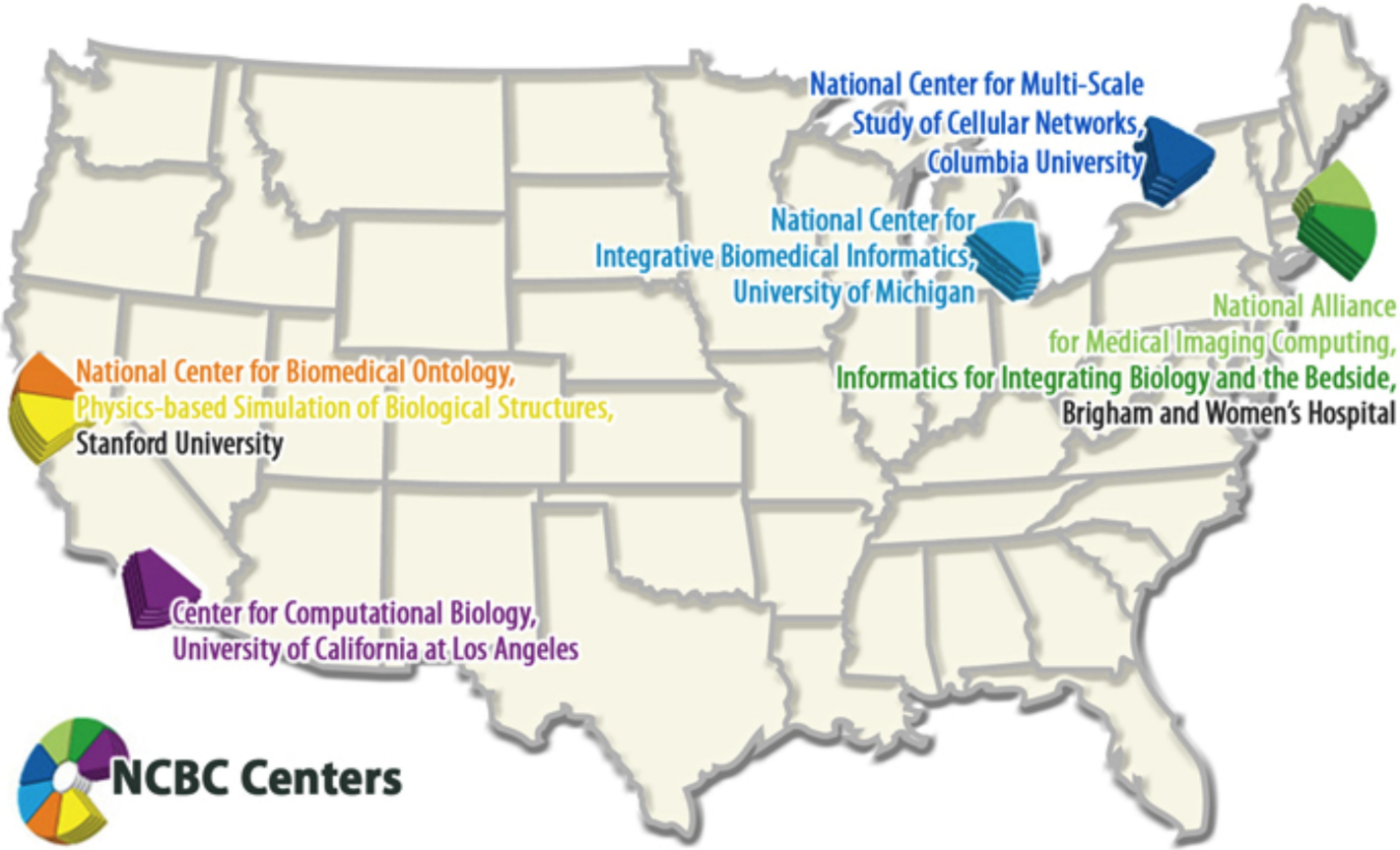
MAGNet

CCB

i2b2

NCIBI

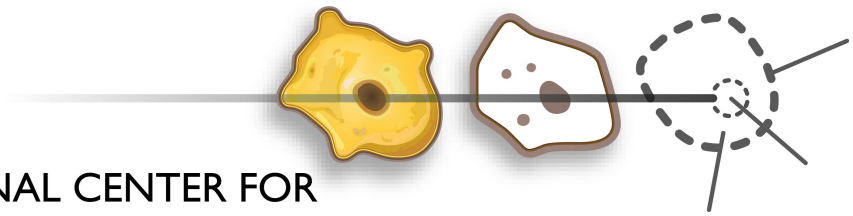
simbios



http://www.ncbcs.org

NCBO will offer

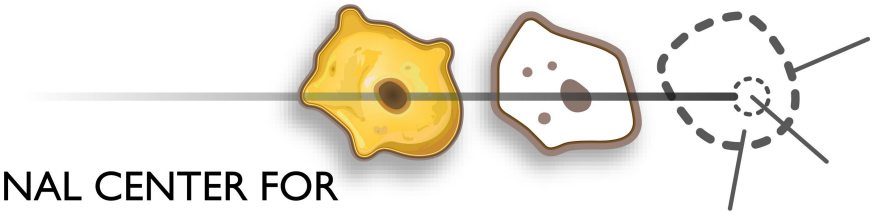
- Technology for uploading, browsing, and using biomedical ontologies
- Methods to make the online “publication” of ontologies more like that of journal articles
- Tools to enable the biomedical community to put ontologies to work on a daily basis



NATIONAL CENTER FOR
BIOMEDICAL ONTOLOGY

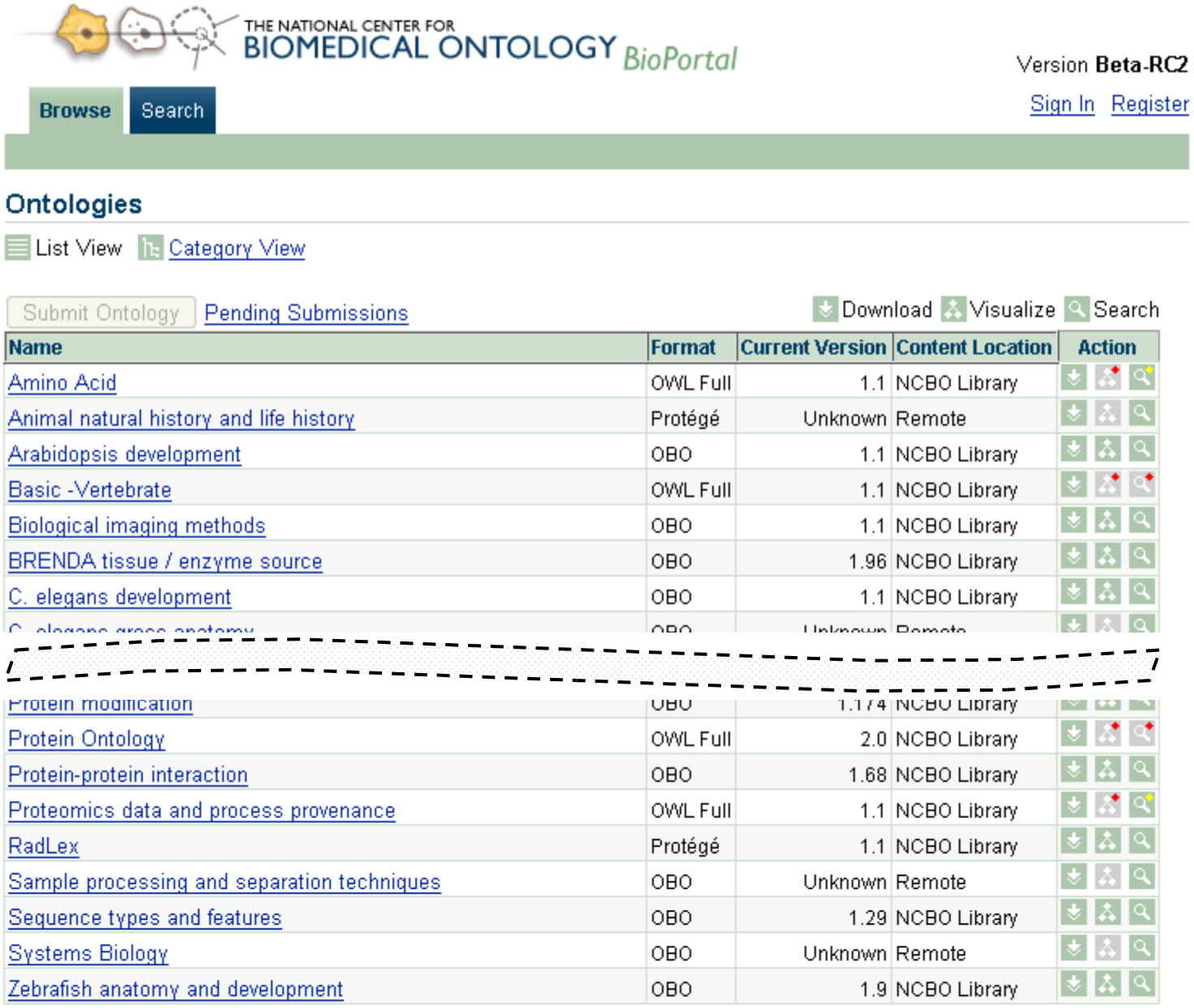
Goals for BioPortal

- Web accessible repository of ontologies for the biomedical community
  - Archived locally
  - Anywhere in cyberspace
- Support for ontology
  - Peer review
  - Annotation (marginalia)
  - Versioning
  - Alignment
  - Search



NATIONAL CENTER FOR
BIOMEDICAL ONTOLOGY

http://bioportal.bioontology.org



Browsing/Visualizing Ontologies

THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY BioPortal

Version **Beta-RC2**

Browse | Search

Sign In | Register

Zebrafish anatomy and development

Tree View

Tree view constructed based on *is_a* hierarchy

- Stages
- zebrafish anatomical entity
  - anatomical set
  - anatomical structure
    - acellular anatomical structure
    - anatomical cluster
    - cardinal organism part
    - cell
      - dopaminergic neuron
      - epidermal cell
      - granulocyte
    - embryonic structure
    - extraembryonic structure
    - organ
    - organ system
    - portion of tissue
    - whole organism
  - unspecified

Class Details

General

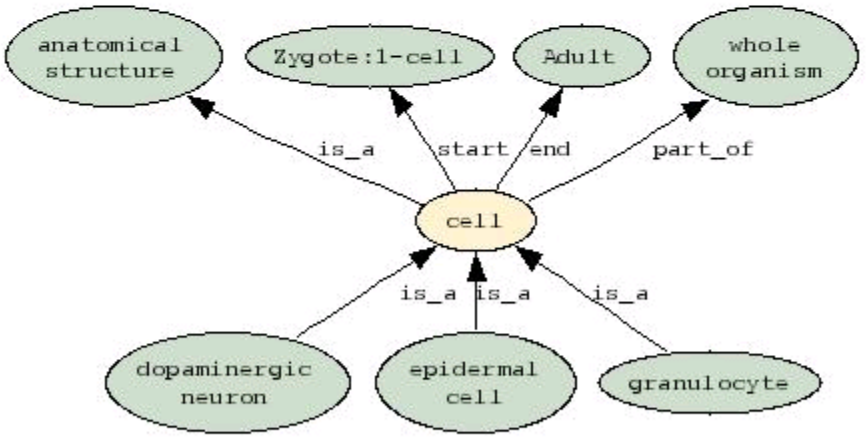
Class Name	**cell**
Id	**CL:0000000**

Attributes

Database_References	**ZFIN:ZDB-ANAT-060816-76**

Graph View

Graph Type: Local Neighborhood



Local Neighborhood view

Zebrafish anatomy and development

Tree View

Tree view constructed based on *is_a* hierarchy

- Stages
- zebrafish anatomical entity
  - anatomical set
  - anatomical structure
    - acellular anatomical structure
    - anatomical cluster
    - cardinal organism part
    - cell
      - dopaminergic neuron
      - epidermal cell
      - granulocyte
    - embryonic structure
    - extraembryonic structure
    - organ
    - organ system
    - portion of tissue
    - whole organism
  - unspecified

Class Details

General

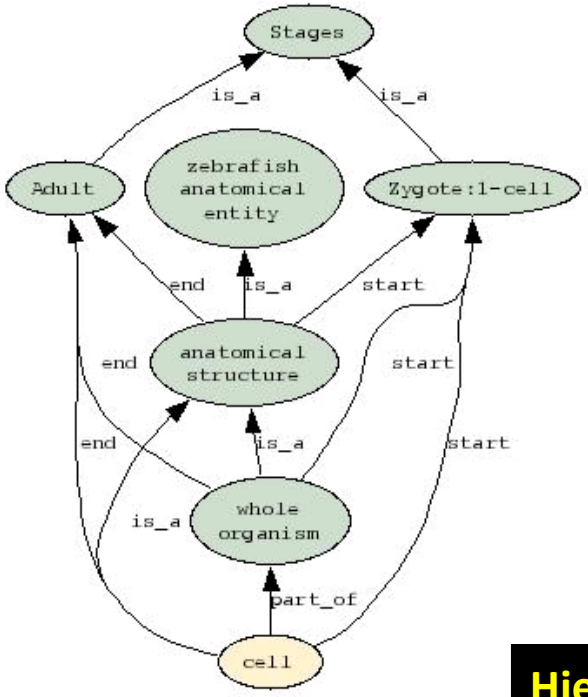
Class Name	**cell**
Id	**CL:0000000**

Attributes

Database_References	**ZFIN:ZDB-ANAT-060816-76**

Graph View

Graph Type: Hierarchy To Root



Hierarchy-to-root view

Search Ontology Content

Search for ontology content within a specific ontology, several ontologies or across all ontologies in the library.

* Ontology: Physico-chemical process; Plant environmental conditions; Plant growth and developmental stage; Protein modification; **Protein-protein interaction**

* Search Text: cell

Search text must be at least 3 characters in length.

Search | Reset

* Search In: ☑ Class Name or ID ☑ Attributes

* Search Type: ◉ Contains ○ Sounds Like

Include Obsolete Classes: ☐

Search Results

Ontology Protein-protein interaction

Class Name (11) | **Attributes (83)**

Class Name	Id	Attributes
3d repertoire	MI:0731	Definition: The aim of 3D Repertoire is to determine the structures of all amenable complexes in a cell at medium or toponomic and dynamic analyses of protein complexes in a cell. Complex models, EM pictures, expression and pur a database connected to the PDB repository. RELATED SYNONYM: "3D Repertoire"
agonist	MI:0625	Definition: Description of an activator that acts on an external cell receptor or other upstream molecule to stimulate or more of the interactors.
alliance for cellulare signaling	MI:0575	Definition: Alliance for Cellular Signaling (AfCS -Nature) store yeast 2-hybrid Interaction data and expression data. Ir all.nhttp://www.signaling-gateway.org EXACT SYNONYM: "afcs" Database_References: search-url: "http://www.signaling-gateway.org/data/Y2H/cgi-bin/y2h_int.cgi?id=${ac}", id-valid RELATED SYNONYM: "AfCS"
nucleic acid conjugation	MI:0715	Definition: Bacterial conjugation is the transfer of genetic material between bacteria through cell-to-cell contact. Bac bacterial equivalent of sexual reproduction or mating. It is not actually sexual, as it does not involve the fusing of gan a conjugative plasmid from a donor cell to a recipient EXACT SYNONYM: "nucl conjugation"

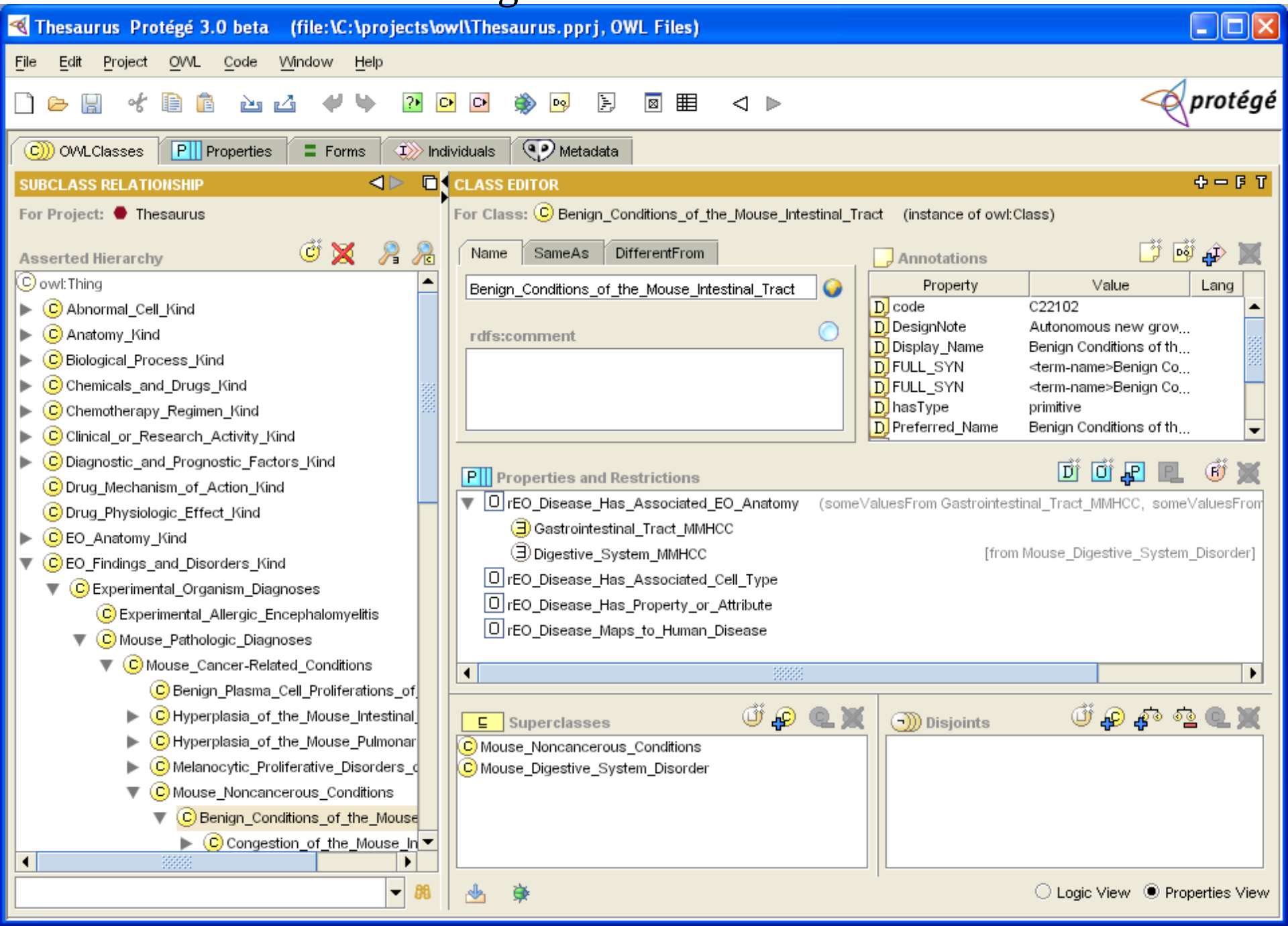
BioPortal's impact in the community

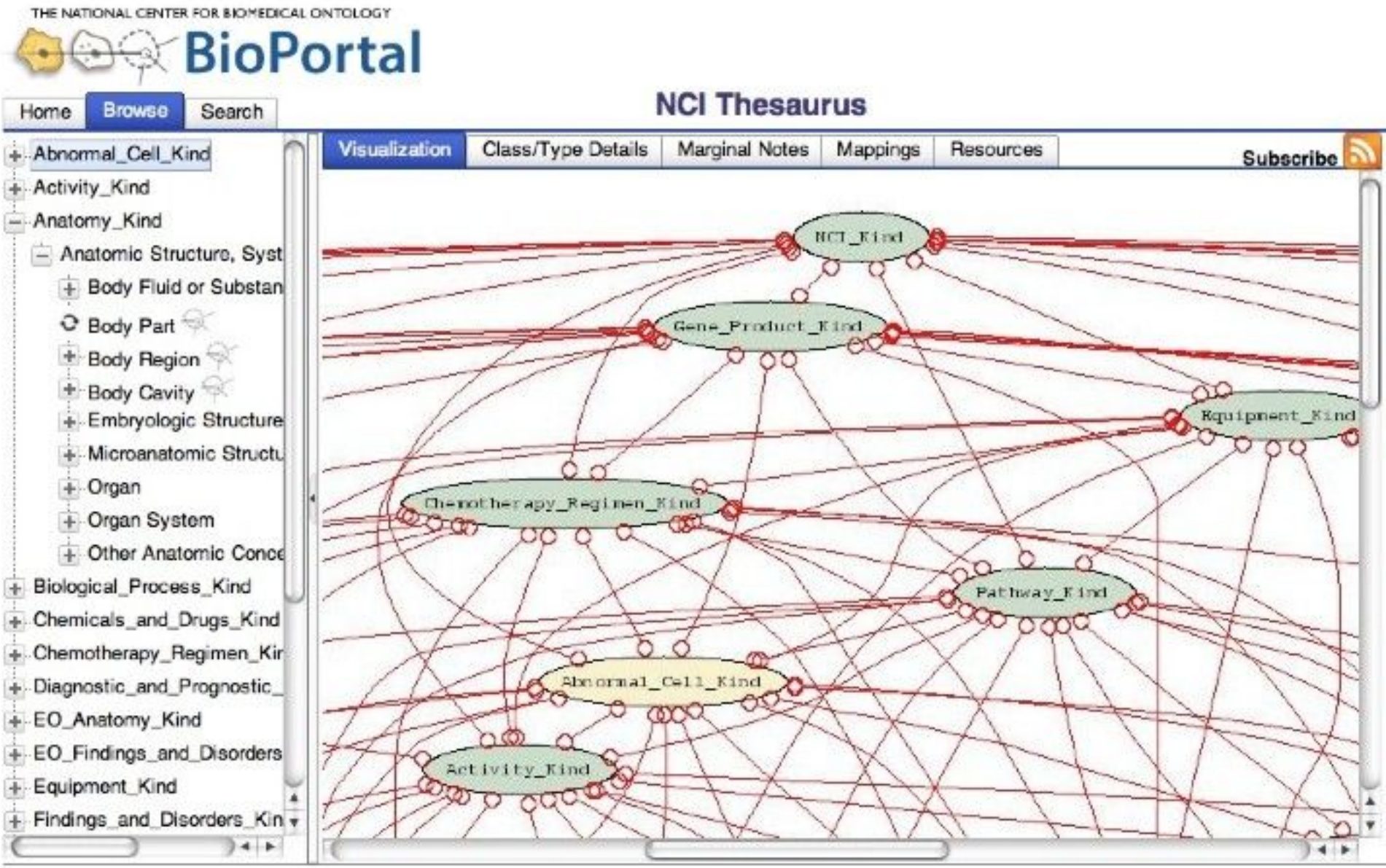
- National Cancer Institute
  - Deploying BioPortal locally to evaluate its use as a method for visualizing and navigating enterprise terminologies and ontologies
- Biomedical Informatics Research Network (BIRN)
  - Adopting BioPortal for disseminating and visualizing BIRNLex terminology
- Radiological Society of North America
  - Using BioPortal for graphical visualization of RadLex

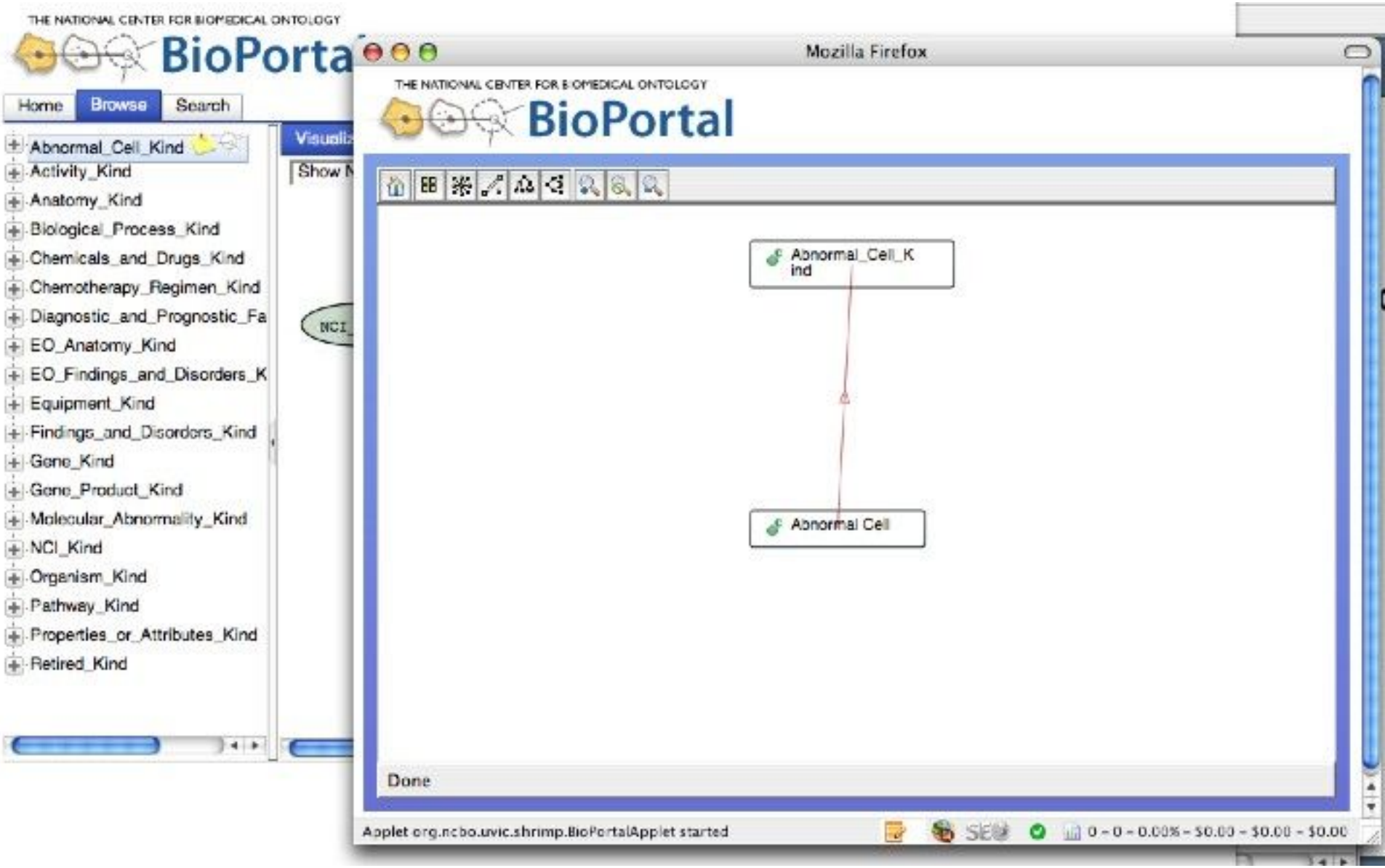
BioPortal will allow NCBO to experiment with new models for

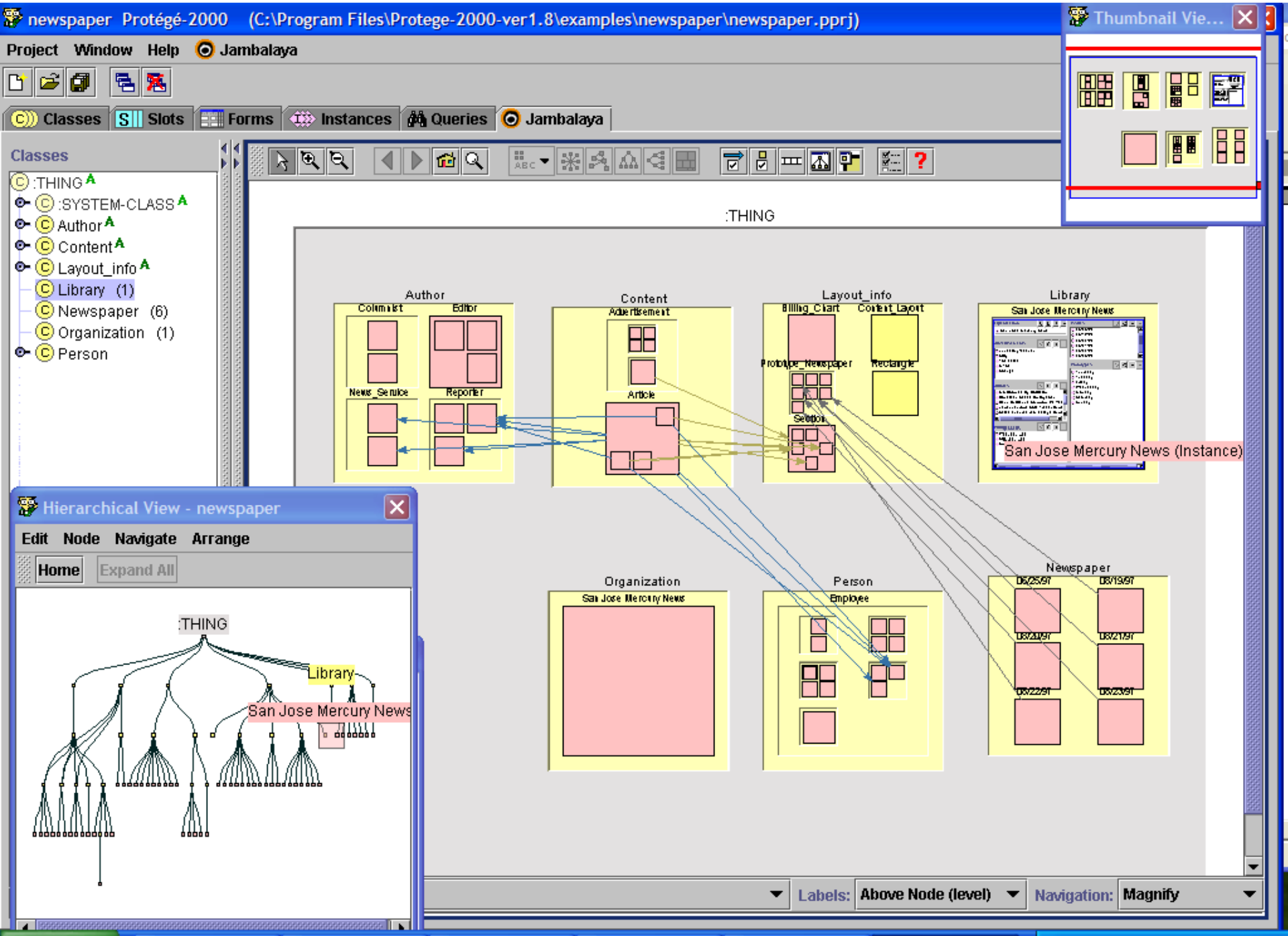
- Dissemination of knowledge on the Web
- Integration and alignment of online content
- Knowledge visualization and cognitive support
- Peer review of online content

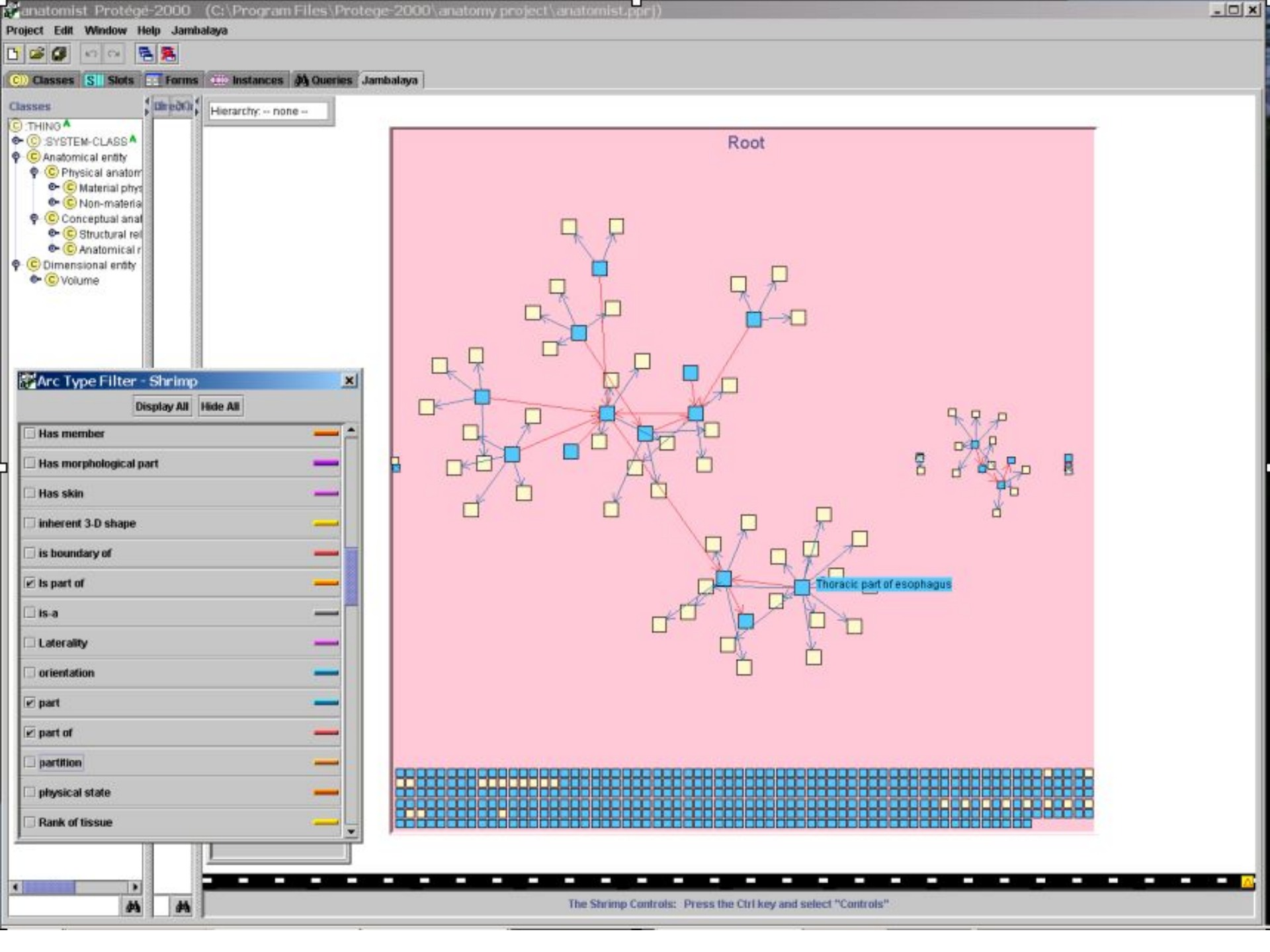
The NCI Thesaurus in Protégé-OWL




THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Home
Browse
Search
NCI Thesaurus
Abnormal_Cell_Kind
Activity_Kind
Anatomy_Kind
Anatomic Structure, Syst
Body Fluid or Substan
Body Part
Body Region
Body Cavity
Embryologic Structure
Microanatomic Structu
Organ
Organ System
Other Anatomic Conce
Biological_Process_Kind
Chemicals_and_Drugs_Kind
Chemotherapy_Regimen_Kir
Diagnostic_and_Prognostic_
EO_Anatomy_Kind
EO_Findings_and_Disorders
Equipment_Kind
Findings_and_Disorders_Kin
Visualization
Class/Type Details
Marginal Notes
Mappings
Resources
Subscribe
NCI_Kind
Gene_Product_Kind
Equipment_Kind
Chemotherapy_Regimen_Kind
Pathway_Kind
Abnormal_Cell_Kind
Activity_Kind


THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPorta
Home
Browse
Search
Abnormal_Cell_Kind
Activity_Kind
Anatomy_Kind
Biological_Process_Kind
Chemicals_and_Drugs_Kind
Chemotherapy_Regimen_Kind
Diagnostic_and_Prognostic_Fa
EO_Anatomy_Kind
EO_Findings_and_Disorders_K
Equipment_Kind
Findings_and_Disorders_Kind
Gene_Kind
Gene_Product_Kind
Molecular_Abnormality_Kind
NCI_Kind
Organism_Kind
Pathway_Kind
Properties_or_Attributes_Kind
Retired_Kind
Mozilla Firefox
THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Abnormal_Cell_K
ind
Abnormal Cell
Done
Applet org.ncbo.uvic.shrimp.BioPortalApplet started


newspaper Protégé-2000 (C:\Program Files\Protege-2000-ver1.8\examples\newspaper\newspaper.pprj)
Project Window Help Jambalaya
Classes Slots Forms Instances Queries Jambalaya
Classes
:THING
:SYSTEM-CLASS
Author
Content
Layout_info
Library (1)
Newspaper (6)
Organization (1)
Person
Thumbnail Vie...
:THING
Author
Columnist
Editor
News_Service
Reporter
Content
Advertisement
Article
Layout_info
Billing_Chart
Content_Layout
Prototype_Newspaper
Rectangle
Section
Library
San Jose Mercury News
San Jose Mercury News (Instance)
Organization
San Jose Mercury News
Person
Employee
Newspaper
Hierarchical View - newspaper
Edit Node Navigate Arrange
Home
Expand All
:THING
Library
San Jose Mercury News
Labels:
Above Node (level)
Navigation:
Magnify


anatomist Protégé-2000 (C:\Program Files\Protege-2000\anatomy project\anatomist.pprj)
Project Edit Window Help Jambalaya
Classes Slots Forms Instances Queries Jambalaya
Classes
THING
:SYSTEM-CLASS
Anatomical entity
Physical anatom
Material phys
Non-materia
Conceptual anat
Structural rel
Anatomical r
Dimensional entity
Volume
Hierarchy: -- none --
Arc Type Filter - Shrimp
Display All
Hide All
Has member
Has morphological part
Has skin
inherent 3-D shape
is boundary of
Is part of
is-a
Laterality
orientation
part
part of
partition
physical state
Rank of tissue
Root
Thoracic part of esophagus
The Shrimp Controls: Press the Ctrl key and select "Controls"

Ontologies are not like journal articles

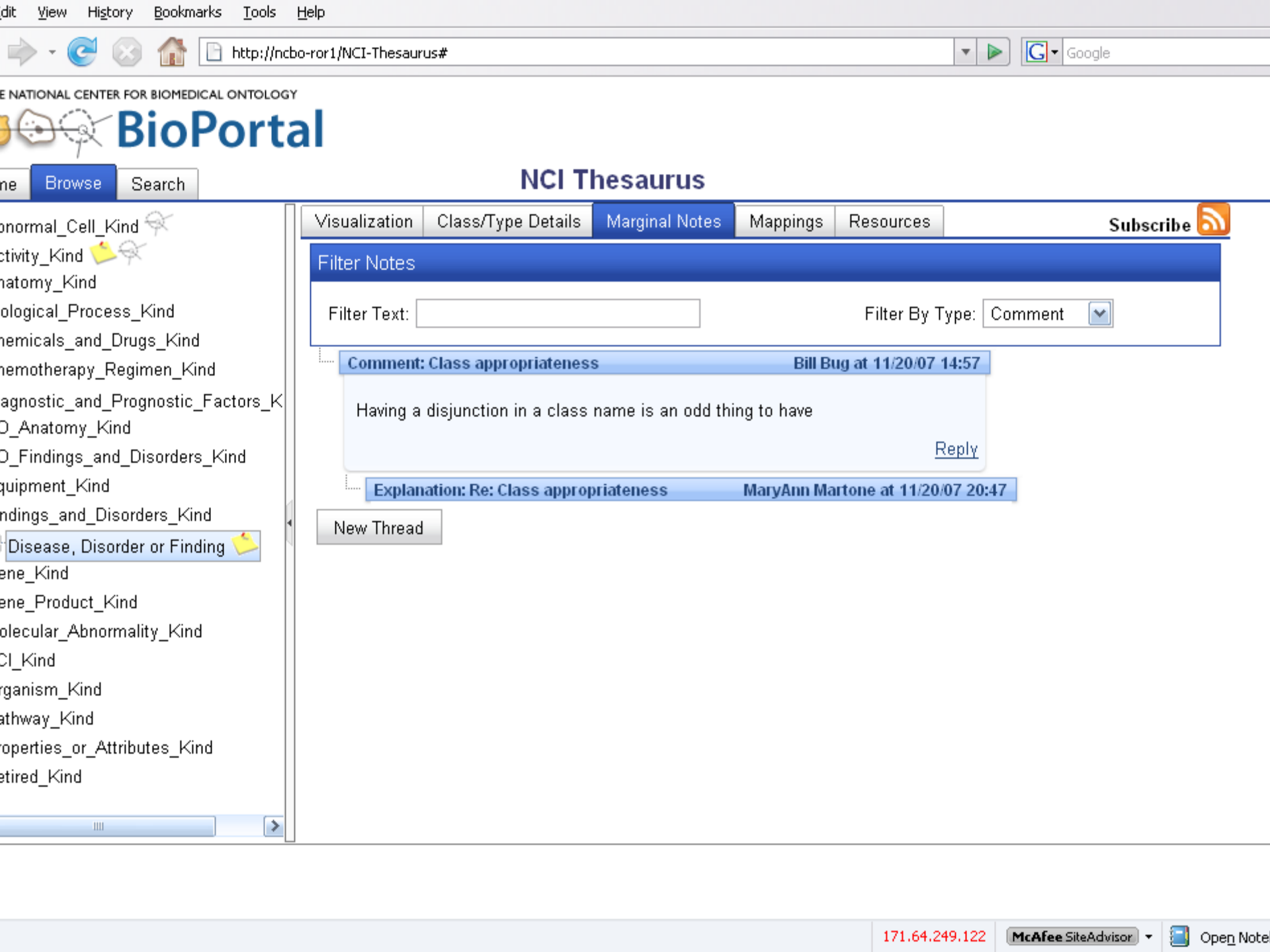
- It is difficult to judge methodological soundness simply by inspection
- We may wish to use an ontology even though some portions
  - Are not well designed
  - Make distinctions that are different from those that we might want

Ontologies are not like journal articles

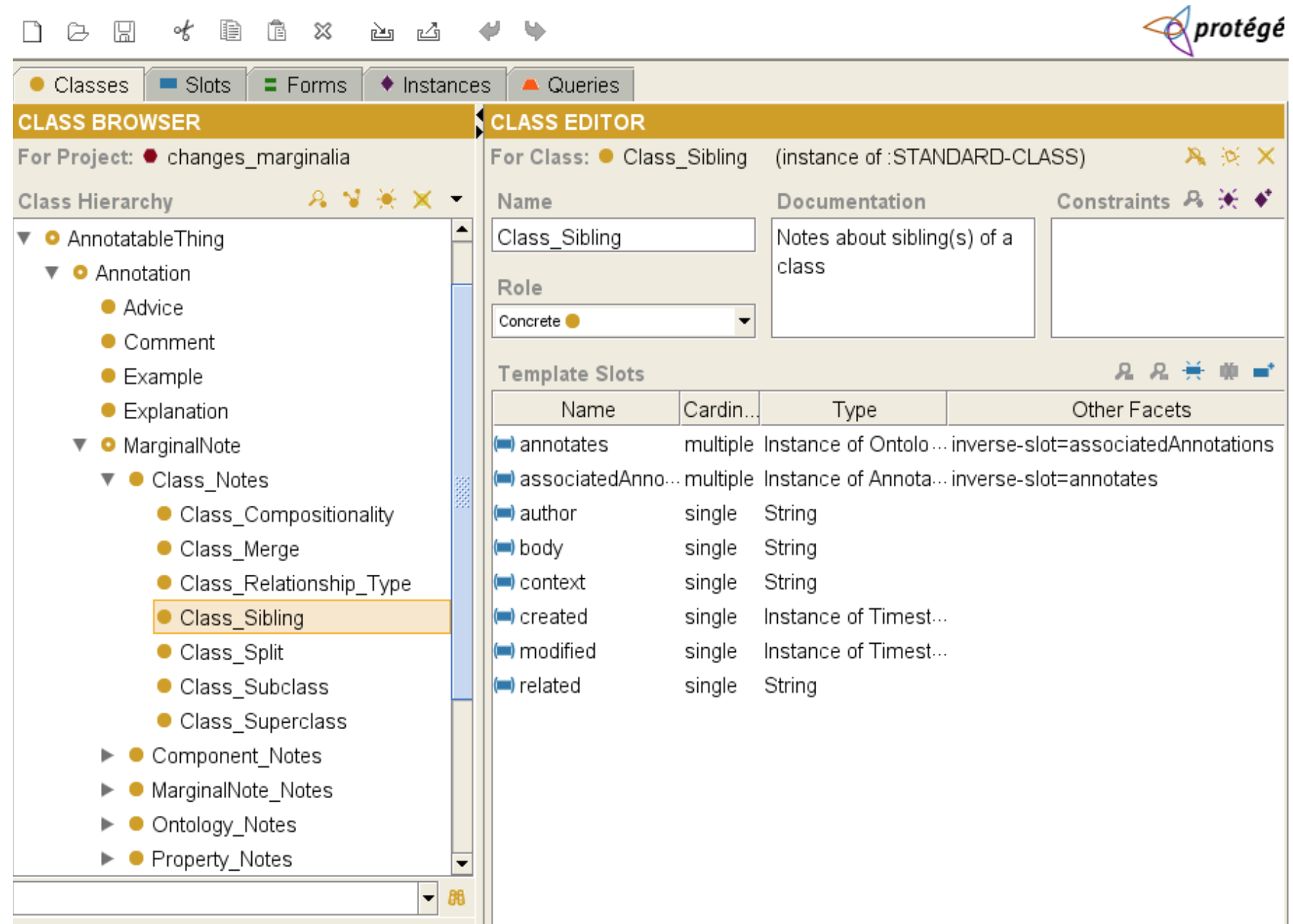
- The utility of ontologies
  - Depends on the task
  - May be highly subjective
- The expertise and biases of reviewers may vary widely with respect to different portions of an ontology
- Users should want the opinions of more than 2–3 hand-selected reviewers
- Peer review needs to scale to the entire user community

Community-Based Annotation as Peer Review

- 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

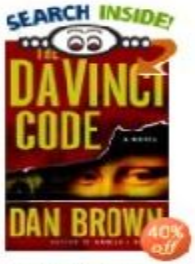

dit View History Bookmarks Tools Help
http://ncbo-ror1/NCI-Thesaurus#
Google
E NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
ne Browse Search
NCI Thesaurus
onormal_Cell_Kind
ctivity_Kind
natomy_Kind
ological_Process_Kind
hemicals_and_Drugs_Kind
hemotherapy_Regimen_Kind
agnostic_and_Prognostic_Factors_K
O_Anatomy_Kind
O_Findings_and_Disorders_Kind
quipment_Kind
ndings_and_Disorders_Kind
Disease, Disorder or Finding
ene_Kind
ene_Product_Kind
olecular_Abnormality_Kind
CI_Kind
rganism_Kind
athway_Kind
roperties_or_Attributes_Kind
etired_Kind
Visualization
Class/Type Details
Marginal Notes
Mappings
Resources
Subscribe
Filter Notes
Filter Text:
Filter By Type: Comment
Comment: Class appropriateness Bill Bug at 11/20/07 14:57
Having a disjunction in a class name is an odd thing to have
Reply
Explanation: Re: Class appropriateness MaryAnn Martone at 11/20/07 20:47
New Thread
171.64.249.122
McAfee SiteAdvisor
Open Note

An ontology of “marginal notes”



The Da Vinci Code

by Dan Brown "Robert Langdon awoke slowly..." (more)



Search inside this book

See 1 customer image

Share your own customer images

List Price: ~~$24.95~~

Price: $14.97 & Eligible for **FREE Super Saver Shipping** on orders over $25. See details

You Save: $9.98 (40%)

Availability: Usually ships within 24 hours from Amazon.com

Want it delivered Monday, February 28? Order it in the next 20 hours and 14 minutes, and choose **One-Day Shipping** at checkout. See details

417 used & new from $6.95

Edition: Hardcover

★★★★★ **Unbelievable Book**, February 16, 2005

Reviewer: **Mohamed Abdulmalik** (Kingdom of Bahrain) - See all my reviews

REAL NAME

There is no question that everybody should read this book. It is very entertaining and full of very peculiar facts (assuming that they are true). The writer skilfully turns religious history (highly sensitive and mostly boring subject to read) into a page turning thriller. I highly recommend it.

I have a general advise though, make sure that you read it on a weekend, as you will not be able to put it down. I read it on a business trip with near disastrous consequences.

Was this review helpful to you? yes no (Report this)

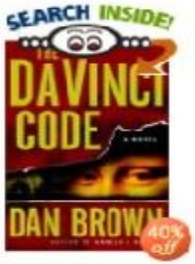
★☆☆☆☆ **Don't Take It as Gospel**, November 9, 2003

Reviewer: **Leslie Strang Akers** (Riverside, CA) - See all my reviews

In the beginning I was intrigued by the premise set down in THE DA VINCI CODE, but my initial interest turned first to annoyance and then by the time I got to the info on Disney was laughing so hard at the absurdity of the whole novel. First of all, this is a work of fiction, so let's deal with that part. Far from being the taut, fast-paced thriller that the potenti reader is lead to believe it is, TDVC is turgid, jerky, and filled with clichés. The characters are characterless and stupid, merely cardboard for the author to push around like pawn a chessboard. Langford, a Harvard professor, can't distinguish between backwards English and a Semitic language. Sophie, a French police cryptologist, doesn't have the brains tc figure out that an armor truck from a Swiss bank might be lo-jacked. These are only two of the many idiotic things the main characters aren't intelligent enough to figure out. The characters ponder clues ad nauseum, which turns a 300-page book into 454 pages. I don't know if the author is writing down to his audience, or if he really thinks that gifted peop are idiot savants. Whatever it is, it's exasperating.

The Da Vinci Code

by Dan Brown "Robert Langdon awoke slowly..." (more)



Search inside this book

See 1 customer image

Share your own customer images

List Price: ~~$24.95~~

Price: $14.97 & Eligible for **FREE Super Saver Shipping** on orders over $25. See details

You Save: $9.98 (40%)

Availability: Usually ships within 24 hours from Amazon.com

Want it delivered Monday, February 28? Order it in the next 20 hours and 14 minutes, and choose **One-Day Shipping** at checkout. See details

417 used & new from $6.95

Edition: Hardcover

★★★★★ **Unbelievable Book**, February 16, 2005

Reviewer: **Mohamed Abdulmalik** (Kingdom of Bahrain) - See all my reviews

REAL NAME

There is no question that everybody should read this book. It is very entertaining and full of very peculiar facts (assuming that they are true). The writer skilfully turns religious history (highly sensitive and mostly boring subject to read) into a page turning thriller. I highly recommend it.

I have a general advise though, make sure that you read it on a weekend, as you will not be able to put it down. I read it on a business trip with near disastrous consequences.

Was this review helpful to you? yes no (Report this)

★☆☆☆☆ **Don't Take It as Gospel**, November 9, 2003

Reviewer: **Leslie Strang Akers** (Riverside, CA) - See all my reviews

In the beginning I was intrigued by the premise set down in THE DA VINCI CODE, but my initial interest turned first to annoyance and then by the time I got to the info on Disney was laughing so hard at the absurdity of the whole novel. First of all, this is a work of fiction, so let's deal with that part. Far from being the taut, fast-paced thriller that the potenti reader is lead to believe it is, TDVC is turgid, jerky, and filled with clichés. The characters are characterless and stupid, merely cardboard for the author to push around like pawn a chessboard. Langford, a Harvard professor, can't distinguish between backwards English and a Semitic language. Sophie, a French police cryptologist, doesn't have the brains tc figure out that an armor truck from a Swiss bank might be lo-jacked. These are only two of the many idiotic things the main characters aren't intelligent enough to figure out. The characters ponder clues ad nauseum, which turns a 300-page book into 454 pages. I don't know if the author is writing down to his audience, or if he really thinks that gifted peop are idiot savants. Whatever it is, it's exasperating.

Solution Snapshot

The MGED Ontology

by EMBL "The primary purpose of the MGED Ontology is to provide standard" (more)

MGED

Search inside this Ontology

List Price: ~~$0~~
Price: $0 & Eligible for **FREE Access**
You Save: $0
Availability: Usually available 24/7 on cBIO.org

Edition: Pragmatic

2 of 3 people found the following review helpful:

★★★★★ **A Great resource**, Aug 11, 2004
Reviewer: Catherine Ball (Stanford, CA USA) - See all my reviews
TOP 500 REVIEWER REAL NAME

MGED Ontology aims to facilitate the sharing of microarray data generated by functional genomics and proteomics experiments.....
Was this review helpful to you? yes no (Report this)

1 of 1 people found the following review helpful:

★☆☆☆☆ **Needs considerable improvement**, November 9, 2003
Reviewer: Barry Smith (Buffalo, NY) - See all my reviews
MGED ontology is indeed an essential part of any solution to the problems of Microarray analysis – but only if it is understood in the right sort of way. Ontological engineering, should in every case go hand in hand with a sound ontological theory....

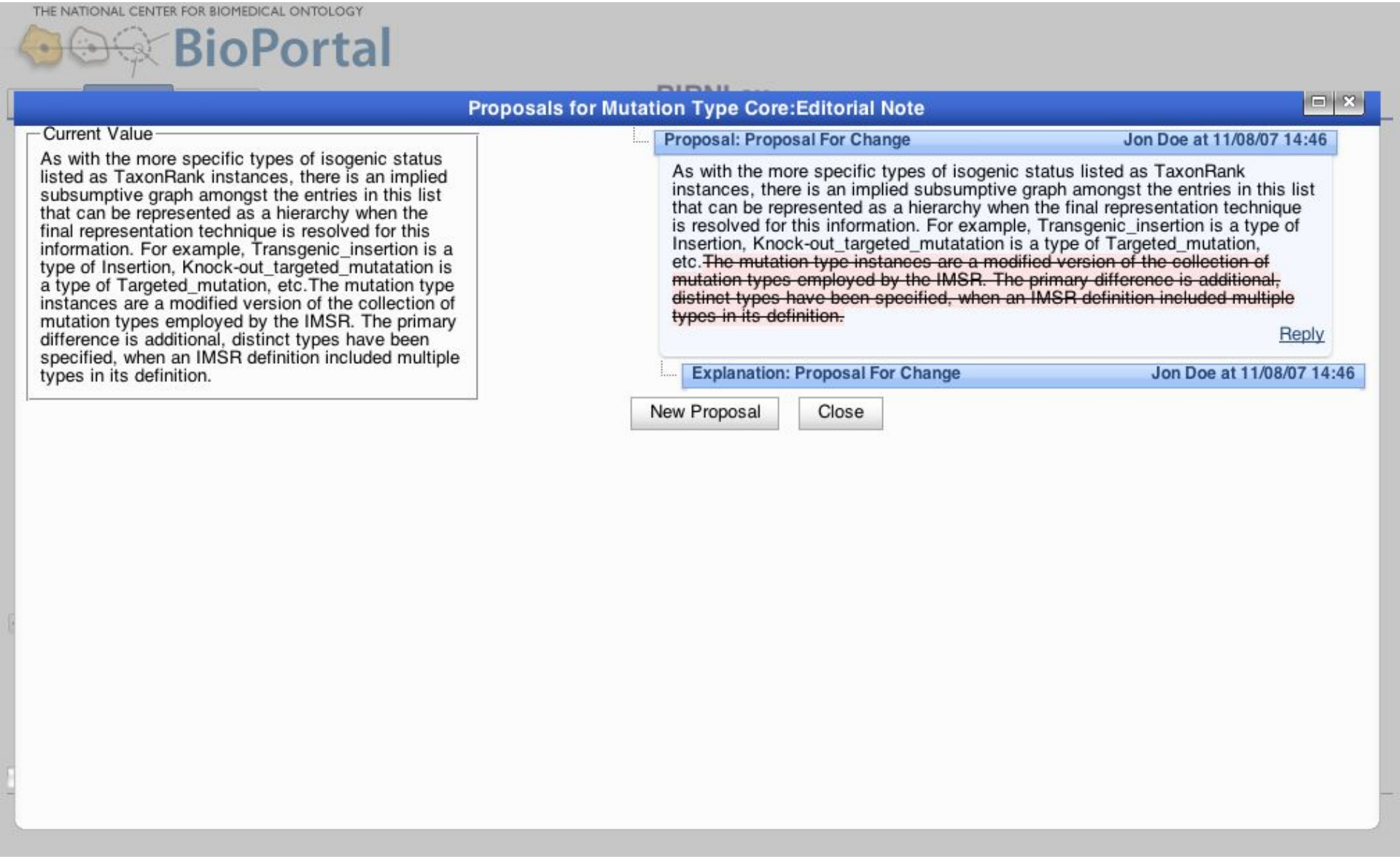
Open ratings for ontologies

- Any user can
  - rate an ontology
  - add a “marginal note”
- Ontology evaluation becomes a community-based initiative
- A *web of trust* can enable users to filter comments or ratings to avoid “noise”

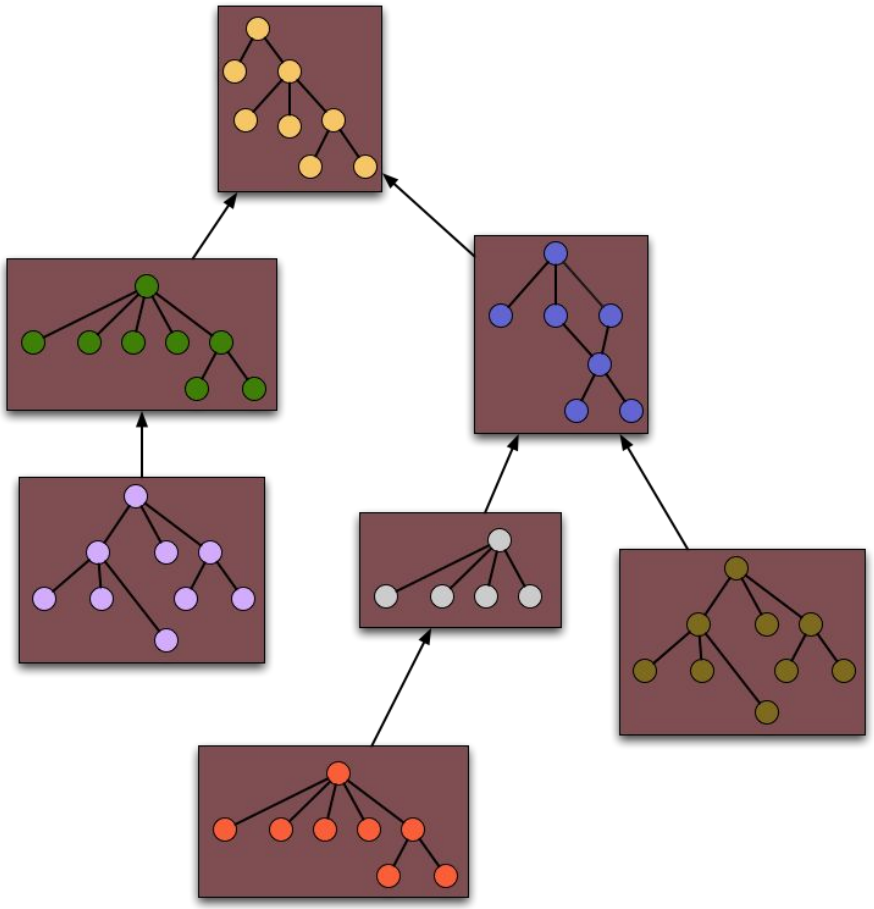
Possible Review Criteria

- What is the level of user support?
- What documentation is available?
- What is the granularity of the ontology content in specific areas?
- How well does the ontology cover a particular domain?
- In what applications has the ontology been used successfully? Where has it failed?

Users can make proposals for changes

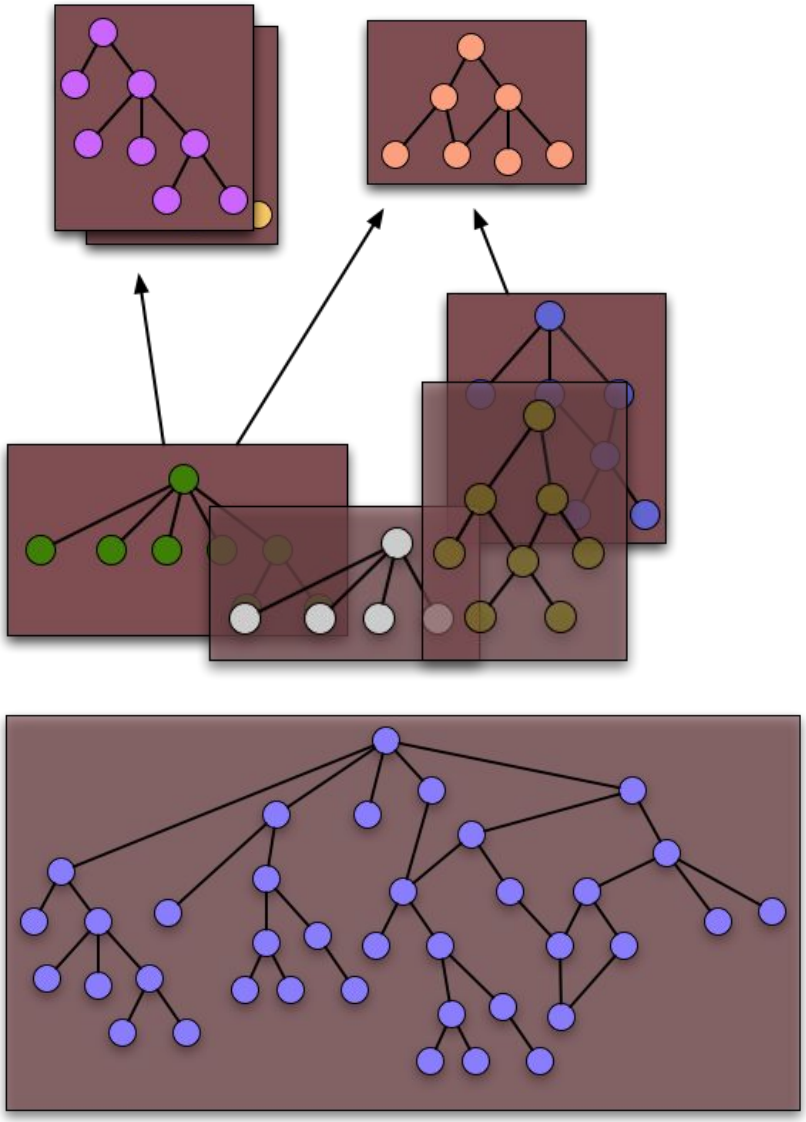


The Ideal World



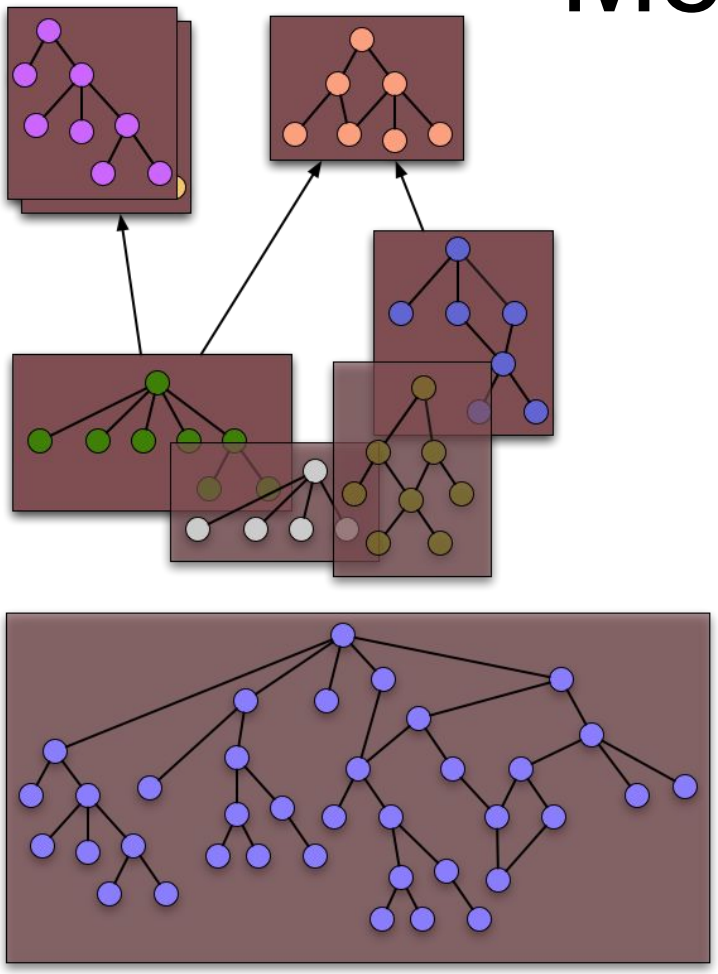
- The same language
- No overlap in coverage
- No new versions
- A single extension tree
- Small reusable modules

The “Bad” News: The Real World

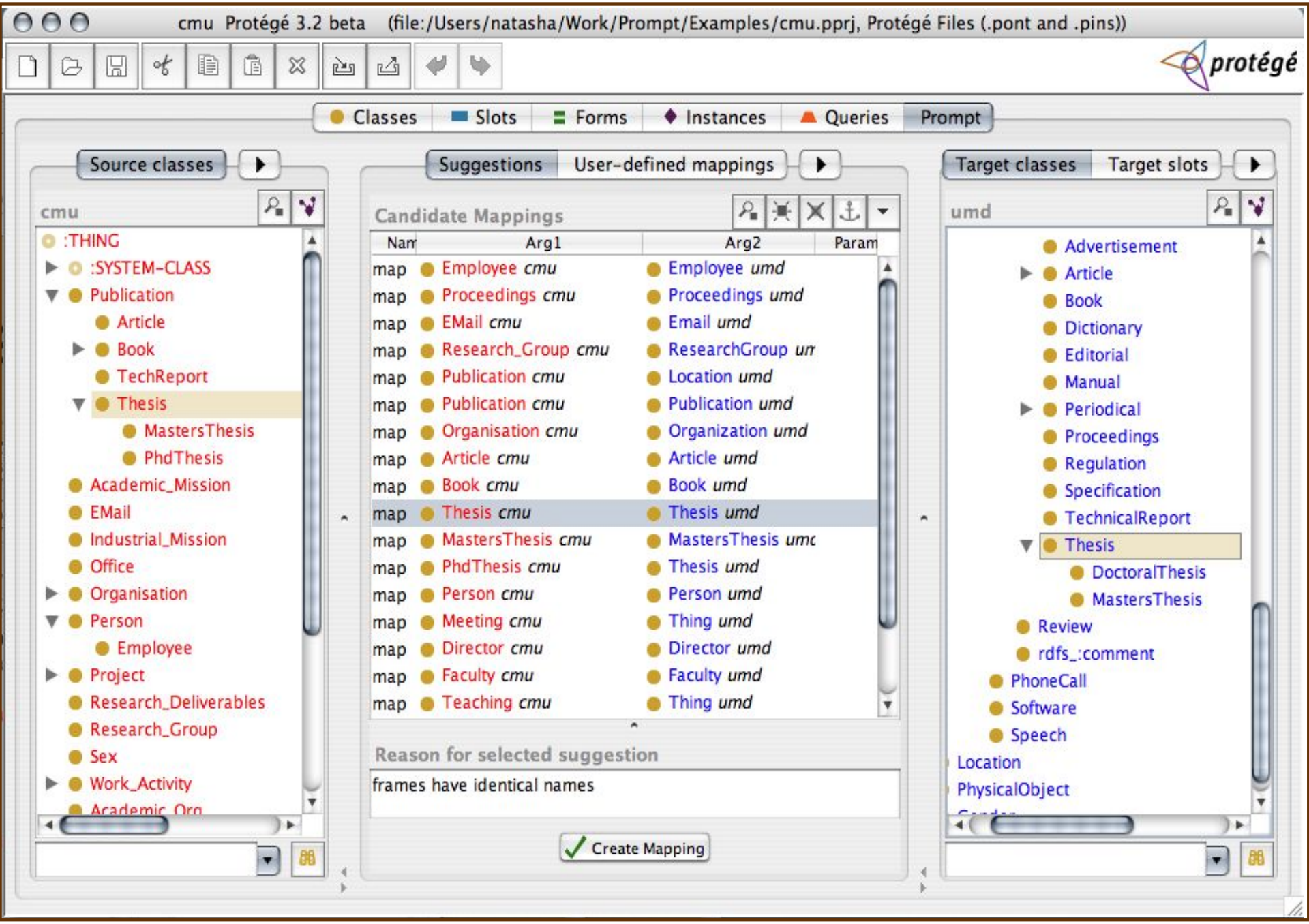


- ~~The same language~~
- ~~No overlap in coverage~~
- ~~No new versions~~
- ~~A single extension tree~~
- ~~Small reusable modules~~

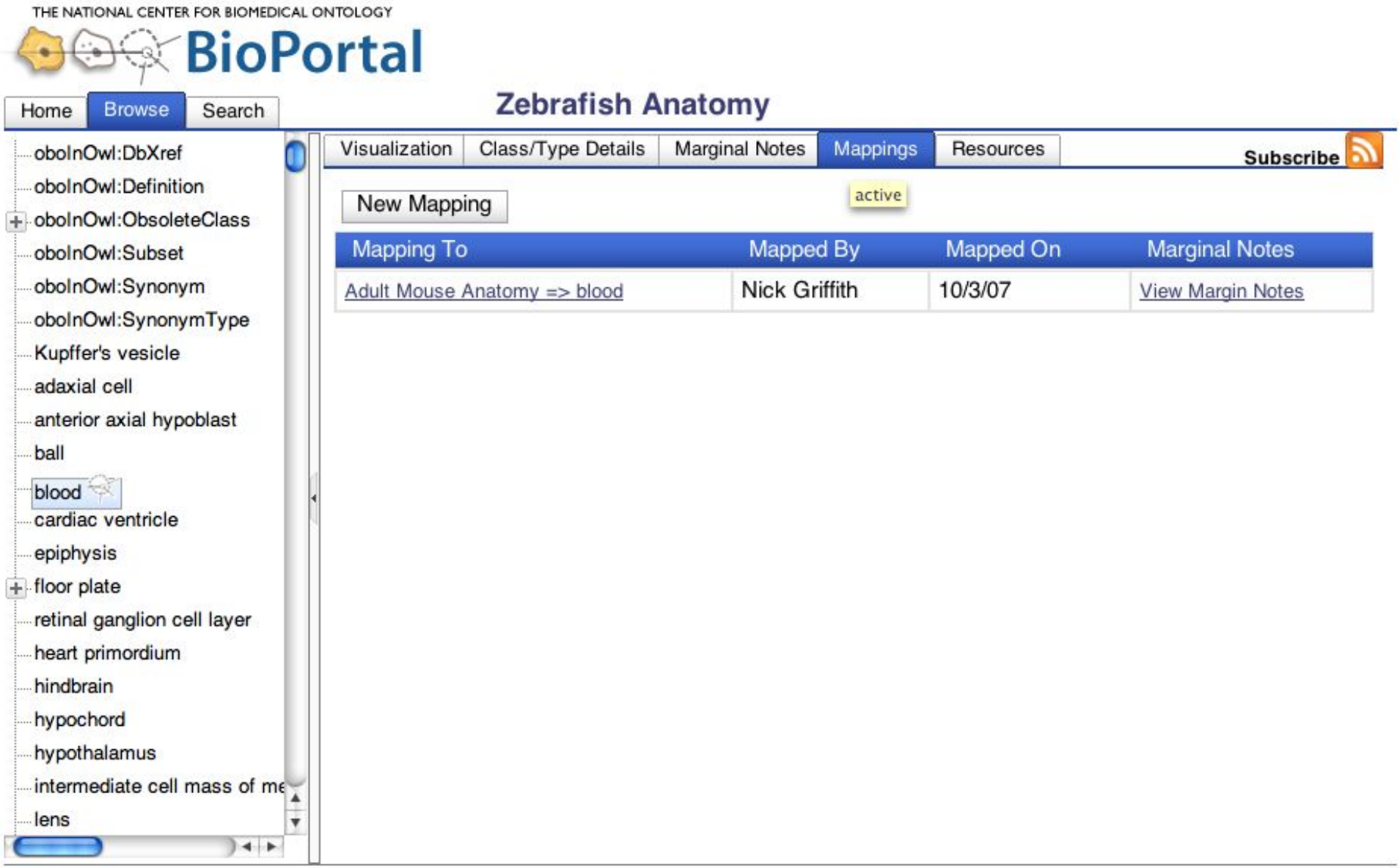
PROMPT: Dealing with the Messy World

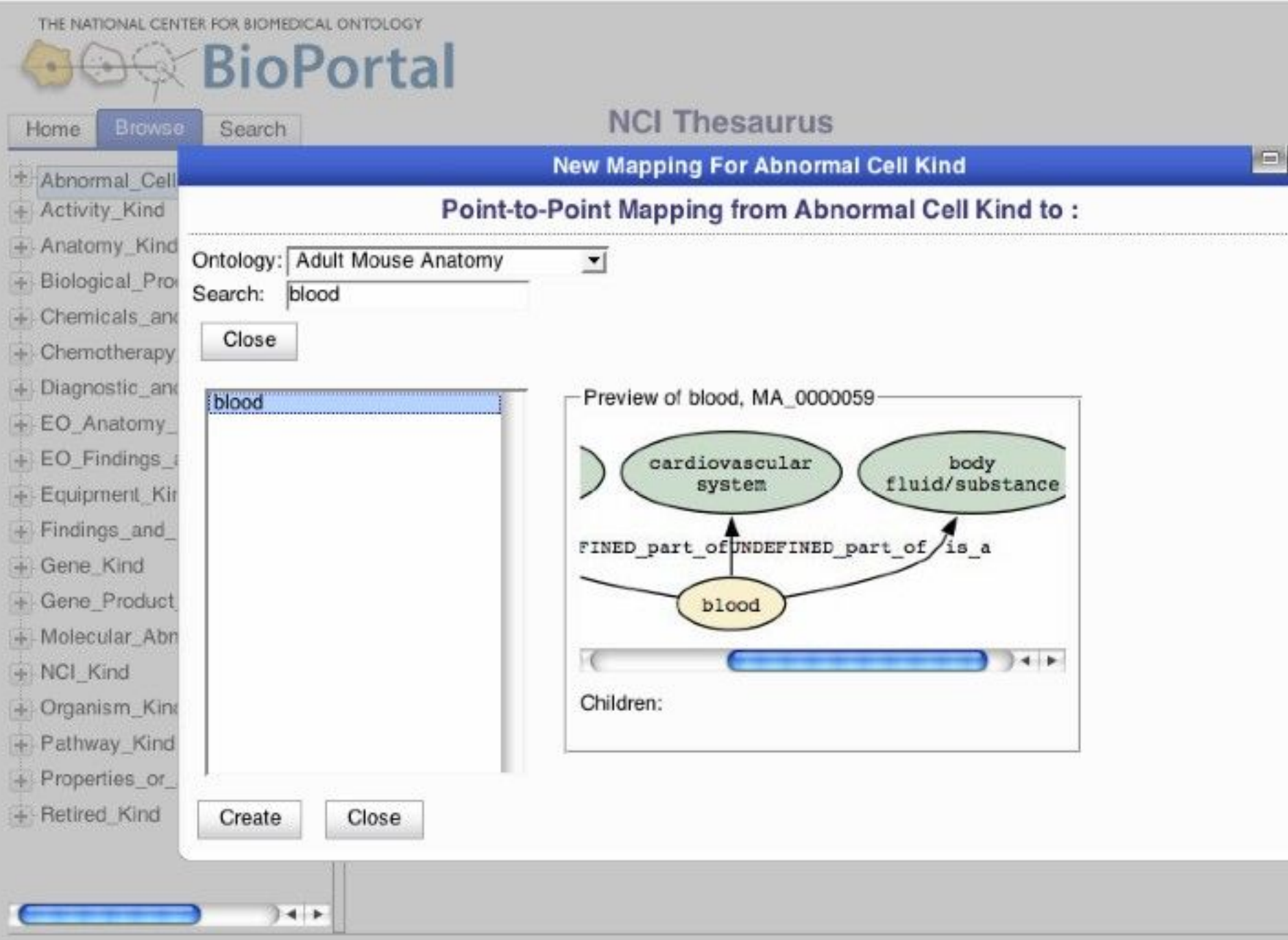


- Find similarities and differences between ontologies
- Compare versions of ontologies
- Extract meaningful portions of ontologies
- Integrate in an ontology-editing environment

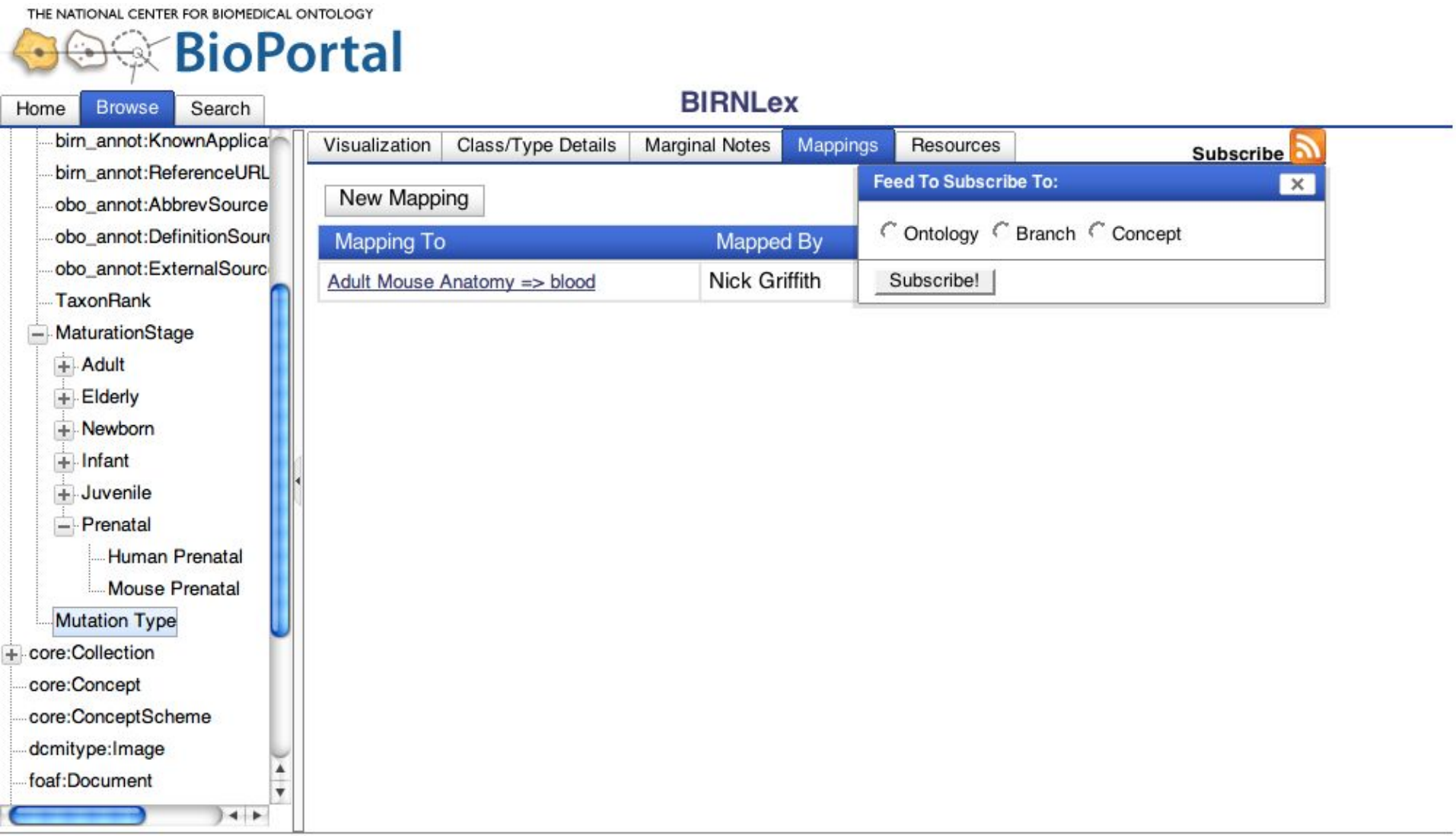

cmu Protégé 3.2 beta (file:/Users/natasha/Work/Prompt/Examples/cmu.pprj, Protégé Files (.pont and .pins))
protégé
Classes
Slots
Forms
Instances
Queries
Prompt
Source classes
Suggestions
User-defined mappings
Target classes
Target slots
cmu
:THING
:SYSTEM-CLASS
Publication
Article
Book
TechReport
Thesis
MastersThesis
PhdThesis
Academic_Mission
EMail
Industrial_Mission
Office
Organisation
Person
Employee
Project
Research_Deliverables
Research_Group
Sex
Work_Activity
Candidate Mappings
Nam
Arg1
Arg2
Param
map Employee cmu Employee umd
map Proceedings cmu Proceedings umd
map EMail cmu Email umd
map Research_Group cmu ResearchGroup um
map Publication cmu Location umd
map Publication cmu Publication umd
map Organisation cmu Organization umd
map Article cmu Article umd
map Book cmu Book umd
map Thesis cmu Thesis umd
map MastersThesis cmu MastersThesis umc
map PhdThesis cmu Thesis umd
map Person cmu Person umd
map Meeting cmu Thing umd
map Director cmu Director umd
map Faculty cmu Faculty umd
map Teaching cmu Thing umd
Reason for selected suggestion
frames have identical names
Create Mapping
umd
Advertisement
Article
Book
Dictionary
Editorial
Manual
Periodical
Proceedings
Regulation
Specification
TechnicalReport
Thesis
DoctoralThesis
MastersThesis
Review
rdfs_:comment
PhoneCall
Software
Speech
Location
PhysicalObject

Users can view mappings uploaded from PROMPT in BioPortal




THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Home
Browse
Search
NCI Thesaurus
Abnormal_Cell
Activity_Kind
Anatomy_Kind
Biological_Pro
Chemicals_an
Chemotherapy
Diagnostic_an
EO_Anatomy_
EO_Findings_
Equipment_Kir
Findings_and_
Gene_Kind
Gene_Product
Molecular_Abn
NCI_Kind
Organism_Kin
Pathway_Kind
Properties_or_
Retired_Kind
New Mapping For Abnormal Cell Kind
Point-to-Point Mapping from Abnormal Cell Kind to :
Ontology:
Adult Mouse Anatomy
Search:
blood
Close
blood
Preview of blood, MA_0000059
cardiovascular system
body fluid/substance
FINED_part_of
UNDEFINED_part_of
is_a
blood
Children:
Create
Close

Users can push changes to RSS feeds



THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY

BioPortal

Home | Browse | Search

Subscribed Feeds

Comment: Xenopus anatomy and development => Cell
"I think the definition for this class would..."

Change: Pathway Ontology => Diabetes Pathway:Definition
"A broad condition with various manifestations that is associated..."

Proposal: NCI Thesaurus => Cell:Definition

Addition: NCI Thesaurus => Blood

Statistics

Total Number of Ontologies 72

NCBO Library 59

Remote 13

Number of Classes/Types 300109*

*ontologies which have been parsed and indexed

My Ontologies

Xenopus anatomy and development =>

7 new comments added

3 proposals added

Sequence types and features =>

7 new comments added

3 proposals added

Pathway ontology =>

7 new comments added

3 proposals added

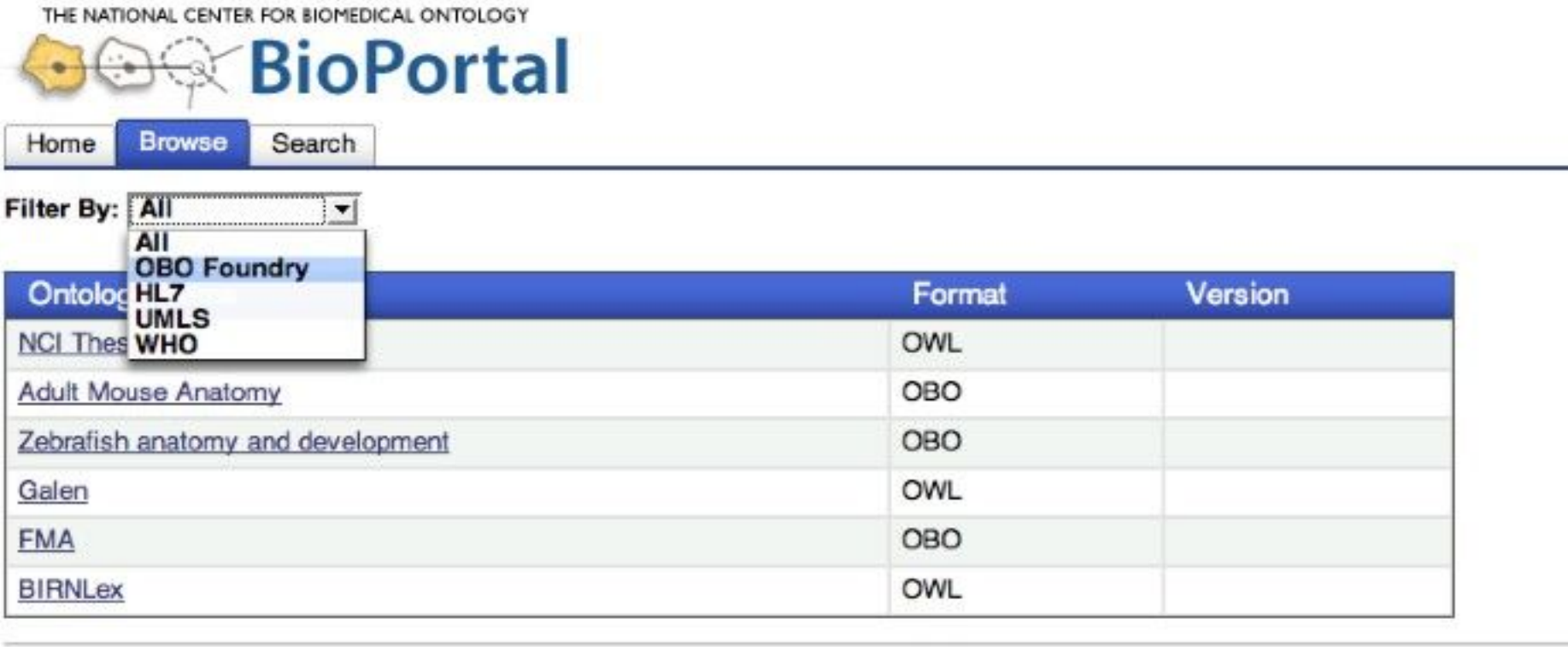
Proposals

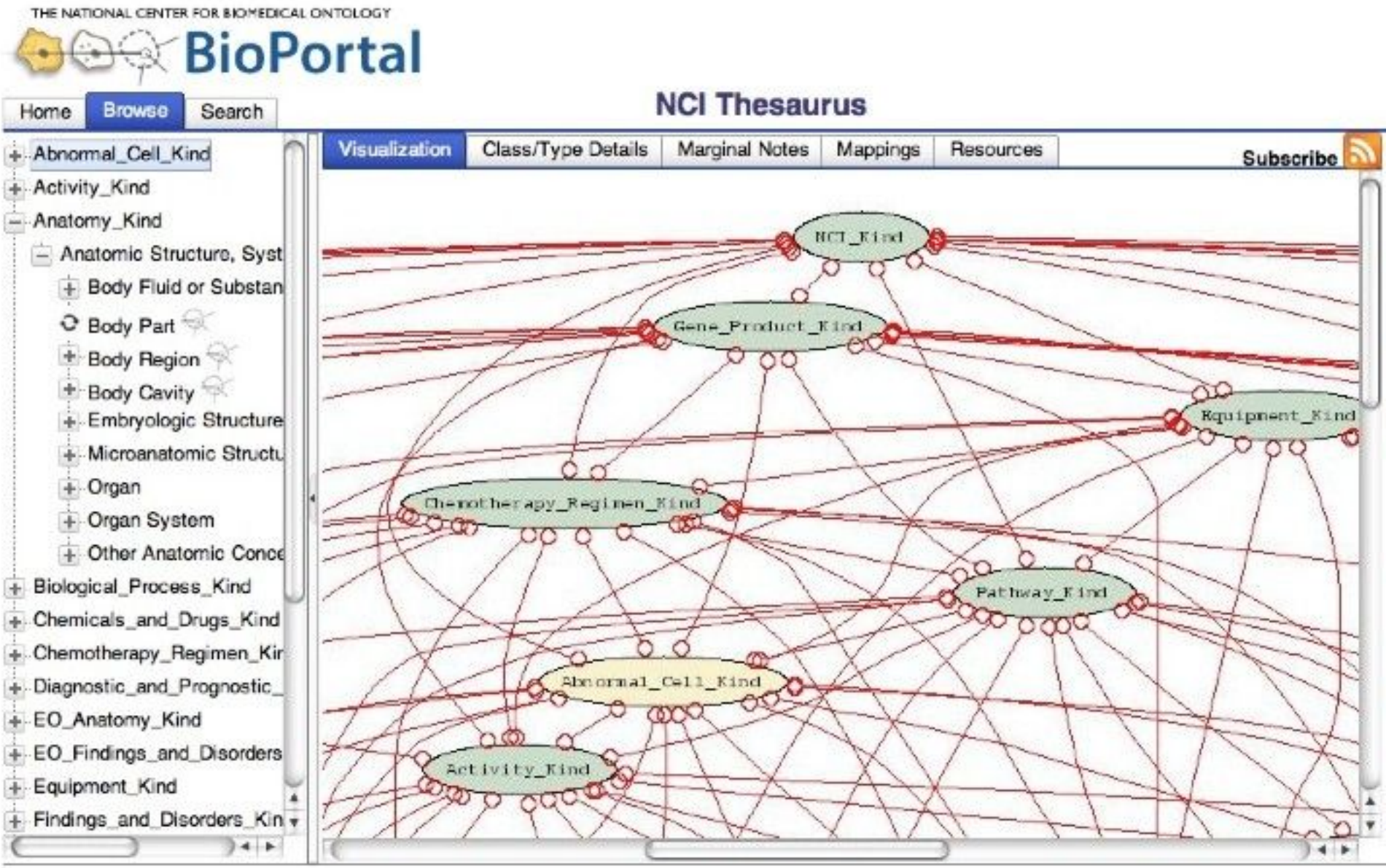
Your proposal for Xenopus anatomy and development => adult is still pending.

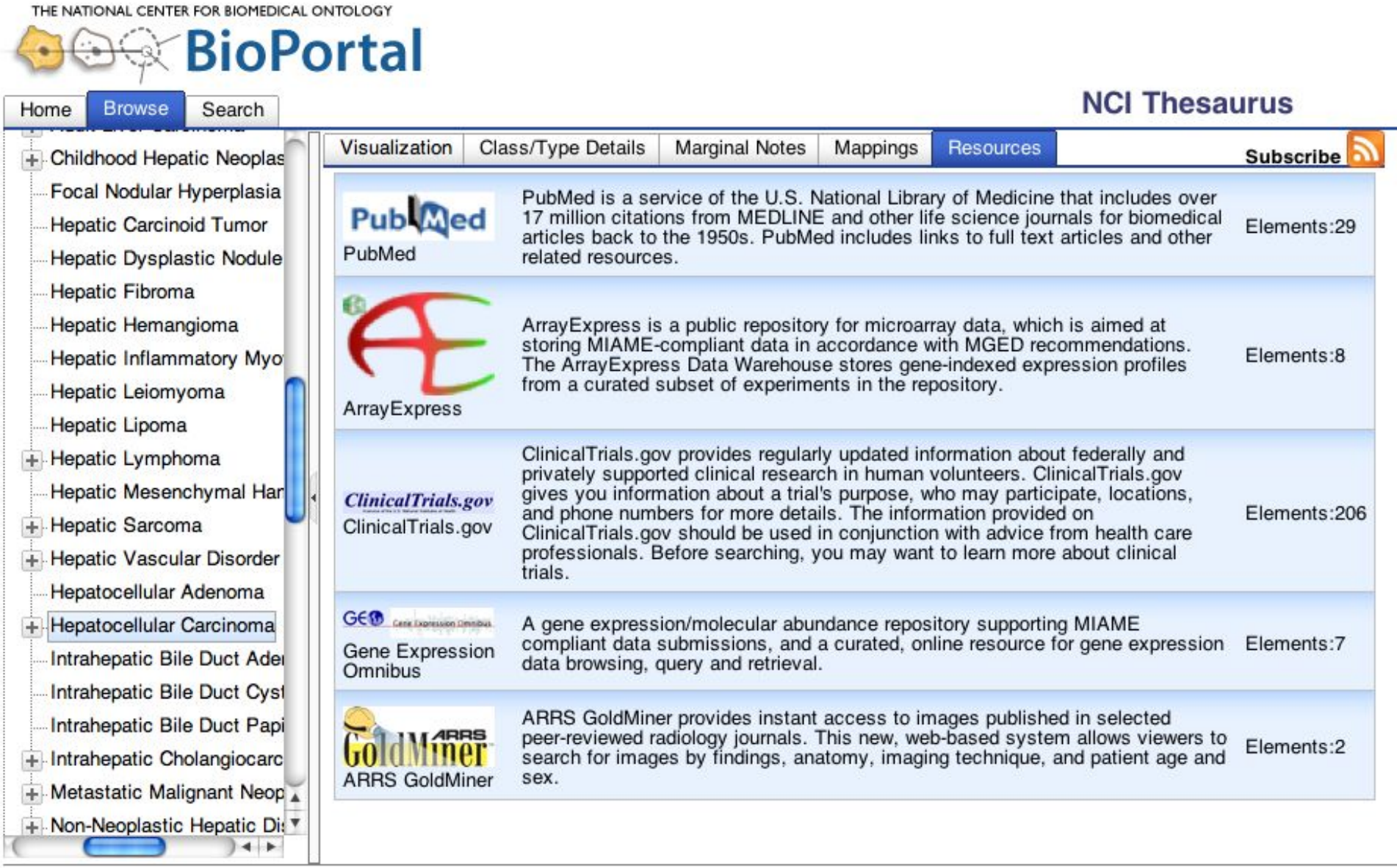
Your proposal for Xenopus anatomy and development => embryo has been approved.

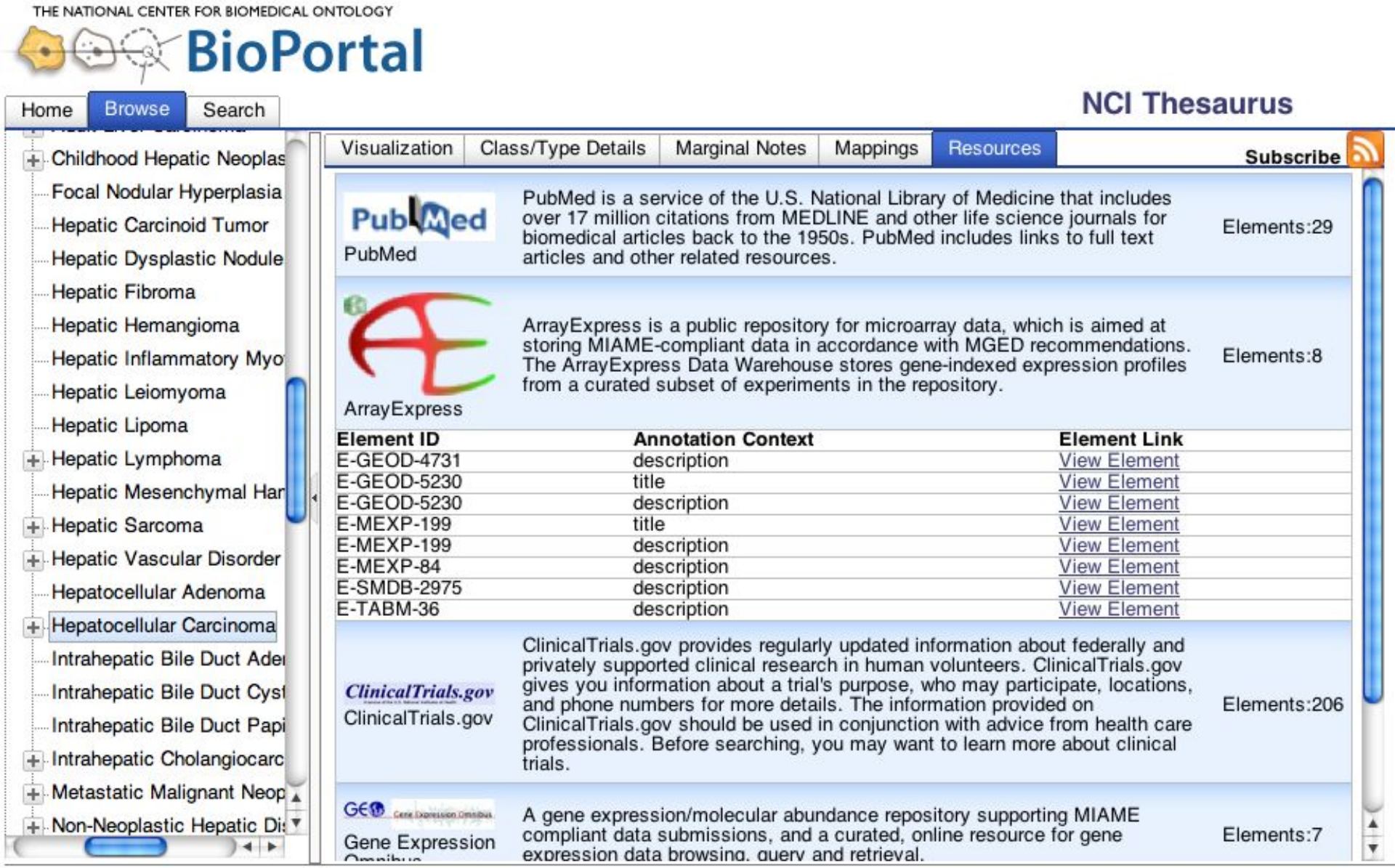
A proposal has been created for Sequence types and features => mutation.

BioPortal will support specialized views on the repository




THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Home
Browse
Search
NCI Thesaurus
Abnormal_Cell_Kind
Activity_Kind
Anatomy_Kind
Anatomic Structure, Syst
Body Fluid or Substan
Body Part
Body Region
Body Cavity
Embryologic Structure
Microanatomic Structu
Organ
Organ System
Other Anatomic Conce
Biological_Process_Kind
Chemicals_and_Drugs_Kind
Chemotherapy_Regimen_Kir
Diagnostic_and_Prognostic_
EO_Anatomy_Kind
EO_Findings_and_Disorders
Equipment_Kind
Findings_and_Disorders_Kin
Visualization
Class/Type Details
Marginal Notes
Mappings
Resources
Subscribe
NCI_Kind
Gene_Product_Kind
Equipment_Kind
Chemotherapy_Regimen_Kind
Pathway_Kind
Abnormal_Cell_Kind
Activity_Kind


THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Home
Browse
Search
NCI Thesaurus
Childhood Hepatic Neoplas
Focal Nodular Hyperplasia
Hepatic Carcinoid Tumor
Hepatic Dysplastic Nodule
Hepatic Fibroma
Hepatic Hemangioma
Hepatic Inflammatory Myo
Hepatic Leiomyoma
Hepatic Lipoma
Hepatic Lymphoma
Hepatic Mesenchymal Har
Hepatic Sarcoma
Hepatic Vascular Disorder
Hepatocellular Adenoma
Hepatocellular Carcinoma
Intrahepatic Bile Duct Ade
Intrahepatic Bile Duct Cyst
Intrahepatic Bile Duct Papi
Intrahepatic Cholangiocarc
Metastatic Malignant Neop
Non-Neoplastic Hepatic Di
Visualization
Class/Type Details
Marginal Notes
Mappings
Resources
Subscribe
PubMed
PubMed is a service of the U.S. National Library of Medicine that includes over 17 million citations from MEDLINE and other life science journals for biomedical articles back to the 1950s. PubMed includes links to full text articles and other related resources.
Elements:29
ArrayExpress
ArrayExpress is a public repository for microarray data, which is aimed at storing MIAME-compliant data in accordance with MGED recommendations. The ArrayExpress Data Warehouse stores gene-indexed expression profiles from a curated subset of experiments in the repository.
Elements:8
ClinicalTrials.gov
ClinicalTrials.gov provides regularly updated information about federally and privately supported clinical research in human volunteers. ClinicalTrials.gov gives you information about a trial's purpose, who may participate, locations, and phone numbers for more details. The information provided on ClinicalTrials.gov should be used in conjunction with advice from health care professionals. Before searching, you may want to learn more about clinical trials.
Elements:206
Gene Expression Omnibus
A gene expression/molecular abundance repository supporting MIAME compliant data submissions, and a curated, online resource for gene expression data browsing, query and retrieval.
Elements:7
ARRS GoldMiner
ARRS GoldMiner provides instant access to images published in selected peer-reviewed radiology journals. This new, web-based system allows viewers to search for images by findings, anatomy, imaging technique, and patient age and sex.
Elements:2


THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Home
Browse
Search
NCI Thesaurus
Childhood Hepatic Neoplas
Focal Nodular Hyperplasia
Hepatic Carcinoid Tumor
Hepatic Dysplastic Nodule
Hepatic Fibroma
Hepatic Hemangioma
Hepatic Inflammatory Myo
Hepatic Leiomyoma
Hepatic Lipoma
Hepatic Lymphoma
Hepatic Mesenchymal Har
Hepatic Sarcoma
Hepatic Vascular Disorder
Hepatocellular Adenoma
Hepatocellular Carcinoma
Intrahepatic Bile Duct Ade
Intrahepatic Bile Duct Cyst
Intrahepatic Bile Duct Papi
Intrahepatic Cholangiocarc
Metastatic Malignant Neop
Non-Neoplastic Hepatic Di
Visualization
Class/Type Details
Marginal Notes
Mappings
Resources
Subscribe
PubMed
PubMed is a service of the U.S. National Library of Medicine that includes over 17 million citations from MEDLINE and other life science journals for biomedical articles back to the 1950s. PubMed includes links to full text articles and other related resources.
Elements:29
ArrayExpress
ArrayExpress is a public repository for microarray data, which is aimed at storing MIAME-compliant data in accordance with MGED recommendations. The ArrayExpress Data Warehouse stores gene-indexed expression profiles from a curated subset of experiments in the repository.
Elements:8
Element ID
Annotation Context
Element Link
E-GEOD-4731
description
View Element
E-GEOD-5230
title
View Element
E-GEOD-5230
description
View Element
E-MEXP-199
title
View Element
E-MEXP-199
description
View Element
E-MEXP-84
description
View Element
E-SMDB-2975
description
View Element
E-TABM-36
description
View Element
ClinicalTrials.gov
ClinicalTrials.gov provides regularly updated information about federally and privately supported clinical research in human volunteers. ClinicalTrials.gov gives you information about a trial's purpose, who may participate, locations, and phone numbers for more details. The information provided on ClinicalTrials.gov should be used in conjunction with advice from health care professionals. Before searching, you may want to learn more about clinical trials.
Elements:206
Gene Expression
A gene expression/molecular abundance repository supporting MIAME compliant data submissions, and a curated, online resource for gene expression data browsing, query and retrieval.
Elements:7

1 / 4	Experiment : **E-GEOD-4612**	Submitter(s) : **Katzenellenbogen**	Lab : **Hadassah University Hospital**

Experiment Design Type : individual genetic characteristics , co expression , time series

(Generated description): Experiment with 12 hybridizations, using 12 samples of species [Mus musculus], using 12 arrays of array design [Affymetrix GeneChip® Mouse Genome 430A 2.0 [Mouse430A_2]], producing 12 raw data files and 12 transformed and/or normalized data files.

(Submitter's description 1): We studied the molecular mechanisms of hepatocellular carcinoma (HCC) initiation and promotion using the Mdr2-knockout (Mdr2-KO) mice at pre-cancerous stages of liver disease. These mice lack the liver-specific P-glycoprotein responsible for phosphatidylcholine transport across the canalicular membrane. Portal inflammation ensues at an early age followed by the development of HCC between the ages of 12 and 15 months. Liver tissue samples of Mdr2-KO and control Mdr2-heterozygotes mice aged 3 and 12 months, were subjected to histological, biochemical and gene expression profiling analysis using Affymetrix Mouse Genome Array. The RNA samples from Mdr2-KO and control heterozygous mice aged 3 and 12M (3 males in each experimental group) were subjected to genome scale gene expression profiling with Affymetrix Mouse Array. The gene expression values were extracted with the help of MAS 5.0 software, and analyzed by cluster analysis, and by fold change filtering

Retrieve data >>

Experimental protocols >>

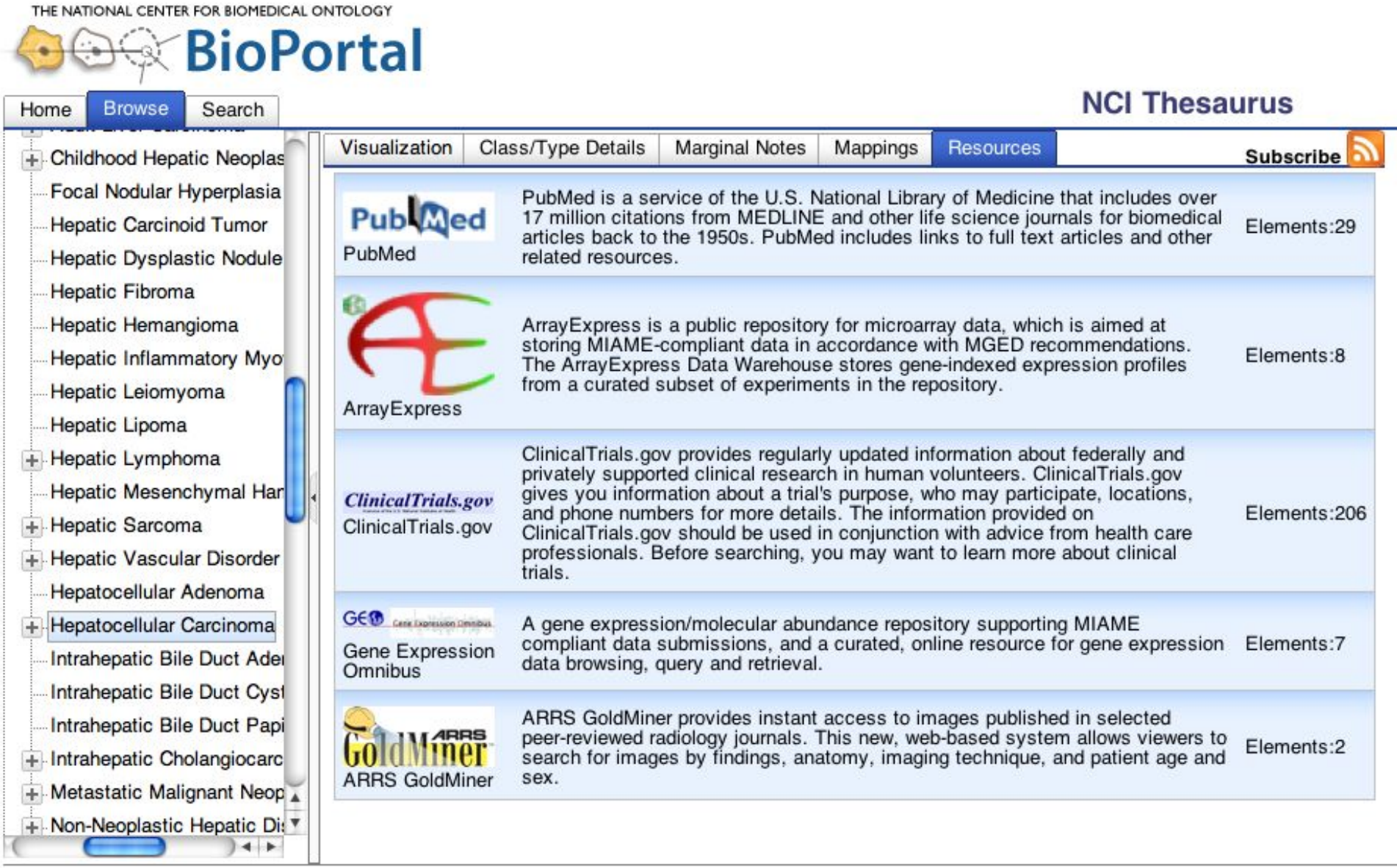
Providers >>

Array design used >>

- **Experiment's directory** in the **FTP >>**
- **MAGE-ML** : (**.gz** (661 KB))
- **Sample annotation** : (**.txt** **.xls**)
- **Experiment design** : (**.png** **.svg**)
- **Detailed sample annotation** : (**.txt** **.xls**)

Bibliographic references >>

Samples >>


THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Home
Browse
Search
NCI Thesaurus
Childhood Hepatic Neoplas
Focal Nodular Hyperplasia
Hepatic Carcinoid Tumor
Hepatic Dysplastic Nodule
Hepatic Fibroma
Hepatic Hemangioma
Hepatic Inflammatory Myo
Hepatic Leiomyoma
Hepatic Lipoma
Hepatic Lymphoma
Hepatic Mesenchymal Har
Hepatic Sarcoma
Hepatic Vascular Disorder
Hepatocellular Adenoma
Hepatocellular Carcinoma
Intrahepatic Bile Duct Ade
Intrahepatic Bile Duct Cyst
Intrahepatic Bile Duct Papi
Intrahepatic Cholangiocarc
Metastatic Malignant Neop
Non-Neoplastic Hepatic Di
Visualization
Class/Type Details
Marginal Notes
Mappings
Resources
Subscribe
PubMed
PubMed is a service of the U.S. National Library of Medicine that includes over 17 million citations from MEDLINE and other life science journals for biomedical articles back to the 1950s. PubMed includes links to full text articles and other related resources.
Elements:29
ArrayExpress
ArrayExpress is a public repository for microarray data, which is aimed at storing MIAME-compliant data in accordance with MGED recommendations. The ArrayExpress Data Warehouse stores gene-indexed expression profiles from a curated subset of experiments in the repository.
Elements:8
ClinicalTrials.gov
ClinicalTrials.gov provides regularly updated information about federally and privately supported clinical research in human volunteers. ClinicalTrials.gov gives you information about a trial's purpose, who may participate, locations, and phone numbers for more details. The information provided on ClinicalTrials.gov should be used in conjunction with advice from health care professionals. Before searching, you may want to learn more about clinical trials.
Elements:206
Gene Expression Omnibus
A gene expression/molecular abundance repository supporting MIAME compliant data submissions, and a curated, online resource for gene expression data browsing, query and retrieval.
Elements:7
ARRS GoldMiner
ARRS GoldMiner provides instant access to images published in selected peer-reviewed radiology journals. This new, web-based system allows viewers to search for images by findings, anatomy, imaging technique, and patient age and sex.
Elements:2

Gene Expression Omnibus

e.g., element GDS1989

Eutils Web Service API

Resource element fetching

<title>
Melanoma progression
</title>

<description>
Analysis of tissue specimens representing benign nevus, atypical nevus, melanoma in situ, vertical growth phase (VGP) melanoma, and metastatic growth phase (MGP) melanoma. Results identify expression signatures that distinguish benign and atypical nevi and melanomas in situ from VGPs and MGPs.
</description>

Annotation

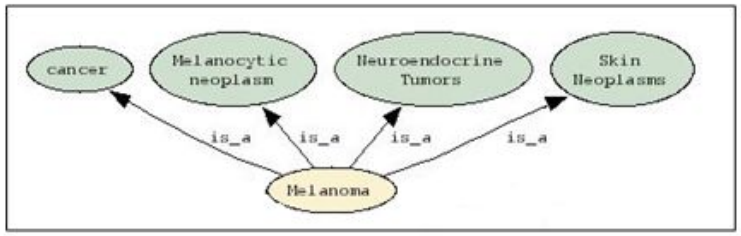
<title>
Melanoma progression
</title>

<description>
Analysis of tissue specimens representing benign nevus, atypical nevus, melanoma in situ, vertical growth phase (VGP) melanoma, and metastatic growth phase (MGP) melanoma. Results identify expression signatures that distinguish benign and atypical nevi and melanomas in situ from VGPs and MGPs.
</description>

23 direct annotations
(4 title, 19 description)

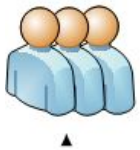
Example:
Melanoma, concept (DOID:1909) in ontology *Human disease.*

Transitive closure

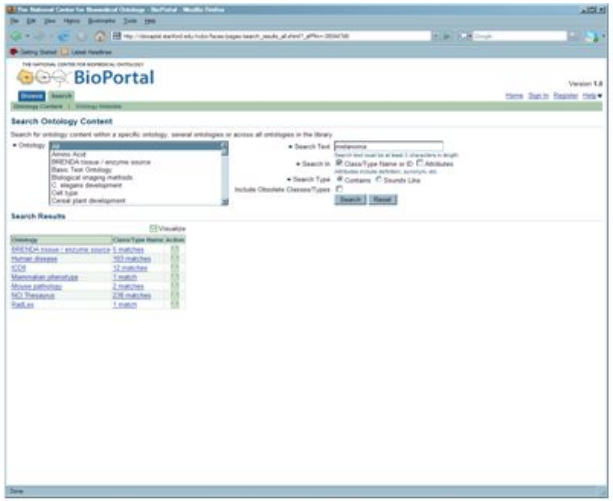


172 closure annotations and 171 useful.

Examples:
Cancer, concept (DOID:162) in ontology *Human disease*
Skin Neoplasms, concept (DOID:3165) in ontology *Human disease*



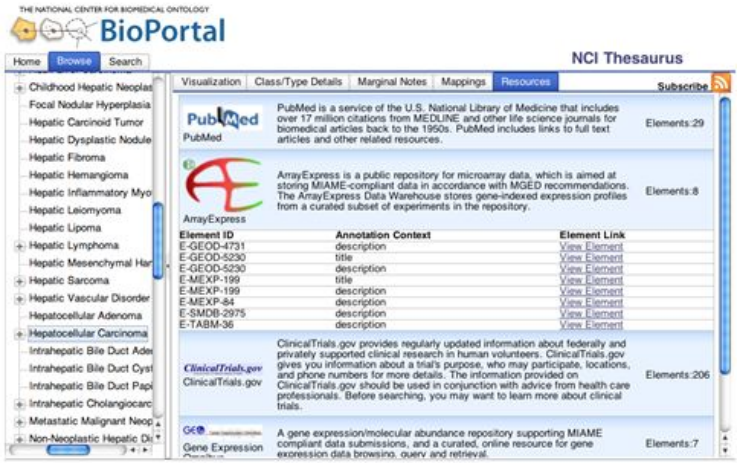
User search



Bioportal search for “melanoma”

OBS index request

362 matches in all Bioportal ontologies.
Example:
Melanoma, concept (DOID:1909) in ontology *Human disease*.



Onrez index results display

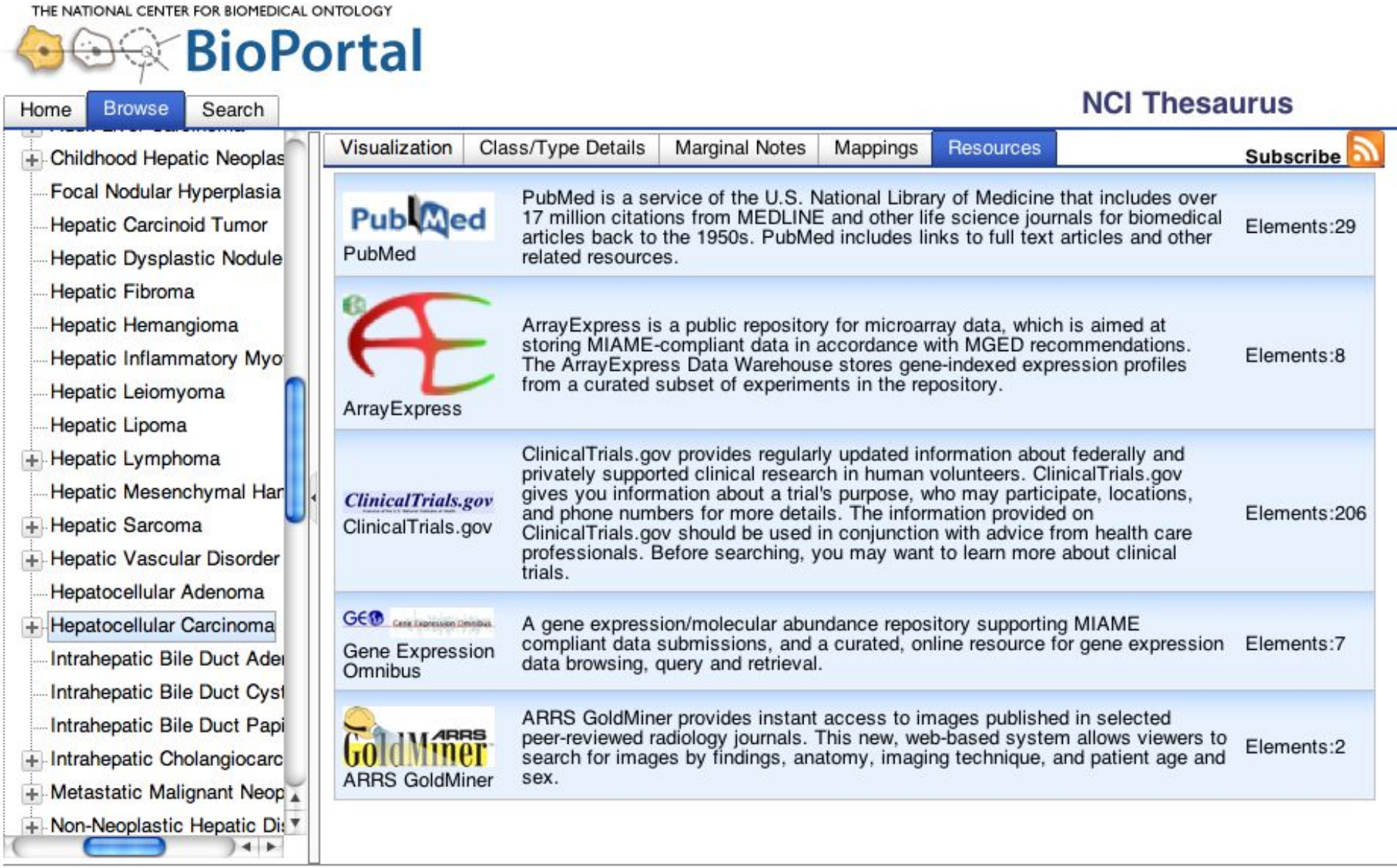
- 227 PubMed elements,
- 3 ArrayExpress elements,
- 969 ClinicalTrials.gov elements,
- 10 ARRS GoldMiner elements,
- 3 Gene Expression Omnibus elements.

Example:
Melanoma progression element (GDS1989)

Link to the original resource element

Gene Expression Omnibus

e.g., element GDS1989


THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
BioPortal
Home
Browse
Search
NCI Thesaurus
Childhood Hepatic Neoplas
Focal Nodular Hyperplasia
Hepatic Carcinoid Tumor
Hepatic Dysplastic Nodule
Hepatic Fibroma
Hepatic Hemangioma
Hepatic Inflammatory Myo
Hepatic Leiomyoma
Hepatic Lipoma
Hepatic Lymphoma
Hepatic Mesenchymal Har
Hepatic Sarcoma
Hepatic Vascular Disorder
Hepatocellular Adenoma
Hepatocellular Carcinoma
Intrahepatic Bile Duct Ade
Intrahepatic Bile Duct Cyst
Intrahepatic Bile Duct Papi
Intrahepatic Cholangiocarc
Metastatic Malignant Neop
Non-Neoplastic Hepatic Di
Visualization
Class/Type Details
Marginal Notes
Mappings
Resources
Subscribe
PubMed
PubMed is a service of the U.S. National Library of Medicine that includes over 17 million citations from MEDLINE and other life science journals for biomedical articles back to the 1950s. PubMed includes links to full text articles and other related resources.
Elements:29
ArrayExpress
ArrayExpress is a public repository for microarray data, which is aimed at storing MIAME-compliant data in accordance with MGED recommendations. The ArrayExpress Data Warehouse stores gene-indexed expression profiles from a curated subset of experiments in the repository.
Elements:8
ClinicalTrials.gov
ClinicalTrials.gov provides regularly updated information about federally and privately supported clinical research in human volunteers. ClinicalTrials.gov gives you information about a trial's purpose, who may participate, locations, and phone numbers for more details. The information provided on ClinicalTrials.gov should be used in conjunction with advice from health care professionals. Before searching, you may want to learn more about clinical trials.
Elements:206
Gene Expression Omnibus
A gene expression/molecular abundance repository supporting MIAME compliant data submissions, and a curated, online resource for gene expression data browsing, query and retrieval.
Elements:7
ARRS GoldMiner
ARRS GoldMiner provides instant access to images published in selected peer-reviewed radiology journals. This new, web-based system allows viewers to search for images by findings, anatomy, imaging technique, and patient age and sex.
Elements:2


If we build it, will they come?

A problem in both technology and sociology

- How can we identify communities of likely early adopters?
- How will we know when we will have sufficient functionality to entice early adopters to adopt?
- How can we measure the affects of our technology on the way that science gets done?
- How can we engage in participatory design of technology that potential users cannot even imagine?

BioPortal User Group

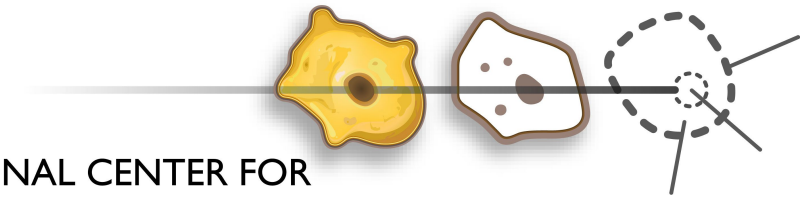
- CTSAs
- Immunology
- Imaging
- RadLex
- W3C HCLSIG
- BioPAX
- CVRGrid
- caBIG
- HL7
- MODs
- GO Consortium
- BIRN

BioPortal can build an online community of users who

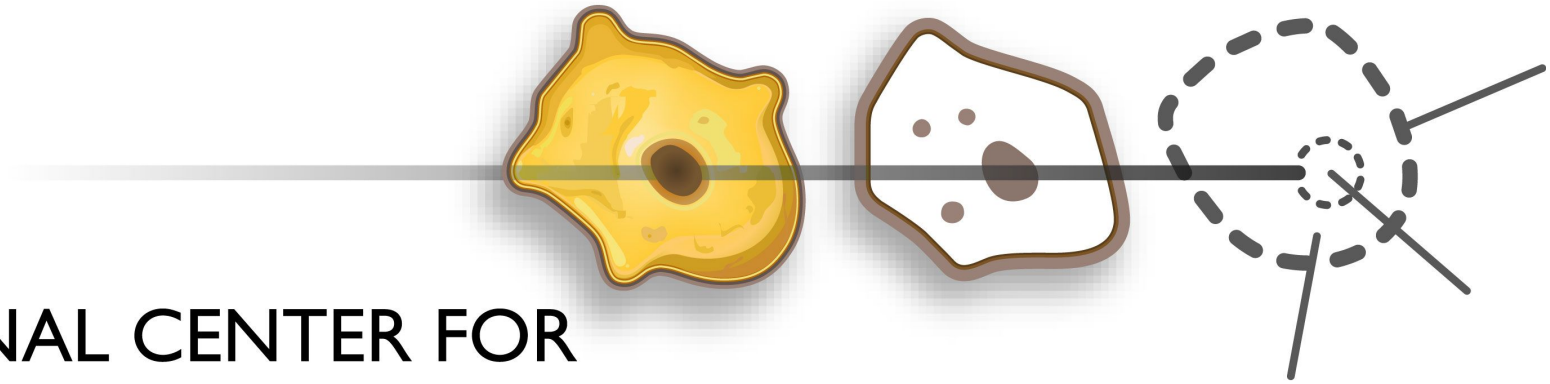
- Develop, upload, and apply ontologies
- Map ontologies to one another
- Comment on ontologies via “marginal notes” to give feedback
  - To the ontology developers
  - To one another
- Make proposals for specific changes to ontologies
- Stay informed about ontology changes and proposed changes via active feeds

Goals for the NCBO

- Providing technology for ontology archiving, access, browsing, visualization, peer review, mapping, versioning
- Making most biomedical ontologies accessible via a common portal
- Educating the community about principles of ontology development and use
- Serving as a generalizable model for the formalization of knowledge in e-science



NATIONAL CENTER FOR
BIOMEDICAL ONTOLOGY



NATIONAL CENTER FOR

BIOMEDICAL ONTOLOGY

http://bioontology.org