Ontology Metadata in NCBO BioPortal: Requirements and Solutions

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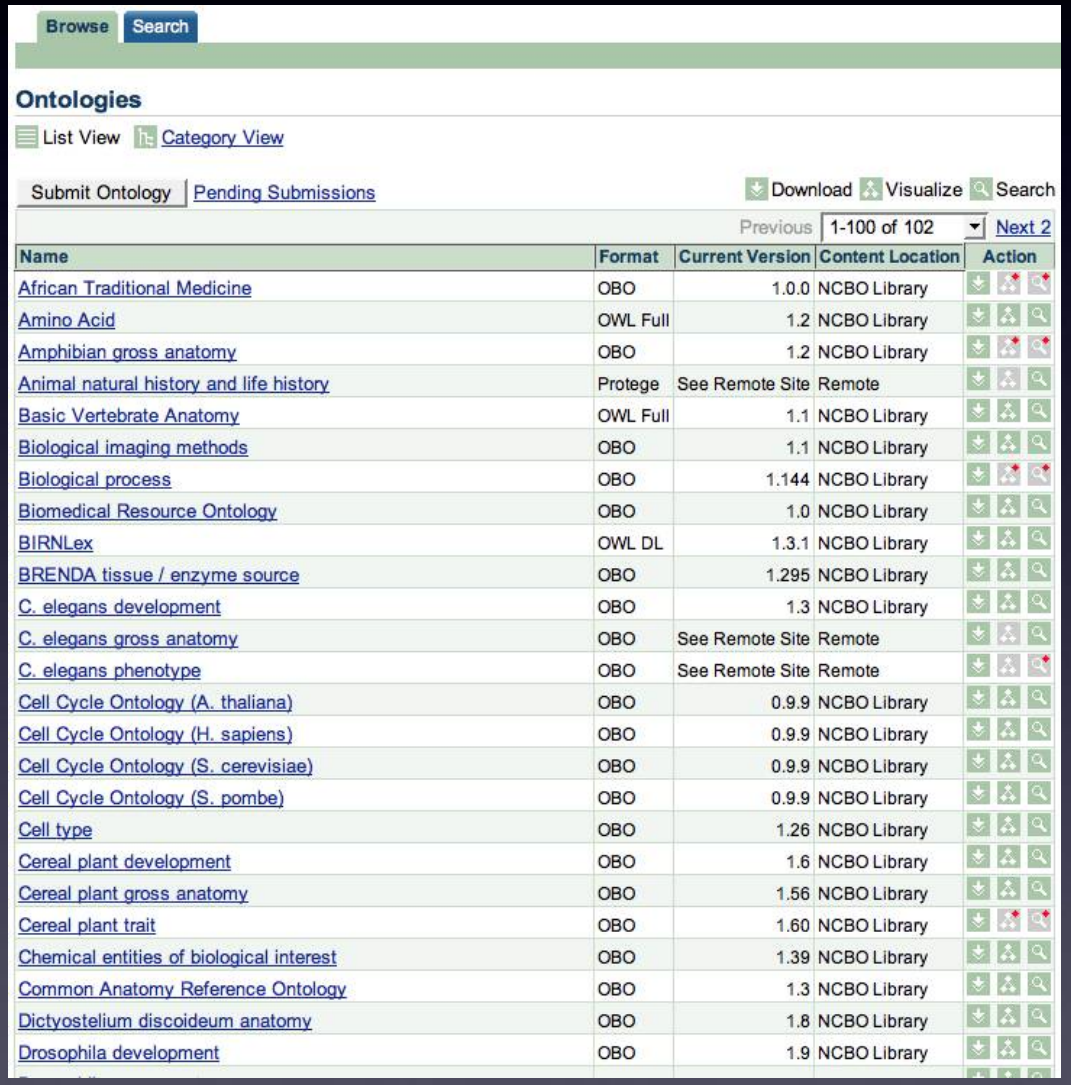
NCBO BioPortal

- The National Center for Biomedical Ontology (http://bioontology.org) is developing BioPortal, an open-source repository of ontologies, terminologies, and thesauri of importance in biomedicine.
- An early version of BioPortal is accessible at http://bioportal.bioontology.org. An alpha version of the next release is at http://alpha.bioontology.org/
- Users can access the BioPortal content interactively via Web browsers or programmatically via Web services.

BioPortal *Is* An Ontology Repository

- Open repository of ontologies in biomedicine
- The original set of ontologies is from the Open Biomedical Ontologies repository (OBO)
- New ontologies are being added
- Each ontology is described by a set of metadata



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Ontologies

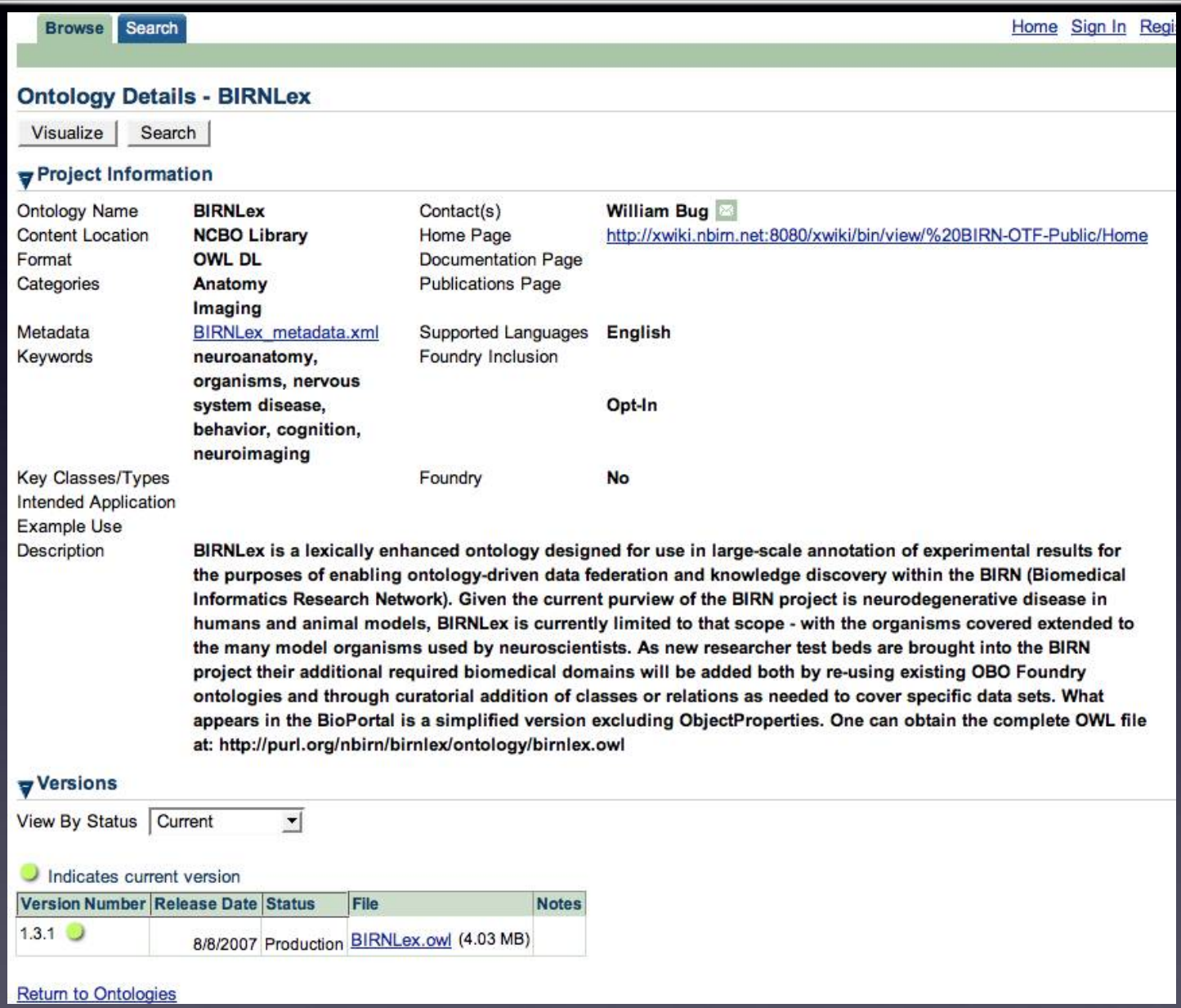
List View | Category View

Submit Ontology | Pending Submissions — Download | Visualize | Search

Previous | 1-100 of 102 | Next 2

Name	Format	Current Version	Content Location	Action
African Traditional Medicine	OBO	1.0.0	NCBO Library	
Amino Acid	OWL Full	1.2	NCBO Library	
Amphibian gross anatomy	OBO	1.2	NCBO Library	
Animal natural history and life history	Protege	See Remote Site	Remote	
Basic Vertebrate Anatomy	OWL Full	1.1	NCBO Library	
Biological imaging methods	OBO	1.1	NCBO Library	
Biological process	OBO	1.144	NCBO Library	
Biomedical Resource Ontology	OBO	1.0	NCBO Library	
BIRNLex	OWL DL	1.3.1	NCBO Library	
BRENDA tissue / enzyme source	OBO	1.295	NCBO Library	
C. elegans development	OBO	1.3	NCBO Library	
C. elegans gross anatomy	OBO	See Remote Site	Remote	
C. elegans phenotype	OBO	See Remote Site	Remote	
Cell Cycle Ontology (A. thaliana)	OBO	0.9.9	NCBO Library	
Cell Cycle Ontology (H. sapiens)	OBO	0.9.9	NCBO Library	
Cell Cycle Ontology (S. cerevisiae)	OBO	0.9.9	NCBO Library	
Cell Cycle Ontology (S. pombe)	OBO	0.9.9	NCBO Library	
Cell type	OBO	1.26	NCBO Library	
Cereal plant development	OBO	1.6	NCBO Library	
Cereal plant gross anatomy	OBO	1.56	NCBO Library	
Cereal plant trait	OBO	1.60	NCBO Library	
Chemical entities of biological interest	OBO	1.39	NCBO Library	
Common Anatomy Reference Ontology	OBO	1.3	NCBO Library	
Dictyostelium discoideum anatomy	OBO	1.8	NCBO Library	
Drosophila development	OBO	1.9	NCBO Library	

Example: BirnLEX



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Ontology Details - BIRNLex

Visualize | Search

Project Information

Ontology Name	**BIRNLex**	Contact(s)	**William Bug**
Content Location	**NCBO Library**	Home Page	http://xwiki.nbirn.net:8080/xwiki/bin/view/%20BIRN-OTF-Public/Home
Format	**OWL DL**	Documentation Page	
Categories	**Anatomy** **Imaging**	Publications Page	
Metadata	BIRNLex_metadata.xml	Supported Languages	**English**
Keywords	**neuroanatomy, organisms, nervous system disease, behavior, cognition, neuroimaging**	Foundry Inclusion	**Opt-In**
Key Classes/Types		Foundry	**No**
Intended Application			
Example Use			

Description: **BIRNLex is a lexically enhanced ontology designed for use in large-scale annotation of experimental results for the purposes of enabling ontology-driven data federation and knowledge discovery within the BIRN (Biomedical Informatics Research Network). Given the current purview of the BIRN project is neurodegenerative disease in humans and animal models, BIRNLex is currently limited to that scope - with the organisms covered extended to the many model organisms used by neuroscientists. As new researcher test beds are brought into the BIRN project their additional required biomedical domains will be added both by re-using existing OBO Foundry ontologies and through curatorial addition of classes or relations as needed to cover specific data sets. What appears in the BioPortal is a simplified version excluding ObjectProperties. One can obtain the complete OWL file at: http://purl.org/nbirn/birnlex/ontology/birnlex.owl**

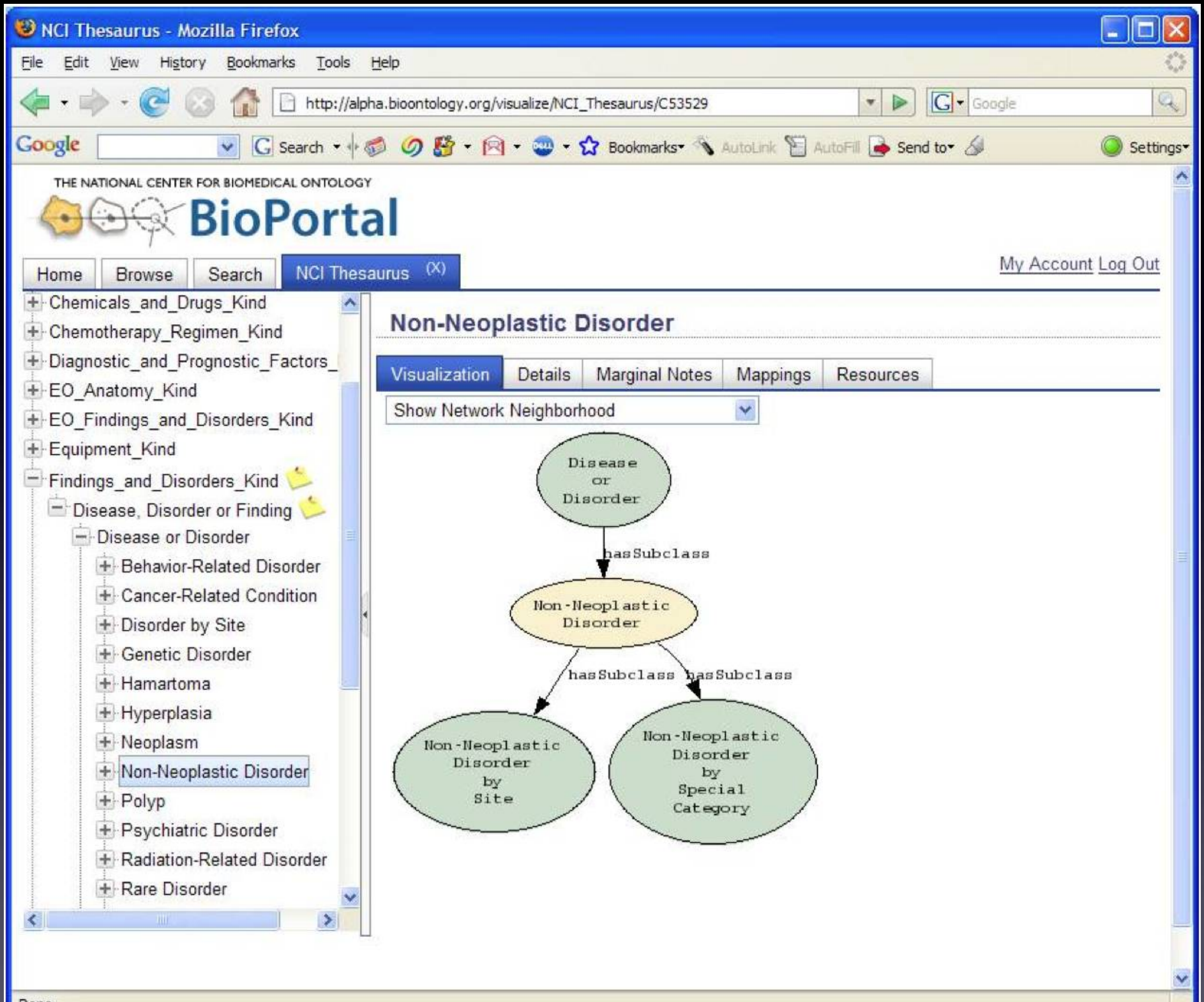
Versions

View By Status: Current

Indicates current version

Version Number	Release Date	Status	File	Notes
1.3.1	8/8/2007	Production	BIRNLex.owl (4.03 MB)	

Return to Ontologies


NCI Thesaurus - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://alpha.bioontology.org/visualize/NCI_Thesaurus/C53529
THE NATIONAL CENTER FOR BIOMEDICAL ONTOLOGY
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Chemotherapy_Regimen_Kind
Diagnostic_and_Prognostic_Factors_
EO_Anatomy_Kind
EO_Findings_and_Disorders_Kind
Equipment_Kind
Findings_and_Disorders_Kind
Disease, Disorder or Finding
Disease or Disorder
Behavior-Related Disorder
Cancer-Related Condition
Disorder by Site
Genetic Disorder
Hamartoma
Hyperplasia
Neoplasm
Non-Neoplastic Disorder
Polyp
Psychiatric Disorder
Radiation-Related Disorder
Rare Disorder
Non-Neoplastic Disorder
Visualization
Details
Marginal Notes
Mappings
Resources
Show Network Neighborhood
Disease or Disorder
hasSubclass
Non-Neoplastic Disorder
hasSubclass
hasSubclass
Non-Neoplastic Disorder by Site
Non-Neoplastic Disorder by Special Category

Major Function: Ontology Assessment

Which ontology from the repository

is appropriate for my task?

- Sources of information for the answer:
  - Ontology metadata
    - *usually provided by authors*
  - Computable metrics
    - *can be provided by the tools in the library*
  - Community-based evaluation
    - *provided by other users of the ontologies*

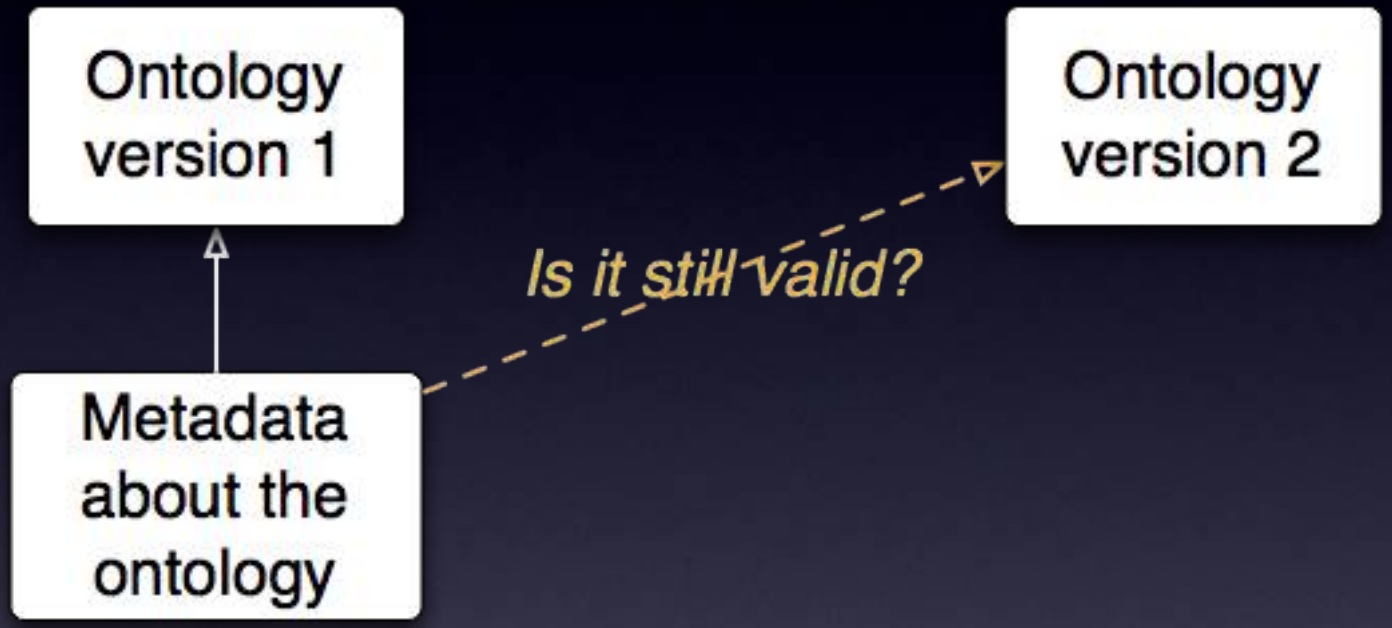
Requirements For Ontology Metadata in BioPortal

- Flexible, extensible, and easy-to-change solution
  - *We don't necessarily have all the answers right now; not many ontology repositories exist.*
- Support for ontology versioning
  - *Any new version of an ontology in the repository can invalidate the value of any metadata field.*
- Reuse of metadata across different repositories
  - *If we share the same metadata schema, we can exchange ontology profiles more easily (think: FOAF for ontologies).*
- Query access for standard tools and languages
  - *Use a standard mechanism rather than a proprietary solution.*

OMV in BioPortal

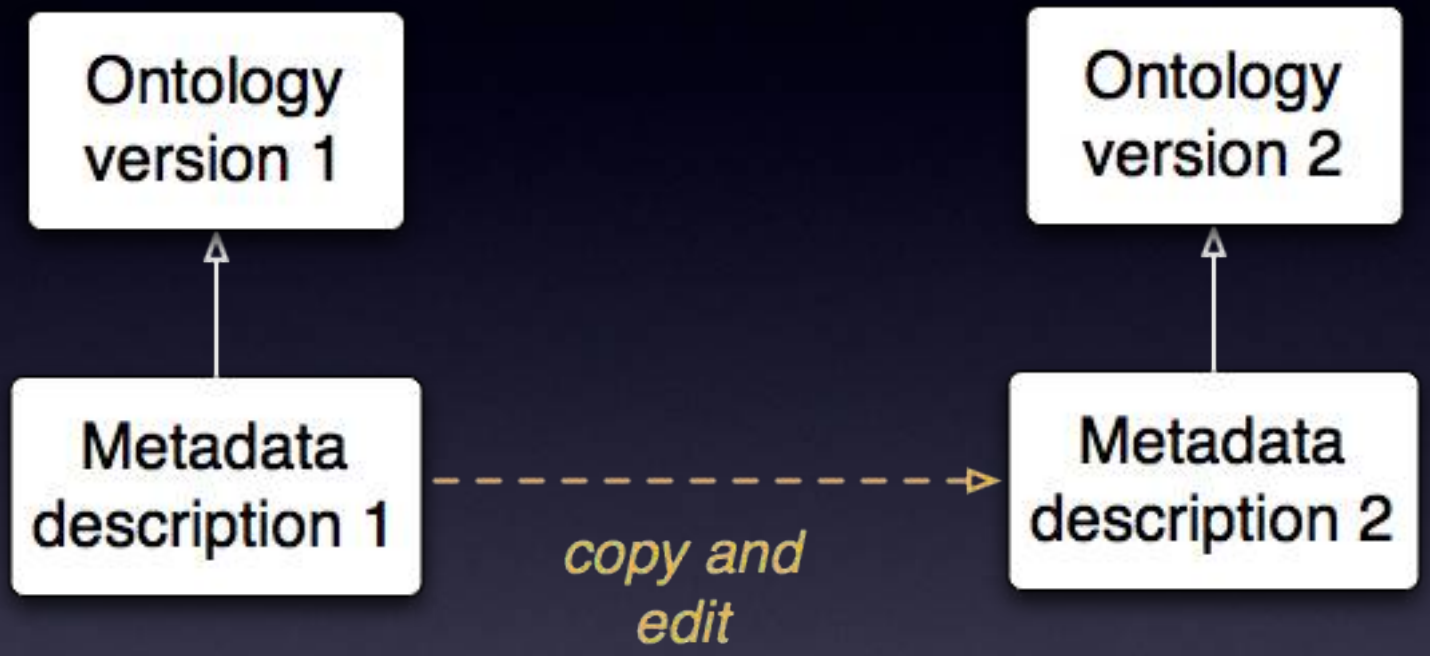
- We are adopting OMV as the metadata schema for ontologies
- We are working actively with the OMV Consortium on the representation
- Key features of OMV from the BioPortal's point of view:
  - support for ontology versioning
  - fields for "extrinsic" information about an ontology (references, usage reports, etc.)
  - clear separation into core and extensions

Maintaining Metadata through Ontology Versioning



Potentially, any part of the description can change:
author, language, domain, scope, coverage, level of support, license, ...

OMV (and BioPortal) Solution



Each metadata instance describes a specific version

Pragmatic Considerations

- Most author-supplied metadata remains unchanged from version to version
  - copy the metadata by default, allowing users to change any part of it
- Users of the ontology (not its authors) may not come back to update the metadata they provided (reviews, projects, etc.)
  - keep reference to the specific version for which the metadata was created
  - present all the user-supplied metadata from previous versions
  - make it clear that, for example, a review was for a previous version

Key Metadata Fields

- Provenance: author, institution, license…
- Policy for maintenance and distribution
- Domain and scope
- Key classes
- References
  - describing the ontology itself
  - describing the use of the ontology
- Projects using the ontology

OMV Evaluation Extension

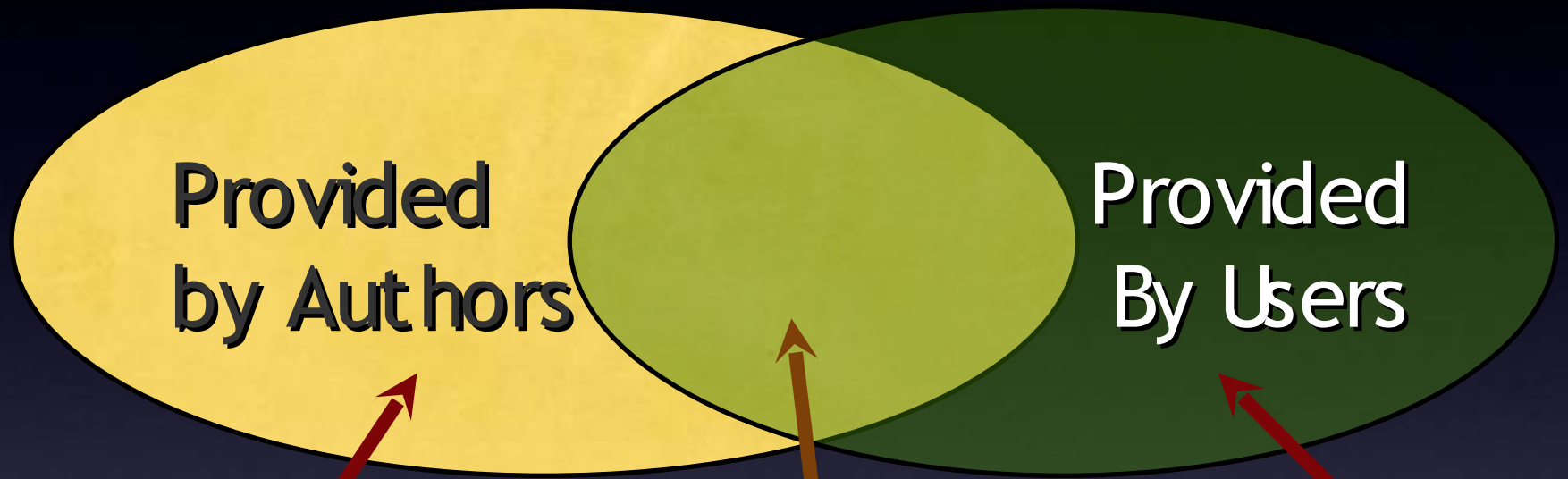
Who Should Provide the Metadata?

Which ontology from the repository

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 metadata for ontologies
  - reviews
  - ratings
  - usage reports

Metadata And Where It Comes From



Provenance
License
Maintenance policy
…

References
Logical consistency
Quality of documentation
Level of maturity
…

Reviews
Ratings
Usage reports
…

Conflicting Sources of Metadata

- Authors and users can contradict one another
  - Quality of documentation?
  - References (e.g., positive and negative analyses of the ontology)
  - …
- Metadata schema must enable diversity of views on some metadata values

Lessons (Still Being) Learned

- We must remember what the ontology metadata is for
  - helping users find the "right" ontologies
- Flexibility of metadata schema is key
- Maintenance across ontology versions is essential
- Metadata must support plurality of views and provide context for the specific values