



BioPortal: A Web Repository for Biomedical Ontologies and Data Resources

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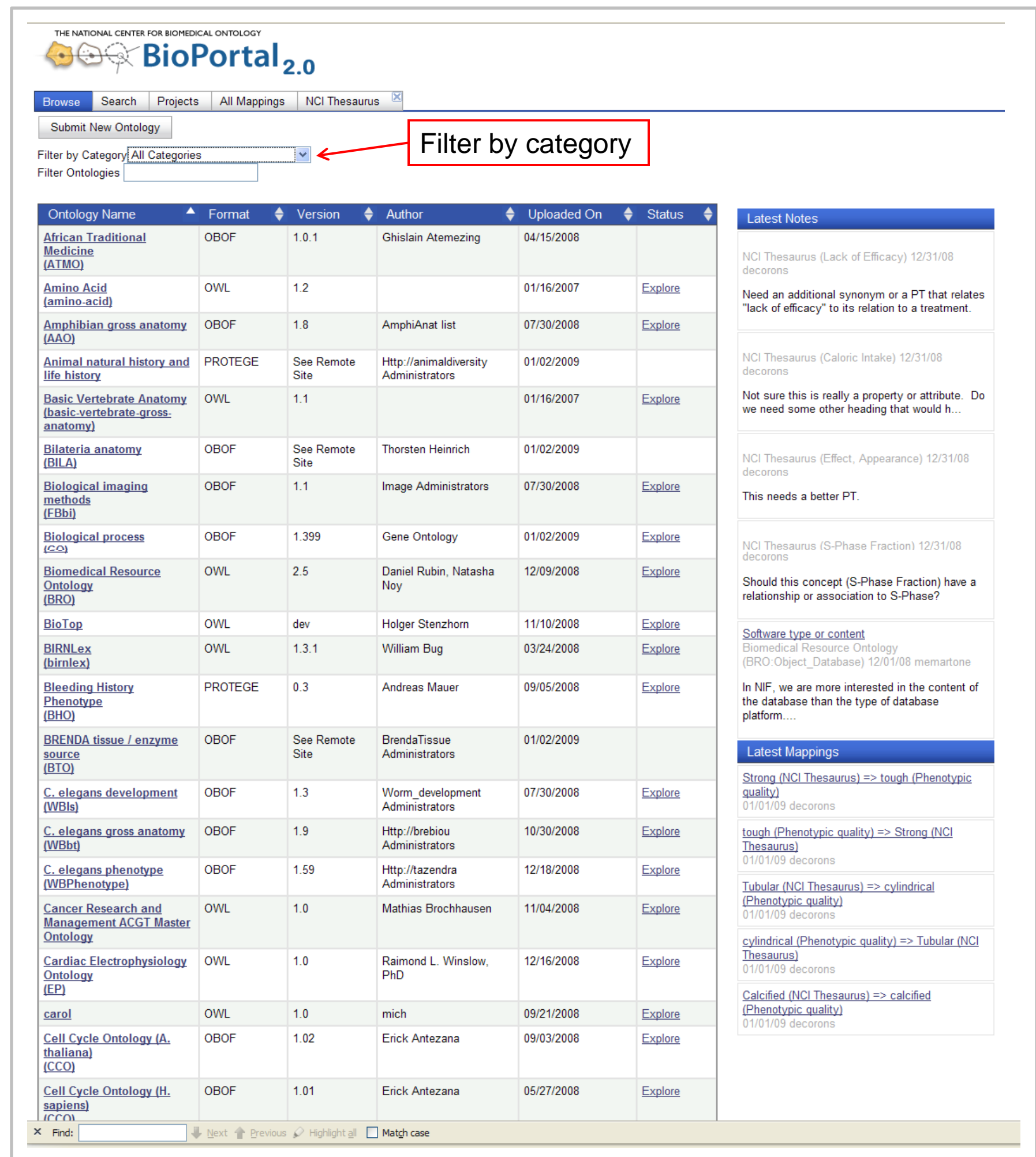
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Introduction

Biomedical ontologies provide essential domain knowledge to drive data integration, information retrieval, natural-language processing, and decision support. The National Center for Biomedical Ontology, one of the seven National Centers for Biomedical Computing created under the NIH Roadmap, is developing BioPortal, a Web-based system that serves as a repository for biomedical ontologies. BioPortal defines relationships among those ontologies and between the ontologies and online data resources such as PubMed, ClinicalTrials.gov, and the Gene Expression Omnibus (GEO). BioPortal supports not only the technical requirements for access to biomedical ontologies either via Web browsers or via Web services, but also community-based participation in the evaluation and evolution of ontology content. BioPortal enables ontology users to learn what biomedical ontologies exist, what a particular ontology might be good for, and how individual ontologies relate to one another. BioPortal is available online at the following location: <http://bioportal.bioontology.org/>.

BioPortal Ontology Library

- Total number of ontologies: 127
- Number of classes/types: 500,109
- Ontology formats: OWL, OBO format, Protégé



Ontology Name	Format	Version	Author	Uploaded On	Status	Latest Notes
African Traditional Medicine (ATMO)	OBOF	1.0.1	Ghislain Asemeng	04/15/2008	Explains	NCI Thesaurus (lack of efficacy) 12/31/08 deprecates
Amino Acid (amino acid)	OWL	1.2		01/16/2007	Explains	Need an additional synonym or a PT that relates 'lack of efficacy' to its relation to a treatment.
Amphibian gross anatomy (AAO)	OBOF	1.8	AmphAnat list	07/30/2008	Explains	NCI Thesaurus (Cortic Intake) 12/31/08 deprecates
Animal natural history and life history	PROTEGE	See Remote Site	Http://animaldiversity Administrators	01/02/2009	Explains	Not sure this is really a property or attribute. Do we need some other heading that would h...
Basic Vertebrate Anatomy (basicvertebrate.gross.anatomy)	OWL	1.1		01/16/2007	Explains	NCI Thesaurus (Effect, Appearance) 12/31/08 deprecates
Bilateria anatomy (BLA)	OBOF	See Remote Site	Thorsten Heinrich	01/02/2009	Explains	This needs a better PT
Biological Imaging methods (EBM)	OBOF	1.1	Image Administrators	07/30/2008	Explains	NCI Thesaurus (S-Phase Fraction) 12/31/08 deprecates
Biological process	OBOF	1.399	Gene Ontology	01/02/2009	Explains	Should this concept (S-Phase Fraction) have a relationship or association to S-Phase?
Biomedical Resource Ontology (BRO)	OWL	2.5	Daniel Rubin, Natasha Noy	12/09/2008	Explains	Software type or context
BioTop	OWL	dev	Holger Stenchem	11/10/2008	Explains	Biomedical Resource Ontology (BRO Object_Database) 12/31/08 deprecates
BIRNLex (BIRNlex)	OWL	1.3.1	William Bug	03/24/2008	Explains	In HIF, we are more interested in the content of the database than the type of database platform...
Bleeding History Therapeutics (BHT)	PROTEGE	0.3	Andreas Maurer	09/05/2008	Explains	Latest Mappings
BRENDa tissue / enzyme (BTD)	OBOF	See Remote Site	BrendaTissue Administrators	01/02/2009	Explains	Strong (NCI Thesaurus) => tough (Phenotypic quality) 01/01/09 deprecates
C.elegans development	OBOF	1.3	Worm_development Administrators	07/30/2008	Explains	tough (Phenotypic quality) => Strong (NCI Thesaurus) 01/01/09 deprecates
C.elegans gross anatomy (VGBA)	OBOF	1.9	Http://biodid Administrators	10/30/2008	Explains	Tubular (NCI Thesaurus) => cylindrical (Phenotypic quality) 01/01/09 deprecates
C.elegans phenotype (VBPPhenotypic)	OBOF	1.59	Http://tazendra Administrators	12/18/2008	Explains	cylindrical (Phenotypic quality) => Tubular (NCI Thesaurus) 01/01/09 deprecates
Cancer Research and Management (CCM) Master Ontology	OWL	1.0	Mathias Brochhausen	11/04/2008	Explains	Catcliffed (NCI Thesaurus) => catcliffed (Phenotypic quality) 01/01/09 deprecates
Cardiac Electrophysiology Ontology (ECP)	OWL	1.0	Raymond L. Winslow, PhD	12/16/2008	Explains	
card	OWL	1.0	mich	09/21/2008	Explains	
Cell Cycle Ontology (A. Ballal) (CCO)	OBOF	1.02	Erick Antezana	09/03/2008	Explains	
Cell Cycle Ontology (B. Ballal) (CCO)	OBOF	1.01	Erick Antezana	05/27/2008	Explains	

BioPortal Web Services

Access ontology content via REST web services

- Prefix** for REST URLs <http://rest.bioontology.org/bioportal/rest>

Examples of service calls

- List metadata for the latest version of all ontologies
- List all ontology categories
- Get latest version of an ontology by virtual ontology id
- Download a given version of an ontology
- Get all root concepts for an ontology
- Get concept id by term name
- Search for terms in 1 or more ontologies

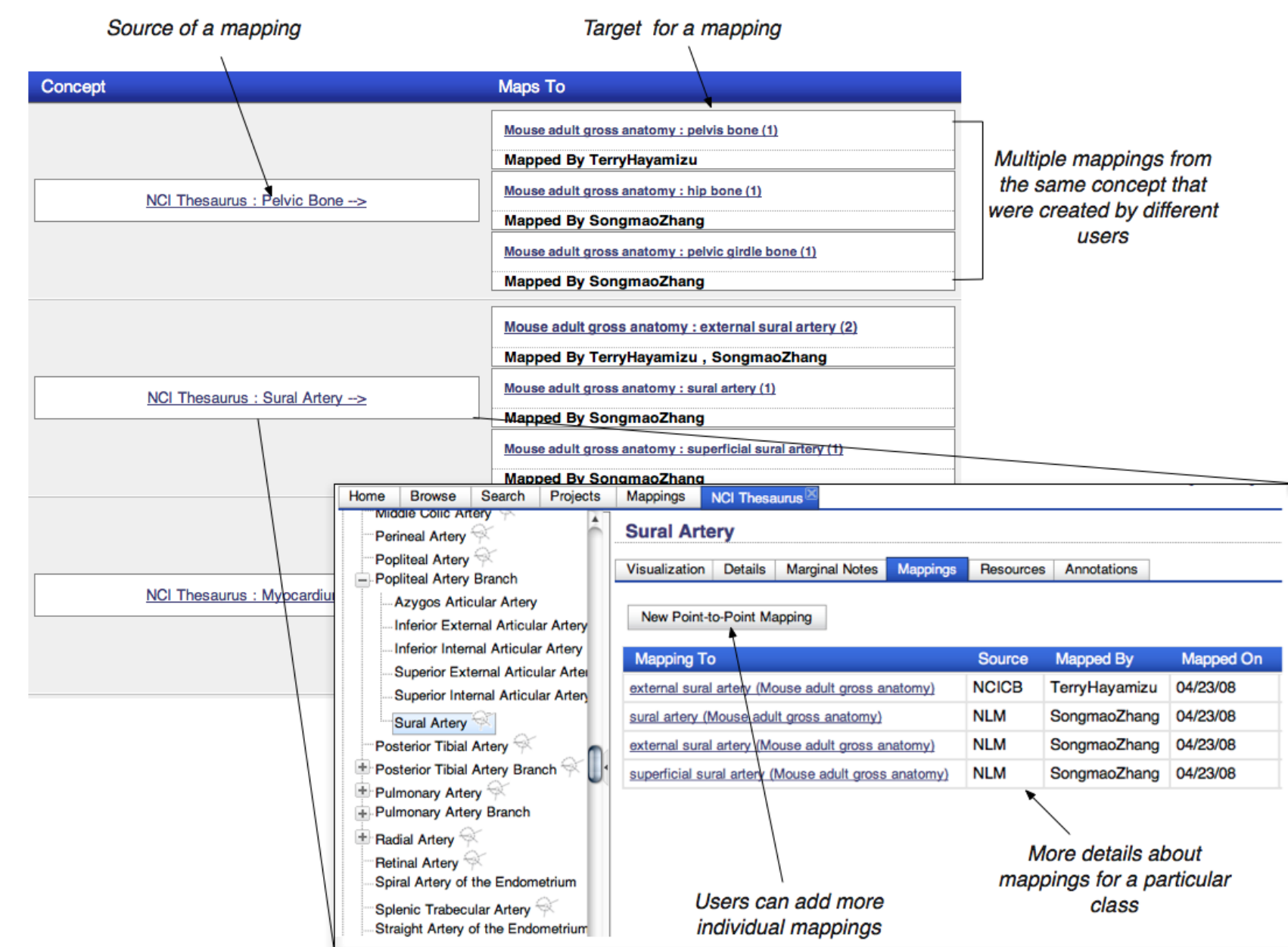
- List of Web Services:

http://bioontology.org/wiki/index.php/NCBO_REST_services

Ontology Mappings in BioPortal

BioPortal provides a community-based repository of ontology mappings, which enables users to

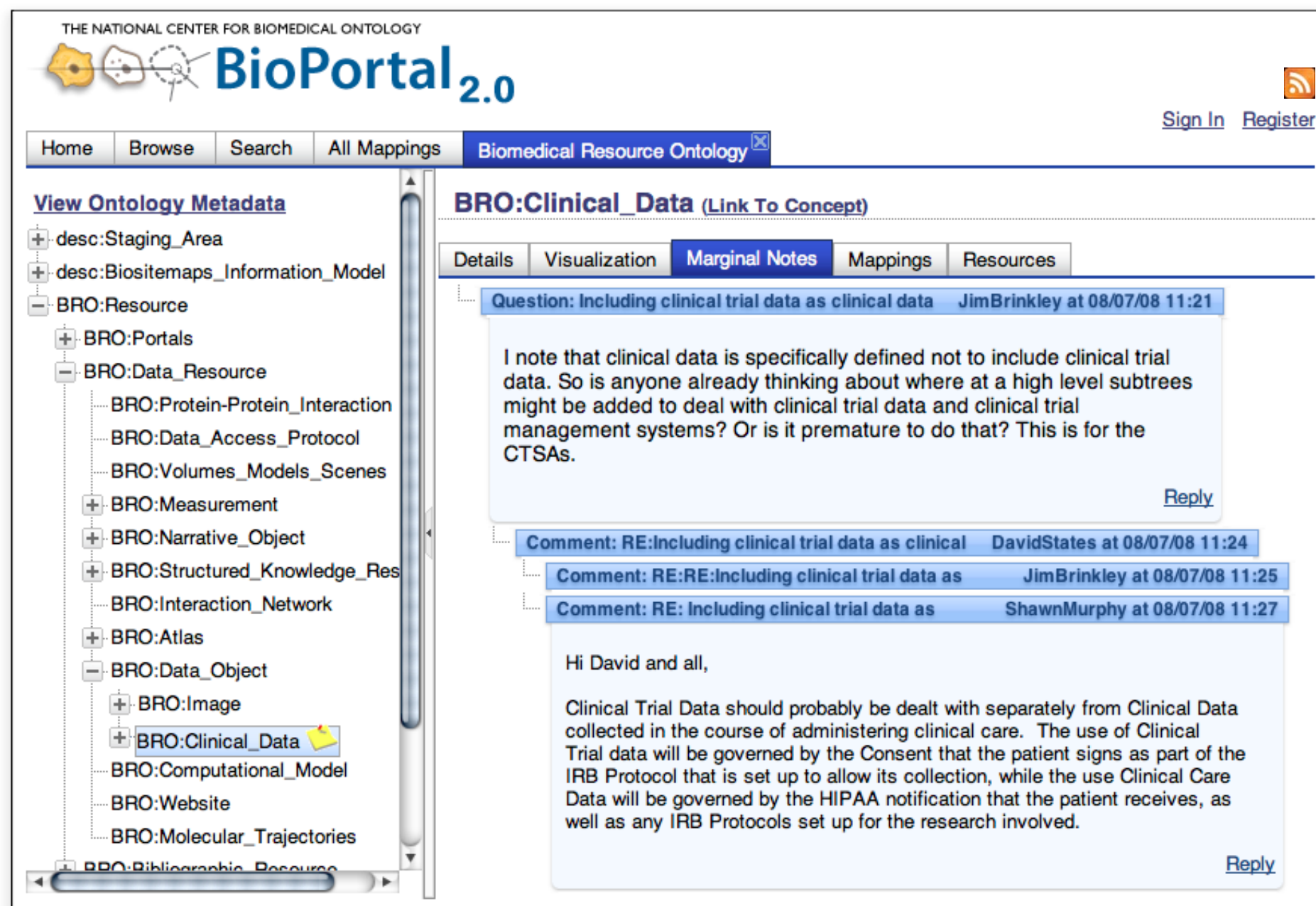
- Upload** bulk mappings in a structured format
- Download** mappings based on a selected parameters
- Define** point-to-point mappings interactively
- Comment** on mappings created by others
- Refine and discuss** existing mappings
- Access** mappings through web services
- Provide **metadata** about the mappings, such as:
 - mapping relationship
 - provenance (who created the mapping and when)
 - application context
 - mapping dependency
 - algorithm used to create the mapping (configuration, parameters, etc.)
 - external references



Community Feedback

Members of biomedical research communities can use the **Notes** functionality in BioPortal to

- Provide feedback to ontology authors
- Reach consensus on ontology decisions
- Review ontology components



Ontology Peer-Review

BioPortal enables ontology *users* to provide feedback on ontologies in BioPortal. Ontology reviewers can provide the following information

- General review and rating of the ontology
- 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 better developed than others?
- Concept-specific comments
 - Are there problems with specific concepts?
 - What alternative definitions should be used?
- Web of Trust** mechanism will enable users to specify reviewers that they trust, or to create filters to see reviews from particular groups (e.g., OBO Foundry members).

Ontology-Indexed Data Resources

Find biomedical data resources indexed by ontology terms

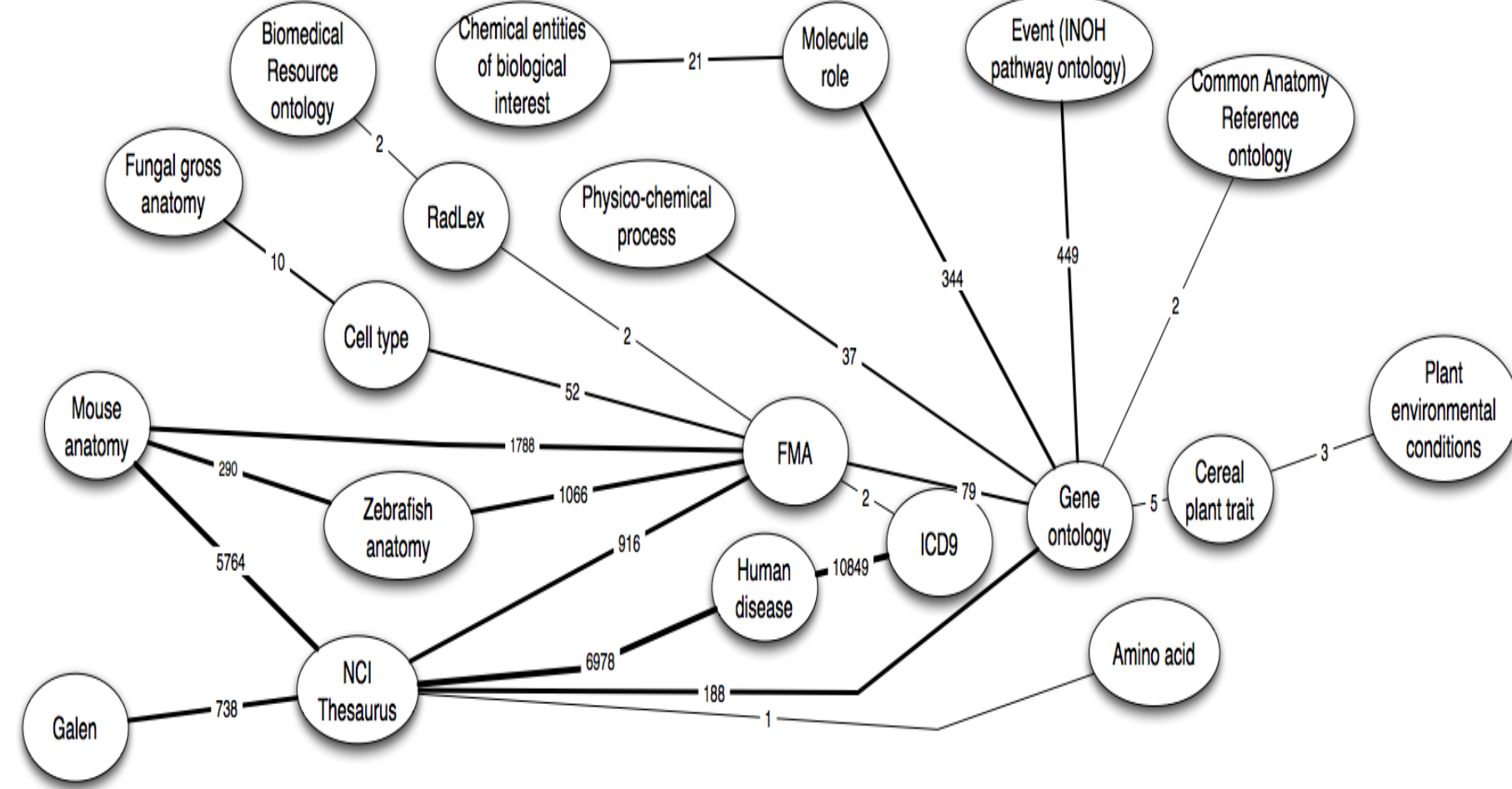
- Current resources: Gene Expression Omnibus (GEO), ArrayExpress, ClinicalTrials.gov, ARRS GoldMiner



Functionalities

BioPortal users can

- Upload their own ontologies to the repository
- Download ontologies
- Navigate classes and properties and visualize relationships between classes
- View and edit ontology metadata
- Access ontology metadata and content via Web services
- Add mappings
- Comment on ontologies and individual terms within an ontology
- Add Projects that use ontologies
- Link to resources annotated with specific ontology terms



Acknowledgements

BioPortal is developed by the National Center for Biomedical Ontology (NCBO), one of seven National Centers for Biomedical Computing under the NIH Roadmap. BioPortal is developed in conjunction with partners at the University of Victoria and the Mayo Clinic. For more information on NCBO and working the Center, visit <http://bioontology.org/> or email support@bioontology.org.