



# BioPortal: Ontologies and Integrated Data Resources at the Click of a Mouse

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<http://bioportal.bioontology.org>

## 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: 144
- Number of classes/types: 723,806
- Ontology formats: OWL, OBO format, Protégé

The screenshot shows a search results page for the term 'Category'. The results list various ontologies, each with a brief description, version, author, and status. Some results include links to their source code (e.g., GitHub) and an 'RSS' link. The interface includes filters for category, version, and author.

## Functionalities

- BioPortal users can
  - Upload their own ontologies to the repository
  - Edit their ontology metadata
  - Navigate classes and properties and visualize relationships between classes
  - Download ontologies
  - 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

## BioPortal Web Services

- Services to access ontologies and ontology versions
  - List metadata for the latest version of all ontologies
  - Download a given version of an ontology
- Concept services
  - Get concept
  - Get all root concepts for an ontology
- Search services
  - Search BioPortal with added parameters
- Hierarchy Services
  - Get parents/children of a given concept in a specific ontology version

Web Services:  
[http://bioontology.org/wiki/index.php/NCBO\\_REST\\_services](http://bioontology.org/wiki/index.php/NCBO_REST_services)

## Ontology Mappings in BioPortal

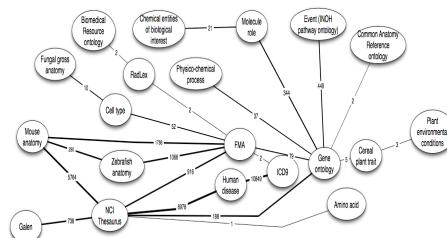
BioPortal provides a community-based repository of ontology mappings, which enables users to

- Upload** bulk mappings in a structured format
- Download** mappings based on 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

The screenshot shows a detailed view of a single mapping between two ontologies. It displays the source and target of the mapping, the specific terms being mapped, and the provenance information. It also shows multiple mappings for the same source term created by different users. A note indicates that the target term is a synonym of the source term.

## Current Set of Mappings in BioPortal

BioPortal has more than 30,000 mappings in its repository, involving 20 ontologies:



## 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

The screenshot shows a discussion thread titled 'Notes' where users can post comments and receive notifications. It includes a sidebar for filtering notes by type and a list of recent notes.

## 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: ArrayExpress, ARRS GoldMiner, ClinicalTrials.gov, Conserved Domain Database, Gene Expression Omnibus (GEO), OMIM, PharmGKB, Reactome, Research Crossroads, UniProt, WikiPathways,

The screenshot shows a search results page for the term 'RDA'. It lists various data resources indexed by the RDA ontology, including ArrayExpress, ARRS GoldMiner, ClinicalTrials.gov, Conserved Domain Database, Gene Expression Omnibus (GEO), OMIM, PharmGKB, Reactome, Research Crossroads, UniProt, and WikiPathways. Each resource has a brief description and a link to its details page.

## 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 with the Center, visit <http://bioontology.org/> or email [support@bioontology.org](mailto:support@bioontology.org).