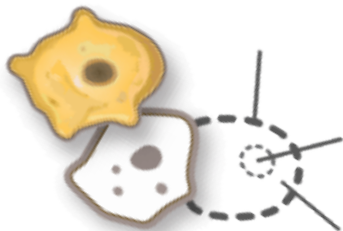
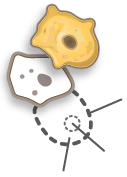


Web Services and Development of Semantic Applications

Trish Whetzel
Outreach Coordinator

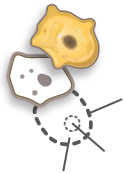


THE NATIONAL CENTER FOR
BIOMEDICAL ONTOLOGY



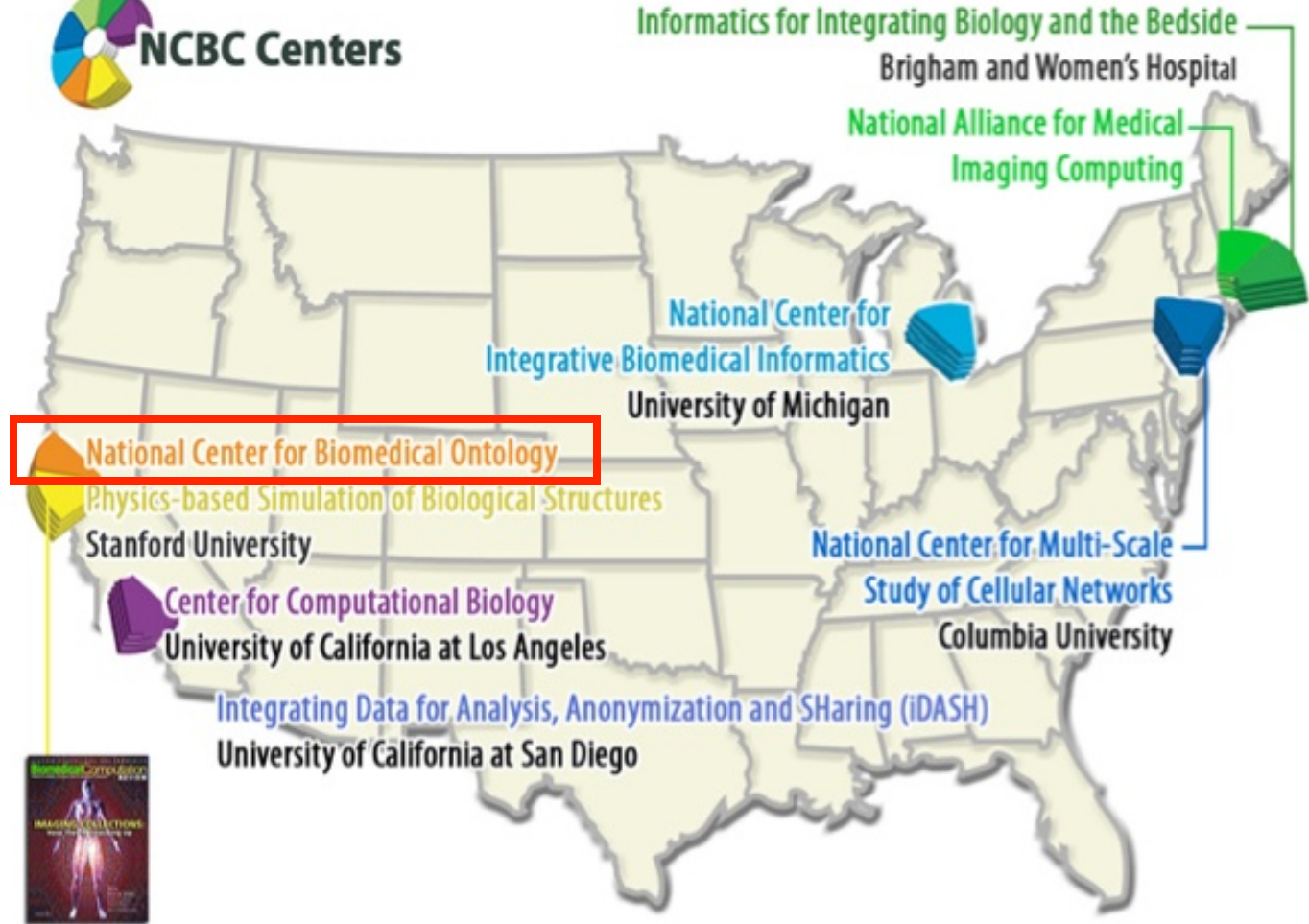
Introductions

- Who you are
- What organization are you from
- What projects do you work on
- How do you want to incorporate the Web services into your project

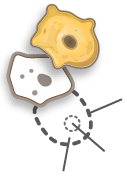


National Center for Biomedical Ontology

- Mission
 - To create software for the application of ontologies in biomedical science and clinical care
- NCBO Partners
 - Stanford University - Dr. Mark A. Musen
 - Mayo Clinic - Dr. Christopher G. Chute
 - University of Buffalo - Dr. Barry Smith
 - University of Victoria - Dr. Margaret-Anne Storey



National Centers for Biomedical Computing
(<http://www.ncbcs.org>)



NCBO Key Activities

- We ***create and maintain a library*** of biomedical ontologies
- We ***build tools and Web services*** to enable the use of ontologies
- We ***collaborate with scientific communities*** that develop and use ontologies



Search

Search Site

Search Google

LOGIN

Home

News & Events

Dissemination & Training

Collaboration

Community

Technology

About Us

Like 111

Of Current Interest

- ▶ **News:** Study Extracts Vioxx Heart-Attack Risk from EMRs, Shift from Ontology Development to Use
- ▶ **Webinar:** Wed, Dec. 7, 10:00am PT, Stephen Wu, Mayo Clinic, UMLS Term Occurrences in Clinical Notes: A Large Scale Corpus Analysis
- ▶ **Recent Publication:** Whetzel, PL, et al. (2011): BioPortal: enhanced functionality via new Web services...
- ▶ **Recent Release:** BioPortal 3.4 (Oct 31, 2011)
- ▶ **NCBO Webinar Announcements - Subscribe**
- ▶ **NCBO Software Support - Mailing List Archive**
- ▶ **More News & Events**

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National Center for Biomedical Ontology

Community

Learning About Ontologies

Dissemination & Training

NCBO Collaborations

Forum, Blog Publications

Technology

Ontology Library

Go to BioPortal

Data Annotation

Go to Annotator

Ontology Development

Data Access Using Ontologies

Go to Resource Index

NCBO User Profile

Susanna-Assunta Sansone, Eamonn Maguire, Philippe Rocca-Serra
University of Oxford



"Our job is to contribute to the realization of the data sharing vision..."

More >

Other profiles >

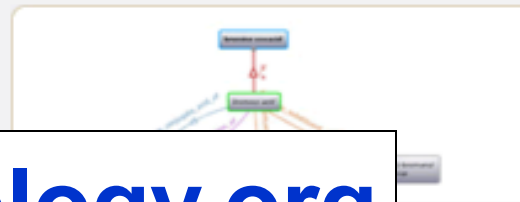
Video

Learn about Biomedical Ontologies. Watch a series of introductory videos.

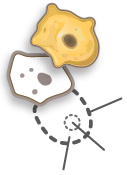


Browse ontologies in BioPortal!

BioPortal allows users to browse, search and visualize ontologies.

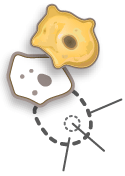


www.bioontology.org



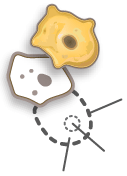
Links of Interest

- Web service tutorial document:
<http://bit.ly/ncbo-amia-demo>



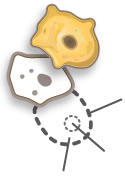
Outline

- Learning Objectives
- REST Web services
- BioPortal
- NCBO Web Services



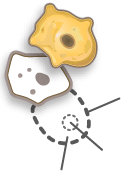
Learning Objectives

- Learn what Web services are available from NCBO
- Learn how to programmatically use these Web services
- Learn how to combine these Web services to perform tasks



REST Web Services

- Accessed via HTTP
 - <http://rest.bioontology.org/{parameters}>
- Each unique URL is a representation of some object
- Operations include GET, POST, PUT, DELETE
- Lightweight, easy to build



BioPortal Browse Search Projects Annotate All Mappings All Resources Alpha Sign In Register Help/About Send Feedback

Welcome to the NCBO BioPortal

Use BioPortal to access and share ontologies that are actively used in biomedical communities. You can search for terms in ontologies (try typing "Melanoma" in the "Search all ontologies" box in the left column), browse a list of ontologies in BioPortal (type "NCI Thesaurus" in the "Find an ontology" box in the middle column), search biomedical resources that we automatically annotated with ontology terms (try typing "Melanoma" in the "Search resources" box in the right column). You can create ontology-based annotations for your own text, link your own project that uses ontologies to the description of those ontologies, find and create relations between terms in different ontologies, review and comment on ontologies and their components as you browse them. Sign in to BioPortal to submit a new ontology or ontology-based project, provide comments on ontologies or add ontology mappings.

Search all ontologies

[Advanced Search](#)

Find an ontology

[Browse Ontologies >](#)

Search resources

[Advanced Resource Search](#)

Most Viewed Ontologies (May, 2010)

Ontology	Views
NCBI organismal classification	1612
NCI Thesaurus	1567
SNOMED Clinical Terms	1170
RadLex	880
Foundational Model of Anatomy	804

Latest Notes

[relationship with Smoking Behavior \(NCI Thesaurus\)](#) 19 days ago by [discourtesy](#)
Seems odd that Tobacco Use as a term is disconnected from the term Smoking Behavior. Although To...

[terms to add under technique \(NanoParticle Ontology\)](#) 24 days ago by [dgt78](#)
electron microscope analysis environmental transmission electron microscopy spectrophotometry etc...

[terms to add under instrument \(NanoParticle](#)

Latest Mappings

[JERMOntology:BioMaterial \(SysMO-JERM\) => BioMaterial \(MGED Ontology\)](#)
BioPortal UID:0710.kawolstercroft

[BioMaterial \(MGED Ontology\) => JERMOntology:BioMaterial \(SysMO-JERM\)](#)
BioPortal UID:0710.kawolstercroft

[JERMOntology:ReplicateType \(SysMO-JERM\) => ReplicateDescriptionType \(MGED Ontology\)](#)
BioPortal UID:07110.kawolstercroft

[ReplicateDescriptionType \(MGED Ontology\) => JERMOntology:ReplicateType \(SysMO-JERM\)](#)
BioPortal UID:07110.kawolstercroft

User Interface

```
use strict;
use LWP::UserAgent;
use URI::Escape;
use List::Util qw{first max maxstr min minstr reduce shuffle sum};

$|=1;

# Read in text to annotate, this is just a dump of the _EF table for any resource in OBR:
my $fTestSet;
open( PUBMED, "C:/All_current_work/NCBO/Optima/QC/Pubmed/Pubmed_EF.txt" ) or die "Can't open t
open( PUBMED, "../Pubmed_EF.txt" ) or die "Can't open input file\n";
while (<PUBMED>){
    chomp $_;
    my ($elementID, $localElementID, $dictionaryID, $SNM3_title, $SNM3_abstract, $SNM3_lo
meshheading) = split /\t/;
    $fTestSet{$localElementID} = "$SNM3_title $SNM3_abstract";
}
print "Done reading input file\n";
print scalar keys %$fTestSet, " entries in file\n";

# create a user agent
my $ua = new LWP::UserAgent;
my $time1 = time;
my $sofTime = 0;
my $sofWords = 0;
# make request to the desired URL
# http://ncbo-obs-stage1.stanford.edu:8080/obs_hibernata/annotator
# http://ncbo-obs-prod1.stanford.edu:8080/obs_hibernata/annotator
my $req = new HTTP::Request 'POST' => "http://rest.bioontology.org/obs_hibernata/annotator";
$req->content_type('application/x-www-form-urlencoded');

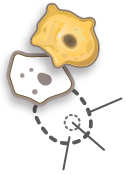
my $numTests = 0;
my %fTestText = shuffle (sort keys %$fTestSet);
foreach my $k (%fTestText){
    # set parameters
    my $text = $fTestSet{$k};
    # $text = "African"
```

Code

```
<-access>
<-data>
<-list>
  <-ontologyBean>
    <id>40133</id>
    <ontologyId>1200</ontologyId>
    <displayName>ABA Adult Mouse Brain</displayName>
    <description>Allen Brain Atlas P56 Mouse Ontology</description>
    <abbreviation>ABA</abbreviation>
    <format>OWL</format>
    <internalVersionNumber>1</internalVersionNumber>
    <versionNumber>1.0</versionNumber>
    <contactName>Allen Institute for Brain Science</contactName>
    <contactEmail>chibba@alleninstitute.org</contactEmail>
    <statusId>3</statusId>
  <-categoryId>
    <id>2817</id>
    </categoryId>
    <isFoundry>0</isFoundry>
    <dateCreated class="sql-timestamp">2009-06-25 15:52:15.0</dateCreated>
  </ontologyBean>
  <-ontologyBean>
    <id>40223</id>
    <ontologyId>1099</ontologyId>
    <displayName>African Traditional Medicine</displayName>
    </description>
    <description>
      African Traditional Medicine Ontology (ATMO) describes the actors' function (healer, fe
      roles and the disease consideration.
    </description>
    <abbreviation>ATMO</abbreviation>
    <format>OBO</format>
```

Browser

Web Services



Outline

- REST Web services
- **BioPortal**
- NCBO Web Services
- BioPortal SPARQL Endpoint

Welcome to BioPortal! For help using BioPortal, click on this icon: ?

Search all ontologies

Enter term, e.g. Melanoma

Search

[Advanced Search](#)

Find an ontology

Enter ontology name, e.g. NCI Thesaurus

Explore

[Browse Ontologies >](#)

Search resources

Enter a term, e.g. Melanoma

Search

[Advanced Resource Search](#)

Most Viewed Ontologies (October, 2011)

Ontology	Views
National Drug File	7975
SNOMED Clinical Terms	3977
MedDRA	3293
Medical Subject Headings	1620
NCI Thesaurus	1227

Latest Notes

[RE: what's the difference between this note and notes on mappings? \(Biomedical Resource Ontology\)](#) about 1 month ago by whetzel
The Term Notes refer to comments or actions requested on Terms in the ontology. The Mapping Notes...

[what's the difference between this note and notes on mappings? \(Biomedical Resource Ontology\)](#) 2 months ago by imposimon
Would you guys please answer this for me?

[Re: Why have you deprecated this? \(Biomedical Resource Ontology\)](#) 4 months ago by whetzel
This term was deprecated because there was a typo in the term name.

[Why have you deprecated this? \(Biomedical](#)

Latest Mappings

[b117. Intellectual functions \(International Classification of Functioning, Disability and Health \(ICF\)\) => Ability to perform cognitive activity \(SNOMED Clinical Terms\)](#)
11/18/11 samsontu

[b110. Consciousness functions \(International Classification of Functioning, Disability and Health \(ICF\)\) => Consciousness related finding \(SNOMED Clinical Terms\)](#)
11/18/11 samsontu

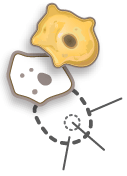
[b114. Orientation functions \(International Classification of Functioning, Disability and Health \(ICF\)\) => Orientation \(SNOMED Clinical Terms\)](#)
11/18/11 samsontu

[b1109. Consciousness functions, unspecified \(International Classification of Functioning, Disability and Health \(ICF\)\) => Consciousness](#)

Statistics

Ontologies	294
Terms	5,670,579

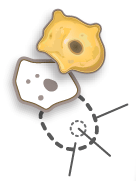
<http://bioportal.bioontology.org>



Outline

- REST Web services
- BioPortal
- **NCBO Web Services**
- BioPortal SPARQL Endpoint

<http://rest.bioontology.org>



Ontology Services

Views

- Search
- Traverse
- Comment
- Download

Mapping Services

- Create
- Upload
- Download

Widgets

- Tree-view
- Auto-complete
- Graph-view

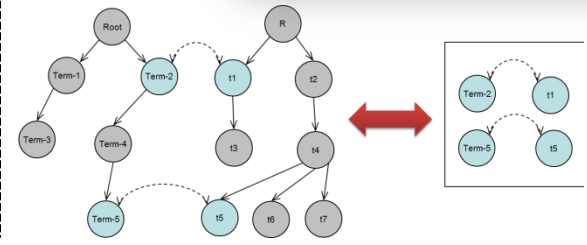
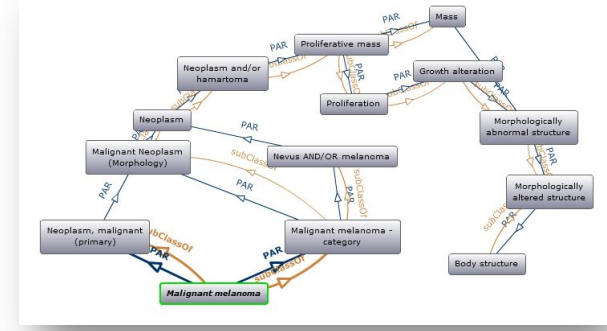
Annotation

Term recognition

Data Access

Fetch "data" annotated with a given term

<http://bioportal.bioontology.org>

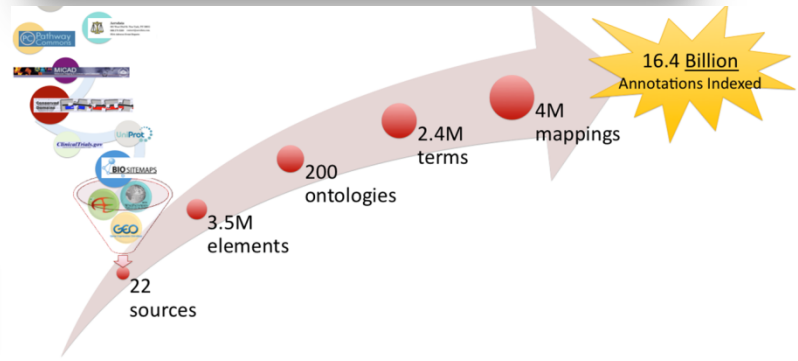


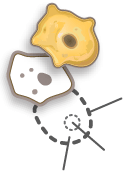
Jump To:

Legend

- Malignant melanoma (synonym)
- Amelanotic melanoma (preferred name)
- Excision of melanoma (preferred name)
- Melanoma in situ (preferred name)
- Melanoma vaccine (preferred name)

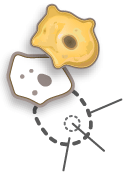
Expression, Expression of bladder, bladder, smooth, bladder muscle, muscle, smooth muscle, cells, mechanical, mechanical stimulation, stimulation, Chronic, results, bladder overdistension, associated, associated with, with, loss, genes, altered





ONTOLOGY WEB SERVICES

Accessing, browsing, searching and traversing ontologies in *Your* application



Ontology Web Services

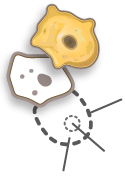
- List All Ontologies
 - List all ontologies in BioPortal
 - Documentation: <http://bit.ly/sxL2Qi>
 - GoogleDoc Excel example:
<http://bit.ly/ncbo-list-all-ontologies>

One ontology id has many ontology version ids

```
- <success>
  <accessedResource>/bioportal/ontologies</accessedResource>
  <accessDate>2011-12-04 22:01:39.603 PST</accessDate>
- <data>
  - <list>
    + <ontologyBean></ontologyBean>
    + <ontologyBean></ontologyBean>
    + <ontologyBean></ontologyBean>
    - <ontologyBean>
      <id>44776</id>
      <ontologyId>1351</ontologyId>
      - <virtualViewIds>
        <int>1420</int>
        <int>1456</int>
      </virtualViewIds>
      <internalVersionNumber>3</internalVersionNumber>
      - <userIds>
        <int>38134</int>
      </userIds>
      <versionNumber>2011_2010_08_30</versionNumber>
      <isRemote>0</isRemote>
      <statusId>3</statusId>
      <dateCreated>2010-11-09 11:16:42.0 PST</dateCreated>
      <dateReleased>2010-08-30 00:00:00.0 PDT</dateReleased>
      <isManual>1</isManual>
      <displayLabel>Medical Subject Headings</displayLabel>
      - <description>
        Medical Subject Headings (MeSH);National Library of Medicine;February, 2009;Bethesda, MD;ENG
      </description>
      <abbreviation>MSH</abbreviation>
      <format>RRF</format>
```

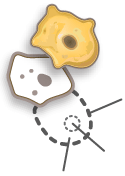
Ontology version id

Ontology id



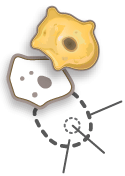
Ontology Web Services cont.

- Search
 - Search by term or term identifier across all ontologies in BioPortal
- Documentation: <http://bit.ly/tMDkr6>
- GoogleDoc Excel example:
- Example clients
 - Java: <http://bit.ly/ttTb1G>
 - Perl: <http://bit.ly/sPXC2X>



Ontology Web Services cont.

- Term
 - get details about a term including it's definition, synonyms, URI, super- and sub-classes, and other properties <http://bit.ly/teedbd>
- Hierarchy
 - get parent, children, and sibling terms <http://bit.ly/tPzm75>



RightField

RightField - /home/sowen/Downloads/microarray1.xls

File Edit Insert

	A	B	C
1	[IDF] Investigation Descrip...		
2			
3	# MAGE-TAB template Submiss...		
4			
5			
6			
7	# This section contains the top-l...		
8	Assay Title	<i>Title</i>	
9	Experiment Class	<i>Transcriptomics</i>	
10	Experiment Description		
11	Experimental Design	<i>Design Type</i>	
12			
13	# Please create as many Experi...		
14	# describe the variables investig...		
15	Experimental Factor Name	<i>TIME</i>	
16	Experimental Factor Type	<i>time</i>	
17			
18	# Quality Control Type example...		
19	Quality Control Type	<i>biological_replicate</i>	
20			
21	# Dates should be entered in th...		
22	# It is recommended that you s...		
23	# to help avoid any unwanted c...		
24	Public Release Date	<i>YYYY-MM-DD</i>	
25			
26	# Please list contact details in c...		
27	Person Last Name	<i>name</i>	
28	Person First Name		
29	Person SEEK ID	<i>SEEK/ID</i>	
30	Person Mid Initials		
31	Person Email		
32	Person Phone		
33	Person Address		
34	Person Affiliation		
35	Person Roles	<i>submitter</i>	
36	# Submitter is the same as per...		
37	# Please list all publications asso...		
38	PubMed ID		
39			

CELLS: B11:B11

HIERARCHY

Experi...

- ExperimentalFactor
- ExperimentalFactorCate...
- ExperimentDesign
- ExperimentDesignType
- FactorValue
- FactorValueDependenc...
- FactorValueSet
- NormalizationDescriptio...
- NormalizationDescriptio...

TYPE OF ALLOWED VALUES

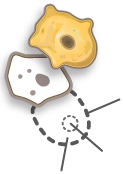
- "Free text"
- "Direct subclasses"
- "Subclasses"
- "Instances"
- "Direct instances"

ALLOWED VALUES

- RNA_stability_design
- all_pairs
- array_platform_variation_design
- binding_site_identification_desi
- cell_component_comparison_de
- cell_cycle_design
- cell_type_comparison_design

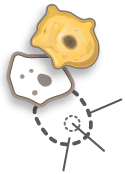
IDF SDRF

<http://www.sysmo-db.org/rightfield>



ECG Gadget

The screenshot displays the CVRG Grid Node web application. The main interface includes a navigation bar with 'Back', 'Forward', 'Refresh', 'Stop', and 'Compile/Browse' buttons. The central area shows an ECG waveform for 'Lead II Amplitude (mV) -69' on '19:08 January 01, 1970'. A red box highlights an annotation: 'A, MN Code 1-1-1 Q/R amplitude ratio >= 1/3, plus Q duration >= 0.03 sec.' The left sidebar contains 'Connect', 'Store', 'Visualize', 'Analyze', and 'Review' options. A 'Time & Amplitude' dialog box is open, showing 'Second: 1 .00' and 'Ontology: MN Code 1-1-1'. The 'Annotation' field contains the text: 'Q/R amplitude ratio >= 1/3, plus Q duration >= 0.03 sec.' Below the dialog are 'Save', 'Delete', and 'Close' buttons. The bottom of the page features the URL: <http://wiki.cvrgrid.org/index.php/ECGGadget>

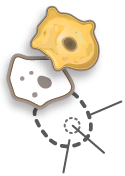


ISAcreeator

The screenshot displays the ISAcreeator application window. At the top, there is a menu bar with 'file', 'view', and 'help'. Below it is a toolbar with icons for various data types: 'fact', 'char', 'prot', and 'para'. The main area is divided into several sections:

- OVERVIEW:** Shows a tree view of growth control experiments. Under 'BII-S-1', there are four data files: 's_BII-S-1.txt', 'a_proteome.txt', 'a_metabolome.txt', and 'a_transcriptome.txt'. Under 'BII-S-2', there is no data listed.
- Table:** A table with columns: 'Data Transformation Name', 'Derived Data File', 'Factor Value[limiting nutrient]', 'Factor Value[rate]', and 'Unit'. It lists 15 rows of transformations (1-3) with their corresponding PRIDE files and factor values for sulphur, carbon, and nitrogen.
- ontologylookup:** A search window where 'nitrogen' has been entered. It shows 279 results across 18 ontologies. The 'CCO - Cell Cycle Ontology' is expanded, showing 'CHEBI - Chemical Entities of Biological Interest' with 'CHEBI:Nitrogen' selected. The 'recent history' panel on the right lists various terms like 'UO:microliter', 'EFO:genotype', etc.
- INFORMATION:** A panel on the left showing 'ontology term information' for 'Nitrogen'. It lists 'source ref: CHEBI' and 'accession no: 17997'. A red arrow points from the 'CHEBI:Nitrogen' entry in the ontology lookup window to this information panel.

<http://isatab.sourceforge.net/isacreeator.html>



DOG4DAG Ontology Generation Tool for OBO-Edit and Protégé

The screenshot displays the DOG4DAG tool interface, which is used for generating ontologies from external sources. The main window shows the 'Go3R-GCI' ontology being edited. The 'Onology Lookup Service Settings' panel is open, showing the 'Service' set to 'NCBO BioPortal Service' and the 'Language' set to 'English'. The 'Network Proxy Settings' panel is also visible, with fields for URL, Port, User, and Password, and buttons for 'Reset' and 'Save'.

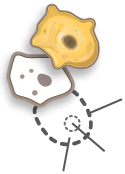
The 'Ontology Generation' panel is active, showing 'Step 1: Term Generation'. The 'Query PubMed' field contains the text 'skin sensitization'. The results list includes the following terms:

- local lymph node assay
- THP-1 cells
- skin [FMA:7163, TAO:0000368, EHDA:95]
- dinitrochlorobenzene
- dendritic cell
- allergen [BS:01016]
- hapten [CHEBI:59174]
- worker
- Langerhans cells

'Step 2: Definition Generation' is also visible, showing the 'Find Definitions for:' field set to 'local lymph node assay' and the 'Generate Definitions' button. The results list includes the following definitions:

- local lymph node assay** is a **well-established method for assessing skin sensitization**; it involves the
- local lymph node assay** is an **alternative method** for the identification of chemicals that have the ability to ...
- local lymph node assay** is a **new mouse test** for the detection of skin sensitizing activity.
- local lymph node assay** is an alternative to the guinea pig sensitization test used to ...
- murine Local Lymph Node Assay** is a **test method** for assessing the allergic contact dermatitis (skin
- It was determined that for de novo investigations, the **Local Lymph Node Assay** is the **recommended method for**

The bottom status bar indicates 'No Reasoner set. Select a reasoner from the Reasoner menu' and 'Show Inferences' is checked.



Word Add-in

Background

Tuberculosis (TB) remains a major cause of **mortality** in developing countries, and in these countries diabetes **prevalence** is increasing rapidly. Diabetes increases the risk of TB. Our aim was to assess the potential impact of diabetes as a risk factor for incident pulmonary tuberculosis, using India as an example.

Methods

We constructed an epidemiological model using data on tuberculosis **incidence**, diabetes **prevalence** with diabetes. We

Results

In India in 2000 there were an estimated 20.7 million adults with diabetes, and 900,000 incident adult cases of pulmonary tuberculosis. Our calculations suggest that diabetes accounts for 14.8% (uncertainty range 7.1% to 23.8%) of pulmonary tuberculosis and 20.2% (8.3% to 41.9%) of smear-positive (i.e. infectious) tuberculosis.

We estimate that the increased diabetes prevalence in urban areas is associated with a 15.2% greater smear-positive tuberculosis incidence in urban than rural areas – over a fifth of the

BioLit Info Pane

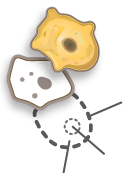
BROWSER INFO

incidence

- INFECTIOUS DISEASE ONTOLOGY
 - quality
 - quality of infectious disease
 - incidence
- INFECTIOUS DISEASE ONTOLOGY
 - quality
 - quality of infectious disease
 - incidence

Ontology Name:

Page: 1 of 2 Words: 244

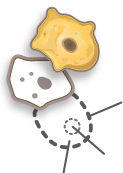


cgMDR

The screenshot displays two windows side-by-side. The left window is a Windows Internet Explorer browser showing the NCBO BioPortal page for the 'clinician' ontology class. The page includes a search bar with 'clinician' entered, a 'Link Here' button, and a 'Subscribe' button. Below the search bar, there are tabs for 'Details', 'Visualization', 'Notes (0)', 'Mappings (3)', and 'Resource Index'. The 'Details' tab is active, showing the ID '10231:D', the full ID 'http://purl.bioontology.org/ontology/HL7/10231_D', and a definition: 'Only clinicians may see this item, billing and administration persons can not access this item without special permission.'

The right window is a Microsoft Excel spreadsheet. The formula bar shows the text '10231:D:clinician' in cell A1. The 'Query Metadata' panel is open, showing search results for 'clinician'. The 'Results' section lists 'Clinician', 'clinician', 'clinician', 'Clinician', and 'Clinician'. The 'Definition' section shows the same definition as the BioPortal page: 'Only clinicians may see this item, billing and administration persons can not access this item without special permission.'

<http://cancergrid.org/index.php>



openMDR

openMDR

Searching for a reference uri

community.org https://mdr-dev.triadcommunity.org:8443/exist/rest/db/mdr/edit/popup-search-reference-uri.xquery?element=940cdfb5-ef3c-45fe-8b4d-3a44cf77f180

Search Patient BioPortal-HL7 Submit query Clear

- LexEVS REST interface supports case sensitive search only at this time!

Preferred Name

Context * CCTS

Name * Patient

Preferred

Definition please complete definitions_...

Language Identifier US eng

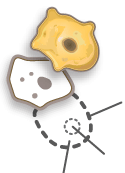
Source

ObjectClass specific properties

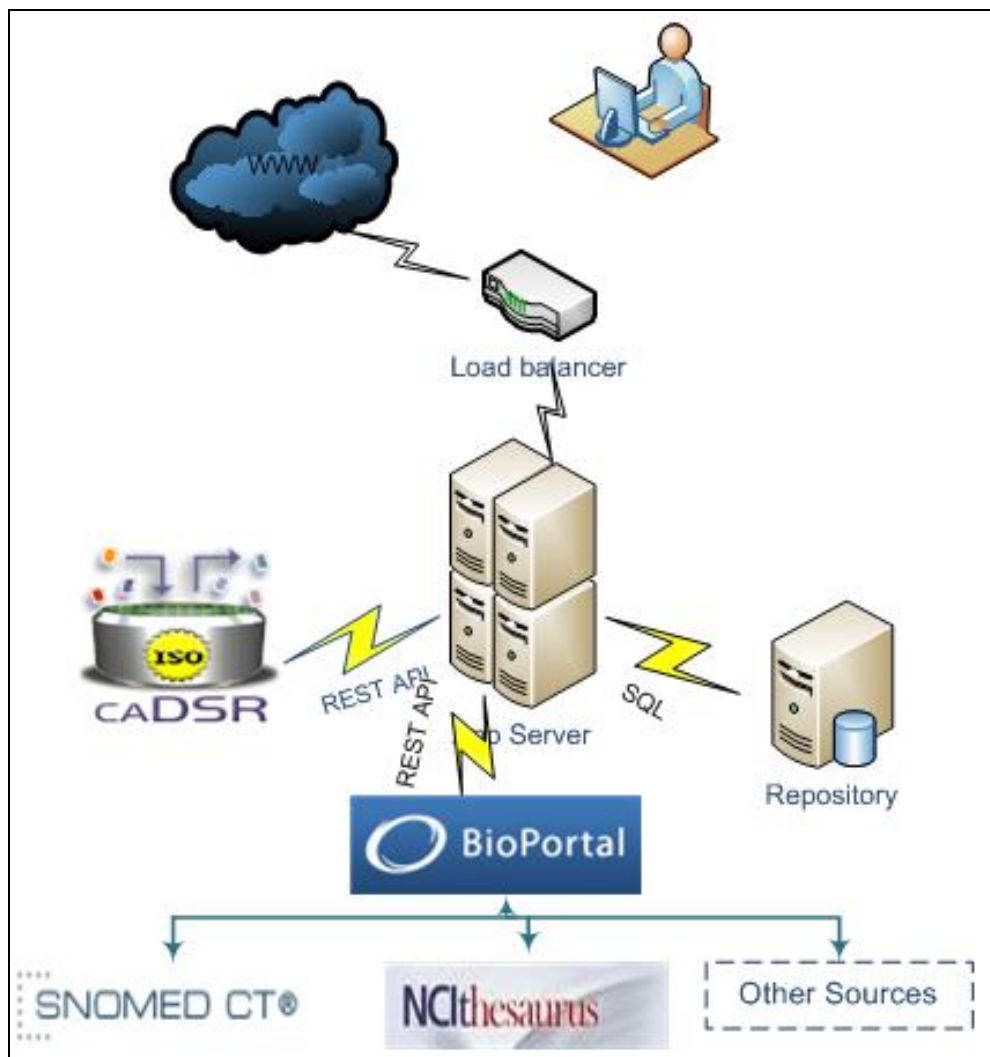
Concept Reference 1 |lexevsapi.nci.nih.gov_NCI_MetaThesaurusConcept_C0009853 | get concept | delete uri entry 1

Concept Reference 2 |lexevsapi.nci.nih.gov_NCI_ThesaurusEVS_C15239 | get concept | delete uri entry 2

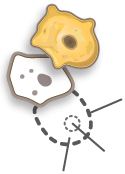
<http://citih.osumc.edu/projects/project&r=1032>



eleMap



<https://victr.vanderbilt.edu/eleMAP/>



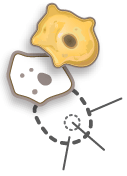
BioPortal Import Plugin

The screenshot shows the Protégé 3.4.7 interface with the 'Import classes from BioPortal' dialog box open. The dialog box is titled 'Import classes from BioPortal' and contains a search bar for selecting a BioPortal ontology. The selected ontology is 'SNOMED Clinical Terms'. Below the search bar, there is a 'Jump To:' field and a list of classes. The 'Body structure' class is selected and highlighted. To the right of the class list, a table displays the properties and values for the selected class.

Property	Value
ID	123037004
Full Id	http://purl.bioontology.org/ontology/SNOMEDCT/123037004
Label	Body structure
Synonyms	Body structures, Body structure (body structure)
ChildCount	9
CONCEPTSTATUS	0
CTV3ID	XUStN
ISPRIMITIVE	1
Semantic_Type	Anatomical Structure
SNOMEDID	T-D000A

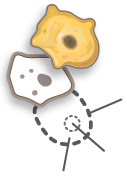
Below the table, there are links for 'Anatomical site notations for tumor staging', 'Nonspecific site', and 'Physical anatomical entity'.

http://protegewiki.stanford.edu/wiki/BioPortal_Import_Plugin



WIDGETS

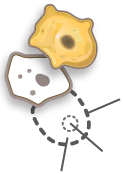
Using NCBO technology on your web pages



Widgets

- Form auto-complete – auto-complete function and can return term URI, term ID or term name
- Jump To – auto-complete function to select term and Jump To BioPortal to view term details
- Visualize widget – view the ontology structure and relations
- Tree widget – view the ontology tree

[Code for widgets is available on BioPortal](#)



Widgets

Example 1 (start typing the term name to get its full URI)

Example 2 (get the ID for a term)

Example 3 (get the preferred name for a term)

- melanocyte** (preferred name)
- MELAS syndrome** (preferred name)
- Drosophila **melanogaster** (preferred name)
- melanoma** (preferred name)
- Drosophila

Form auto-complete

Jump To:

- melanoma** (preferred name)
- cutaneous **melanoma** (preferred name)
- metastatic **melanoma** (preferred name)
- amelanotic skin **melanoma** (preferred name)

Example 1
 Results provided by NCBO BioPortal

Jump To

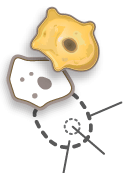
Get RSS feed for changes in Experimental Factor Ontology

[Ontology added](#) 11/05/09
Ontology Experimental Factor Ontology version 1.7 was added to the repository

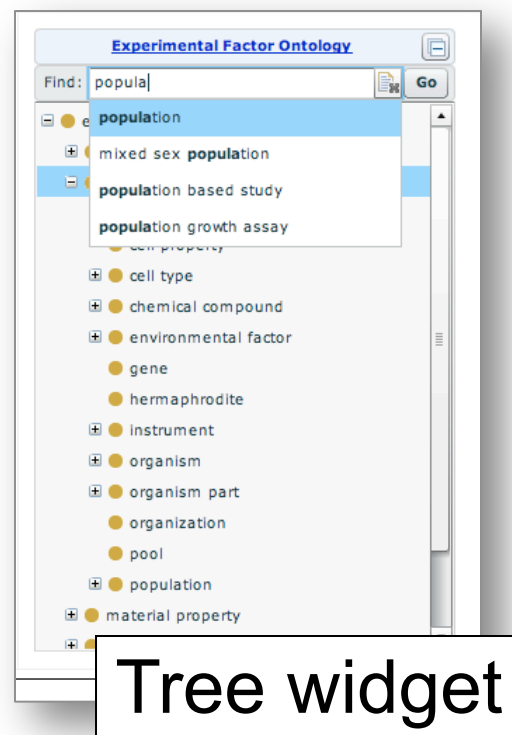
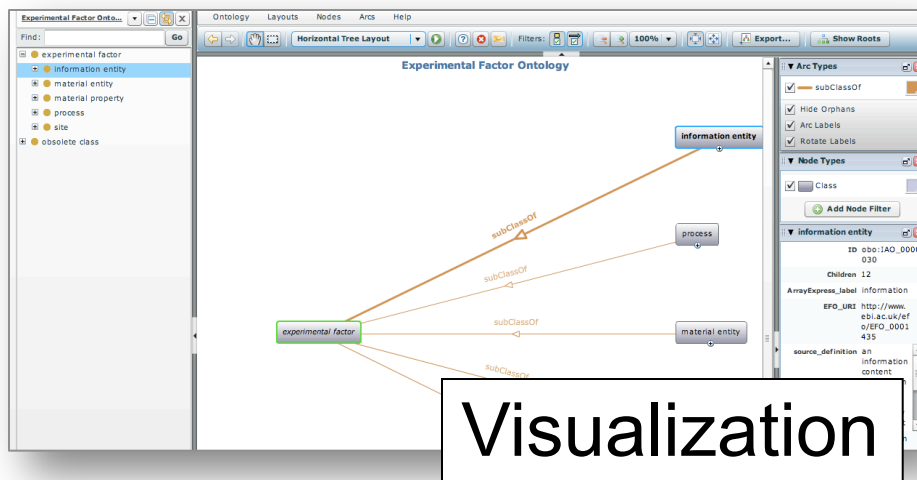
[Ontology added](#) 10/07/09
Ontology Experimental Factor Ontology

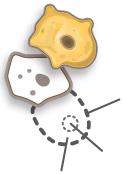
BioPortal

RSS feed



Widgets





RedFly

NCBO BioPortal Ontology Visualization

Ok Cancel

Double click on the structure you would like, either in the tree view on the left or the main view in the center.
Then click the "ok" button below to add it to your search.

Drosophila gross anatomy

Find: wing Go

Ontology Layouts Nodes Arcs Help

Vertical Tree Layout Filters: 100% Show Roots

Drosophila gross anatomy

part_of develops_from

wing

dorsal mesothoracic disc

part_of part_of part_of part_of part_of part_of part_of part_of part_of part_of part_of

sal wing blade wing nerve wing sensillum chordotonal organ of wing wing blade wing hinge

▼ Arc Types

- develops_from
- is_a
- part_of
- Hide Orphans
- Arc Labels
- Rotate Labels

▼ Node Types

- concept

▼ wing

ID	FBbt:00004729
Children	11
xref_definition	FB:gg
subset	cur

Position ?

5' to gene

Chr:

Any

Restrict Evidence

Select Evidence

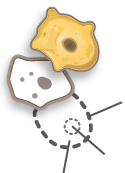
Ontology/ID

FBbt:00004729

Last Updated After... ?

Entry Added After... ?

<http://redfly.ccr.buffalo.edu/index.php>



Radiological Society of North America

RSNA Informatics™
RadLex®

RadLex Tree Browser

radiolog

imaging procedure (Synonym)
interventional radiology procedure (Synonym)

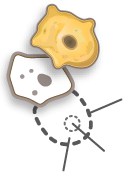
Results provided by [NCBO BioPortal](#)

- Radlex disjoined term
- Radlex conjoined term
- Continuant
 - Dependent continuant
 - Pathophysiologic process
 - Procedure
 - Marking for intervention
 - Treatment
 - Ablation
 - Thrombolysis
 - Chemoembolization
 - Interventional radiology procedure**
 - Stent placement
 - Balloon dilation procedure
 - Temporary occlusion
 - Dilation of structure
 - Brachytherapy

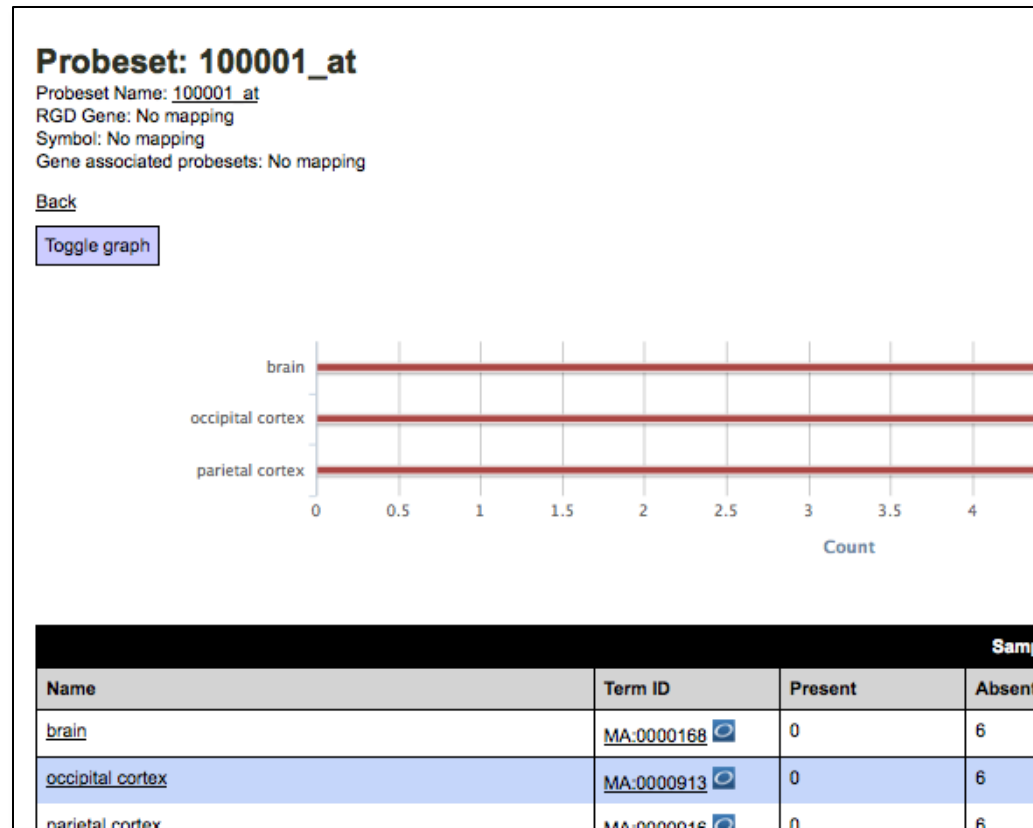
[Visualize](#)

Preferred Name: Interventional radiology procedure
RadLex ID: [RID10367](#)
PURL: <http://www.radlex.org/RID/RID10367>
Definition: Subspecialty of radiology that combines organ system radiography, catheter techniques and sectional imaging. [MeSH]
Synonyms: interventional radiology
Subtypes: [stent placement](#), [balloon dilation procedure](#), [temporary occlusion](#), [dilation of structure](#)
Is a: [treatment](#)

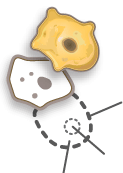
<http://radlex.org/>



GMiner



<http://gminer.mcw.edu/>



Knowledge Egg

 **Kunnskapsegget** Dypdykk i medisin & helsefag

denosumab SØK

Kunnskapsegget Legemiddelsøk Kodeverk Ordbøker

Alternative søketermer
Denosumab, denosumab 60 MG/ML, denosumab 70 MG/ML, denosumab Injectable Solution, denosumab Injectable Solution [Prolia], denosumab Injectable Solution [Xgeva], denosumab Prefilled Syringe

KBP Fagprosedyrer
Fagprosedyrer (0)

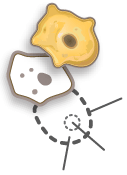
KBP oppslagsverk
100+ BestPractice, Clinical Evidence, UpToDate (2)

Retningslinjer & kvalitetsvurderte systematiske oversikter
COCHRANE DARE, Retningslinjer helsebiblioteket (1), Kval. vurd. syst. oversikter McMaster PLUS (0), Best practice Joanna Briggs, Retningslinjer NHS (1)

Systematiske oversikter
COCHRANE (1), Syst. Reviews Joanna Briggs, Systematiske oversikter McMaster PLUS (1)

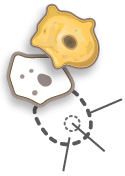
Kvalitetsvurderte enkeltstudier & meta-analyser

<http://www.kunnskapsegget.no/>



NOTES WEB SERVICES

Propose new terms and comment on ontologies



Notes Web Service

- Add term proposals and comments on ontology terms
- Documentation:
http://www.bioontology.org/wiki/index.php/Ontology_Notes

Notes

[Subscribe to notes emails](#)

Show entries

[Filtering Options >](#)

Search:

SUBJECT	AUTHOR	TYPE	TARGET	CREATED
New Term Proposal: Exercise Study Facility <small>archived</small>	Mette	New Term Proposal	Physiology Facility (Class)	06/15/2010

New Term Proposal: Exercise Study Facility archived

New Term Proposal submitted by Mette over 1 year ago on [Physiology Facility](#) in [Biomedical Resource Ontology](#)

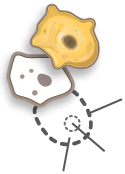
PREFERRED NAME	Exercise Study Facility	PROVISIONAL ID	PARENT	http://bioontology.org/ontologies/BiomedicalResourceOntology.owl#Physiology_Facility
REASON FOR CHANGE	Physiology facility child	STATUS	CONTACT INFO	
SYNONYMS				
DEFINITION	A facility or core devoted to exercise studies			

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

RE: New Term Proposal: Exercise Study Facility by whetzel over 1 year ago

Can you expand on what an exercise study is?

reply



WebProtégé

The screenshot displays the WebProtégé interface with three main panels highlighted by red boxes:

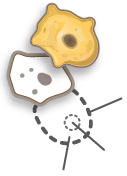
- Panel 1 (Classes):** A tree view of classes. The 'Physiology Facility' class is selected and highlighted in blue.
- Panel 2 (Properties for Physiology Facility):** A table showing properties and their values for the selected class.
- Panel 3 (BioPortal notes and proposals for Physiology Facility):** A table showing notes and proposals, including a dropdown menu for the status.

Property	Value
core:note	pending final vetting: Refine definition
core:prefLabel	Physiology Facility
core:editorialNote	pending final vetting: Refine definition
definition	A facility or core devoted to physiology (http://en.wikipedia.org/wiki/Physiology)
rdfs:label	Physiology Facility

Subject	Date
New Term Proposal: Exercise Study Facility	Tue Jun 15 13:59:36 PDT 2010
RE: New Term Proposal: Sleep Study Facility	Tue Jun 15 22:18:05 PDT 2010
RE: New Term Proposal: Exercise Study Facility	Tue Jun 15 22:23:20 PDT 2010

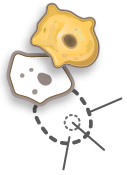
Author: Mette Date: 06/15/10
Type: ProposalForCreateEntity Status: Under review
Body: A facility or core that provides services and equ
Status dropdown: Under review, New term created, Rejected, Linked to existing term

<http://protegewiki.stanford.edu/wiki/WebProtege>



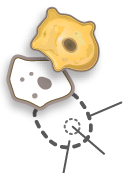
VIEWS

Custom subset of large ontologies



Views and Value Sets

- Users can submit their own derivatives of BioPortal ontologies
 - these which become first-class objects in BioPortal and can be used as all other Web services



Views in BioPortal

Views [Create new view](#)

[Expand All](#) | [Collapse All](#)

▶ **CORE Subset of SNOMED CT**

▶ **Neoplasm_breast_cancer**

▶ **Neoplasm_hamartoma**

▶ **SNOMED Anatomy**

▼ **SNOMED Clinical Findings**

- **Description:** The Clinical Finding subtree of SNOMED CT
- **Definition:** Class subtree of ClinicalFinding
- **Ontology ID:** 2018
- **Definition Language:** Manual

VERSION	BASE VERSION	CREATED	CREATED BY	ONTOLOGY FILE	DIFF FILE	VISIBILITY
1.2	2009_07_31	07/16/2010	Tania Tudorache, tudorache@stanford.edu	Download View		Public
1.1	2009_07_31	03/23/2010	Tania Tudorache, tudorache@stanford.edu	Download View		Public
1.0	2009_01_31	09/09/2009	Tania Tudorache, tudorache@stanford.edu	Download View		Public

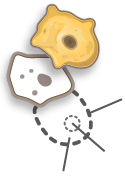
▶ **SNOMED Ethnic Group**

▶ **SNOMED Morphologically Abnormal Structure**

▶ **SNOMED Organism**

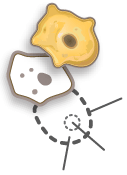
▶ **SNOMED Terminos Clinicos**

▶ **SNOMED Test Findings**



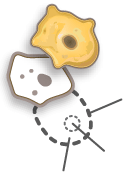
Views and Value Sets

- View Extraction Web service
 - Given a root node term, extracts all child terms
<http://bit.ly/uXeh2s>
- Access directly from Protégé via the BioPortal Import plugin
http://protegewiki.stanford.edu/wiki/BioPortal_Import_Plugin

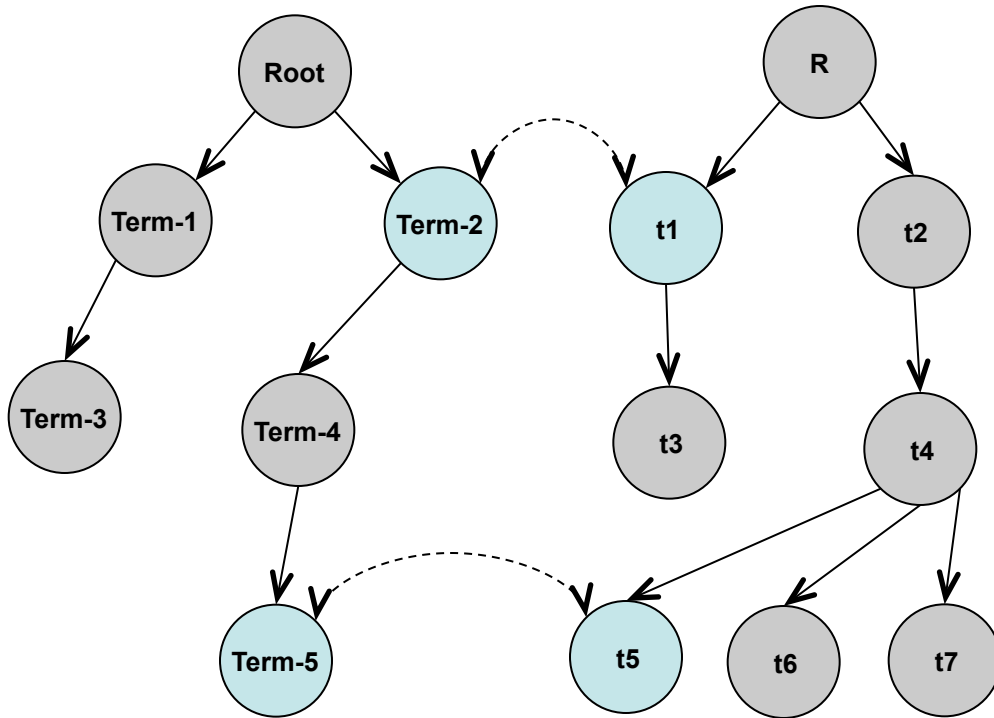


MAPPING WEB SERVICES

Using NCBO technology to integrate terminologies and ontologies

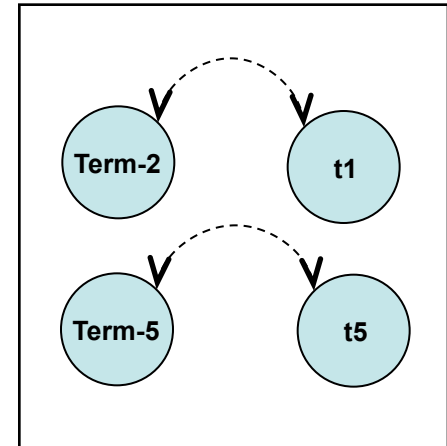


Mappings

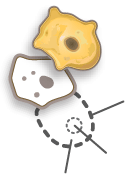


Ontology A

Ontology B



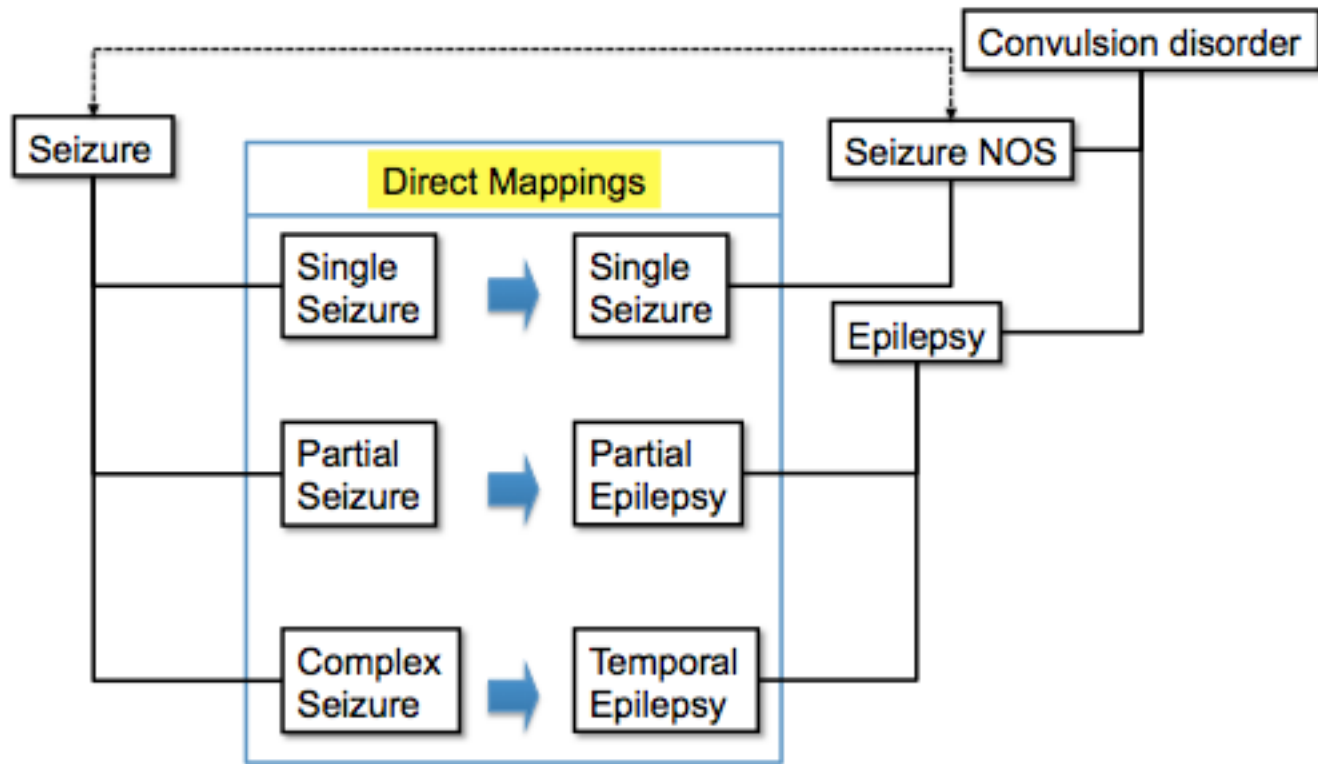
**Upload or Download
mapping subsets**

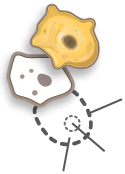


Using Mappings for query federation

FROM (site #1)

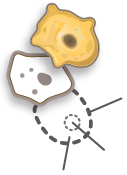
TO (site #2)





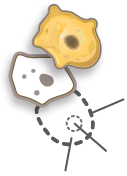
Mappings

- Mappings Web service
 - Documentation:
http://www.bioontology.org/wiki/index.php/BioPortal_Mappings_Service
- Functions
 - Get/Download
 - Create/Upload
- Example Perl client to Get mappings:
<http://bit.ly/tDKPQd>



ANNOTATOR WEB SERVICE

Using Ontologies to Annotate *Your* Data



Annotator: The Basic Idea

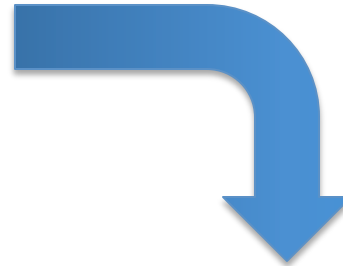
- Tag textual metadata with ontology terms

NCBI GEO - Accession Display [?](#)
GEO Publications | [FAQ](#) | [MIAME](#) | [Email GEO](#)
Not logged in | [Login](#) [?](#)

Scope: [Self](#) | Format: [HTML](#) | Amount: [Quick](#) | GEO accession: [GO](#)

Series GSE12391 [Query DataSets for GSE12391](#)

Status: Public on Sep 30, 2009
Title: Melanoma: comparison between common nevi, radial/vertical growth phase melanoma, metastases and dysplastic nevi
Organism: [Homo sapiens](#)
Experiment type: Expression profiling by array
Summary: **Despite malignant cutaneous melanoma is relatively rare compared to other skin cancers, it is still responsible for 80% of all skin cancer-related deaths. To identify molecular signatures of melanoma progression, excisional biopsies from 18 common melanocytic nevi (CMN), 8 primary radial growth phase melanomas (RGPM), 15 primary vertical growth phase melanomas (VGPM) and 5 melanoma metastases (MTS) were profiled using whole genome oligo-microarrays. Differentially expressed genes for each progression step were identified, and validation of selected transcripts by qRT-PCR was performed on an independent cohort of fixed samples. The comparison between CMN and RGPM showed an enrichment of Gene Ontology (GO) terms related to inter and intra-cellular junctions, whereas the transition from RGPM to VGPM was characterized by the deregulation of WNT3, MAPK and AKT pathways. In this step, enrichment analysis underlined the alteration of biological processes linked to apoptosis. Upregulation of genes involved into DNA double-strand breaks repair and downregulation of cellular adhesion genes were observed in**



Melanoma Genes Malignant melanoma

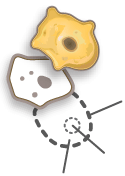
[growth & development](#) [Structural gene](#) [Growth](#) [Skin](#) [Skin](#) [Skin Neoplasms](#)

[Nevus](#) [Neoplasms](#) [Abnormal or excess nevi](#) [DNA](#) [Oncogenes](#) [Genome](#) [Biological Processes](#) [Genome](#)

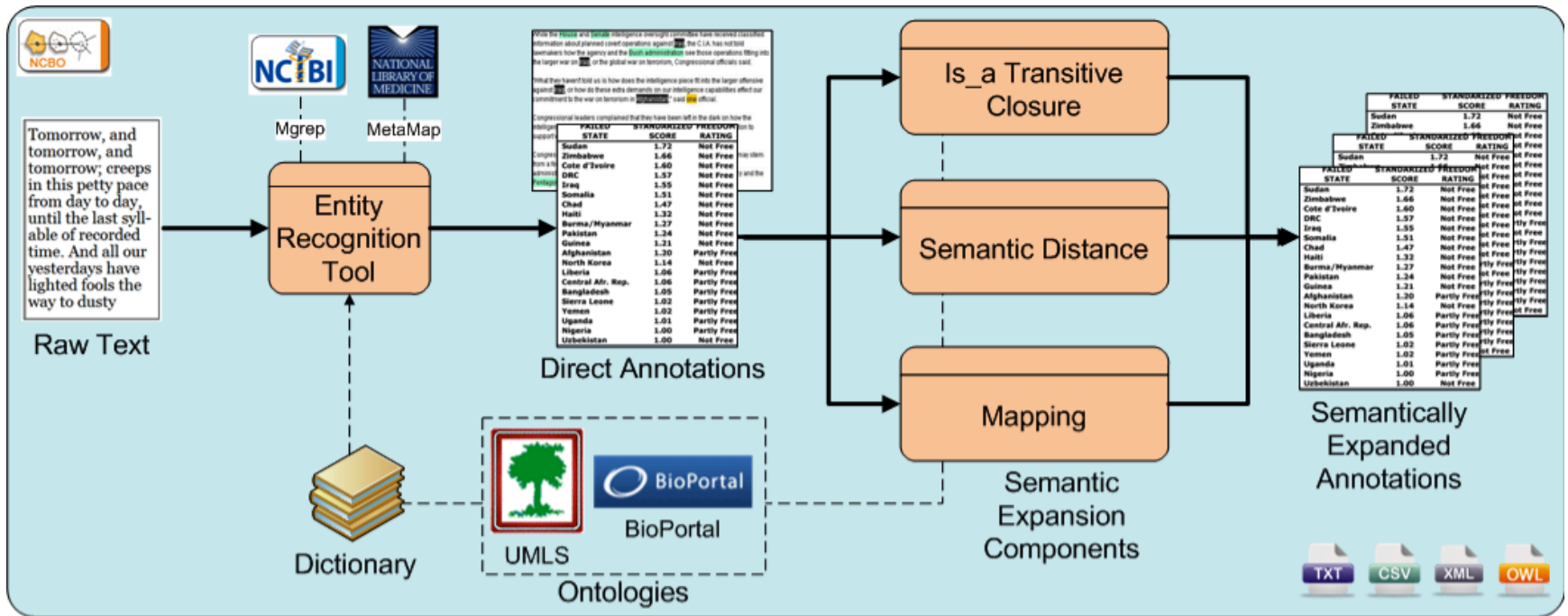
[Risk](#) [Gene Expression](#) [Overall](#) [Heterogeneous](#) [analysis](#) [Intermediate](#) [Vertical](#) [Apoptosis](#) [Biopsy](#)

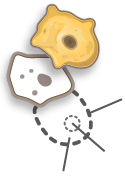
[Gene Expression Profiling](#) [DNA Mismatch Repair](#) [Neoplasm Metastasis](#) [Nevus, Pigmented](#) [Down-Regulation](#) [Up-Regulation](#)

[Deoxyribonucleic acid](#) [Pigmented nevi](#) [Circumpennate](#) [Polymerase Chain Reaction](#) [Dysplastic Nevus Syndrome](#) [Family](#)



Annotator Workflow





Annotator Web Service

- Tag free text with ontology terms

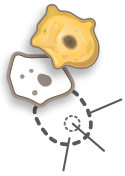
- Documentation:

http://www.bioontology.org/wiki/index.php/Annotator_Web_service

- Example clients:

- Perl: <http://bit.ly/vKYpCP>

- Java: <http://bit.ly/rRFoKd>



Gene Wiki

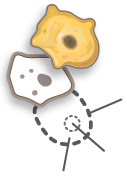
The screenshot shows the Wikipedia article for Reelin. The article text describes Reelin as a protein that helps regulate processes of neuronal migration and positioning in the developing brain. It also mentions its role in the adult brain, modulating synaptic plasticity and enhancing the induction and maintenance of long-term potentiation. The article notes that Reelin is also found in the spinal cord, blood, and other body organs and tissues. It is suggested to be implicated in the pathogenesis of several brain diseases, such as schizophrenia and psychotic bipolar disorder, but the cause of this remains uncertain as studies show that psychotropic medication itself affects RELN expression and the epigenetic hypothesis aimed at explaining the changed levels has received some contradictory evidence. Total lack of reelin causes a form of lissencephaly. Reelin may also play a role in Alzheimer's disease, temporal lobe epilepsy and autism.

The article includes a 3D ribbon diagram of the Reelin protein structure, labeled "Reelin". Below the structure, there is a section for "Available structures" with a link to show more. The "Identifiers" section lists various identifiers for Reelin, including OMM: 600514, MG: 103022, HomoloGene: 3699, and GeneCards: RELN Gene. The "Gene Ontology" section lists the biological process: "GO: Biological Process". The "RNA expression pattern" section shows a bar chart of expression levels across various tissues. The "Orthologs" section lists orthologs for Human and Mouse, including Entrez, Ensembl, UniProt, and RefSeq IDs.

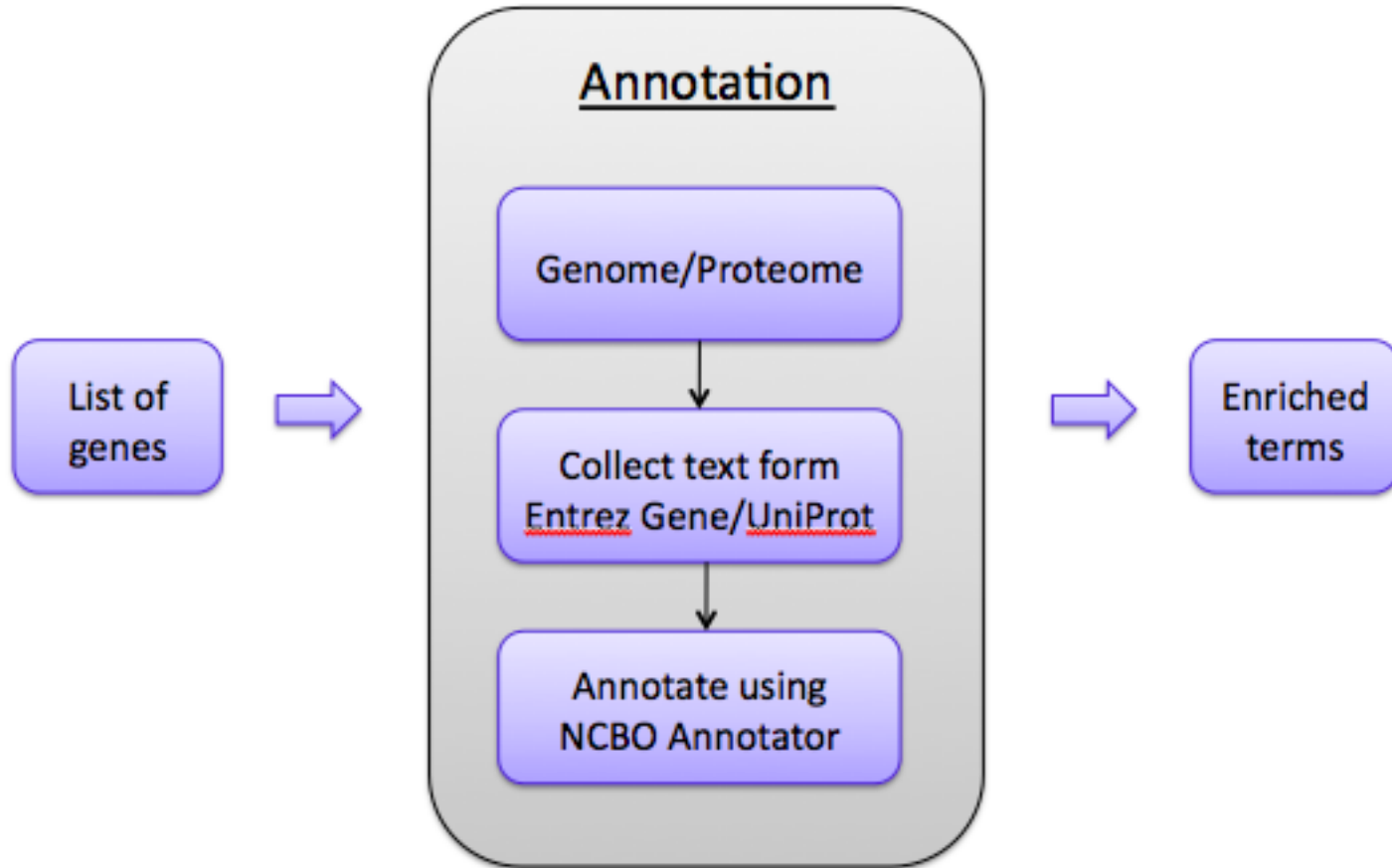
Annotator

Gene	Property	Value
RELN	GO: Biological Process	Brain Development
RELN	DO: Related Disease	Alzheimer's Disease

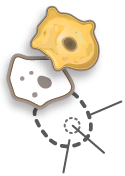
http://en.wikipedia.org/wiki/Portal:Gene_Wiki



Statistical Tracking of Ontological Phrases (STOP)



<http://www.mooneygroup.org/content/webtools>



Ontological Discovery Environment

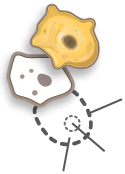
The screenshot shows the website's header with the title "Ontological Discovery Environment" and a navigation menu with links for "Home", "Search", "Manage GeneSets", "Analyze GeneSets", and "About ODE". The main content area is divided into three columns, each with an icon and a description:

- Search for or Upload sets of genes:** Represented by an icon of a magnifying glass over a document with "GS" and a green arrow pointing up to another document with "GS".
- Collect GeneSets into Projects:** Represented by an icon of a green box labeled "Project" containing four documents with "GS".
- Analyze and discover GeneSet relationships:** Represented by an icon of a hierarchical tree diagram above a grid of red and blue circles.

ODE Website and Tools

The Ontological Discovery Environment allows users to integrate phenotype centered gene sets across species, tissue and experimental platform. Sets can be stored, shared and compared privately, among user defined groups of investigators, and across all users.

<http://ontologicaldiscovery.org/>



STRIDE

De-ided version of Note_id: 1058133

PATIENT NAME: X

ADMISSION DIAGNOSIS: Cervical spondylosis at C5-C6 with disk hemiation on the left side and left-sided C6 radiculopathy.

DISCHARGE DIAGNOSIS: Cervical spondylosis at C5-C6 with disk hemiation on the left side and left-sided C6 radiculopathy.

PROCEDURES PERFORMED: C5-C6 anterior cervical discectomy and fusion with instrumentation, performed by Y

REASON FOR HOSPITALIZATION: X is a 48-year-old man with left-sided neck pain and radiation down to the left side of his shoulder and upper arm with numbness of the thumb, index and middle fingers at the tips, more on the left, and ongoing for the past three months. The patient had an MRI scan of the cervical spine done in early MONTH, which revealed cervical spondylosis at C5-C6 with disk hemiation.

PAST MEDICAL HISTORY: Hypertension.

PAST SURGICAL HISTORY: None.

MEDICATIONS ON ADMISSION:

1. Advair Diskus one puff b.i.d.
2. Aciphex 20 mg one tablet q.a.m.
3. Flovent MDI two puffs p.o. b.i.d.
4. Albuterol MDI two puffs q.4-6h. p.r.n.
5. Flonase two sprays per nostril q.d.
6. Nexium 40 mg one capsule q.d.

PHYSICAL EXAMINATION ON ADMISSION: GENERAL: The patient had clear consciousness and no acute distress. NEUROLOGIC: The patient's range of motion was 70% of normal, but there was no Lhermitte sign and no Spurling sign. There were no focal weaknesses present for both upper and lower extremities. Brachioradialis was 1/4 on both sides. Triceps was 1/4 to 2/4 on both sides. Knee jerk and ankle jerk were 2/4 on both sides. Posterior tibialis was 2/4 on both sides. LUNGS: Clear to auscultation bilaterally. CARDIOVASCULAR: Regular rate and rhythm. ABDOMEN: Benign. EXTREMITIES: No cyanosis or edema.

HOSPITAL COURSE: The patient was admitted to the hospital on 2003, and taken to the operating room for a C5-C6 ACDF with instrumentation. The patient tolerated the procedure well. There were no complications. The patient recovered well in the PACU without any events, and the patient was transferred to the floor. While on the floor there were no acute events overnight. The patient was tolerating oral intake, and the patient's pain was under control with oral pain medications. On postoperative day #1 the patient was tolerating an oral diet, ambulating and voiding on his own, and the patient was discharged home.

Annotator

Ontologies: All Ontologies Selected

Semantic Types: All Semantic Types Selected

Options:

The Annotator user interface is currently limited to **300 words**. Please use the [NCBO Annotator web service](#) for more advanced features.

Text: REASON FOR HOSPITALIZATION: X is a 48-year-old man with left-sided neck pain and radiation down to the left side of his shoulder and upper arm with numbness of the thumb, index and middle fingers at the tips, more on the left, and ongoing for the past three months. The patient had an MRI scan of the cervical spine done in early MONTH, which revealed cervical

Annotation Term List **Annotation Tag Cloud**

Terms

Filter: type filter text

- (Hypertensive disease) or (hypertension) (2)
- (Pain) or (C/O: [ache] or [pain]) (1)
- (Spondylosis: [cervical] or [lumbar] or [sacral]) (1)
- Aciphex (1)
- Admission (4)
- Admission diagnosis (2)
- Advair (1)
- Advair Diskus (1)
- Adverse Event Associated with Pain (1)

Annotations

Filter: type filter text (filters by Term or Ontology)

Term: [\(Hypertensive disease\) or \(hypertension\)](#)

Ontology: [SNOMED Clinical Terms](#)

Context: PAST MEDICAL HISTORY: **Hypertension.**

Term: [\(Hypertensive disease\) or \(hypertension\)](#)

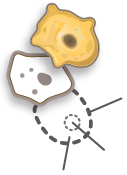
Ontology: [SNOMED Clinical Terms](#)

Context: PAST MEDICAL HISTORY: **Hypertension.**

Term: [\(Pain\) or \(C/O: \[ache\] or \[pain\]\)](#)

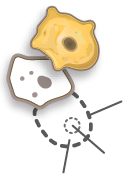
Ontology: [SNOMED Clinical Terms](#)

Context: PROCEDURES PERFORMED: C5-C6 anterior cervical discectomy and fusion with instrumentation, performed by Y

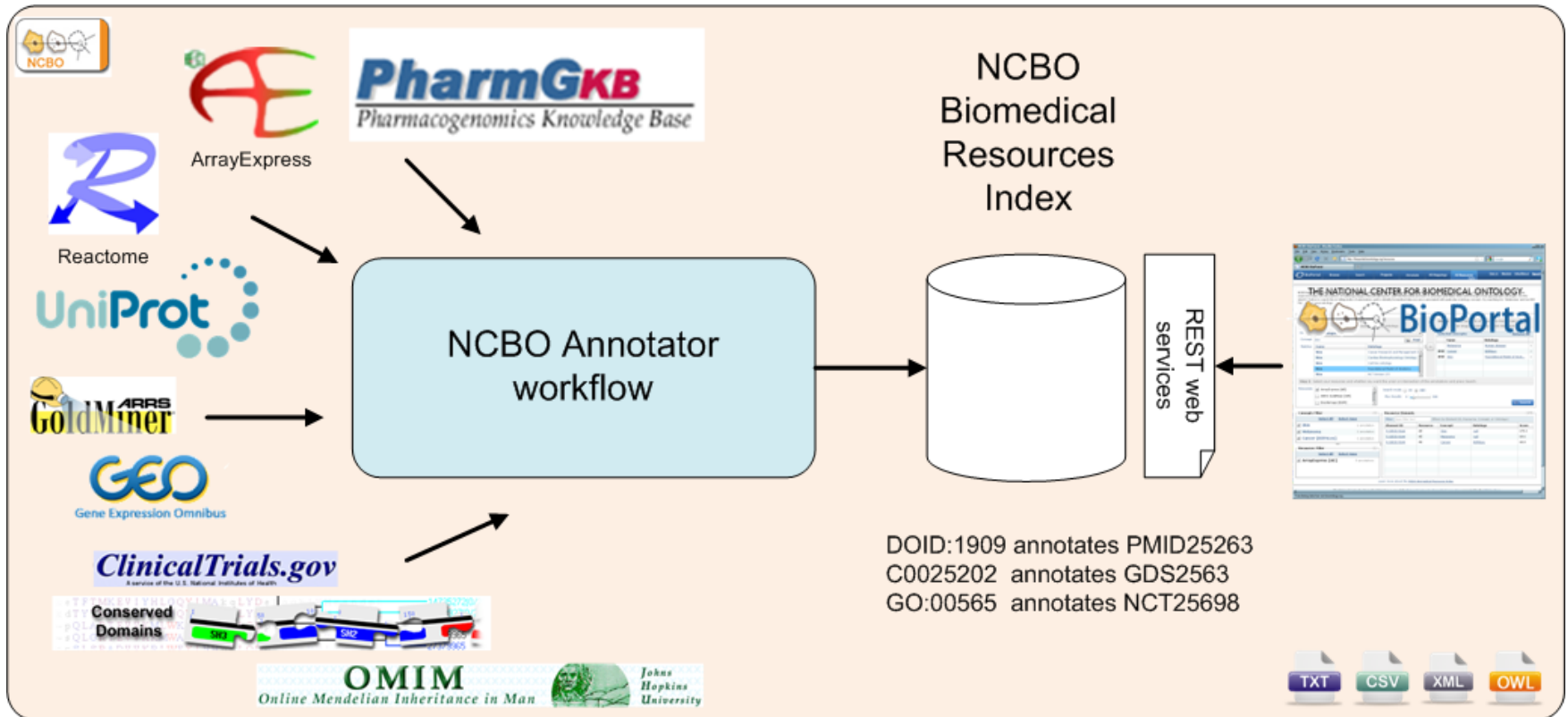


DATA SERVICE

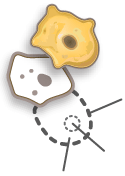
Using Ontologies to Access Public Data



Resource Index: The Basic Idea



- The index can be used for
 - Search
 - Data mining



Resources index: Example

Gene Expression Omnibus

Eutils Web Service API

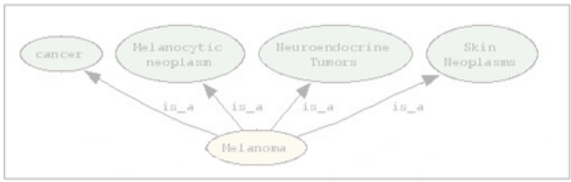
e.g., element GDS1989

Accessing resource elements

```
<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>
```

Concept recognition



172 closure annotations

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

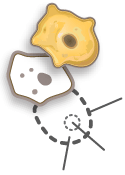
Semantic expansion

```
<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>
```

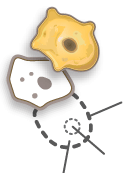
23 direct annotations
 (4 title, 19 description)

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



Data Access

- Resource Index Web service
 - Documentation:
[http://www.bioontology.org/wiki/index.php/
Resource Index](http://www.bioontology.org/wiki/index.php/Resource_Index)



ODiSSea

SciVerse Hub BETA

Hub | ScienceDirect | Scopus | SciTopics | Application

Home | My settings

atherosclerosis

About 1098632 results for: ALL(atherosclerosis)

Search within results

Refine Results

Limit to Exclude

Content Sources

- Scopus (321380)
- ScienceDirect (165169)
- Patent Offices (88092)
- MEDLINE / PubMed (77118)
- MD Consult (19071)

View more

Author

- Blumenthal, Roger S.
- Nasir, Khurram
- Criqui, Michael H.
- Takasu, Junichiro
- Allison, Matthew

View more

Clinical Trials (1146) Drugs (2) Genes (3) Grants (1147)

Results from ClinicalTrials.gov

- 1) Insulin Resistance and Atherosclerosis in Women With Lupus
- 2) Non-traditional Cardiovascular Risk Factors and Atherosclerosis in Type 2 Diabetes
- 3) Carotid Atherosclerosis Regression at Magnetic Resonance Assessment.
- 4) Non-Invasive Assessment of Atherosclerosis in Patients With CGD and Other Disorders of the Immune System
- 5) Multi-Analyte, Genetic, and Thrombogenic Markers of Atherosclerosis
- 6) Understanding the Genetic and Hereditary Basis of Atherosclerosis

See all resources at NCBO

1. **Atherosclerosis (arteriosclerosis - hardening of the arteries)**
<http://www.netdoctor.co.uk/diseases/facts/atheroscler...>, December 2010
...Home / Heart and blood / Heart health **Atherosclerosis** (arteriosclerosis - hardening of...consultant cardiologist What is **atherosclerosis**? Term watch What is an artery? An...arteries carry blood to the heart. **Atherosclerosis** refers to the build up of fatty deposits...
2. **Applications of Nanotechnology to Atherosclerosis, Thrombosis, and Vascular Biology -- Wickline et al. 26 (3): 435 -- Arteriosclerosis, Thrombosis, and Vascular Biology**
<http://atvb.ahajournals.org/cgi/content/full/26/3/435>, September 2010
...differentiation Fibrinogen/fibrin Mechanism of **atherosclerosis**/growth factors Arteriosclerosis...Applications of Nanotechnology to **Atherosclerosis**, Thrombosis, and Vascular Biology...have been applied to the arenas of **atherosclerosis**, thrombosis, and vascular biology...
3. **Atherosclerosis - Overview**
<http://www.umm.edu/ency/article/000171.htm>, September 2010
...Your Heart Maryland Heart Center Our Doctors **Atherosclerosis** - Overview Overview Symptom Treatment Prevention...arteries Plaque buildup - arteries Definition of **Atherosclerosis**: **Atherosclerosis** is a condition in which fatty material collects

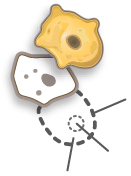
ODiSSea

Recognized Terms found in query

- atherosclerosis
- atherosclerosis (& [nos])
- arteriosclerotic vascular disease nos
- coronary atherosclerosis
- heart disease: [arteriosclerotic] or [chronic ischemic nos]
- generalized atherosclerosis
- arteriosclerotic vascular disease
- vascular sclerosis
- arteriosclerosis

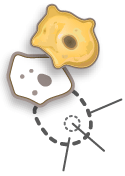
See all terms & resources

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BioPortal SPARQL Endpoint

- Documentation:
http://www.bioontology.org/wiki/index.php/SPARQL_BioPortal
- Query interface: <http://sparql.bioontology.org/>
- Example queries:
<http://sparql.bioontology.org/examples>
- Sample code:
<https://github.com/ncbo/sparql-code-examples>



Thank you!

- Web service documentation:
http://www.bioontology.org/wiki/index.php/NCBO_REST_services
- Keep in touch
 - NCBO Announce mailing list: <http://bit.ly/osLzng>
 - Software support: support@bioontology.org
 - Twitter: @bioontology
 - Facebook: <http://on.fb.me/bioontology>
 - LinkedIn: <http://linkd.in/ncbo-group>
- Questions:
support@bioontology.org

