

What's Hot in Ontology?

Mark A. Musen, M.D., Ph.D.
Stanford University



Biologist have adopted ontologies

- To provide a canonical, machine-processable representation of scientific knowledge
- To annotate experimental data to enable interpretation and comparison across databases
- To facilitate knowledge-based applications for
 - Decision support
 - Natural language-processing
 - Data integration

The National Center for Biomedical Ontology

- An international collaboration among Stanford, Berkeley, Mayo, Buffalo, Victoria, UCSF, Oregon, and Cambridge
- Our goals
 - Ontology access, search, alignment, versioning, and peer review
 - Using ontologies to annotate large data sets—as the ontologies and the data evolve
 - Enhancing the quality of ontology development in the biomedical community



- Stanford: Tools for ontology alignment, indexing, and management (Mark Musen)
- Lawrence–Berkeley Labs: Tools to use ontologies for data annotation (Suzanna Lewis)
- Mayo Clinic: Tools for access to large controlled terminologies (Christopher Chute)
- Victoria: Tools for ontology visualization (Margaret-Anne Story)
- University at Buffalo: Dissemination of best practices for ontology engineering (Barry Smith)

NCBO Driving Biological Projects

- Flybase (Cambridge, Ashburner)



- ZFIN (Oregon, Westerfield)



- Trial Bank (UCSF, Sim)



The OBO Library on Sourceforge

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



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Ontologies

View By: Category

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[+ Ontologies](#)

Select Focus	Ontology	Knowledge Representation Language	Foundry	Current Version	Release Date	Version Status
<input type="radio"/>	Ontologies					
<input type="radio"/>	Anatomy					
<input type="radio"/>	BRENDA tissue / enzyme source	OBO Text	No	1.1	5/3/2006	Production
<input type="radio"/>	Cell type	OBO Text	Yes	1.1	5/3/2006	Pre-Production
<input type="radio"/>	Drosophila gross anatomy	OBO Text	Yes	1.1	5/3/2006	Production
<input type="radio"/>	Mesquito gross anatomy	OBO Text	No	1.1	5/3/2006	Production
<input type="radio"/>	Gross Anatomy					
<input type="radio"/>	Animal Gross Anatomy					
<input type="radio"/>	Fish Anatomy					
<input type="radio"/>	Medaka fish anatomy and development	OBO Text	Yes	1.1	5/3/2006	Pre-Production
<input type="radio"/>	Zebrafish anatomy and development	OBO Text	Yes	1.1	5/3/2006	Production
<input type="radio"/>	Human Developmental Anatomy					
<input type="radio"/>	Human developmental anatomy, abstract version	OBO Text	Yes	1.1	5/3/2006	Production
<input type="radio"/>	Human developmental anatomy, timed version	OBO Text	Yes	1.1	5/3/2006	Production
<input type="radio"/>	Mouse Anatomy					
<input type="radio"/>	Mouse gross anatomy and development	OBO Text	Yes	1.1	5/3/2006	Production
<input type="radio"/>	Mouse adult gross anatomy	OBO Text	Yes	1.1	5/3/2006	Production
<input type="radio"/>	Microbial Anatomy					
<input type="radio"/>	Dictyostelium discoideum anatomy	OBO Text	Yes	1.1	5/3/2006	Pre-Production
<input type="radio"/>	Fungal gross anatomy	OBO Text	Yes	1.1	5/3/2006	Production
<input type="radio"/>	Plant Anatomy					
<input type="radio"/>	Maize gross anatomy	OBO Text	Yes	1.1	5/3/2006	Pre-Production
<input type="radio"/>	Cereal plant gross anatomy	OBO Text	Yes	1.1	5/3/2006	Retired
<input type="radio"/>	Chemical					

What's Hot?

- Ontologies!

Ontologies are hot!

- Just ask Google

Results 1 - 20 of about 53,700,000 for **ontology**

- Just ask the W3C Semantic Web for Health Care and Life Sciences SIG

<i>period</i>	<i>re-sorted</i>	<i>messages</i>
July 2006	by thread by author by subject	91
June 2006	by thread by author by subject	212
May 2006	by thread by author by subject	136
April 2006	by thread by author by subject	89
March 2006	by thread by author by subject	149
February 2006	by thread by author by subject	207

- Just ask NIH

What's Hot?

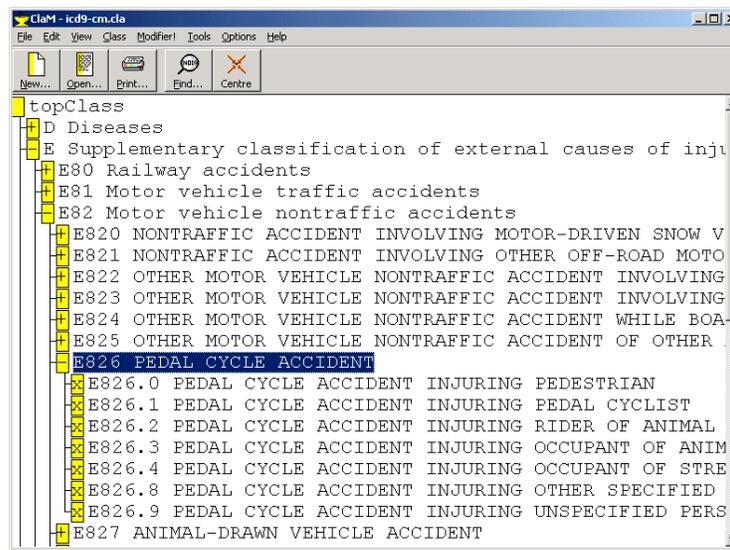
- Ontologies!
- Building ontologies that can scale!



The International Classification of Diseases

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

ICD9 (1977): A Handful of Codes for Traffic Accidents



ICD10 (1999): 587 codes for such accidents

<p>•V31.22 Occupant of three-wheeled motor vehicle injured in collision with pedal cycle, person on outside of vehicle, nontraffic accident, while working for income</p> <p>•W65.40 Drowning and submersion while in bath-tub, street and highway, while engaged in sports activity</p> <p>•X35.44 Victim of volcanic eruption, street and highway, while resting, sleeping, eating or engaging in other vital activities</p>	<p>ICD-10-CM, Vol. 1, 2019 Edition Copyright © 2019 American Medical Association. All rights reserved.</p>
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“Legacy” Ontologies

- Are already in widespread use
- Are typically not engineered using consistent, standardized representation systems
- May have poorly specified or underspecified content
- Reflect the phenomenon of “he who gets there first gets to define the standard”

What's Hot?

- Ontologies!
- Building ontologies that can scale!
- Creating development methods that can scale!



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Cellular component	GO	gene_ontology.obo	included in gene_ontology.obo

The NCI Thesaurus in Protégé-OWL

The screenshot displays the Protégé 3.0 beta interface for editing the NCI Thesaurus. The main window is titled 'Thesaurus Protégé 3.0 beta (file:VC:\projects\owl\Thesaurus.pprj, OWL Files)'. The 'CLASS EDITOR' is active for the class 'Benign_Conditions_of_the_Mouse_Intestinal_Tract'. The 'Annotations' pane shows the following table:

Property	Value	Lang
D code	C22102	
D DesignNote	Autonomous new grow...	
D Display_Name	Benign Conditions of th...	
D FULL_SYN	<term-name>Benign Co...	
D FULL_SYN	<term-name>Benign Co...	
D hasType	primitive	
D Preferred_Name	Benign Conditions of th...	

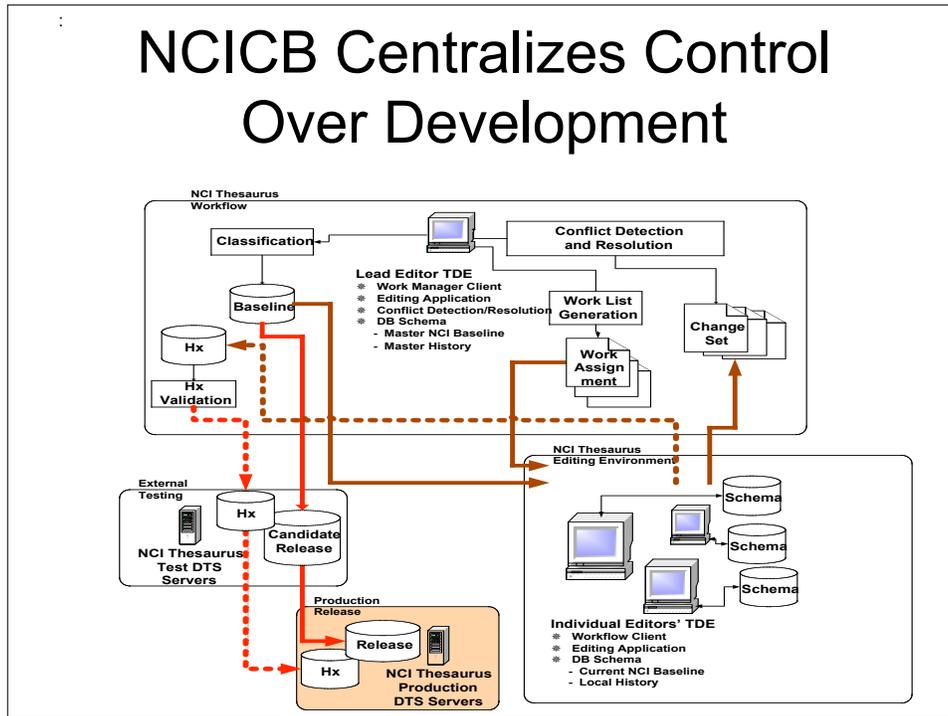
The 'Properties and Restrictions' pane shows the following restrictions:

- rEO_Disease_Has_Associated_EO_Anatomy (someValuesFrom Gastrointestinal_Tract_MM#HCC, someValuesFrom Gastrointestinal_Tract_MM#HCC, [from Mouse_Digestive_System_Disorder])
- rEO_Disease_Has_Associated_Cell_Type
- rEO_Disease_Has_Property_or_Attribute
- rEO_Disease_Maps_to_Human_Disease

The 'Superclasses' pane shows the following classes:

- Mouse_Noncancerous_Conditions
- Mouse_Digestive_System_Disorder

NCICB Centralizes Control Over Development



Imagine building ontologies in the “Wikipedia” framework!

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Ontology (computer science)

From Wikipedia, the free encyclopedia

In **computer science**, an **ontology** is a **data model** that represents a **domain** and is used to **reason** about the objects in that domain and the relations between them.

Ontologies are used in **artificial intelligence**, the **semantic web**, **software engineering** and **information architecture** as a form of **knowledge representation** about the world or some part of it. Ontologies generally describe:

- **Individuals**: the basic or "ground level" objects
- **Classes**: sets, collections, or types of objects^[1]
- **Attributes**: properties, features, characteristics, or parameters that objects can have and share
- **Relations**: ways that objects can be related to one another

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The web organized by topic into categories.

Arts[Movies](#), [Music](#), [Television](#),...**Home**[Consumers](#), [Homeowners](#), [Family](#),...**Regional**[Asia](#), [Europe](#), [North America](#),...**Business**[Industries](#), [Finance](#), [Jobs](#),...**Kids and Teens**[Computers](#), [Entertainment](#), [School](#),...**Science**[Biology](#), [Psychology](#), [Physics](#),...**Computers**[Hardware](#), [Internet](#), [Software](#),...**News**[Media](#), [Newspapers](#), [Current Events](#),...**Shopping**[Autos](#), [Clothing](#), [Gifts](#),...**Games**[Board](#), [Roleplaying](#), [Video](#),...**Recreation**[Food](#), [Outdoors](#), [Travel](#),...**Society**[Issues](#), [People](#), [Religion](#),...**Health**[Alternative](#), [Fitness](#), [Medicine](#),...**Reference**[Education](#), [Libraries](#), [Maps](#),...**Sports**[Basketball](#), [Football](#), [Soccer](#),...**World**[Deutsch](#), [Español](#), [Français](#), [Italiano](#), [Japanese](#), [Korean](#), [Nederlands](#), [Polska](#), [Svenska](#), ...

Open Directory Project

- Started in 1998 as a volunteer effort to develop an open-content directory of Web pages
- In its first year, 4500 editors had indexed 100K Web sites
- By July 2005, 69K editors had indexed 4.6M sites using 580K categories
- On average, between 9K and 10K volunteer editors are working on ODP at any given time

What's Hot?

- Ontologies!
- Building ontologies that can scale!
- Creating development methods that can scale!
- Treating ontologies as published knowledge in machine-processable form!



- An experiment to offer peer-review standards that define minimal criteria for “good” ontologies
- An attempt to inform users of our Center’s resources when selecting ontologies
- A major topic for the NCBO Dissemination event (Wednesday, July 19, 9:00 a.m.–12:00 p.m., Natcher Balcony A)

Ontologies are not like journal articles

- It is difficult to judge soundness of the content simply by inspection
- Developers may wish to use an ontology even though some portions
 - Are not well designed
 - Make distinctions that are different from those that the user might prefer
- Peer review needs to scale to the entire user community

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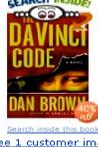
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The Da Vinci Code
by [Dan Brown](#) "Robert Langdon awakes slowly..." (page)



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Edition: Hardcover

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★★★★★ **Unbelievable Book**, February 16, 2005
Reviewer: [Mohamed Abdulmalk](#) (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 skillfully 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 abuse](#)

★★★★★ **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 to 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

BIO cBIO: National Center for Biomedical Ontology

Home Resources Services Education myCBIO

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

MGED List Price: \$0
Price: \$0 & Eligible for FREE Access
You Save: \$0
Availability: Usually available 24/7 on cBIO.org
Edition: Pragmatic

Search inside this Ontology

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](#)

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....

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