

Cinical Informatics and Decision Making:

Challenges for Large-Scale Analytics and Intelligent Services

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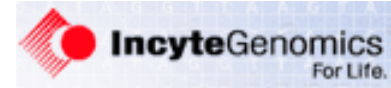
What are the gaps?

- Intelligent services based on individual **rule bases will never scale**
- It is difficult to characterize the **feature space** that leads to a diagnosis
- It is difficult to characterize the **category space** when you decide on a diagnosis
- Imprecision in the category spaces mean **imprecision in therapeutics**
- The underlying information infrastructure is evolving—very slowly—from a 19th century model

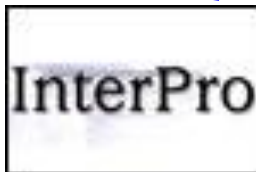
Ontologies are essential for biology

WormBase

FlyBase



UniProt
the universal protein resource



AstraZeneca

[GO:0003673 : Gene Ontology \(92932\)](#)  **[GO:0008150 : biological process \(56952\)](#)**  **[GO:0007610 : behavior \(566\)](#)**

- [GO:0000004 : biological process unknown \(6152\)](#)**

 [GO:0007154 : cell communication \(11916\)](#)  **[GO:0007155 : cell adhesion \(830\)](#)**

- [GO:0030260 : cell invasion \(0\)](#)**

 [GO:0008037 : cell recognition \(210\)](#) **[GO:0007267 : cell-cell signaling \(1318\)](#)** 

- [GO:0045168 : cell-cell signaling involved in cell fate commitment \(0\)](#)**

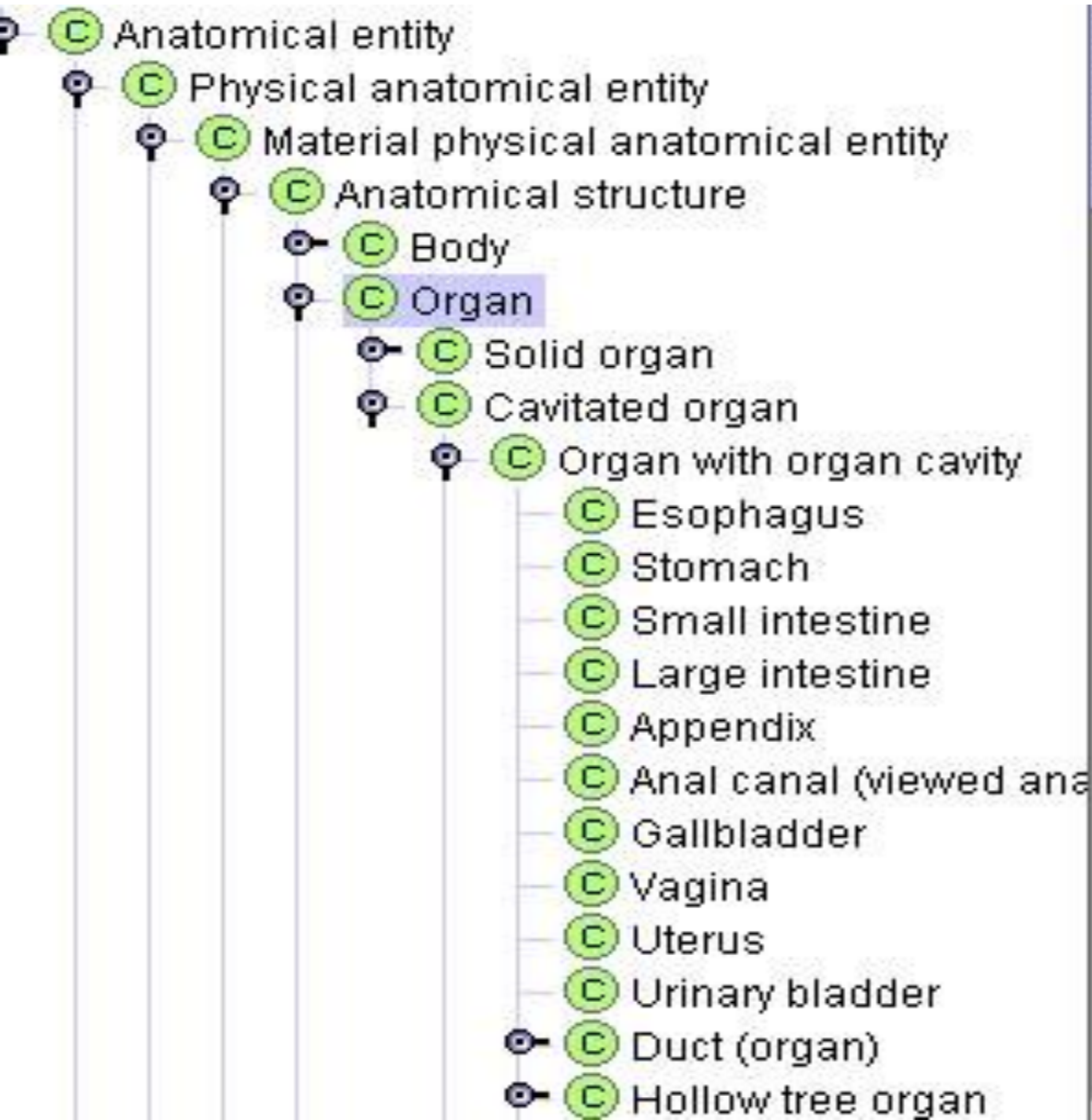
 [GO:0030072 : peptide hormone secretion \(6\)](#) 

- [GO:0030252 : growth hormone secretion \(2\)](#)**
- [GO:0030073 : insulin secretion \(4\)](#)**
- [GO:0030103 : vasopressin secretion \(2\)](#)**

- [GO:0019226 : transmission of nerve impulse \(688\)](#)**

 [GO:0030383 : host-pathogen interaction \(12\)](#) **[GO:0000000 : root \(0\)](#)**

The Foundational Model of Anatomy



Template Slots

	Name
S	continuous with
S	contained in
S	member of
S	arterial supply
S	venous drainage
S	lymphatic drainage
S	nerve supply
S	has boundary
S	bounded by
S	inherent 3-D shape
S	Has inherent 3-D shape
S	attributed part
S	adjacency
S	orientation
S	has mass
S	physical state
S	dimension
S	has dimension

File Edit Project OWL Reasoning Code Tools Window Help



Metadata(Thesaurus.owl) OWLClasses Properties Individuals Forms

SUBCLASS EXPLORER

For Project: Thesaurus_db

Asserted Hierarchy

- owl:Thing
 - Abnormal_Cell_Kind
 - Activity_Kind
 - Anatomy_Kind
 - Biological_Process_Kind
 - Chemicals_and_Drugs_Kind
 - Chemotherapy_Regimen_Kind
 - Diagnostic_and_Prognostic_Factors_Kind
 - EO_Anatomy_Kind
 - EO_Findings_and_Disorders_Kind
 - Experimental_Organism_Diagnoses
 - Experimental_Allergic_Encephalomyelitis
 - Merged_EO_Findings_and_Disorders_Concepts
 - Mouse_Pathologic_Diagnoses
 - Mouse_Cancer-Related_Conditions
 - Benign_Plasma_Cell_Proliferations_of_the_Mouse_Skin
 - Hyperplasia_of_the_Mouse_Intestinal_Tract
 - Hyperplasia_of_the_Mouse_Pulmonary_System
 - Melanocytic_Proliferative_Disorders_of_Mouse
 - Mouse_Noncancerous_Conditions
 - Benign_Conditions_of_the_Mouse_Intestinal_Tract
 - Inflammatory_Conditions_of_the_Mouse_Mammary_Gland
 - Inflammatory_Conditions_of_the_Mouse_Prostate_Gland

CLASS EDITOR for Benign_Conditions_of_the_Mouse_Intestinal_Tract (insta

For Class: http://ncicb.nci.nih.gov/xml/owl/EVS/Thesaurus.owl#Benign_Condit

Property	Value
ALT_DEFINITION	<def-source>MMHCC</def-source><def-definit intestinal epithelium that has limited growth poten surrounding structures. Cells do not penetrate th membrane.</def-definition><Definition_Review_ te><Definition_Reviewer_Name>DEFAULT_Review
code	C22102
Display_Name	Benign Conditions of the Intestinal Tract
FULL_SYN	<term-name>Benign Conditions of the Mouse Inti Tract</term-name><term-group>PT</term-gr nource>
FULL_SYN	<term-name>Benign Conditions of the Intestinal Tract</term-name><term-group>DN</term-gr ource>
NCI_META_CUI	CL318703
Preferred_Name	Benign Conditions of the Mouse Intestinal Tract
rdfs:label	Benign Conditions of the Mouse Intestinal Tract
Semantic_Type	Disease or Syndrome

- Mouse_Digestive_System_Disorder
- Mouse_Noncancerous_Conditions
- EO_Disease_May_Associated_EO_Anatomy_... Gastrointestinal_Tract_MM

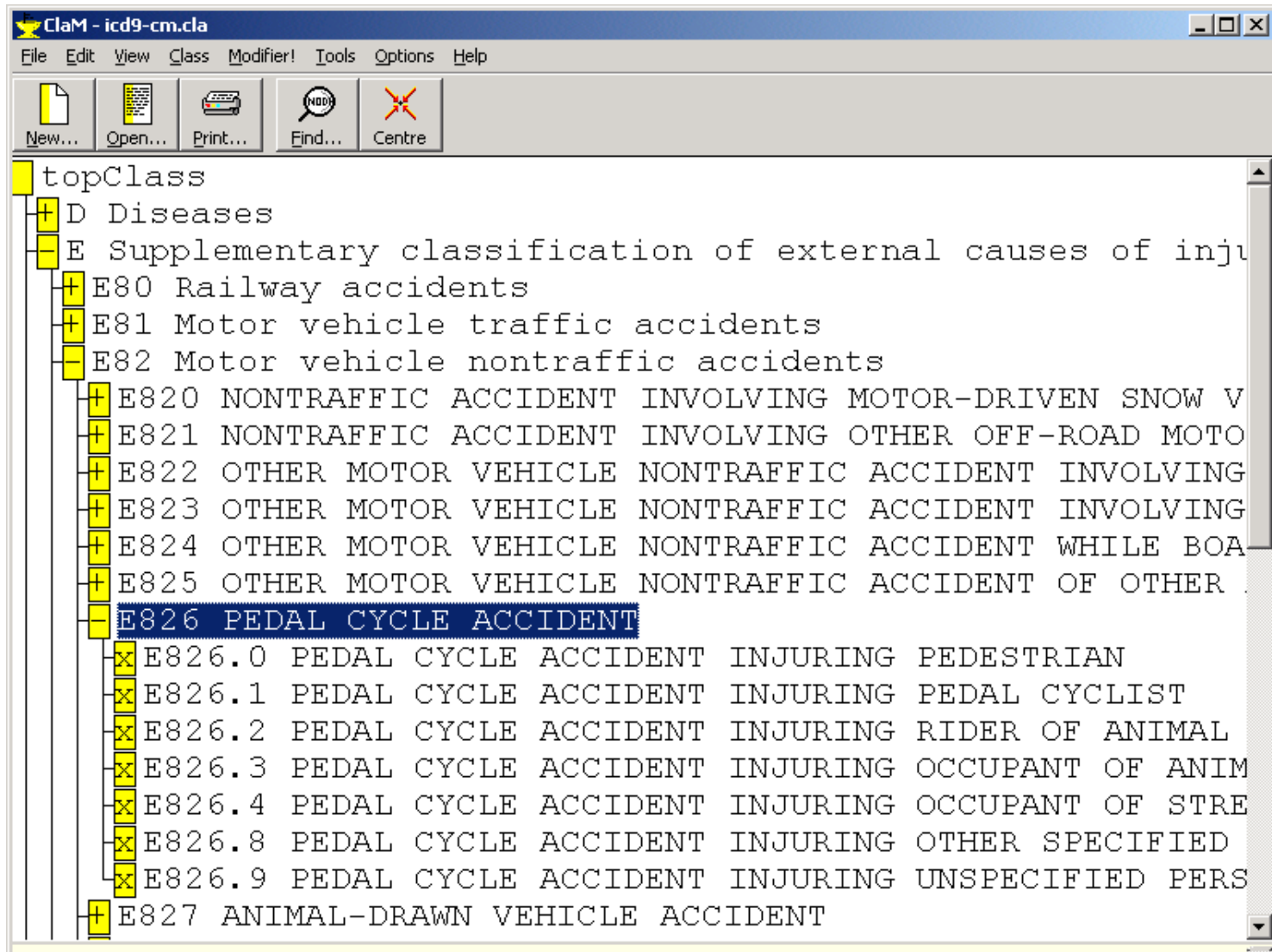
Biomedical scientists have adopted ontologies

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

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



There is a plethora of controlled terminologies!

- Diseases: ICD-9, ICD-9-CM, ICD-10, ICD-10-CM, DRG
- Procedures: CPT-4, ICD-10-PCS
- Laboratory tests: LOINC
- Nursing activities: NIC, NOC, HHCC, Omaha
- Drugs: NDC, Multum, Micromedex, NDDF,
- Biomedical literature: MeSH
- Clinical documentation: Medcin, Purkinjie
- Cross-references among terminologies: UMLS

REPORT TO THE PRESIDENT
REALIZING THE FULL POTENTIAL OF
HEALTH INFORMATION TECHNOLOGY
TO IMPROVE HEALTHCARE
FOR AMERICANS:
THE PATH FORWARD

Executive Office of the President
President's Council of Advisors
on Science and Technology

What are some of the Advisors recommendations?

- Continue incentives for “meaningful use” of EHRs
- Encourage exchange of information across health-care facilities
- Establish a “universal exchange language” for clinical data
- Initiate pilot projects to allow the approach to scale



Of Current Interest

- ▶ **News:** Study Extracts Vioxx Heart-Attack Risk from EMRs, Shift from Ontology Development to Use
- ▶ **Webinar:** Wed, Sep 21, 10:00am PT, Sean Mooney, The Buck Institute
- ▶ **Recent Publication:** Whetzel, PL, Noy, N, Shah, NH, et al. (2011): BioPortal: enhanced functionality via new Web services to access and use ontologies in software applications
- ▶ **Recent Release:** BioPortal 3.2 (Sep 1, 2011)
- ▶ **NCBO Webinar Announcements - Subscribe**
- ▶ **NCBO Software Support - Mailing List Archive**
- ▶ **More News & Events**

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Simon Twigger, Ph.D.
Medical College of Wisconsin



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Video

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



Browse ontologies in BioPortal!

BioPortal allows users to browse, search and visualize ontologies.



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: Key activities

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

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 Active Ontologies

Ontology	Version	Notes	Mappings
Human developmental anatomy, timed version	1.3	0	168488
Human developmental anatomy, abstract version	1.3	0	146067
NCI Thesaurus	09.07	11	91995
Cell Cycle Ontology (H. sapiens)	1.01	0	61199
Cell Cycle Ontology (S. cerevisiae)	1.01	0	58563

- Latest Notes
- [Term name misspelled? leaf vsular tissue \(Minimal anatomical terminology\)](#) 10/11/09 whetzel
 - [Incorrect mapping SDN \(Rat Strain Ontology\)](#) 09/23/09 whetzel
 - [RE:NEMO.owl subontologies/modules scalp_surface_region \(Neural ElectroMagnetic Ontologies\)](#) 08/22/09 gfrishkoff
 - [NEMO subontologies/modules entity \(Neural ElectroMagnetic Ontologies\)](#) 08/22/09 gfrishkoff
 - [NEMO.owl subontologies/modules scalp_surface_region \(Neural ElectroMagnetic Ontologies\)](#) 08/22/09 gfrishkoff

- Latest Mappings
- [human \(Human developmental anatomy, timed version\) => Humans \(Medical Subject Headings\)](#) 10/03/09 yongqunh@med.umich.edu
 - [Humans \(Medical Subject Headings\) => human \(Human developmental anatomy, timed version\)](#) 10/03/09 yongqunh@med.umich.edu
 - [sand_fly \(Parasite Life Cycle\) => Phlebotomus \(SNOMED Clinical Terms\)](#) 08/17/09 preets1511
 - [Phlebotomus \(SNOMED Clinical Terms\) => sand_fly \(Parasite Life Cycle\)](#) 08/17/09 preets1511
 - [amastigote \(Parasite Life Cycle\) => Amastigote form of protozoa \(SNOMED Clinical Terms\)](#) 08/14/09 preets1511

Statistics

Ontologies	168
Concepts	723,806
Resources Indexed	11

Access all ontologies that are available in BioPortal: You can filter this list by category to display ontologies relevant for a certain domain (try selecting "Anatomy or Experimental Conditions" in the "Filter by category" menu below). You can also filter ontologies that belong to a certain group such as ontologies from the [OBO Foundry](#), or ontologies from the [Cancer Biomedical Informatics Grid \(caBIG\)](#). [Subscribe to the BioPortal RSS feed](#) to receive alerts for submissions of new ontologies, new versions of ontologies, new notes, and new projects. You can subscribe to feeds for a specific ontology at the individual ontology page. Add a new biomedical ontology to BioPortal using the Submit New Ontology link (you need to [sign in](#) to see this link).

SUBMIT ONTOLOGY	Submit New Ontology
FILTER BY CATEGORY	All Categories
FILTER BY GROUP	All Groups Link To This Filter
FILTER BY TEXT	<input type="text"/>

 [Subscribe to all updates](#)

ONTOLOGY NAME ▲	FORMAT	VERSION	AUTHOR	UPLOADED ON	GROUP	STATUS
ABA Adult Mouse Brain (ABA)	OWL	1.0	Allen Institute for Brain Science	08/08/2009		Explore
African Traditional Medicine (ATMO)	OBO Format	1.101	Ghislain Atemezing	06/28/2009		Explore
Amino Acid (amino-acid)	OWL	1.2	Nick Drummond, Georgina Moulton, Robert Stevens, Phil Lord	04/25/2009		Explore
Amphibian gross anatomy (AAO)	OBO Format	1.8	AmphiAnat list	07/30/2008	OBO Foundry	Explore
Amphibian taxonomy (ATO)	OBO Format	See Remote Site	AmphiAnat list	08/14/2009		
Animal natural history and life history (ADW)	PROTEGE	See Remote Site	Http://animaldiversity Administrators	04/27/2009		
Ascomycete phenotype ontology (APO)	OBO Format	1.6	Fungal_anatomy Administrators	09/01/2009		Explore
Basic Formal Ontology (BFO)	OWL	1.1		07/24/2009		Explore
Basic Vertebrate Anatomy (basic-vertebrate-gross-anatomy)	OWL	1.1		01/16/2007		Explore
Bilateria anatomy (BILA)	OBO Format	See Remote Site	Thorsten Heinrich	04/13/2009		
Biological imaging methods (FBbi)	OBO Format	1.1	Image Administrators	07/30/2008		Explore

View Ontology Details

Jump To: Go

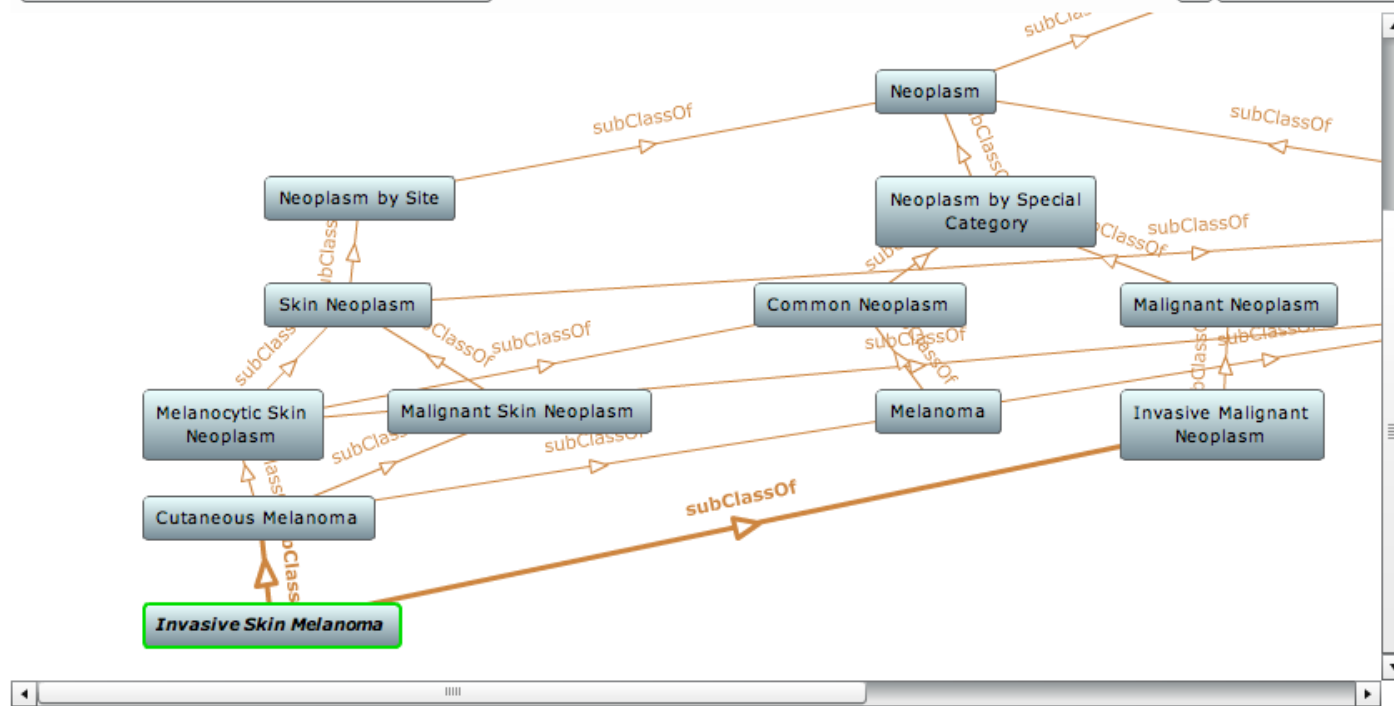
Legend

- Endocrine Neoplasm
- Eye Neoplasm
- Gastrointestinal Neoplasm
- Head and Neck Neoplasm
- Hematopoietic and Lymphoid System Neoplasm
- Nervous System Neoplasm
- Peritoneal and Retroperitoneal Neoplasms
- Reproductive System Neoplasm
- Respiratory Tract Neoplasm
- Skin Neoplasm
 - Benign Skin Neoplasm
 - Cutaneous Hematopoietic and Lymphoid
 - Dermal Neoplasm
 - Epithelial Skin Neoplasm
 - Malignant Skin Neoplasm
 - Blastic Plasmacytoid Dendritic Cell N
 - Cutaneous Lymphoma
 - Cutaneous Melanoma
 - Acral Lentiginous Melanoma
 - Amelanotic Skin Melanoma
 - Balloon Cell Melanoma
 - Desmoplastic Melanoma
 - Hereditary Melanoma
 - Invasive Skin Melanoma
 - Lentigo Maligna Melanoma
 - Malignant Melanoma in Precance
 - Melanoma Arising from Blue Nev
 - Melanoma in Congenital Melanoc
 - Melanoma in Junctional Nevus
 - Minimal Deviation Melanoma
 - Nevoid Melanoma
 - Nodular Melanoma
 - Old Burn Scar-Related Skin Mela
 - Recurrent Melanoma of the Skin
 - Regressing Skin Melanoma

Details Visualization Notes (0) Mappings (0) Resources alpha

Show Hierarchy To Root (All Relationships)

Full Version



BioPortal allows us to experiment with new models for

- Dissemination of terminologies, ontologies, and knowledge on the Web
- Integration and alignment of online content
- Knowledge visualization and cognitive support
- Peer review of online content

Biomedical Resource Ontology in BioPortal

View Ontology Details

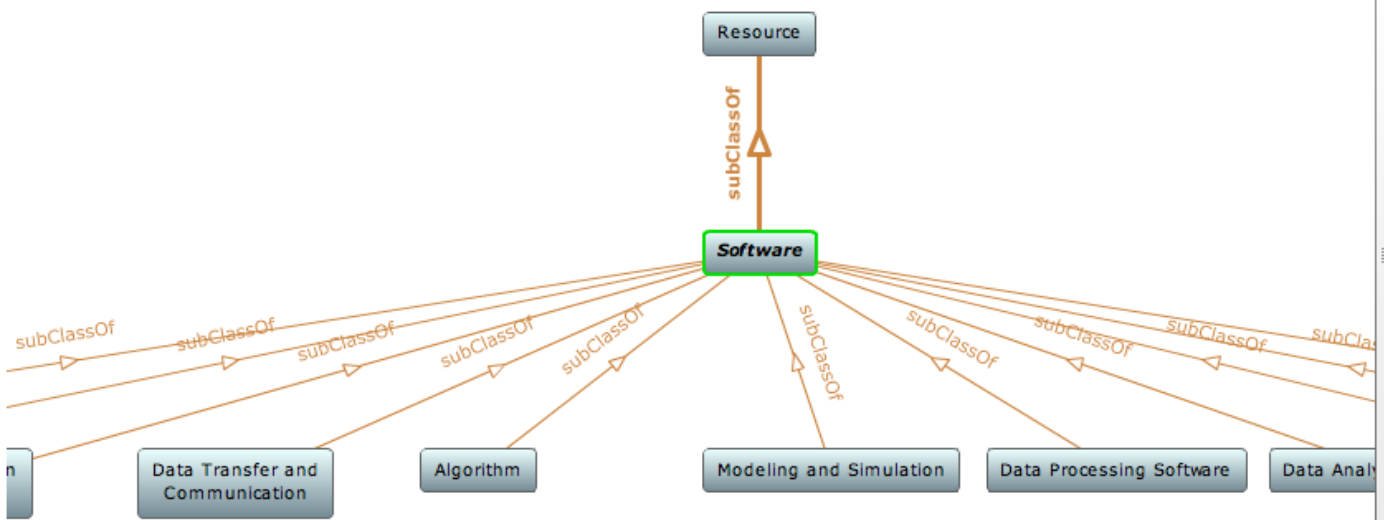
Jump To: [Go](#)

- Legend
- Activity
 - Area of Research
 - Biositemaps Information Model
 - core:Collection
 - core:Concept
 - core:ConceptScheme
 - Deprecated Activity
 - Deprecated Area of Research
 - Deprecated Resource
 - Resource
 - Funding Resource
 - Information Resource
 - Material Resource
 - People Resource
 - Service Resource
 - Software**
 - Training Resource

Details **Visualization** Notes (3) Mappings (0) Resource Index

Show Network Neighborhood

[Full Version](#)



“Notes” in BioPortal

Biomedical Resource Ontology Version 2.7.1

[Software](#) | [Link Here](#) | [Subscribe](#)

View Ontology Details

Details Visualization **Notes (3)** Mappings (0) Resource Index

Jump To: [Go](#)

[Legend](#)

- Activity
- Area of Research
- Biositemaps Information Model
- core:Collection
- core:Concept
- core:ConceptScheme
- Deprecated Activity
- Deprecated Area of Research
- Deprecated Resource
- Resource
 - Funding Resource
 - Information Resource
 - Material Resource
 - People Resource
 - Service Resource
 - Software
 - Algorithm
 - Data Acquisition Software
 - Data Analysis Software
 - Data Processing Software
 - Data Storage Repository
 - Data Transfer and Communication
 - Integration and Interoperability Tool
 - Interactive Tool
 - Knowledge Mining and Capturing
 - Modeling and Simulation
 - Software Distribution
 - Training Resource

Comment: [Software needs structure, too many top level subclasses](#) DavidStates at 08/09/08 06:56

"binary executable" is not a top level subclass of software, it is a form of software distribution and there are several other subclasses of software distribution (source code, web site, library, toolkit, etc.).

Similarly, "network editor" is just one class of interactive editing tools. Lots of others.

These are just a couple of examples. Software really needs a complete reorganization.

[Reply](#)

Comment: [RE:Software needs structure, too many top level subclasses](#) PeterLyster at 08/12/08 08:29

The BRO used the initial design principle of: when in doubt make it flat at the top. This is a design principle whose purpose is to get the class names 'on the board and agreed upon' first, i.e., it is a componentization of the design process. This is a way of avoiding getting into debates about hierarchical location too early in the process. We can discuss location in the hierarchy in the future; that is appropriate.

[Reply](#)

Comment: [RE:Software needs structure, too many top level subclasses](#) PeterLyster at 08/12/08 08:43

I (Peter Lyster) copy marginal notes that I also place in the 'Portals' class. I think this helps to explain the design principles.

We adopted the design principle of (i) initially align the BRO top level with NIFSTD (**Data Resource; Bibliographic Resource; Software; Research Supplies; Portals; Funding Source**) (see agreement that was made in broad tcon of 20080416 http://na-mic.org/Wiki/index.php/SDIWG:Meeting_Minutes_20080416). As with the discussion on 'Software' class, the goal was to get a reasonable first cut and then stabilize the BRO development process; then the development team (called 'tiger team' after the April tcon) agreement (interdigitate etc) on the overall list of class names (this was successfully done by Rubin, Martone, and Lyster between July 28 and August 1 2008). This process was highly successful, and validated the logic behind taking one step at a time; (ii) continue to work with NIFSTD and other stakeholders to plan current and future efficient and effective mappings. It is good to revisit in th future the position of upper-level classes such as 'portals' or 'funding source'.

[Reply](#)

BioPortal is building an online community of users who

- Develop, upload, and apply ontologies
- Map ontologies to one another
- Comment on ontologies via “notes” to give feedback
 - To the ontology developers
 - To one another
- Make proposals for specific changes to ontologies
- Stay informed about ontology changes and proposed changes via “push” technology
- Incorporate BioPortal services into their own technologies

My WebProtégé **Collaborative Pizza**

[Classes](#) | [Properties](#) | [Individuals](#) | [Notes and Discussions](#) | [Other Terminologies](#) | [Test Properties](#) | [Manage Hierarchy](#)

Add content to this tab | Add tab

Classes

Create Delete Watch | Search:

- owl:Thing
 - DomainConcept
 - Country
 - IceCream**
 - Pizza
 - CheeseyPizza
 - InterestingPizza
 - MeatyPizza
 - NamedPizza
 - NonVegetarianPizza
 - RealltalianPizza
 - SpicyPizza
 - SpicyPizzaEquivalent
 - VegetarianPizza
 - VegetarianPizzaEquivalent1
 - VegetarianPizzaEquivalent2
 - PizzaBase
 - PizzaTopping
 - ValuePartition

Properties for IceCream

Add property value Delete property value

Property	Value	Lang
rdfs:comment	A class to demonstrate mistakes made with setting a property domain. The property hasTopping has a domain of Pizza. This means that the reasoner can infer that all individuals using the hasTopping property must be of type Pizza. Because of the restriction on this class, all members of IceCream must use the hasTopping property, and therefore must also be members of Pizza. However, Pizza and IceCream are disjoint so this causes an	en

Axioms for IceCream

Superclasses (Necessary conditions)
DomainConcept
hasTopping *some* FruitTopping

Notes Tree for IceCream

New Topic

- Missing entities Sean Falconer **NewEntityProposal** 0 replies 3 months ago

More subclasses are needed. We should have classes for GoodIcecream, VeryBadIcecream, BadIcecream, and AverageIcecream.

Reply Open Edit Archive Delete 03/25/2010 13:40:20 PDT

WebProtégé allows collaborative ontology authoring online

Like BioPortal, WebProtégé supports notes and threaded discussions

My ICD ICD Content **Category Notes and Discussions** Reviews Change History Manage Hierarchy Export and Import

ICD Categories

Create Watch Branch Search: Type search string

- ICD Categories 1 7582
 - 01 I Certain infectious and parasitic diseases 501
 - 02 II Neoplasms 435
 - 03 III Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism 1399
 - 04 IV Endocrine, nutritional and metabolic diseases 71
 - 05 V Mental and behavioural disorders 535
 - 06 VI Diseases of the nervous system 2 524
 - 07 VII Diseases of the eye and adnexa 5
 - 08 VIII Diseases of the ear and mastoid process 37
 - 09 IX Diseases of the circulatory system 30
 - 10 X Diseases of the respiratory system 909
 - 11 XI Diseases of the digestive system 3 2163
 - Draft for ICD-10 Revision update 1 108
 - Needing a decision to be made 1 16
 - To be retired 1 88
 - LA Infections and infestations affecting the skin 2 467**
 - LB Inflammatory dermatoses 1 242
 - LC Metabolic and nutritional disorders affecting the skin 1 142
 - LD Genetic, chromosomal and developmental disorders affecting the skin 1 288
 - LE Psychological, psychiatric, sensory and neurological disorders affecting the skin 1 121
 - LF Disorders of the epidermis and epidermal appendages 1 103
 - LG Disorders of the dermis and subcutis 1 103
 - LH Disorders of cutaneous blood and lymphatic vessels 1 103

Notes Tree for LA Infections and infestations affecting the skin

New Topic Expand All Collapse All

Topic	Author	Explanation	Replies	Time
Decision as to which infections and infestations should be in Skin chapter	Robert Chalmers	ICD-10 chapter XII has a curious mix of infectious diseases. Non-specific skin-limited infections (tinea) are not included. Acute lymphadenitis is although lymphadenitis NOS is in chapter IX. Acute lymphadenitis can be retroperitoneal (and may result in an ischiorectal abscess). Lymph nodes (unspecified) would not normally be considered part of the skin and subcutis. Cellulitis is included though erysipelas, which is closely related if not, in the usage of some countries, virtually synonymous, is not. The rationale used for this section is explained in further detail in each subcategory.	0 replies	11 months ago
[Reason for change]: Create class with name: LA Infections and infestations affecting the skin, parents: 12 XII Diseases of the skin and subcutaneous tissue	Robert Chalmers		0 replies	1 year ago
New hierarchy for chapter				

Reply Open Edit Archive Delete 02/17/2010 23:07:58 PST

Reply Open Edit Archive Delete 02/11/2010 03:20:00 PST

As with BioPortal, notes may include multimedia

WebProtégé - Mozilla Firefox

File Edit View History Bookmarks Tools Help

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My WebProtégé Classes Properties Discussions

Ontology: ICD 11. [Login](#) for more features. [Search](#)

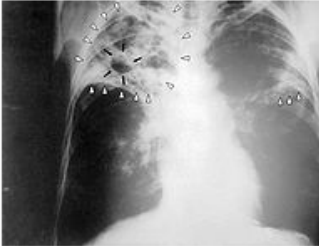
Class Tree

Create class Delete class

- owl:Thing
 - ICD11
 - ICD11 (A00-B99) Certain infectious and parasitic diseases (CHAPTER I)
 - ICD11 (A00-A09) Intestinal infectious diseases
 - ICD11 (A15-A19) Tuberculosis
 - ICD11 (A20-A28) Certain zoonotic bacterial diseases
 - ICD11 (A30-A49) Other bacterial diseases
 - ICD11 (A50-A64) Infections with a predominantly sexual mode of transmission
 - ICD11 (A65-A69) Other spirochaetal diseases
 - ICD11 (A70-A74) Other diseases caused by chlamydiae
 - ICD11 (A75-A79) Rickettsioses
 - ICD11 (A80-A89) Viral infections of the central nervous system
 - ICD11 (A90-A99) Arthropod borne viral fevers and viral haemorrhagic fevers
 - ICD11 (B00-B09) Viral infections characterized by skin and mucous membrane lesions
 - ICD11 (B15-B19) Viral hepatitis
 - ICD11 (B20-B24) Human immunodeficiency virus (HIV) disease
 - ICD11 (B25-B34) Other viral diseases
 - ICD11 (B35-B49) Mycoses
 - ICD11 (B50-B64) Protozoal diseases
 - ICD11 (B65-B83) Helminthiases
 - ICD11 (B85-B89) Pediculosis acariasis and other infestations
 - ICD11 (B90-B94) Sequelae of infectious and parasitic diseases
 - ICD11 (B95-B97) Bacterial viral and other infectious agents
 - ICD11 (B99) Other infectious diseases

Notes for ICD11 (A15-A19) Tuberculosis

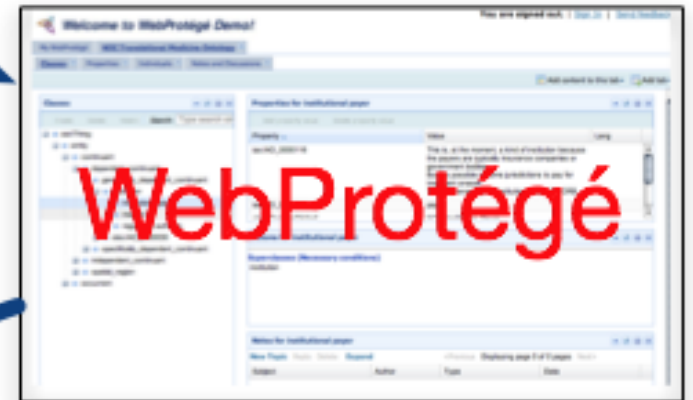
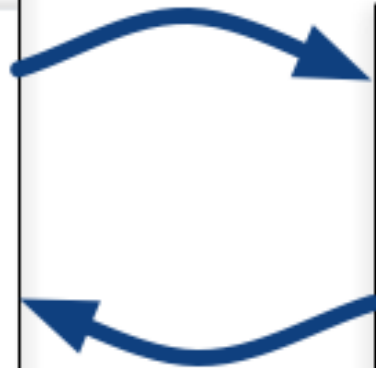
New Topic Reply Collapse <Previous Next> Displaying page 1 of 1 pages

Text	Author	Date
Example Here is a picture from Wikipedia:	Tania Tudorache	03/24/2009 12:12:22 PDT
>>RE: Example Forgot to include the picture!	Tania Tudorache	03/24/2009 12:14:32 PDT
		
T. === On 03/24/2009 11:12, Tania Tudorache wrote: Here is a picture from Wikipedia:		
>>RE: >>RE: Comment And here is the link to the article: http://en.wikipedia.org/wiki/Tuberculosis	icd1	03/24/2009 12:16:14 PDT

Integration of Ontology Authoring, Publishing, and Peer Review

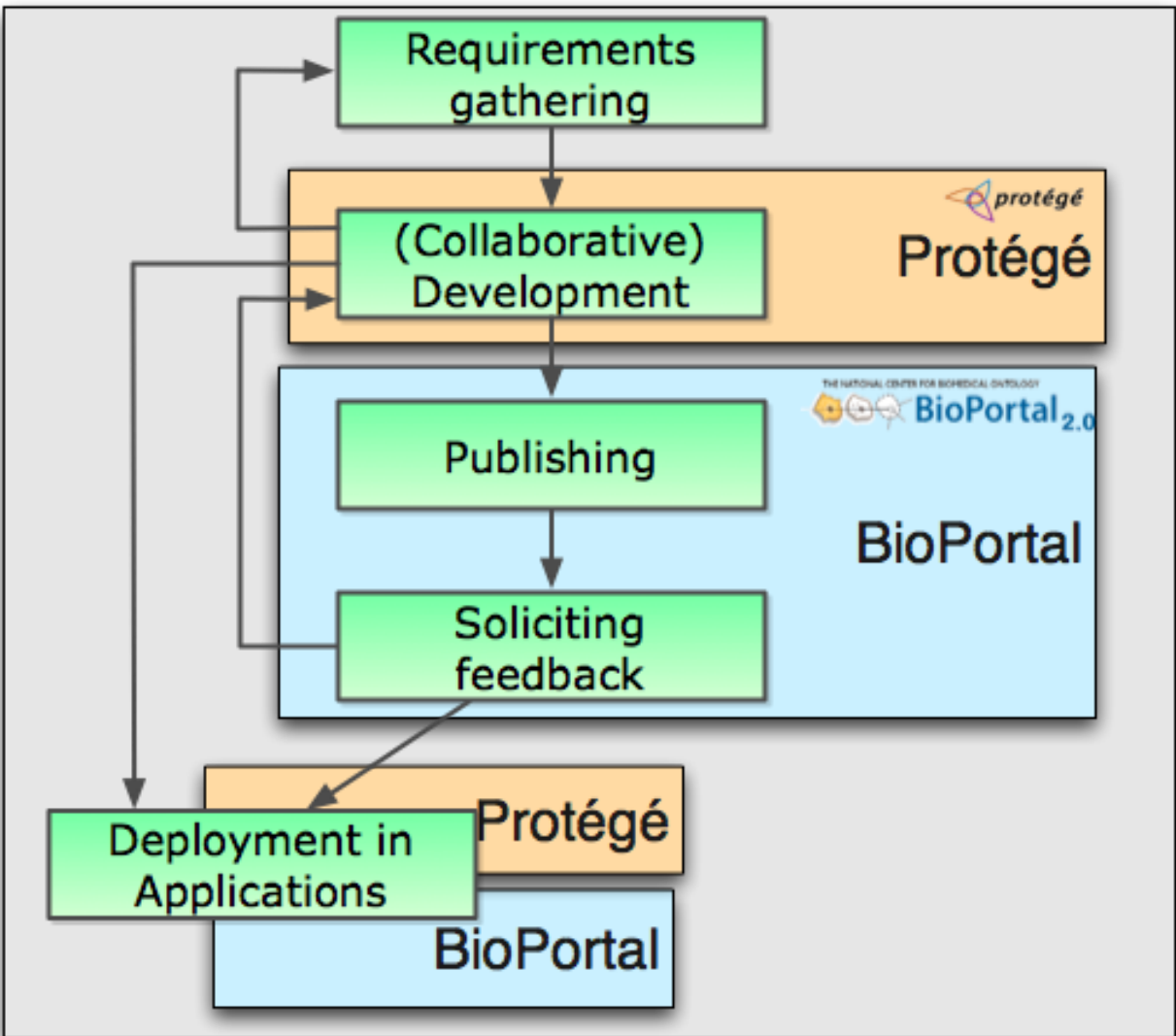


BioPortal



WebProtégé

NCBO will support the complete ontology lifecycle





ATHENA Hypertension Advisory

References Sources

Patient Name

[View Patient Summary](#)

Recommendations

Lifestyle

Adherence

Assumptions

Patient Summary

Blood Pressure apparently not under control: **CARDIO RISK FACTOR***
23% High
 Based on last measurement of **145/92** taken 87 days ago on mm/dd/yyyy

*Estimated 10 Year cardiovascular risk factor for this patient [Explain](#)

Enter a new BP:

Update

Date: MM/DD/YR Write back to Vista

Recommendations

[Other Patient Information and Alerts](#)

- Consider intensifying drug treatment: **BP Elevated** based on most recent available BP
- There appears to be a **Strong Contraindication** to a currently prescribed drug, evaluate clinical significance
- Bronchospasm is a **Strong Contraindication** or use of beta adrenergic receptor antagonists, although many patients tolerate and therefore benefit from this drug therapy

Review lifestyle modifications with the patient. See the [Lifestyle](#) page.

Therapeutic Possibilities

Indications

Contraindications

(CLICK FOR IMPORTANT PRESCRIPTION INFORMATION)

Discontinue [atenolol](#)

AND start one of the following drugs

[ACE Inhibitors \(lisinopril\)](#)

[\(non-DHP\) Calcium Channel Blocker \(diltiazem\)](#)

Add one or more of the following drugs

[ACE Inhibitors \(lisinopril\)](#)

[\(non-DHP\) Calcium Channel Blocker \(diltiazem\)](#)

Increase dosage of hydrochlorothiazide

Heart Failure [EVIDENCE](#)
 CKD

Heart Failure [EVIDENCE](#)
 CKD [EVIDENCE](#)

CKD

Heart Failure [EVIDENCE](#)
 CKD [EVIDENCE](#)

CKD

Brochospastic disease

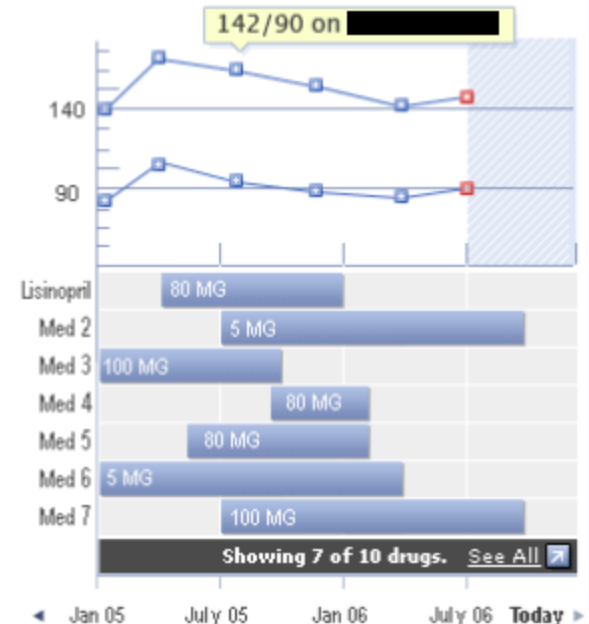
Heart Failure

Heart Failure

Compelling Indication Relative Indication Relative Contraindication Strong Contraindication Adverse Effects

Don't forget you know the patient better than we do message utpat lorem ipsum dolor sit amet consectetur adipiscing

Blood Pressure and Prescription History

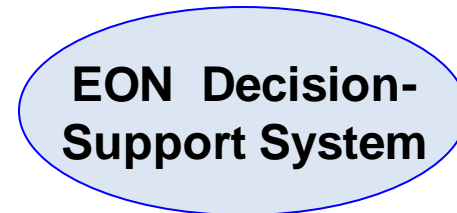
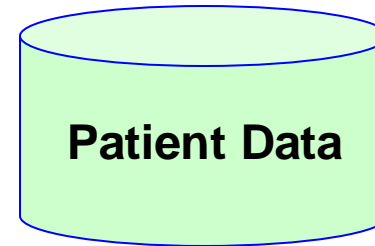
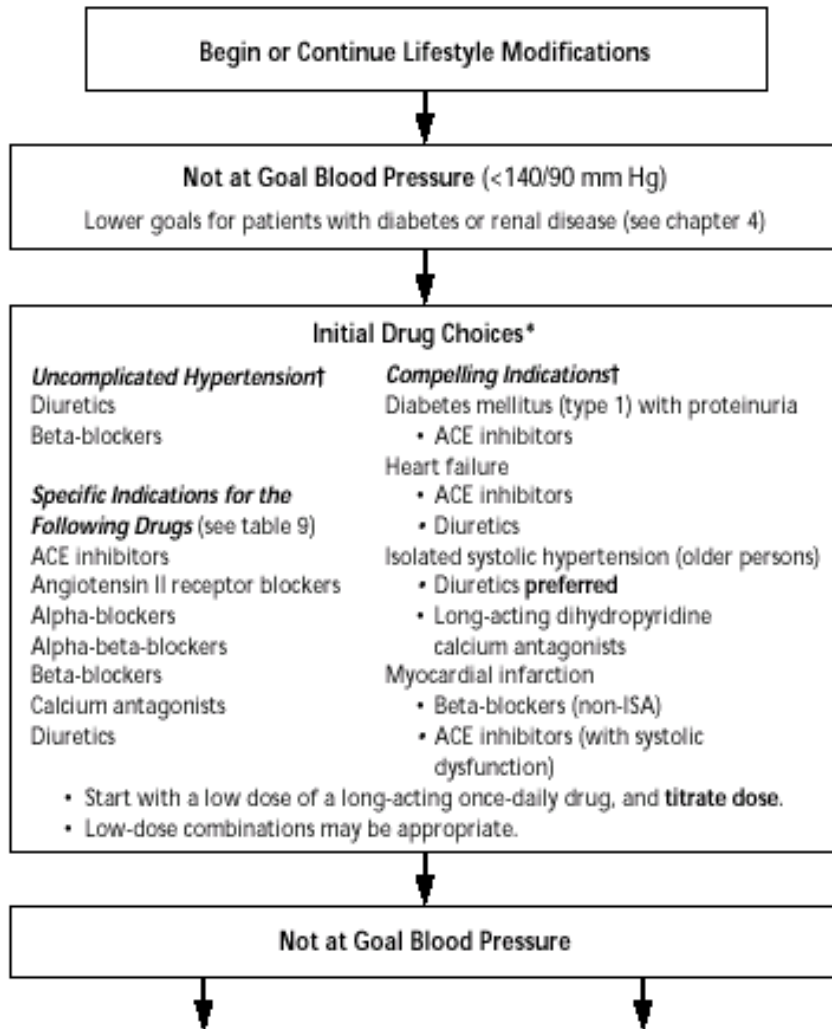


Do you have feedback for the Research team? Thank you!

Do not display advisory for this clinic visit again

Exit

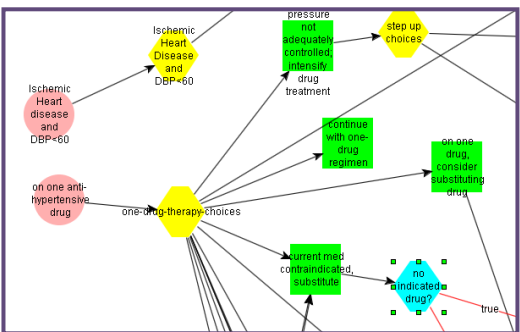
The task: guideline-based patient management



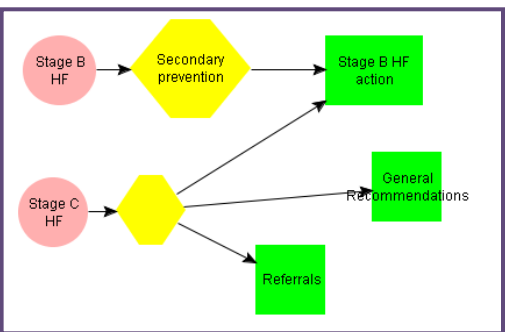
Consider adding an ACE Inhibitor because of a compelling indication (heart failure)

A handful of encoded guidelines gives you, well, a handful of encoded guidelines

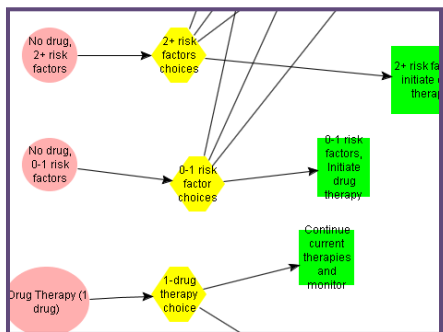
ATHENA Hypertension



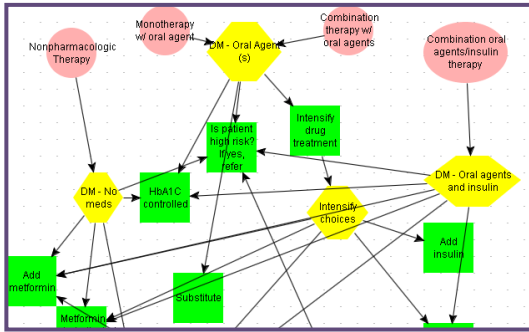
ATHENA Heart Failure



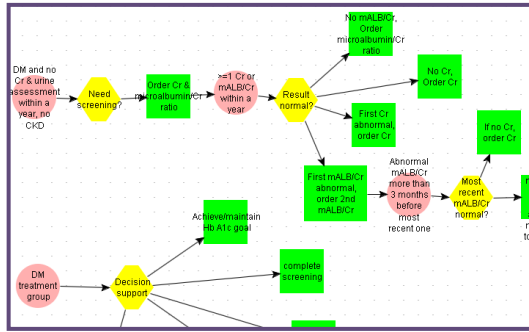
ATHENA Hyperlipidemia



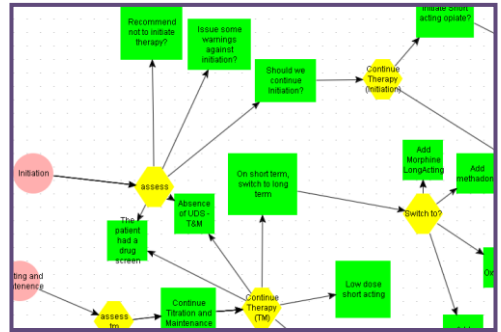
ATHENA Diabetes



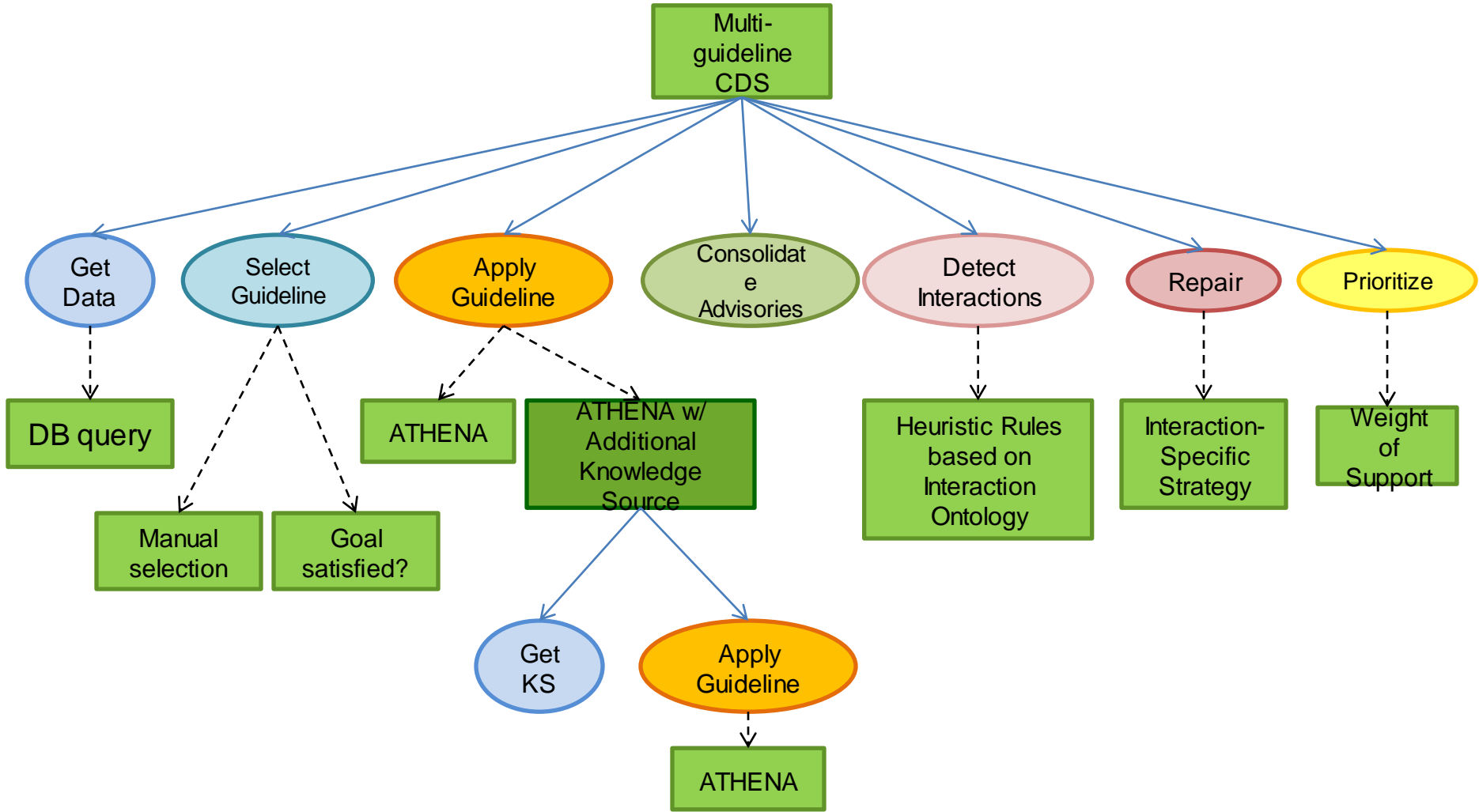
ATHENA Renal Disease



ATHENA Opioid Therapy



GLINDA Task-Method Decomposition

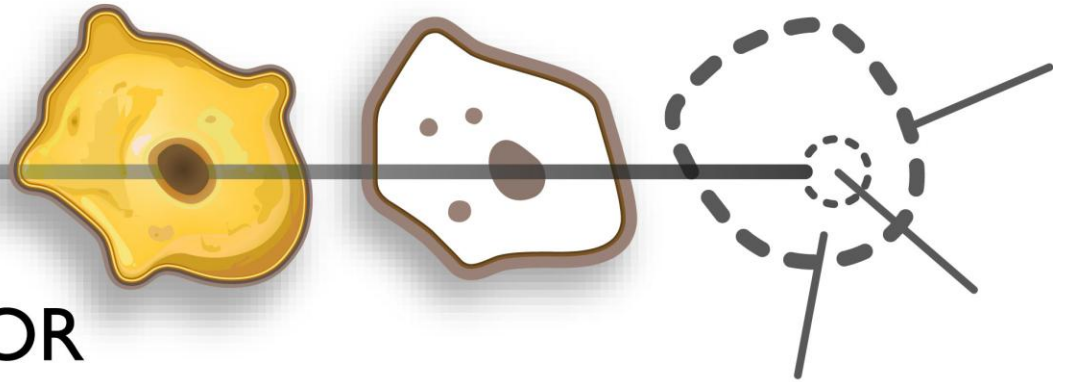


Semantic computing is crucial for biomedicine

- Myriad controlled terminologies in medicine are yielding to new ontologies
- Mandates for “meaningful use” of electronic patient records require processing of symbolic representations of patient data and situations
- The terabytes of data spewing from life-sciences laboratories cannot be managed without semantic organization and interpretation

What are the gaps?

- Intelligent services based on individual **rule bases will never scale**
- It is difficult to characterize the **feature space** that leads to a diagnosis
- It is difficult to characterize the **category space** when you decide on a diagnosis
- Imprecision in the category spaces mean **imprecision in therapeutics**
- The underlying information infrastructure is evolving—very slowly—from a 19th century model



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<http://bioontology.org>