

# OMG TECHNICAL MEETING SPECIAL EVENT

## *Semantics - Crossing the Chasm Workshop*

Reston, Virginia

March 26, 2014

## Standards and Semantics for Biomedicine



*Olivier Bodenreider*

Lister Hill National Center  
for Biomedical Communications  
Bethesda, Maryland - USA



U.S. National Library of Medicine

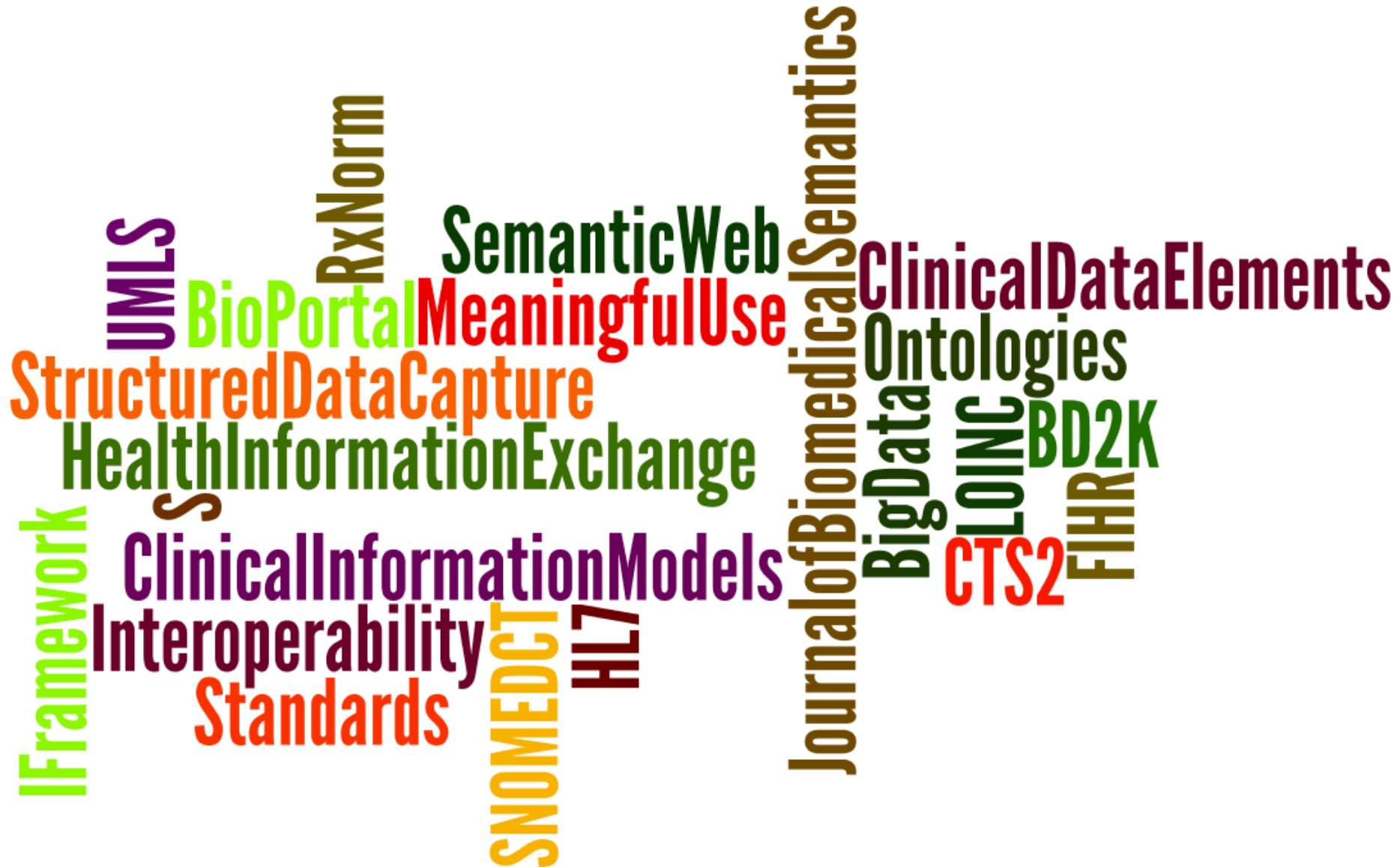


# Disclaimer

The views and opinions expressed do not necessarily state or reflect those of the U.S. Government, and they may not be used for advertising or product endorsement purposes.



# Standards and Semantics for Biomedicine



# Standards and Semantics for Biomedicine

- ◆ Standard vocabularies

- ◆ Data elements

- ◆ Information models

- ◆ Document markup standards

- ◆ Protocols

- ◆ Interfaces

Biomedical standards  
and semantics in action

- ◆ Clinical quality measures (Meaningful Use)





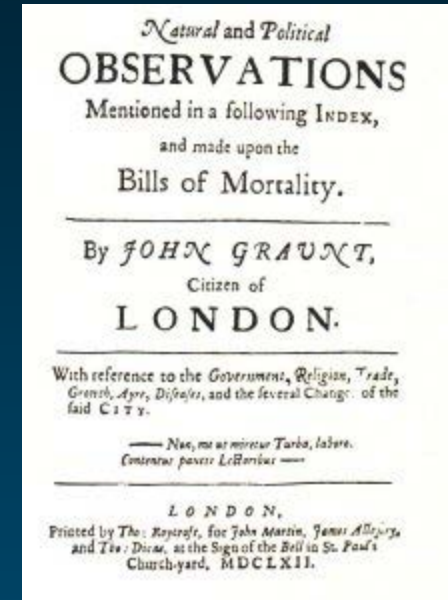
## ◆ Standard vocabularies

- ◆ Data elements
- ◆ Information models
- ◆ Document markup standards

# Standard vocabularies

# Standards to support epidemiology

- ◆ John Graunt (1620-1674)
  - Analyzes the vital statistics of the citizens of London
- ◆ William Farr (1807-1883)
  - Medical statistician
  - Improves Cullen's classification
  - Contributes to creating ICD
- ◆ Jacques Berthillon (1851-1922)
  - Chief of the statistical services (Paris)
  - Classification of causes of death (161 rubrics)



# London Bills of Mortality

**LONDON'S 'Dreadful Visitation:**  
*OR, A COLLECTION of All the*  
**Bills of Mortality**  
*For this Present Year:*  
 Beginning the 27<sup>th</sup> of December 1664. and  
 ending the 19<sup>th</sup>. of December following:  
 As also, The *GENERAL* or whole years *BILL*:  
 According to the Report made to the  
 KING'S Most Excellent Majesty.  
*By the Company of Parish-Clerks of London. etc*

LONDON:  
 Printed and are to be sold by E. Cotes living in Aldersgate-street.  
 Printer to the said Company 1665.

**A general Bill for this present year,**  
 ending the 19 of December 1665. according to  
 the Report made to the KING'S most Excellent Majesty.  
*By the Company of Parish Clerks of London, etc.*

*The Diseases and Casualties this year.*

<b>A</b> Bortive and Stillborne	517	Executed	21	Pallie	30
Aged	1545	Flux and Small Pox	655	Plague	68528
Aque and Peaver	5257	Found dead in Streets, fields, &c.	2	Plasmod	6
Apoplex and Suddenly	116	French Pox	86	Plurisie	19
Bedrid	10	Frighted	23	Posioned	4
Blind	5	Gout and Sciatica	27	Quinsie	35
Bleeding	16	Grief	46	Rickets	137
Bloody Flux, Scouring & Flux	185	Griping in the Guts	1238	Killing of the Lights	197
Burnt and Scalded	8	Hanged & made away themselves	7	Leprosie	14
Cancer	2	Head smote shot & Murther fallen	14	Scurvy	107
Cancer, Gangrene and Fistula	56	Jaundies	120	Shingles and Swine pox	2
Canker and Thrush	121	Impostume	227	Sores, Ulcers, broken and healed	82
Childbed	623	Killed by severall accidents	46	Spleen	14
Christomes and Infants	1258	Kings Evil	28	Spotted Fever and Purples	1929
Cold and Cough	62	Leprosie	14	Stopping of the Stomack	332
Collick and Winde	134	Lechary	21	Stone and Strangury	8
Consumption and Tiflick	4808	Livergown	12	Suckt	1101
Convulsion and Murther	1056	Meargrom and Headach	7	Teeth and Worms	1014
Distacted	3	Measles	9	Vomiting	51
Droove and Turpany	1476	Murthered and Shot	45	Vunn	7
Drowned	5	Overjaud & Starved	45		

Males	5114	Buried	48569	Of the Plague	68528
Children & Females	4853	Females	48737		
In all	9967	In all	97306		

Increased in the Burials in the 130 Parishes and at the Pest-houses this year. 70000  
 Increased of the Plague in the 130 Parishes and at the Pest-houses this year. 68528

# Standard vocabularies in the era of Meaningful Use

- ◆ Diagnoses / Diseases / Conditions
  - International classification of diseases (ICD)
  - **SNOMED CT**
- ◆ Procedures
  - Current Procedural terminology (CPT)
  - ICD10-PCS
  - **SNOMED CT**
- ◆ Drugs
  - **RxNorm**
- ◆ Laboratory tests
  - **LOINC**

# SNOMED Clinical Terms



# SNOMED CT Characteristics (1)

- ◆ Current version: January 31, 2014 (2 annual releases)
- ◆ Type: Reference terminology / ontology
- ◆ Domain: Clinical medicine
- ◆ Developer: IHTSDO
- ◆ Funding: IHTSDO
- ◆ Availability
  - Publicly available: Yes\* (in member countries)
  - Repositories: UMLS
- ◆ URL: <http://www.ihtsdo.org/>



# SNOMED CT Characteristics (2)

- ◆ Number of
  - Concepts: ~300,000 active concepts (Jan. 31, 2014)
  - Terms: ~1.1M active “descriptions”
- ◆ Major organizing principles:
  - Utility for clinical medicine (e.g., assertional + definitional knowledge)
  - Model of meaning (incomplete)
  - Rich set of associative relationships
  - Small proportion of defined concepts (many primitives)
- ◆ Formalism: Description logics (EL++)



# SNOMED CT Top level

Hierarchy		Subtype hierarchy
138875005	SNOMED CT Concept	
+ C 362981000	qualifier value	
+ C 106237007	linkage concept	
+ C 370115009	special concept	
+ C 48176007	social context	
+ C 419891008	record artifact	
+ C 363787002	observable entity	
+ C 308916002	environment or geographical location	
+ C 123038009	specimen	
+ C 254291000	staging and scales	
+ C 123037004	body structure	
+ C 272379006	event	
+ C 78621006	physical force	
+ C 404684003	clinical finding	
+ C 260787004	physical object	
+ C 410607006	organism	
+ C 71388002	procedure	
+ C 373873005	pharmaceutical / biologic product	
+ C 243796009	situation with explicit context	
+ C 105590001	substance	



# SNOMED CT Example

Hierarchy Subtype hierarchy

- 27010001 partial excision of large intestine
- 8613002 operation on appendix
- 80146002 **appendectomy**
  - 82730006 incidental appendectomy
  - 49438003 appendectomy with drainage
  - 174036004 emergency appendectomy
  - 174045003 interval appendectomy
  - 6025007 laparoscopic appendectomy
  - 235313004 non-emergency appendectomy
  - 235314005 inversion appendectomy
  - 1299000 excision of appendiceal stump

appendectomy - Definition

Concept Status: **Current**

Descriptions

- F appendectomy (procedure)
- P appendectomy
- S excision of appendix
- U appendicectomy

Definition: Fully defined by ...

- is a
  - D partial excision of large intestine
  - D operation on appendix
- Group
  - method
    - D excision - action
  - procedure site - Direct
    - D appendix structure
- Qualifiers
  - access
    - p surgical access values
  - priority
    - p priorities

Codes

- Original SnomedId : P1-57450
- Read Code (Ctv3Id) : X20Wz



RxNorm

# RxNorm Characteristics (1)

- ◆ Current version: March, 2014 (monthly releases)
- ◆ Type: Controlled terminology
- ◆ Domain: Drug names
- ◆ Developer: NLM
- ◆ Funding: NLM
- ◆ Availability
  - Publicly available: Yes\*
  - Repositories: UMLS
- ◆ URL: <http://www.nlm.nih.gov/research/umls/rxnorm/>



# RxNorm Characteristics (2)

- ◆ Number of
  - Concepts: 120,000 drug entities (March 2014)
  - Terms: ~1.3 term per concept
- ◆ Major organizing principles:
  - Generic vs. brand
  - Combinations of Ingredient / Form / Dose
  - No hierarchical structure
  - Links to all major US drug information sources
  - No clinical information
- ◆ Formalism: UMLS RRF format

# RxNorm Normalized form

**Strength**

4mg/ml

**Ingredient**

Fluoxetine

**Dose form**

Oral Solution

**Strength**

Semantic clinical drug component

**Ingredient**

**Ingredient**

**Dose form**

Semantic clinical drug form

**Strength**

**Ingredient**

**Dose form**

Semantic clinical drug



# Rx Norm Generic vs. Brand

## ◆ Generic

- Ingredient (IN)

- Clinical drug form (SCDF)

- Clinical drug component (SCDC)

- Clinical drug (SCD)

## ◆ Brand

- Brand name (BN)

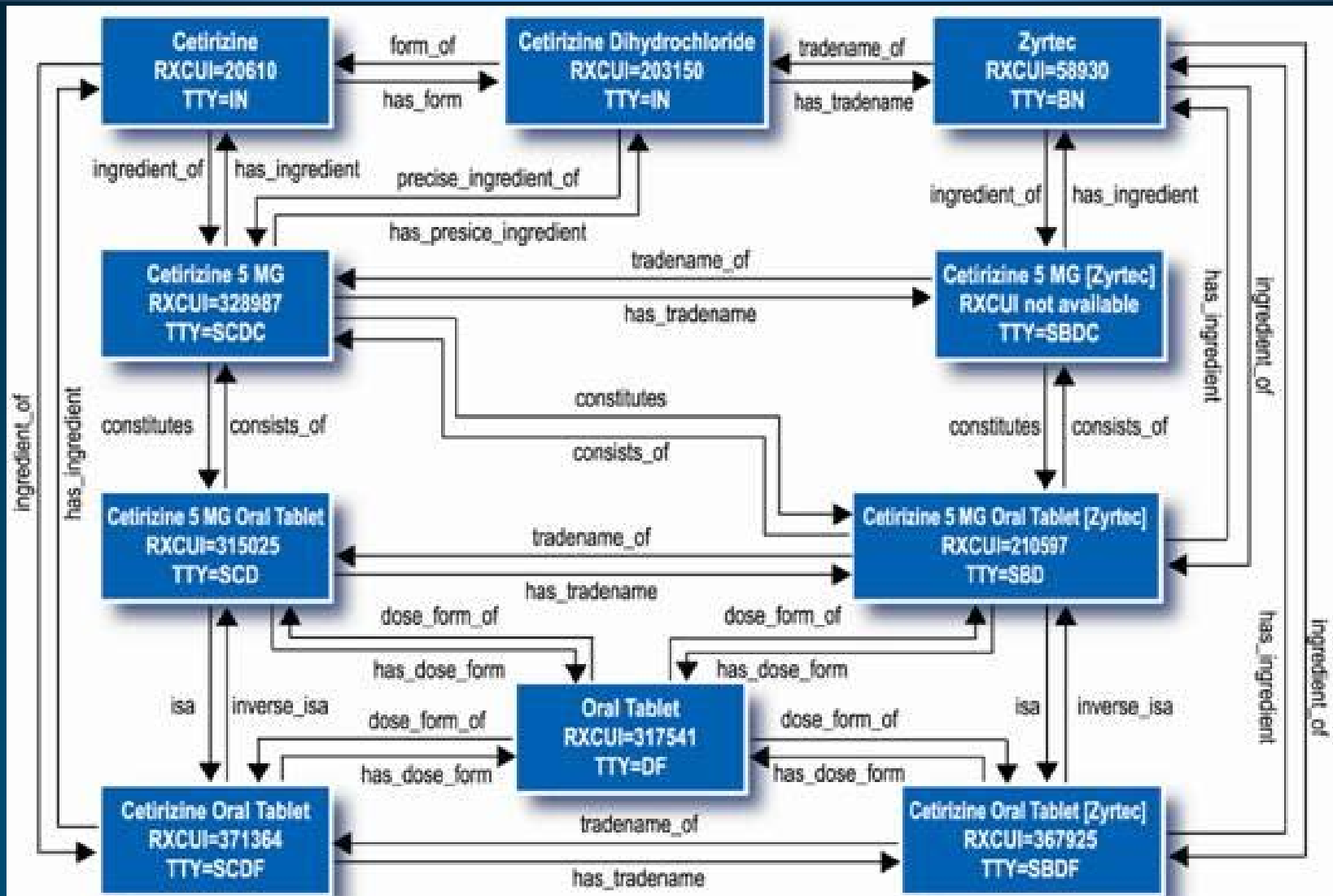
- Branded drug form (SBDF)

- Branded drug component (SBDC)

- Branded drug (SBD)

*tradename\_of*

# RxNorm Relations among drug entities



# Logical Observation Identifiers, Names and Codes (LOINC)





# LOINC Characteristics (1)

- ◆ Current version: 2.46 (Dec. 2013)
- ◆ Type: Controlled terminology\*
- ◆ Domain: Laboratory and clinical observations
- ◆ Developer: Regenstrief Institute
- ◆ Funding: NLM
- ◆ Availability
  - Publicly available: Yes
  - Repositories: UMLS
- ◆ URL: [www.regenstrief.org/loinc/loinc.htm](http://www.regenstrief.org/loinc/loinc.htm)



# LOINC Characteristics (2)

- ◆ Number of
  - Concepts: ~70k active codes (2.46)  
(2 annual releases)
  - Terms: n/a\*
- ◆ Major organizing principles:
  - No hierarchical structure among the main codes
  - 6 axes
    - Component (analyte [+ challenge] [+ adjustments])
    - Property
    - Timing
    - System
    - Scale
    - [Method]
- ◆ Formalism: “DL-like”

# LOINC Example

- ◆ *Sodium:SCnc:Pt:Ser/Plas:Qn*  
[the molar concentration of sodium is measured in the plasma (or serum), with quantitative result]

Axis	Value
Component	Sodium
Property	SCnc – Substance Concentration (per volume)
Timing	Pt – Point in time (Random)
System	Ser/Plas – Serum or Plasma
Scale	Qn – Quantitative
Method	--

# Semantics across standards

*Terminology integration systems*

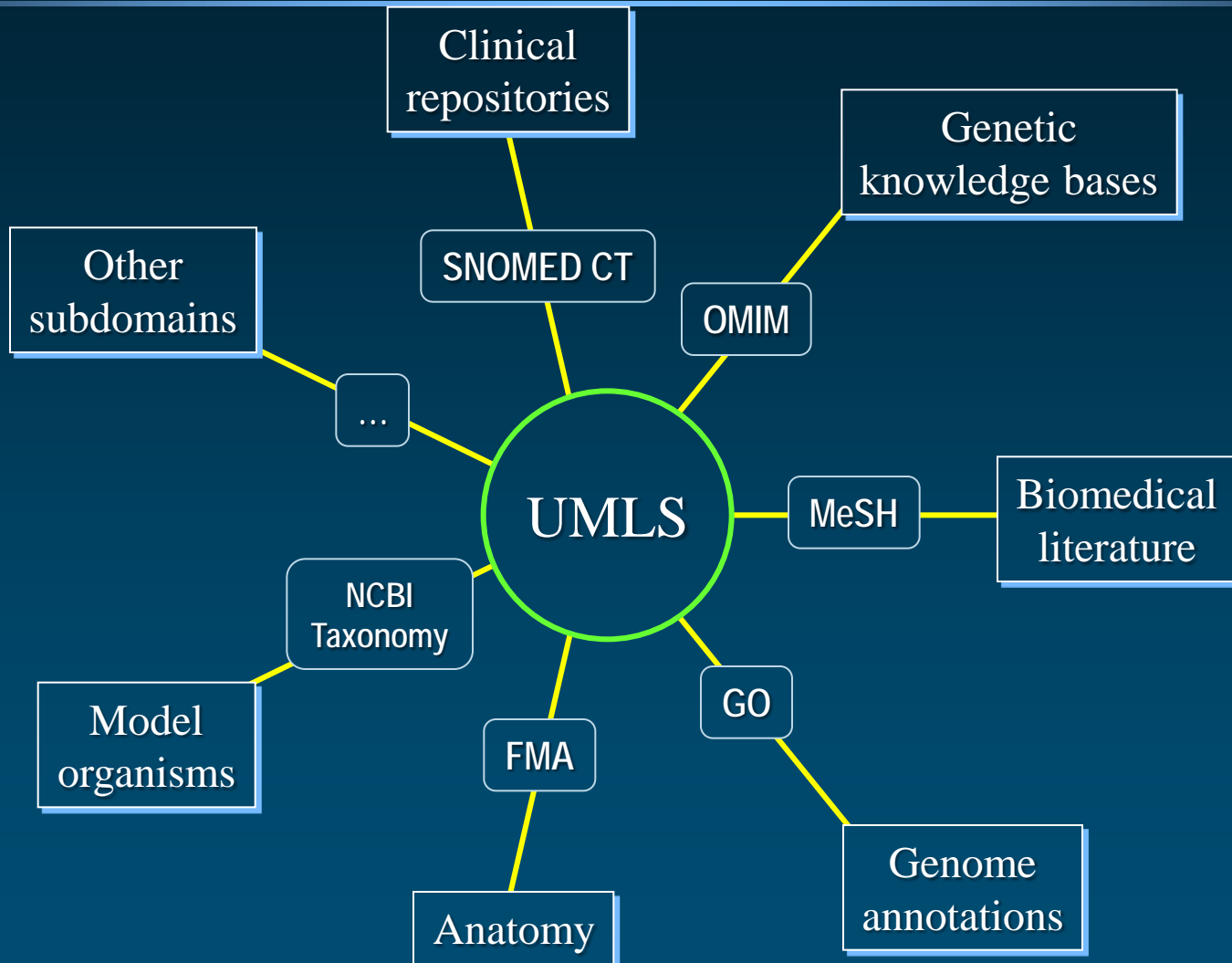
# Addison's disease – Different names

Addison Disease	MeSH	D000224
Primary hypoadrenalism	MedDRA	10036696
Primary adrenocortical insufficiency	ICD-10	E27.1
Addison's disease (disorder)	SNOMED CT	363732003

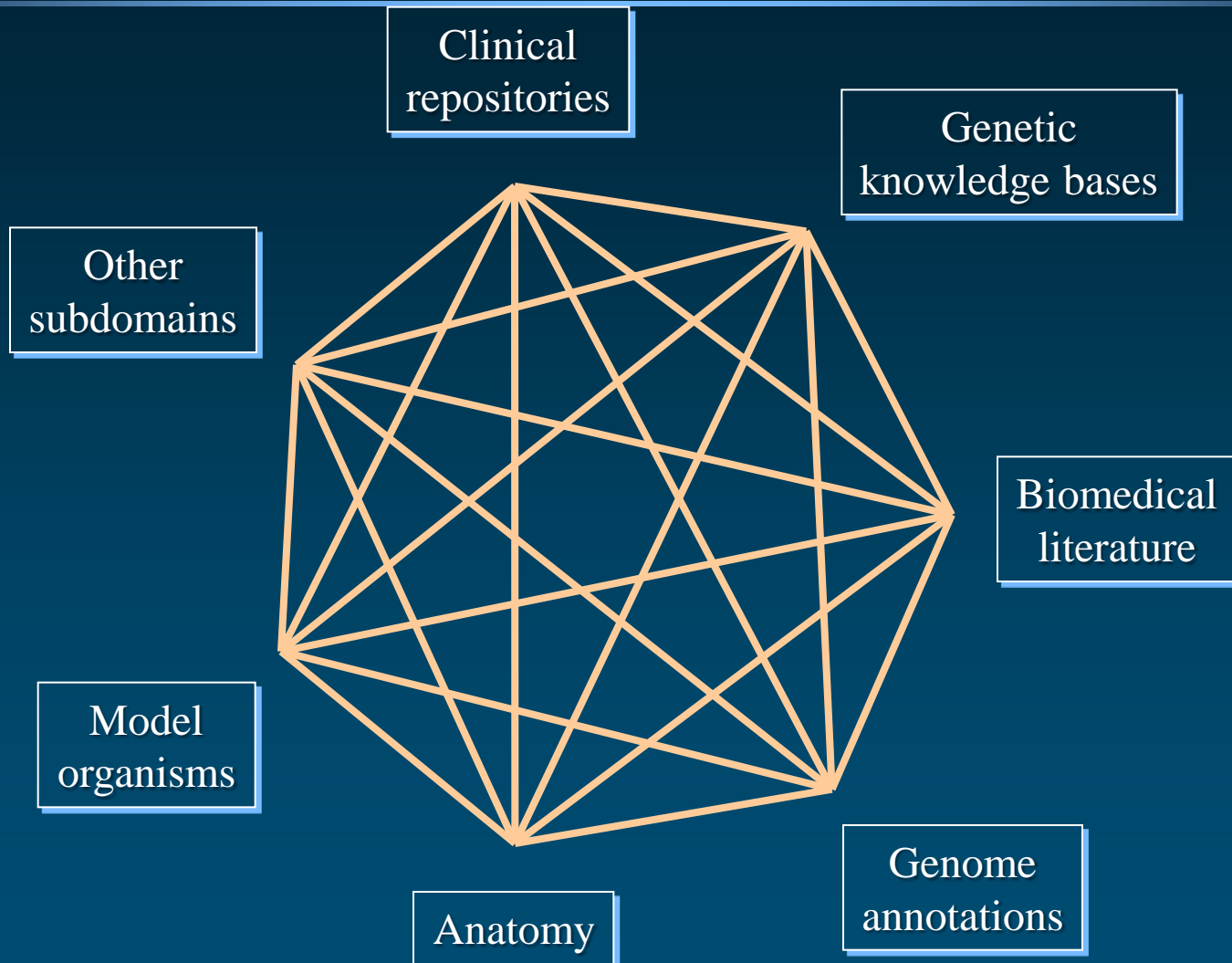


Addison's disease

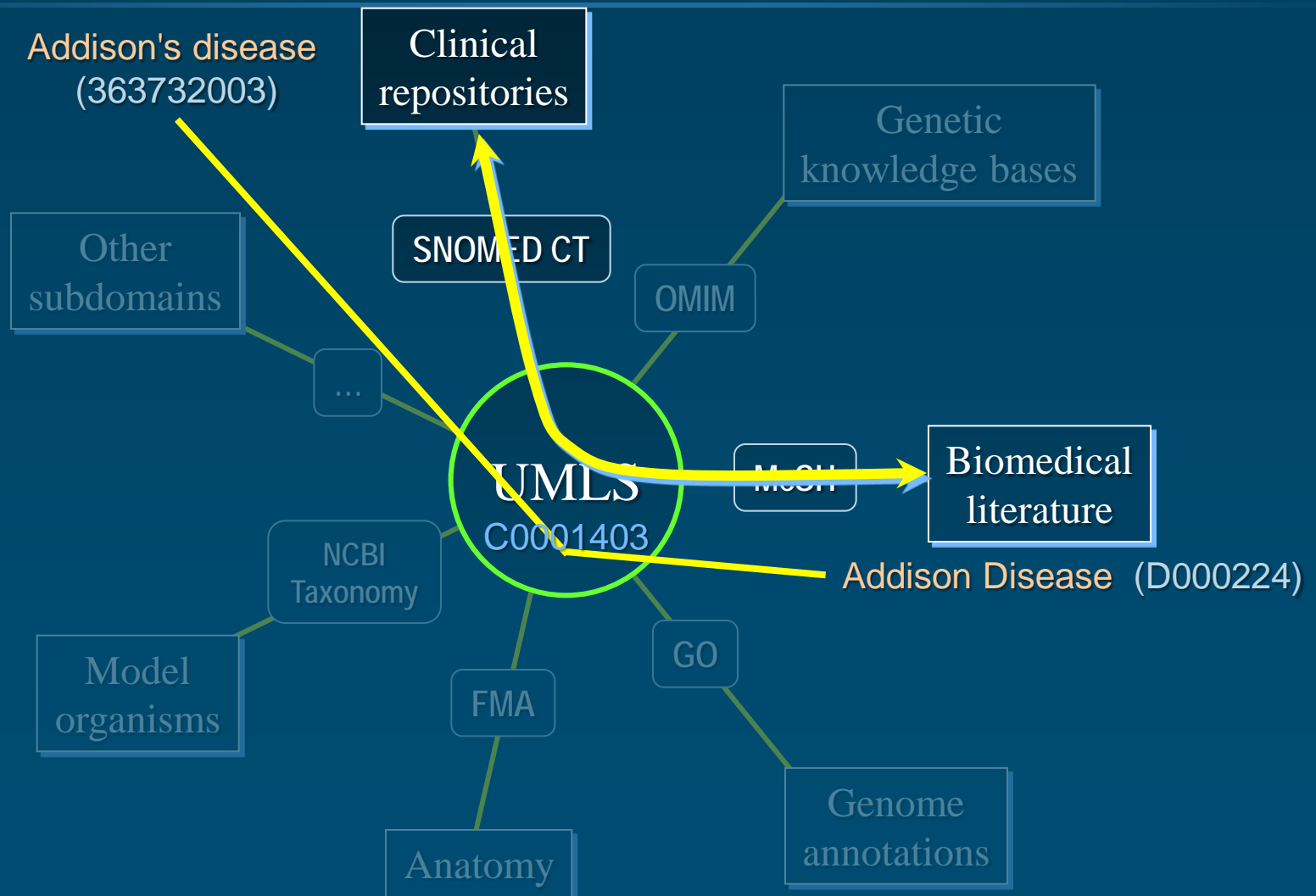
# Integrating subdomains



# Integrating subdomains



# Terminology integration





# Unified Medical Language System

A service of the U.S. National Library of Medicine | National Institutes of Health

[Sign In](#) | [Sign Up](#) | [Contact](#)



Unified Medical  
Language System®

## UMLS Terminology Services

[UTS Home](#) [Applications](#) [SNOMED CT](#) [Resources](#) [Downloads](#) [Documentation](#) [UMLS Home](#) 

### Welcome to the UTS

[Welcome »](#)

[Request a License](#)

[News/Announcements](#)

[Training](#)

[Supported Browsers](#)

#### The UMLS Terminology Services (UTS) allows you to:

- Request a UMLS Metathesaurus License and create a UTS account
- Search and display content from UTS Applications including:
  - Metathesaurus Browser
  - Semantic Network Browser
  - SNOMED CT Browser
- Download data files including:
  - UMLS Knowledge Sources
  - RxNorm weekly and monthly updates
  - SNOMED CT
  - CORE Problem List and Route of Administration Subsets of SNOMED CT
- Query data remotely via Web Services (see API Documentation)
- Complete UMLS Annual Report and SNOMED CT® Affiliate Reports

<https://uts.nlm.nih.gov/>

# NCBO BioPortal

<http://bioportal.bioontology.org/>



BioPortal

[Browse](#)

[Search](#)

[Mappings](#)

[Recommender](#)

[Annotator](#)

[Resource Index](#)

[Projects](#)

[Sign In](#)

[Help](#)

[Feedback](#)

[Follow @bioontology](#)

1,583 followers

[Like](#)

312

[Cite Us](#)

Welcome to BioPortal! For help using BioPortal, click on this icon: [?](#)

Search all ontologies

Enter concept, e.g. Melanoma

Search

[Advanced Search](#)

Find an ontology

Enter ontology name, e.g. NCI Thesaurus

Explore

[Browse Ontologies >](#)

Search resources

Enter a concept, e.g. Melanoma

Search

[Advanced Resource Search](#)

Most Viewed Ontologies

Ontology	Views
<a href="#">SNOMED Clinical Terms</a>	13,601
<a href="#">National Drug File</a>	9,320
<a href="#">MedDRA</a>	4,254
<a href="#">International Classification of Diseases</a>	3,415
<a href="#">NCI Thesaurus</a>	1,528

Statistics

Ontologies	375
Classes	5,903,413

Latest Notes

[test \(Chemical Entities of Biological Interest Ontology\)](#)  
about 17 hours ago by steschu  
test by stefan to see whether bioportal notes arrive

[New Term Proposal-lzXVqSUMoQCQc \(Radiology Lexicon\)](#)  
5 months ago by rboden

[New Term Proposal-OqPnBnZbfGppdoi \(Radiology Lexicon\)](#)  
5 months ago by rboden

[New Term Proposal-IttxKlyGottfkuQ \(Radiology Lexicon\)](#)  
5 months ago by rboden

[New Term Proposal-WMPPrfBiLOEDqFyz \(Radiology Lexicon\)](#)  
5 months ago by rboden

Latest Mappings

[Mixed ductal and lobular carcinoma of breast \(SNOMEDCT\) <=> Abnormal Cell \(NCIT\)](#)  
REST Mapping 03/05/2014 by catpes

[synaptic dysfunctioning \(ADO\) <=> amyloid beta protein \(ADO\)](#)  
REST Mapping 12/26/2013 by dnjswns1988

[Malignant neoplasm of bronchus and lung, unspecified \(ICD9CM\) <=> Non-small cell lung cancer \(SNOMEDCT\)](#)  
BioPortal UI 04/02/2013 by twicker

[Malignant neoplasm of unspecified part of unspecified bronchus or lung \(ICD10CM\) <=> Non-small cell lung cancer \(SNOMEDCT\)](#)  
BioPortal UI 04/02/2013 by twicker

# Collaborations between SDOs

## ◆ SNOMED CT-LOINC

- Description of lab tests and clinical measurements in reference to SNOMED CT concepts

## ◆ SNOMED CT-ICD11

- SNOMED CT is being used as the ontological framework for ICD11

# CTS2 – Common Terminology Services



<http://informatics.mayo.edu/cts2/>

## CTS2

[Home](#)

[About CTS2](#)

[Primer](#)

## Specification

[FAQ](#)

[REST](#)

[SOAP](#)

[HL7 SFM](#)

## Development

[CTS2 Development Framework](#)

[Implementations](#)

[Github Page](#)

## Community

[Who is Using CTS2?](#)

[Get Help](#)

[Links](#)

## What is CTS2?

### Latest CTS2 News

### About CTS2

CTS2 is a model and specification for discovering, accessing, distributing and updated terminological resources on the internet.

### A Specification

**CTS2 is an Application Programming Interface (API) specification.**

- It defines the semantics, syntax and valid interactions that can occur
- It is a "blueprint" for software
- If everyone follows the blueprint (and the blueprint is sufficiently precise) then CTS2 clients and services can interoperate

## Get Started

### Learn and Explore CTS2



### See CTS2 In Action

Browse online [demos](#) to see CTS2 working on the Web!

## Implementations

### CTS2 Development Framework

The CTS2 Development Framework is a development kit for rapidly creating CTS2 compliant applications.

### NCBO Bioportal Implementation

A CTS2 Implementation based on the NCBO Bioportal

### ...more implementations!

Learn more about the CTS2 implementation work being done!

## OMG® Standard



### CTS2 - an Object Management Group® (OMG) Standard

For the latest info on the CTS2 OMG® Specification, visit the [specification](#) page.

- ◆ Standard vocabularies

- ◆ Data elements

- ◆ Information models

- ◆ Document markup standards

## Data elements

*Individual variables*

# Common data elements at NIH

The image is a screenshot of the NIH Common Data Element (CDE) Resource Portal homepage. At the top, the NIH logo is followed by the text "U.S. National Library of Medicine". To the right is a search bar with a magnifying glass icon and the word "Search". Below the header is a navigation bar with five tabs: "Databases", "Find, Read, Learn", "Explore NLM", "Research at NLM", and "NLM for You". To the right of these tabs is a "Contact NLM" link and social media icons for RSS, Twitter, and Facebook. Below the navigation bar is a dark blue banner with the NIH logo and the text "Common Data Element (CDE) Resource Portal". To the right of this banner are links for "Home", "Resource Summaries", and "Glossary". Below the banner is a yellow box containing the URL <http://www.nlm.nih.gov/cde/>. The main content area has a "Home" heading. Below it is a paragraph explaining that NIH encourages the use of common data elements (CDEs) in clinical research, patient registries, and other human subject research to improve data quality and opportunities for comparison and combination of data from multiple studies and with electronic health records. This portal provides access to NIH-supported CDE initiatives and other tools and resources that can assist investigators developing protocols for data collection. A link to "What is a CDE?" is provided. Below this paragraph are two columns. The left column is titled "NIH CDE Initiatives" and describes collections of CDEs that have been identified for use in particular NIH-supported research projects or registries after a formal evaluation and selection processes. Below this text are two buttons: "Summary Table" and "Subject Areas". The right column is titled "NIH CDE Tools and Resources" and describes databases and repositories of data elements and case report forms that may assist investigators in identifying and selecting data elements for use in their projects. Below this text are two buttons: "Summary Table" and "Subject Areas".

NIH U.S. National Library of Medicine

Search

Databases Find, Read, Learn Explore NLM Research at NLM NLM for You

Contact NLM

NIH Common Data Element (CDE) Resource Portal

Home | Resource Summaries | Glossary

<http://www.nlm.nih.gov/cde/>

## Home

NIH encourages the use of common data elements (CDEs) in clinical research, patient registries, and other human subject research in order to improve data quality and opportunities for comparison and combination of data from multiple studies and with electronic health records. This portal provides access to NIH-supported CDE initiatives and other tools and resources that can assist investigators developing protocols for data collection. [What is a CDE?](#)

### NIH CDE Initiatives

Collections of CDEs that have been identified for use in particular NIH-supported research projects or registries after a formal evaluation and selection processes.

[Summary Table](#) [Subject Areas](#)

### NIH CDE Tools and Resources

Databases and repositories of data elements and case report forms that may assist investigators in identifying and selecting data elements for use in their projects.

[Summary Table](#) [Subject Areas](#)

The CDE Resource Portal also includes [Other CDE Resources](#) and [Relevant Standards](#). Descriptions of all four groups can be found in the

- ◆ Standard vocabularies
- ◆ Data elements
- ◆ Information models
- ◆ Document markup standards

## Information models

*Questionnaires, forms*

# Clinical research data



[HOME](#) [BLOG](#) [SITE MAP](#) [FAQ](#) [CONTACT](#) [SEARCH](#) [CDISC PORTAL](#)



<http://www.cdisc.org/>

[ABOUT CDISC](#)

[STANDARDS & INNOVATIONS](#)

[RESOURCES](#)

[NEWS](#)

[EDUCATION & EVENTS](#)

[MEMBERSHIP](#)

[MEMBERS ONLY](#)

## Mission & Principles

### Mission Statement

CDISC is a global, open, multidisciplinary, non-profit organization that has established standards to support the acquisition, exchange, submission and archive of clinical research data and metadata. **The CDISC mission is to develop and support global, platform-independent data standards that enable information system interoperability to improve medical research and related areas of healthcare.** CDISC standards are vendor-neutral, platform-independent and freely available via the CDISC website.

*The CDISC Vision is to Inform Patient Care & Safety Through Higher Quality Medical Research.*

### Core Principles

- Lead the development of standards that improve efficiency while supporting the scientific nature of clinical research.
- Recognize the ultimate goal of creating regulatory submissions that allow for flexibility in scientific content and are easily interpreted, understood, and navigated by regulatory reviewers.

### Become a CDISC Member (Fee Based)

[Become A Member](#)

### Member Log-in

\*

\*

[Forgot my password](#)

### CDISC Newsletter Archive

Please note that we will be adding prior newsletters soon.

[CDISC October Newsletter 2013.](#)

[CDISC December Newsletter 2013.](#)

[CDISC January Newsletter 2014.](#)



# Clinical information modeling initiative (CIMI)

## ◆ Information models for healthcare

- Clinical decision support

## ◆ International consortium

- SDOs
- Clinical institutions
- Governmental agencies

## ◆ Isosemantic models

- Harmonization across models
- Interface with terminology



<http://informatics.mayo.edu/CIMI/>

- ◆ Standard vocabularies
- ◆ Data elements
- ◆ Information models
- ◆ Document markup standards

# Document markup standards

*Information exchange*

# Clinical Document Architecture



Health Level Seven International

Log In

Search



Home

About HL7

Standards

Membership

Resources

HL7 Store

Newsroom

Events

My HL7

[Home](#) > [Standards](#) > Product Brief

## Section 1: Primary Standards

## Section 3: Clinical and Administrative Domains

### CDA® Release 2

#### DESCRIPTION

The HL7 Version 3 Clinical Document Architecture (CDA®) is a document markup standard that specifies the structure and semantics of "clinical documents" for the purpose of exchange between healthcare providers and patients. It defines a clinical document as having the following six characteristics: 1) Persistence, 2) Stewardship, 3) Potential for authentication, 4) Context, 5) Wholeness and 6) Human readability.

A CDA can contain any type of clinical content -- typical CDA documents would be a Discharge Summary, Imaging Report, Admission & Physical, Pathology Report and more. The most popular use is for inter-enterprise information exchange, such as is envisioned for a US Health Information Exchange (HIE).

#### ALTERNATIVE NAMES

CDA® Release 2 may also go by the following names or acronyms:

*"Clinical Document Architecture, R2", "Clinical Document Architecture, R2 (Reaffirmation)", CDAR2*

#### TARGETS

- Healthcare Providers
- Healthcare IT Vendors

<https://www.hl7.org/>

Introduction

HL7 Standards Licensed  
At No Cost

Master grid of all  
standards

Section 1: Primary  
Standards

Section 2: Foundational  
Standards

Section 3: Clinical and  
Administrative Domains

Section 4: EHR Profiles

Section 5:  
Implementation Guides

Section 6: Rules and  
References

Section 7: Education &  
Awareness

IP Policy

# Exchanging information with patients

## Blue Button



Blog | Consumer Toolkit | Contact | Get Email Updates |      

FAQs | Multimedia | Newsroom 

Providers & Professionals ▶ Patients & Families Policy Researchers & Implementers ▶

Basics of Health IT ▶ E-Health ▶ Benefits of Health IT ▶ Protecting Your Privacy & Security ▶ Health IT Stories ▶ Your Health Records ▶

HealthIT.gov > For Patients & Families > Your Health Records > About Blue Button  Print |  Share

## Your Health Records

About Blue Button

About the Blue Button Movement

Benefits of Blue Button

How to begin downloading and using your health records

Join the Blue Button Movement

### About Blue Button

Do you want to feel more in control of your health and your personal health information? Do you have a health issue? Are you caring for an elderly parent? Are you changing doctors? Do you need to find the results of a medical test or a complete and current list of your medications? Blue Button may be able to help.

### Your Health Records

Millions of Americans can get easy, secure online access to their health records thanks to "Blue Button". Health information about you may be stored in many places, such as doctors' offices, hospitals, drug stores and health insurance companies. Blue Button is a way you can access your health records electronically so you can:

- Share them with your doctor or trusted family members or caregivers
- Check to make sure the information, such as your medication list, is accurate and

### Quick Links

- [Your health records](#)
- [Your rights](#)
- [What kind of information is available to you?](#)

# Getting relevant information – InfoButton



Health Level Seven International

Log In

Search



Home

About HL7

Standards

Membership

Resources

HL7 Store

Newsroom

Events

My HL7

[Home](#) > [Standards](#) > Product Brief

## Section 3: Clinical and Administrative Domains Section 7: Education & Awareness

### HL7 Version 3 Standard: Context Aware Knowledge Retrieval Application (“Infobutton”), Knowledge Request

#### DESCRIPTION

Context-aware knowledge retrieval into clinical information systems (CIS), such as electronic health record (EHR) and personal health record (PHR) systems, is an increasingly promising approach for delivering relevant clinical knowledge to the point of care as well as patient-tailored educational material to support patient-centered care. These kinds of knowledge retrieval tools have been known as “Infobuttons.” For example, an infobutton displayed in the context of a patient’s problem list may allow a user to view directly educational material regarding the evaluation and treatment of a specific disease without having to leave the CIS and look up the knowledge elsewhere.

#### ALTERNATIVE NAMES

HL7 Version 3 Standard: Context Aware Knowledge Retrieval Application (“Infobutton”), Knowledge Request may also go by the following names or acronyms:

<https://www.hl7.org/>



ANSI/HL7 V3 INFOB, R1-2010  
July 21, 2010

HL7 Version 3 Standard:  
Context-Aware Retrieval Application (Infobutton);  
Knowledge Request, Release 1

### HL7 Version 3 Standard: Context-Aware Retrieval Application (Infobutton); Release 1 July 2010

Editor:

Robert Seliger, Scintillon

Contributing Editors:

David Fawcett, Scintillon

Michael Russell, Duke University

Kevin Sengstacker, Careix

David Stapp, Veterans Health Administration (SAC)

Copyright © 2010 Health Level Seven International. All RIGHTS RESERVED. The reproduction of this material in any form is strictly prohibited without the written permission of the publisher. HL7 International and Health Level Seven are registered trademarks of Health Level Seven International. Reg. U.S. Pat. & TM Off.

Introduction

HL7 Standards Licensed  
At No Cost

Master grid of all  
standards

Section 1: Primary  
Standards

Section 2: Foundational  
Standards

Section 3: Clinical and  
Administrative Domains

Section 4: EHR Profiles

Section 5:  
Implementation Guides

Section 6: Rules and  
References

Section 7: Education &  
Awareness

IP Policy

# Biomedical standards and semantics in action

*VALUE SETS  
IN  
CLINICAL QUALITY MEASURES*

# “Meaningful Use”

---

## ◆ Health Information Technology for Economic and Clinical Health (HITECH) Act

- Eligible health care professionals and hospitals can qualify for Medicare and Medicaid incentive payments when they adopt certified EHR technology and use it to achieve specified objectives

## ◆ Two sets of regulations

- *Incentive Program for Electronic Health Records*  
Medicare and Medicaid Services (CMS)
- *Standards and Certification Criteria for Electronic Health Records*  
Office of the National Coordinator (ONC)



# Meaningful Use stages

<b>Stage 1</b> <b>2011-2012</b>  Data capture and sharing	<b>Stage 2</b> <b>2014</b>  Advance clinical processes	<b>Stage 3</b> <b>2016</b>  Improved outcomes
<b>Stage 1:</b> <b>Meaningful use criteria focus on:</b>	<b>Stage 2:</b> <b>Meaningful use criteria focus on:</b>	<b>Stage 3:</b> <b>Meaningful use criteria focus on:</b>
Electronically capturing health information in a standardized format	More rigorous health information exchange (HIE)	Improving quality, safety, and efficiency, leading to improved health outcomes
Using that information to track key clinical conditions	Increased requirements for e-prescribing and incorporating lab results	Decision support for national high-priority conditions
Communicating that information for care coordination processes	Electronic transmission of patient care summaries across multiple settings	Patient access to self-management tools
Initiating the reporting of clinical quality measures and public health information	More patient-controlled data	Access to comprehensive patient data through patient-centered HIE
Using information to engage patients and their families in their care		Improving population health



## Details for: CMS MEDICARE AND MEDICAID EHR INCENTIVE PROGRAMS: STAGE 2 FINAL RULE

[Return to List](#)

**For Immediate Release:** Thursday, August 23, 2012  
**Contact:** CMS Office of Public Affairs  
202-690-6145

### CMS MEDICARE AND MEDICAID EHR INCENTIVE PROGRAMS: STAGE 2 FINAL RULE

On August 23, 2012, the Centers for Medicare & Medicaid Services (CMS) announced a final rule to govern Stage 2 of the Medicare and Medicaid Electronic Health Record (EHR) Incentive Programs. The rule specifies the Stage 2 criteria that eligible professionals (EPs), eligible hospitals, and critical access hospitals (CAHs) must meet in order to continue to participate in the EHR Incentive Programs.

---

#### Rule Provisions

Through the Stage 2 requirements of the Medicare and Medicaid EHR Incentive Programs, CMS seeks to expand the meaningful use of certified EHR technology. Certified EHR technology used in a meaningful way is one piece of a broader health information technology infrastructure needed to reform the health care system and improve health care quality, efficiency, and patient safety. Highlights of the rule's provisions follow.

#### *Stage 2 Timing*

In the Stage 1 meaningful use regulations, CMS established an original timeline that would have required Medicare providers who first demonstrated meaningful use in 2011 to meet the Stage 2 criteria in 2013. The Stage 2 rule gives providers more time to meet Stage 2 criteria. A provider that attested to Stage 1 of meaningful use in 2011 would attest to Stage 2 in 2014, instead of in 2013. Therefore, providers are not required to meet Stage 2 meaningful use before 2014. The table below illustrates the progression of meaningful use stages from the first year a Medicare provider begins participation in the program.



---

## *Clinical Quality Measures (CQMs)*

### **Measure Sets and Reporting**

The rule finalized that:

- EPs must report on 9 out of 64 total clinical quality measures (CQMs)
- Eligible hospitals and CAHs must report on 16 out of 29 total CQMs

In addition, all providers must select CQMs from at least 3 of the 6 key health care policy domains from the Department of Health and Human Services' National Quality Strategy:

- Patient and Family Engagement
- Patient Safety
- Care Coordination
- Population and Public Health
- Efficient Use of Healthcare Resources
- Clinical Processes/Effectiveness



## **ONC Fact Sheet: 2014 Edition Standards & Certification Criteria (S&CC) Final Rule**

### **Summary**

The 2014 Edition S&CC final rule completes the Office of the National Coordinator for Health IT's (ONC) second full rulemaking cycle to adopt standards, implementation specifications, and certification criteria for EHR technology. This final rule complements the newly released Centers for Medicare & Medicaid Services (CMS) final rule which establishes Stage 2 of the Medicare and Medicaid Electronic Health Record (EHR) Incentive Programs, updates Stage 1, and includes other program modifications.

The 2014 Edition S&CC final rule reflects ONC's commitment to reduce regulatory burden; promote patient safety and patient engagement; enhance EHR technology's interoperability, electronic health information exchange capacity, public health reporting, and security; enable clinical quality measure data capture, calculation, and electronic submission to CMS or States; and introduce greater transparency and efficiency to the certification process.

# CLINICAL QUALITY MEASURES (CQMs)

Tools that help measure and track the quality of healthcare services provided by eligible professionals, eligible hospitals and critical access hospitals within our health care system

CQMs measure many aspects of patient care including: health outcomes, clinical processes, patient safety, efficient use of healthcare resources, care coordination, patient engagements, population and public health, and clinical guidelines

[[cms.gov](https://www.cms.gov)]

# 93 CLINICAL QUALITY MEASURES

in 2014 Meaningful Use criteria

**64**

for

**ELIGIBLE  
PROVIDERS**

(NEED TO REPORT ON 9)

**29**

for

**ELIGIBLE  
HOSPITALS**

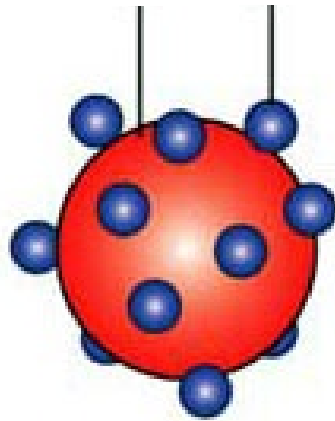
(NEED TO REPORT ON 16)

# CLINICAL QUALITY MEASURE (example)

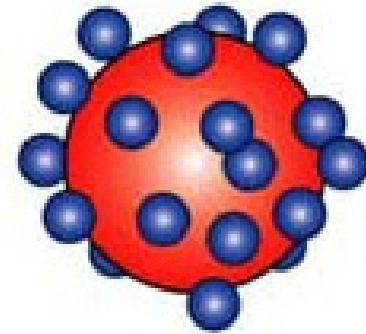
---

## Hemoglobin A1c Test for Pediatric Patients

Hemoglobin      Sugar



Normal glucose levels in blood  
Low HbA1c concentration



High glucose levels in blood  
High HbA1c concentration

# CLINICAL RECOMMENDATIONS

---

1. American Association of Clinical Endocrinologists (2002): Recommends that a glycosylated hemoglobin be performed during an initial assessment and during follow-up assessments, which should occur at no longer than three-month intervals.
2. American Diabetes Association (2006): Recommends obtaining a glycosylated hemoglobin during an initial assessment and then routinely as part of continuing care. In the absence of well-controlled studies that suggest a definite testing protocol, expert opinion recommends glycosylated hemoglobin be obtained at least twice a year in patients who are meeting treatment goals and who have stable glycemic control and more frequently (quarterly assessment) in patients whose therapy was changed or who are not meeting glycemic goals.

# CLINICAL QUALITY MEASURE (simplified)

---

## Hemoglobin A1c Test for Pediatric Patients

# diabetic patients [age 5-17] *tested for HbA1c*

=

---

# diabetic patients [age 5-17]



# CLINICAL QUALITY MEASURE (details)

---

## Hemoglobin A1c Test for Pediatric Patients

Tests for HbA1c

# diabetic patients [age 5-17] *tested for HbA1c*

=

# diabetic patients [age 5-17]

- Type 1 or Type 2 diabetes
- Excludes gestational diabetes

- Requires date of birth

# CLINICAL QUALITY MEASURE (implementation)

---

## Hemoglobin A1c Test for Pediatric Patients

List of LOINC codes

Tests for HbA1c

# diabetic patients [age 5-17] *tested for HbA1c*

=

# diabetic patients [age 5-17]

- Type 1 or Type 2 diabetes
- Excludes gestational diabetes

- Requires date of birth

Data element

List of SNOMED CT or  
ICD 10 codes

# ANATOMY OF A CLINICAL QUALITY MEASURE

---

## Population criteria

- **Initial Patient Population =**
  - AND: "Patient Characteristic Birthdate: birth date"  $\geq$  5 year(s) starts before start of "Measurement Period"
  - AND: "Patient Characteristic Birthdate: birth date"  $\leq$  17 year(s) starts before start of "Measurement Period"
  - AND: "Diagnosis, Active: Diabetes" starts before or during (MOST RECENT : "Occurrence A of Encounter, Performed: Diabetes Visit" during "Measurement Period")
  - AND: "Encounter, Performed: Diabetes Visit"  $\geq$  12 month(s) starts before start of "Occurrence A of Encounter, Performed: Diabetes Visit"
- **Denominator =**
  - AND: "Initial Patient Population"
- **Denominator Exclusions =**
  - AND NOT: "Occurrence A of Diagnosis, Active: Gestational Diabetes" ends before start of "Measurement Period"
  - AND: "Occurrence A of Diagnosis, Active: Gestational Diabetes" starts before or during "Measurement Period"
- **Numerator =**
  - AND: "Laboratory Test, Result: HbA1c Laboratory Test (result)" during "Measurement Period"
- **Denominator Exceptions =**
  - None

## Data criteria (QDM Data Elements)

- "Diagnosis, Active: Diabetes" using "Diabetes Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1001)"
- "Diagnosis, Active: Gestational Diabetes" using "Gestational Diabetes Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1010)"
- "Encounter, Performed: Diabetes Visit" using "Diabetes Visit Grouping Value Set (2.16.840.1.113883.3.464.1003.103.12.1012)"
- "Laboratory Test, Result: HbA1c Laboratory Test" using "HbA1c Laboratory Test Grouping Value Set (2.16.840.1.113883.3.464.1003.198.12.1013)"
- "Patient Characteristic Birthdate: birth date" using "birth date LOINC Value Set (2.16.840.1.113883.3.556.1.1)"

Value set = List of  
LOINC codes for  
HbA1c tests

# ASSOCIATED VALUE SET

Metadata

Measure

Grouping

Name:

HbA1c Laboratory Test

Type:

Grouping

Note:

OID:

2.16.840.1.113883.3.464.1003.198.12.1013

Developer:

National Committee for Quality Assurance

Value Set Members Expansion 20121025 ▼

Expanded Code List

View Toggle Clear

Page 1 of 1 20 ▼

View 1 - 3 of 3

Code ▲	Descriptor	Code System	Version
17855-8	Hemoglobin A1c/Hemoglobin.total in Blood by calculation	LOINC	2.40
17856-6	Hemoglobin A1c/Hemoglobin.total in Blood by HPLC	LOINC	2.40
4548-4	Hemoglobin A1c/Hemoglobin.total in Blood	LOINC	2.40

# Meaningful Use Criteria - 2014

**93**  
**CQMs**

Developed by some  
20 measure  
developers

**3,000**  
**value sets**

1,500 unique

**200,000**  
**codes**

80,000 unique



Welcome

Search Value Sets

Help

[Apply Filters](#)

[Clear Filters](#)

### Search the NLM Value Set Repository

Query:

[Search](#)

Narrow search results by selecting  
from pull-down menus below:

CMS eMeasure (NQF Number)

Quality Data Model Category

Value Set Developer

Meaningful Use Measures

Search Results

Value Set Details

[Export Search Results \(Excel\)](#)

#### Matched Value Sets

[Download](#) [View](#)

Page 1 of 2

View 1 - 20 of 21

<input type="checkbox"/>	Name	Type	Code System	Developer	OID
<input type="checkbox"/>	birth date	Extensional	LOINC	NQF	<a href="#">2.16.840.1.113883.3.560.100.4</a>
<input type="checkbox"/>	Carotid Intervention	Grouping	ICD10PCS ICD9CM SNOMEDCT	Joint Commission	<a href="#">2.16.840.1.113883.3.117.1.7.1.204</a>
<input type="checkbox"/>	Discharge To Another Hospital	Extensional	SNOMEDCT	Joint Commission	<a href="#">2.16.840.1.113883.3.117.1.7.1.87</a>
<input type="checkbox"/>	Discharged to Health Care Facility for Hospice Care	Extensional	SNOMEDCT	Joint Commission	<a href="#">2.16.840.1.113883.3.117.1.7.1.207</a>
<input type="checkbox"/>	Discharged to Home for Hospice Care	Extensional	SNOMEDCT	Joint Commission	<a href="#">2.16.840.1.113883.3.117.1.7.1.209</a>
<input type="checkbox"/>	Discharged to Rehabilitation Facility	Extensional	SNOMEDCT	Joint Commission	<a href="#">2.16.840.1.113883.3.117.1.7.1.132</a>
<input type="checkbox"/>	Emergency Department Visit	Grouping	SNOMEDCT	Lantana	<a href="#">2.16.840.1.113883.3.117.1.7.1.293</a>
<input type="checkbox"/>	Ethnicity	Extensional	CDCREC	CDC NCHS	<a href="#">2.16.840.1.114222.4.11.837</a>
<input type="checkbox"/>	Hemorrhagic Stroke	Grouping	ICD10CM ICD9CM SNOMEDCT	Joint Commission	<a href="#">2.16.840.1.113883.3.117.1.7.1.212</a>
<input type="checkbox"/>	Inpatient Encounter	Extensional	SNOMEDCT	Joint Commission	<a href="#">2.16.840.1.113883.3.117.1.7.1.23</a>

<https://vsac.nlm.nih.gov/>

# Getting involved

*A few pointers*

# Health IT Standards Committee

[Newsroom](#)[Blog](#)[Get Email Updates](#)[Print](#)[Share](#)[For Patients & Families](#)[For Providers & Researchers](#)[For Policy Researchers & Implementers](#)[Federal Advisory Committees \(FACAs\)](#)[FACA Calendar](#)[Health IT Policy Committee](#)[Health IT Standards Committee](#)[- HITSC Workgroups](#)[- How To Participate](#)[- Recommendations to the National Coordinator for Health IT](#)[FACA Membership Application](#)

## Health IT Standards Committee

[Upcoming Meetings](#)[Past Meetings](#)

\*Past meetings are shown from January 2013. For older meetings, please visit [Health IT Archives](#).

The **Health IT Standards Committee** is charged with making recommendations to the National Coordinator for Health IT on standards, implementation specifications, and certification criteria for the electronic exchange and use of health information. Initially, the Health IT Standards Committee will focus on the policies developed by the Health IT Policy Committee's initial eight areas. Within 90 days of the signing of ARRA, the Health IT Standards Committee must develop a schedule for the assessment of policy recommendations developed by the Health IT Policy Committee, to be updated annually. In developing, harmonizing, or recognizing standards and implementation specifications, the Health IT Standards Committee will also provide for the testing of the same by the National Institute for Standards and Technology (NIST).

### Resources

[Meeting Calendar](#)[Meetings/Hearings Archive](#)

### Upcoming Meetings

#### HIT Standards Committee Virtual

Wednesday, March 26, 2014 - 10:00am to 12:45pm

#### Policy: Quality Measures Vendor Tiger Team

Thursday, March 27, 2014 -



# Standards and Interoperability (S&I) Framework

S&I Framework Links: [Home](#) [Wiki](#) [guest](#) | [Join](#) | [Help](#) | [Sign In](#)




<http://wiki.siframework.org/>

- [Wiki Home](#)
- [Recent Changes](#)
- [Pages and Files](#)
- [Members](#)

- [Calendar](#)
- [Contact](#)

home

[Edit](#) [2](#) [334](#) ...



The S&I Framework is a collaborative community of participants from the public and private sectors who are focused on providing the tools, services and guidance to facilitate the functional exchange of health information. Learn more at [www.siframework.org](http://www.siframework.org)

Getting started is easy...

**1** Join  
the Wiki

- [Join an S&I Framework Initiative](#)

**2** Learn  
More

- Understand the Framework

**3** Start  
Contributing

- Sign up to participate in an initiative

## This Week's Agenda

[Today](#) [Tuesday, March 25](#)

### Tuesday, March 25

- 9:00am EU-US Interoperability SI
- 12:00pm PDMP & Health IT Integr.
- 2:00pm Public Health Tiger Team
- 2:00pm LOI-eDOS Working Group
- 3:00pm LOI Implementation Guid

### Wednesday, March 26

- 10:00am AoR L2 Harmonization C
- 10:00am EU-US Interoperability W
- 12:00pm DAF All Hands

Events shown in time zone:

Eastern Time



[This Week's Key Activities](#)

View recent updates from

# IHE



<http://www.ihe.net/>

[For Developers](#)

[For Users](#)

Search

[About IHE](#)

[Participate](#)

[Resources](#)

[IHE Domains](#)

[IHE Worldwide](#)

[News](#)

[Events](#)

## IHE International

Enable seamless and secure access to health information whenever and wherever needed.



### Integrating the Healthcare Enterprise (IHE)

IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care. Systems developed in accordance with IHE communicate with one another better, are easier to implement, and enable care providers to use information more effectively.

### BECOME A MEMBER

Become an IHE member organization and improve the interoperability of healthcare information systems.

# Semantic Web – Health Care and Live Sciences



## SEMANTIC WEB HEALTH CARE AND LIFE SCIENCES (HCLS) INTEREST GROUP

HOME

<http://www.w3.org/blog/hcls/>

### Introduction

The **mission** of the Semantic Web Health Care and Life Sciences Interest Group (HCLS IG) is to develop, advocate for, and support the use of Semantic Web technologies across [health care](#), [life sciences](#), clinical research and [translational medicine](#). These domains stand to gain tremendous benefit from intra- and inter-domain application of Semantic Web technologies as they depend on the interoperability of information from many disciplines. Please see the accompanying [Use Cases and Rationale](#) document.

The group will:

- Continue to develop high level (e.g. [TMO](#)) and architectural (e.g. [SWAN](#)) vocabularies.
- Implement proof-of-concept demonstrations and industry-ready code.
- Document guidelines to accelerate the adoption of the technology.
- Disseminate information about the group's work at government, industry, academic events and by participating in community initiatives.

### LINKS

Interest Group links:

[Group Charter](#)

[Public Wiki page](#)

[Instructions on joining the IG](#)

Participants:

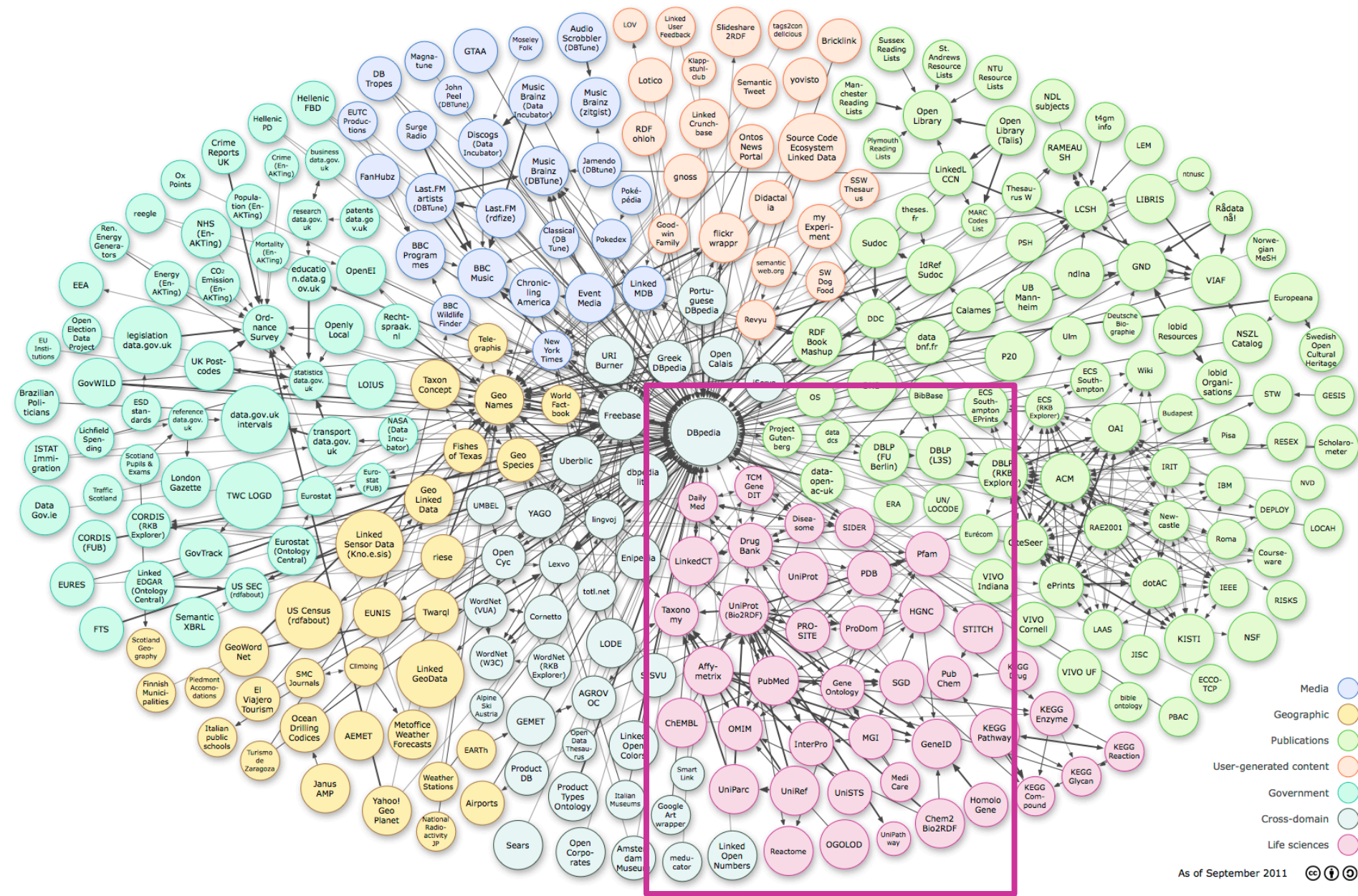
[organizations](#)

[persons](#) (member only link)

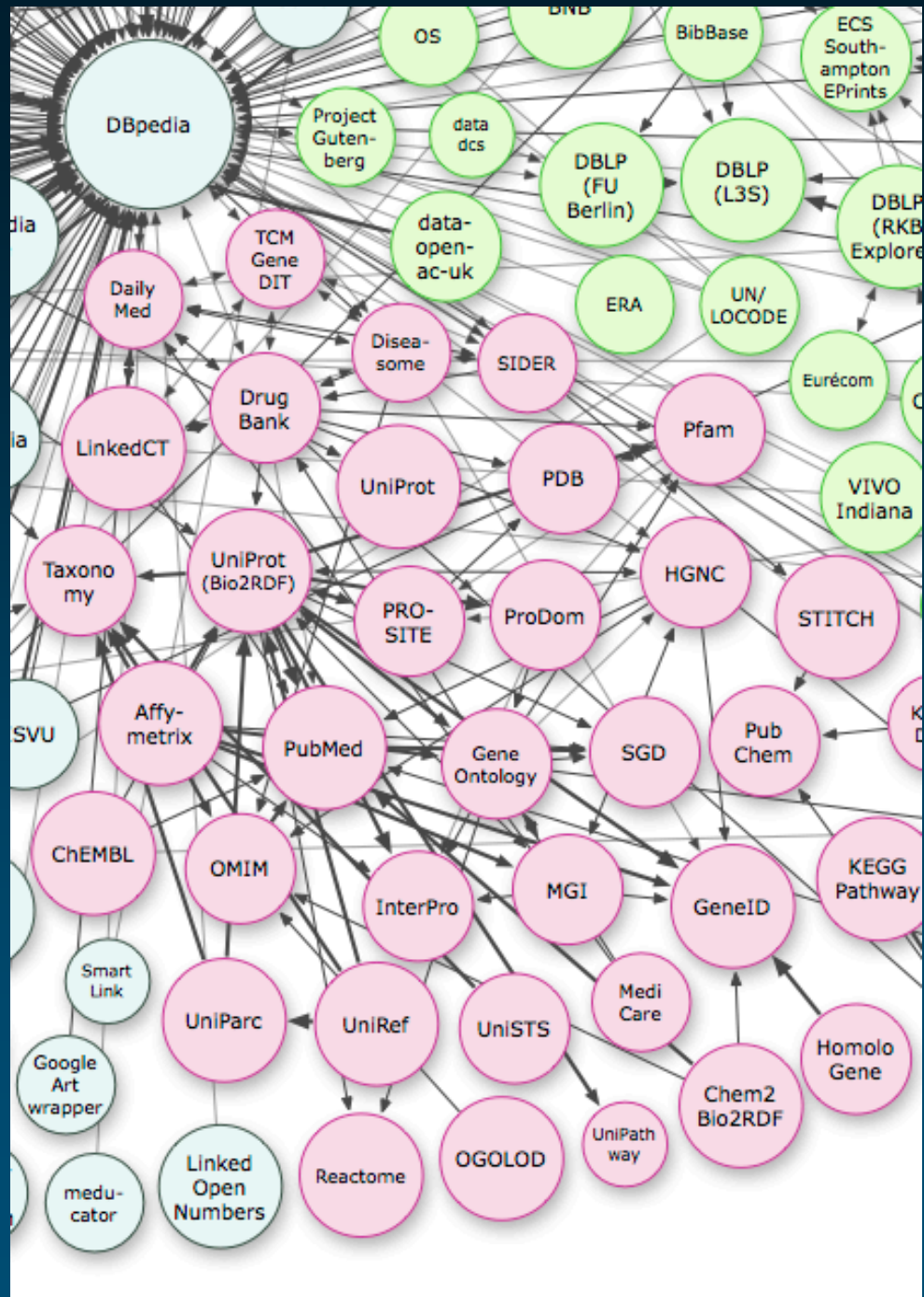
[Mailing list archives](#)

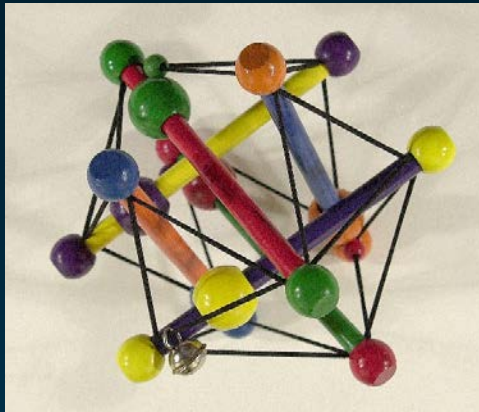


# Linked Open Data Cloud



# Linked Open Data Cloud – Biomedical resources





# Medical Ontology Research

Contact: [olivier@nlm.nih.gov](mailto:olivier@nlm.nih.gov)

Web: <http://mor.nlm.nih.gov>



*Olivier Bodenreider*

Lister Hill National Center  
for Biomedical Communications  
Bethesda, Maryland - USA