



Unified Medical Language System®

SNOMED CT® and the UMLS®

7<sup>th</sup> Annual SNOMED®  
International Users Group  
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Tammy Powell  
Jan Willis  
National Library of Medicine  
National Institutes of Health

[www.nlm.nih.gov](http://www.nlm.nih.gov)



# Outline

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- UMLS overview
- UMLS license agreement
- Accessing the Metathesaurus
- SNOMED CT® in the Metathesaurus
- Mappings
- RxNorm

# What is the UMLS?

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- Unified Medical Language System
- Objective: Help interpret and understand medical meaning across systems
- Overcome:
  - disparities in language
  - disparities in granularity and perspective
  - problems in mapping and aggregating information across systems

# The UMLS consists of ...

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**Metathesaurus**



Biomedical  
Concepts

**Semantic Network**



Broad Categories +  
Relationships

**SPECIALIST Lexicon  
& Lexical Tools**



Lexical information,  
language processing  
programs

... **3 Knowledge Sources**  
used together or separately

# Knowledge Sources are ...

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- Machine-readable data files (relational tables)
  - Records (rows)
  - Fields (columns)
- Applications
  - MetamorphoSys (installation and customization)
  - RRF Browser (view)
  - Ivg (lexical programs)

... sets of data files and programs

the UMLS is not an end-user application



# UMLS Uses

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- Information retrieval
  - Thesaurus construction
  - Natural language processing
  - Automated indexing
  - Electronic health records (EHR)
- 
- Distribution mechanism for U.S. vocabulary standards

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# License Agreement



# First step license agreement

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## ■ Online Web-based license:

<http://www.nlm.nih.gov/research/umls/license.html>

- Read license
- Read appendix
- Print a copy for your records
- Complete the Web form

Accept and continue

Accept

 Printer-friendly Version

Submit

## ■ Verification and turnaround:

- Receive e-mail from NLM and respond within 72 hours
- NLM official countersigns, license added to database
- Receive 2<sup>nd</sup> e-mail from NLM with new license number





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# License Restriction Levels 0-4

■ Level 0 (28.2%)

■ *unrestricted*

■ Level 1 (1.6%)

■ *negotiate to translate*

■ Level 2 (0.4%)

■ *negotiate to use in health data creation*

■ Level 3 (30.6%)

■ *negotiate to use in production*

■ *Explicitly prohibited to provide Internet access*

■ Level 4 (39.2%)

■ *unrestricted for U.S. use and distribution*

There may be additional restrictions, or separate license fees, associated with usage of specific vocabularies.  
Read the UMLS License, including the Appendix!

67%



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# Access



# Accessing the Metathesaurus

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- Remote access

- **UMLS Knowledge Source Server (UMLSKS)**

- download files

- search and browse

- Local access

- **MetamorphoSys**: install files locally, create customized Metathesaurus subsets

- **RRF Browser**: search, browse, view customized subsets



# Remote Access UMLSKS

- UMLS Knowledge Source Server (UMLSKS):

<http://umlsks.nlm.nih.gov>

- Web search interface

**UMLS Knowledge Source Server (UMLSKS)**

National Library of Medicine

**UMLSKS Registered Users**

Login ID:

Password:

**Login**

[Forgot your password!](#)

**New UML SKS Users**

UMLSKS is restricted to registered users. If you are not a registered user and would like to use the resources of the UMLS, please read the [UMLS license agreement](#), obtain a UMLS license number, and fill in the form below to request a UMLSKS user account.

Login ID:

Password:

Confirm Password:

First Name:

Last Name:

**Request Account**

**What's New**

- UMLSKS Version 4.2 released on 07/12/04. Look [here](#) for a list of new features and bug fixes.
- 2004A Metathesaurus – including SNOMED CT® – now available to download for those that have signed the new license agreement!
- Existing users may click on the [Forgot your password link](#) (above) and enter the new license

Returning users log in

New users create account with license #

# UMLSKS Home Page

- Tabs across top access basic searching of 3 Knowledge Sources
- Advanced searching options on right-hand side

The screenshot shows the Netscape browser window displaying the UMLS Knowledge Source Server (UMLSKS) home page. The browser title is "Netscape: UMLS Knowledge Source Server (UMLSKS)". The address bar shows the URL: <http://umlsks.nlm.nih.gov/kss/servlet/Turbine/act:>. The page features a navigation bar with tabs for "Metathesaurus", "Semantic Network", and "SPECIALIST Lexicon". Below the navigation bar, there are three search buttons: "Metathesaurus Concept Search", "Semantic Network Search", and "SPECIALIST Lexicon Search". The main content area is divided into several sections: "About the UMLSKS" with links for Home, Overview, Frequently Asked Questions, and Edit Views/Profile; "Downloads" with links for UMLS Knowledge Sources and Developer's API; "Documentation" with links for User's Guide, Developer's Guide, Developer's API Javadocs, and UMLS Documentation Set; "Resources" with links for NLP & Lexical Resources, Semantic Network Resources, and Metathesaurus Resources; "Quick Search" with a form for selecting a UMLS Release (2004AB) and entering a search value (Jaddison's disease); "Advanced Searches" with a link for Metathesaurus Advanced Search; "What's New" with news about the 2004 AB Metathesaurus and UMLSKS Version 4.3; and "Semantic Network Browser" with a link for Semantic Network Browser. The browser status bar shows "100%" zoom.



# UMLSKS Basic Concept Report

**UMLS Knowledge Source Server (UMLSKS)**  
UMLSKS Version 4.2.2 UMLS Releases: 2002 2002AB 2002AC 2002AD 2003AA 2003AB 2003AC 2004AA 2004AB

Metathesaurus Semantic Network SPECIALIST Lexicon

Home Advanced Search Logout

Metathesaurus Search for: **addison's disease** in UMLS Release 2004AB

**Display** **Display All**

**Concept**

- Definition
- Synonyms
- Other Languages
- Suppressible Synonyms
- Sources

**Context**

- Ancestors
- Parents
- Siblings
- Children

**Relations**

- Narrower
- Broader
- Similar
- Other
- Related and possibly synonymous

**Concept: Addison's disease**  
CUI: C0001403

**Semantic Type:** Disease or Syndrome

**Definition:**  
A disease characterized by hypotension, weight loss, anorexia, weakness, and sometimes a bronze-like melanotic hyperpigmentation of the skin. It is due to tuberculosis- or autoimmune-induced disease (hypofunction) of the adrenal glands that results in deficiency of aldosterone and cortisol. In the absence of replacement therapy, it is usually fatal. (MeSH)

disease characterized by hypotension, weight loss, anorexia, weakness, and sometimes a bronze-like melanotic hyperpigmentation of the skin. It is due to tuberculosis or autoimmune induced disease (hypofunction) of the adrenal glands that results in deficiency of aldosterone and cortisol. (CRISP Thesaurus)

**Synonyms:**  
Addison's disease  
Addison's disease (disorder)  
ADRENAL INSUFFICIENCY (ADDISON'S DISEASE)  
ADRENOCORTICAL INSUFFICIENCY, PRIMARY  
Asthenia pigmentosa  
Bronzed disease

Concept Name/  
CUI

Semantic  
Type(s)

Definition(s)

Synonyms

# MetamorphoSys

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- Multi-platform Java software with each UMLS release
- Installs Knowledge Sources to local storage
- Customizes a local Metathesaurus
  
- Customization is critical and requires:
  - understanding of source vocabularies
  - license arrangements
  - functional requirements, purpose and perspective
  - technical expertise



# RRF Browser search and view subset

Rich Release Format Browser 2005AB C0018787

File Edit Options Help

Subset Directory C:\Documents and Settings\Jan Willis\My Documents\Old No...

CUI Search Tree Browser Word Search

Enter a CUI:

C0018787

Get Concept..

Raw View Report View

**MRCONSO**

C0018787|ENG|P|L0851383|PF|S0900896|Y|A3140621|504537016|80891009||SNOMEDCT|PT|&

C0018787|ENG|S|L0018787|PF|S0047194|Y|A2882201|134173012|80891009||SNOMEDCT|SY|&

C0018787|ENG|S|L0772913|PF|S0833126|Y|A6921135|2478860016|80891009||SNOMEDCT|SY|&

C0018787|ENG|S|L2908483|PF|S3346325|Y|A3488292|822101011|80891009||SNOMEDCT|FN|&

**MRSAT**

**MRSTY**

C0018787|T023|A1.2.3.1|Body Part, Organ, or Organ Component|AT28874607||

**MRHIST**

C0018787|134173012|SNOMEDCT|20001101|0|DESCRIPTIONSTATUS|0|||

C0018787|134173012|SNOMEDCT|20020131|2|DESCRIPTIONSTATUS|0|DESCRIPTIONTYPE

C0018787|2478860016|SNOMEDCT|20040731|0|DESCRIPTIONSTATUS|0|||

C0018787|504537016|SNOMEDCT|20020131|0|DESCRIPTIONSTATUS|0|||

C0018787|80891009|SNOMEDCT|19940101|0|CONCEPTSTATUS|0|||

C0018787|80891009|SNOMEDCT|20020131|2|CONCEPTSTATUS|0|FULLYSPECIFIEDNAME C

C0018787|822101011|SNOMEDCT|20020131|0|DESCRIPTIONSTATUS|0|||

**MRREL**

C0018787|A3140621|SCUI|CHD|[C0040744](#)|[A3734611](#)|SCUI|isa|R19938584|280477021|SNOME

C0018787|A3140621|SCUI|CHD|[C1268110](#)|[A3488260](#)|SCUI|isa|R19938583|136230020|SNOME

C0018787|A3140621|SCUI|CHD|[C1281570](#)|[A3421984](#)|SCUI|isa|R19938582|127878028|SNOME

C0018787|A3140621|SCUI|CHD|[C1281570](#)|[A3421984](#)|SCUI|isa|R19938582|127878028|SNOME

# RRF Browser tree browser

The screenshot shows the 'Rich Release Format Browser 2005AB C0001403' application window. The title bar includes standard Windows window controls (minimize, maximize, close) and the text 'Rich Release Format Browser 2005AB C0001403'. The menu bar contains 'File', 'Edit', 'Options', and 'Help'. The address bar shows 'Subset Directory C:\Documents and Settings\Jan Willis\My Documents\Old No...'. The main interface is divided into two panes. The left pane, titled 'Tree Browser', shows a hierarchical tree structure under 'Context Tree Tops'. The right pane, titled 'Report View', displays detailed information for the selected concept, including its name, semantic type, and a list of contexts with associated links.

Rich Release Format Browser 2005AB C0001403

File Edit Options Help

Subset Directory C:\Documents and Settings\Jan Willis\My Documents\Old No...

CUI Search **Tree Browser** Word Search

Raw View **Report View**

Context Tree Tops

- [-] SNOMED CT Concept
  - [+] Attribute
  - [+] Body structure
  - [+] Clinical finding
  - [+] Context-dependent categories
  - [+] Environments and geographical locations
  - [+] Events
  - [+] Observable entity
  - [+] Organism
  - [+] Pharmaceutical / biologic product
  - [+] Physical force
  - [+] Physical object
  - [+] Procedure
  - [+] Qualifier value
  - [+] Social context
  - [+] Special concept
  - [+] Specimen
  - [+] Staging and scales
  - [+] Substance

[+] **Concept: [CUI: C0001403]** Primary adrenocortical insufficiency

[-] **Semantic Type**  
Disease or Syndrome

[+] **Atoms (5):** (Sorted by Source, String)

[-] **Contexts (40)**

- [-] SNOMEDCT/PT/363732003 10 Addison's disease
  - [-] **ANC**
    - [SNOMED CT Concept](#)
    - [Clinical finding](#)
    - [Finding by site](#)
    - [Finding of body region](#)
    - [Finding of trunk structure](#)
    - [General finding of abdomen](#)
    - [Disorder of abdomen](#)
    - [Disorder of adrenal gland](#)
    - [Disorder of adrenal cortex](#)
    - [Adrenal cortical hypofunction](#)
- [+] **SIB**
- [-] **CHD**
  - [Addison's disease due to autoimmunity](#)
  - [Addison's disease with adrenoleucodystrophy](#)
  - [Polyglandular autoimmune syndrome, type 1](#)
  - [Tuberculous Addison's disease](#)

[-] SNOMEDCT/PT/363732003 11 Addison's disease

# UMLS Metathesaurus

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- The Metathesaurus is a
  - very large
  - multi-purpose
  - multi-lingual biomedical vocabulary
- It contains information about
  - biomedical and health related concepts,
  - their various names, and
  - the relationships among them.

# Metathesaurus Sources

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- Varying purposes, structures, properties
- “Sets of valid values” for data elements:
  - Thesauri, e.g., MeSH
  - Statistical Classifications, e.g., ICD
  - Billing Codes, e.g., CPT
  - Clinical coding systems, e.g., SNOMED
  - Lists of controlled terms
- Full list in Appendix to License Agreement



**The UMLS serves as a vehicle  
for regulatory standards  
(HIPAA, CHI, PHIN)**

# Metathesaurus highlights

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- Represents the meaning in each source
- Tags source information
- Adds context-free unique identifiers
  - “the name that never changes”
- Adheres to principle of “source transparency”
- Includes normalized word and string indexes produced using UMLS lexical tools

# Metathesaurus organization

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- Concepts (MRCONSO)
  - Synonymous terms are clustered into a concept
  - Additional information
    - From source (definitions, attributes)
    - Supplied by NLM (CUI, Semantic Type)
- Relationships (MRREL)
  - Concepts are related to other concepts
  - Relationship attributes (type, source of relationship)
- Attributes (MRSAT)



# Metathesaurus

- Concept (1.2 M) CUI
  - Set of synonymous concept names
- Term (> 4.1 M) LUI
  - Set of normalized names
- String (> 4.7 M) SUI
  - Distinct concept name
- Atom (> 5.4 M) AUI
  - Concept name in a given source

A1412439 headaches (BI)  
S1459113 headaches

A2882187 Headache (SNOMED)  
A0066000 Headache (MeSH)  
S0046854 Headache  
L0018681 headache

A1641293 Cranial Pain (MeSH)  
S1680378 Cranial Pain

A0418053  
HEAD PAIN CEPHALGIA (DxP)  
S0375902  
HEAD PAIN CEPHALGIA

L0290366 cephalgia head pain

C0018681 Headache



# Relationships types

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- Hierarchical
  - Parent / Child
  - Broader / Narrower than
- Associative: other
- Source asserted or editor-assigned



# Relationships Examples: Hierarchical

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## SNOMED Clinical Terms

Clinical finding

Clinical history and observation findings

General finding of observation of patient

Symptom

Pain

Pain finding at anatomical site

Pain of head and neck region

Headache

# Relationships Examples: Children

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Ocular headache

Aural headache

Nasal headache

Posttraumatic headache

Analgesic overuse headache

Benign exertional headache

Cough headache syndrome

Generalized headache

Headache due to cold exposure

# Relationships: Associative

---

Other source relationships to Headache:

Facial Pain (SNOMED Clinical Terms)

Seizures (Clinical Problem Statements)

Sinusitis (Clinical Problem Statements)

Sinusitis (MedlinePlus)

# Semantic Network categorizes

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- 135 high-level categories (**semantic types**)
  - Concept: Discipline of Nursing
  - Semantic Type: **Biomedical Occupation or Discipline**
- Concept: Nursing Homes
- Semantic Type: **Health Care Related Organization**  
**Manufactured Object**
- Concept: Home Nursing
- Semantic Type: **Health Care Activity**

# Semantic Network relations

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- Relations define useful relations between types
- Types + Relations = Network

Biomedical Occupation or Discipline

**ASSOCIATED\_WITH** Social Behavior

Language **ISSUE\_IN** Biomedical Occupation or Discipline

Manufactured Object **CAUSES** Injury or Poisoning

Diagnostic Procedure **USES** Manufactured Object

Health Care Activity **ISA** Occupational Activity

Health Care Activity **AFFECTS** Disease or Syndrome



# SNOMED CT in the Metathesaurus 1

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- Core content U.S. English, Spanish
  - Concepts, Descriptions, Relationships tables
  - Generic drugs
  - History table
  - ICD-9-CM mapping
- Not included:
  - US, UK SNOMED branded drug extensions
  - non-English, non-Spanish content

# SNOMED CT in the Metathesaurus 2

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- Different senses of concepts, synonyms, hierarchies
- UMLS concepts vs. SNOMED CT concepts
  - Useful level of distinction in biomedical practice
- UMLS hierarchies vs. SNOMED CT hierarchies
  - Single vs multiple hierarchies
- Occasional disagreement in synonymy and concepts

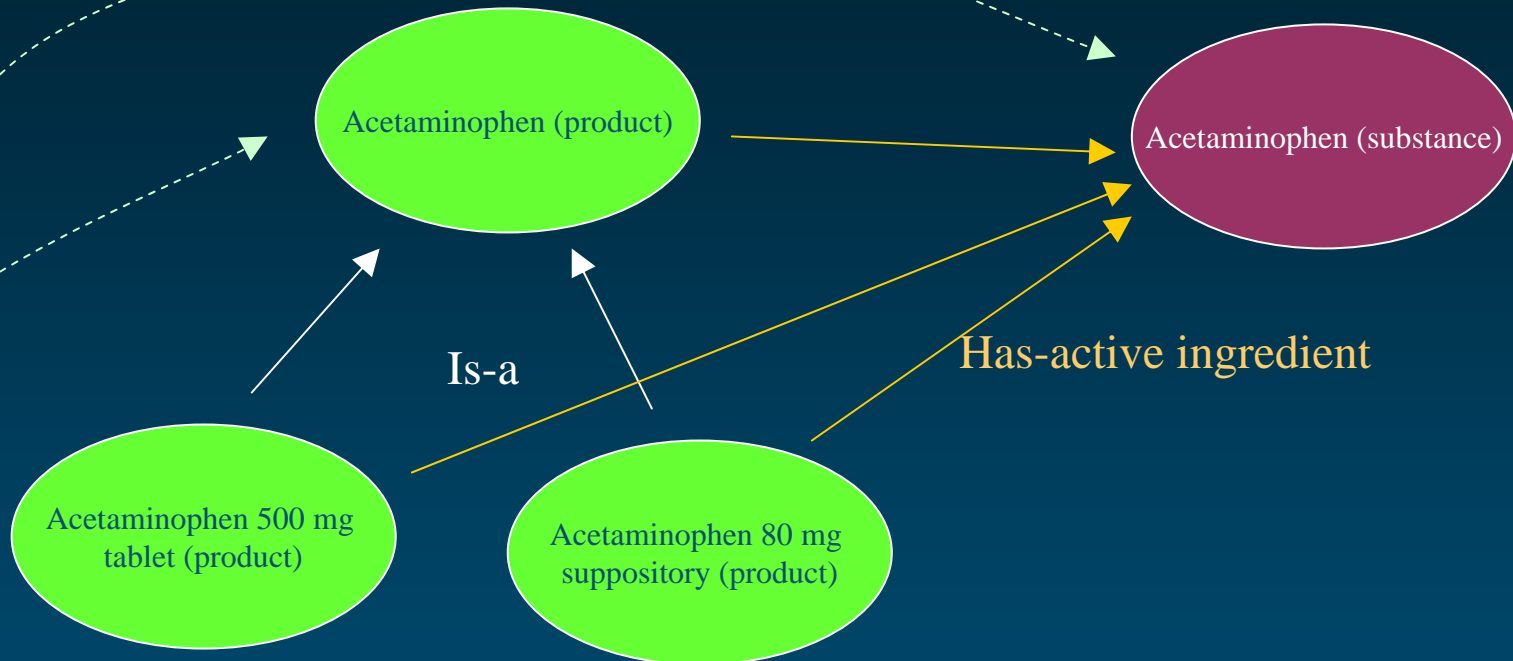
# Different Concept Views 1

---

- Jan. 2005 data
- SNOMED CT differs from UMLS view (14%)
  - Most differences are intentional
  - Some undiscovered synonymy fixed via collegial working relationship
- SNOMED CT 2 concepts / UMLS 1 concept
- For example: substance / product
  - Antacid (substance)
  - Antacid (product)



# SNOMED CT Concept View



'This patient is on acetaminophen.'

'Tylenol contains acetaminophen.'

# Representing and Resolving Differences

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## ■ Merging

- Two or more SNOMED CT concepts merged into one UMLS concept
- 38,485 SNOMED CT concepts involved (12.9%)

## ■ Splitting

- One or more SNOMED CT atoms split into different UMLS concepts
- 3037 SNOMED CT synonyms in 1,970 concepts (0.7%)

# SNOMED CT in the Metathesaurus

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- SNOMED CT January 2004 (English)
  - Concepts: 298,090
  - Descriptions: 736,946
  - Relationships: 1,010,873
  
- Represented in 2004AA UMLS Release as:
  - Concepts: 37,089
  - Descriptions: 350,464 (mostly fully-specified names e.g. Pneumonia (disorder))

# SNOMED CT Concepts in the UMLS

## SNOMED CT Concepts Table:

```
ConceptId|ConceptStatus|FullySpecifiedName|CTV3ID|SNOMEDID  
|IsPrimitive|  
271737000|0|Anemia (disorder)|XM05A|DC-10009|1|
```

## MRCONSO.RRF:

```
CUI|...|AUI|...|SCUI|...|SAB|TTY|...|STR|...|  
C0002871|A3597593|271737000|SNOMEDCT|FN|Anemia  
(disorder)|  
C0002871|A2878480|271737000|SNOMEDCT|PT|Anemia|  
C0002871|A2952250|271737000|SNOMEDCT|SY|Absolute anemia|  
C0002871|A3095181|271737000|SNOMEDCT|PTGB|Anaemia|  
C0002871|A3089808|271737000|SNOMEDCT|SYGB|Absolute  
anaemia|
```

# Additional information on NLM Web site

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- [SNOMED CT® in the UMLS® Metathesaurus®: Inversion Source Transparency Achieved Jan. 2005](#)
- [SNOMED CT in the 2005AB Release](#)
- [SNOMED CT® in the UMLS® Metathesaurus®:Release Source Transparency Achieved Jan. 2005](#)
- [SNOMED CT in the 2005AB Release](#)
- [SNOMED CT Information from the College of American Pathologists](#)

# NLM and Health Data Standards

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- Health Data Standards
  - Administrative (HIPAA)
  - Clinical (CHI)
  - Public Health (PHIN)
- NLM's current contributions
  - Maintains UMLS as distribution mechanism for standards
  - Negotiated and maintains US license for SNOMED CT
- NLM's evolving role
  - Reduce overlap
  - Establish and support mappings between standard clinical vocabularies (SNOMED, LOINC, RxNorm), and between other administrative and clinical standards



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# Mappings



# Mappings

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- Link concepts between two or more specific vocabularies
- Inter-terminology mappings facilitate reuse of information
- Source-asserted
  - SNOMED CT-NIC/NOC/NANDA (coming)
  - ICD-10-ICPC



# Code to Code Mappings

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- NLM mapping projects underway:
  - SNOMED CT to CPT/HCPCS
  - SNOMED CT to ICD-9-CM (specifically to support reimbursement)
  - LOINC to CPT
  
- Mapping projects being discussed:
  - SNOMED CT to MedDRA
  - SNOMED CT to MeSH

# Mappings

# examples

- LOINC - CPT

- LOINC

- 1795-4 AMYLASE:CCNC:PT:FLU:QN
- 1798-8 AMYLASE:CCNC:PT:SER:QN
- 1799-6 AMYLASE:CCNC:PT:UR:QN

- All map to CPT

- 82150 Amylase (blood or urine)

- SNOMED CT - CPT

- SNOMED CT

- 313500004 Urine protein/creatinine ratio measurement

- Maps to two CPT codes

- 82570 Creatinine; other source
- 84155 Protein, total, except by refractometry; serum

# Key NLM Assumptions about Mapping

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- Participants must include **producers** on both ends, and **users** of output
- Mappings must keep current at both ends
- Mappings will be distributed in the UMLS
- Mapping is an R & D problem; iteration is required to build highly functional maps

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# RxNorm



# NLM's RxNorm Project

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- Addresses problems:
  - **missed synonymy** in UMLS clinical drugs
  - **patient safety**
- **CHI recommended standard**  
Designated standard for use in U.S. Federal Government systems for the electronic exchange of clinical health information
- **Supports e-prescribing**

# RxNorm Source and Subset

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- RxNorm Source
  - Normalized forms of clinical drugs
  - Created by NLM
  - Forms only from existing commercial and government clinical drug vocabularies
- RxNorm Subset
  - RxNorm forms from NLM
  - Clinical drug content including SNOMED CT, First DataBank NDDF, FDA NDC
- Users must respect license restrictions



# RxNorm Normalized Forms

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- Active standardized (generic) ingredients
  - Strengths
  - Units of measure
  - Dosage form
- 
- As administered to a patient

# Creating RxNorm Concepts

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- PALIFERMIN 6.25 MG INTRAVENOUS INJECTION, POWDER, LYOPHILIZED, FOR SOLUTION [KEPIVANCE]
- Standardize measurement and strength
  - Convert **6.25 MG** to **mg/ml**
  - **5 mg/ml** solution (per prescribing information)
- Identify brand name, base ingredient, dose form
  - Brand name (BN) = Kepivance
  - Base Ingredient (IN) = Palifermin
  - Dose Form = Injectable Solution
- **SBD = Palifermin 5 mg/ml Injectable Solution [Kepivance]**

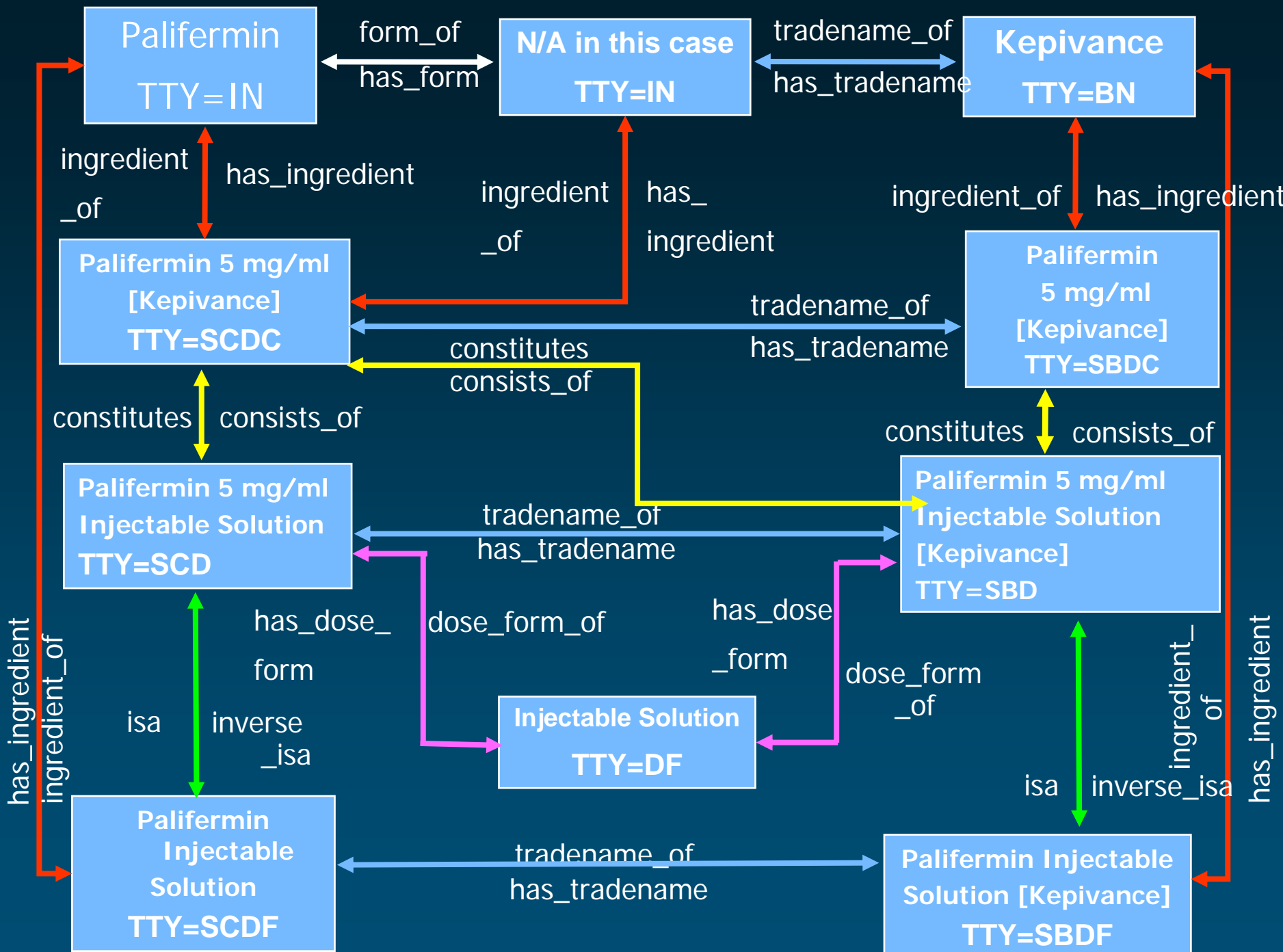


# RxNorm Term Types

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- SBD = Palifermin 5 mg/ml Injectable Solution [Kepivance] → 7 additional concepts
- IN= Palifermin
- BN= Kepivance
- SBDC= Palifermin 5 mg/ml [Kepivance]
- SBDF = Palifermin Injectable Solution [Kepivance]
- SCD= Palifermin 5 mg/ml Injectable Solution
- SCDC= Palifermin 5 mg/ml
- SCDF= Palifermin Injectable Solution

all are separate concepts



# RxNorm Nav

<http://mor.nlm.nih.gov/download/rxnav/>

RxNorm Navigator

Search

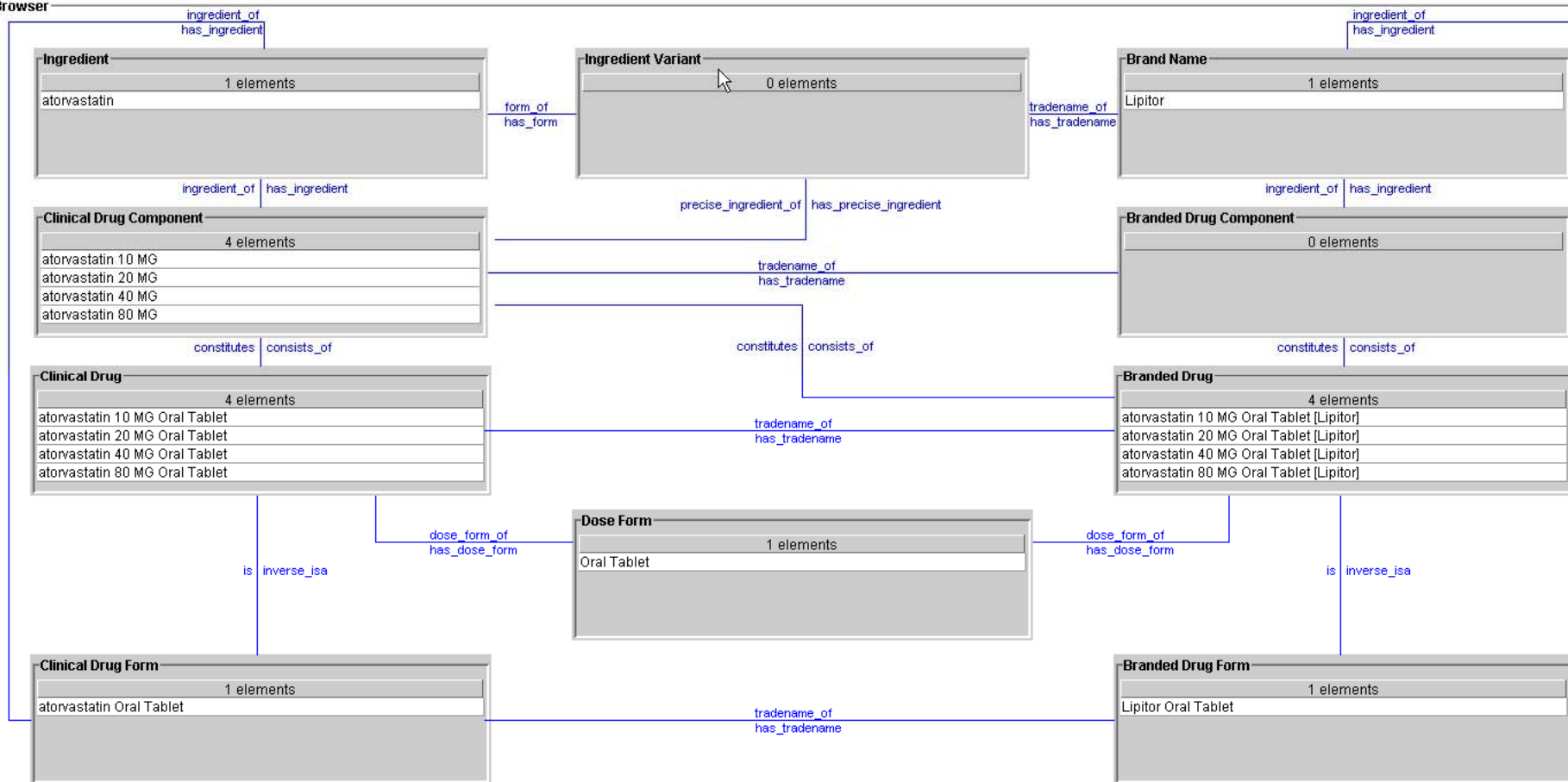


Please enter the search term:

Lipitor

Search

Browser



Anchor View: | RXCUI | SAB | TTY | CODE | STR

Retrieved "Lipitor".

# RxNorm Subset

---

- More than 8 full and partial sources
- Full sources
  - FDA, Medispan, Micromedex, NDDF, MDDB
  - More to come
- Partial sources
  - SNOMED CT, MeSH
- NOT in RxNorm
  - USP Medicare Model Guidelines

RxNorm (NLM)  
SNOMED CT (CAP)  
MTHFDA (FDA NDC)  
VANDF (VA)  
NDDF (FirstDataBank)  
MDDB (Medispan)  
MMX (Micromedex)  
Multum

# RxNorm Subset 2 ways

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- Download RxNorm Source zip files
  - More frequent updates than UMLS
  - Monthly schedule to begin soon
  - Regular updates of individual sources coming
- Extract RxNorm Subset from UMLS
  - 3-4 releases per year
  - MetamorphoSys extracts preconfigured subset
  - Default setting includes Level 0 sources and SNOMED CT
  - Option to select specific sources

# What's Not in RxNorm

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- Inactive ingredients (e.g., lactose, preservatives, alcohol)
- Pack size
- Flavors

# RxNorm Development

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- Clinical Drugs from sources are released but RxNorm forms are not created:
  - Radiopharmaceuticals
  - Multi-vitamins
  - More than 3 ingredients
  - Drug Delivery Devices

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# Conclusion





# Current UMLS Release

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- UMLS 2005AB Release (June)
  - Metathesaurus
    - 133 sources including SNOMED CT, RxNorm
    - 1,196,265 concepts; 4,752,383 names
  - Semantic Network
  - SPECIALIST Lexicon
- Next release: 2005AC (November)
  - Updated sources include July 2005 SNOMED CT, MeSH 2006, RxNorm, ICD-9-CM 2006
  - New sources include HL7, PNDS
  - MetamorphoSys, Browser enhancements



# Current RxNorm Release

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- August 2005 (7/29/05)
  - Consistent with 2005AB UMLS Metathesaurus
  - Updates: SNOMED CT (Jan. 2005), NDDF, VA NDF, NDF-RT
  
- September 2005 (on or about 9/12)
  - FDA NDC

# Documentation and Support

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- UMLS homepage:
  - <http://umlsinfo.nlm.nih.gov/>
  - links to all other UMLS information
- UMLSKS homepage:
  - <http://umlsks.nlm.nih.gov>
  - links to the User's and Developer's guides
- UMLSUSERS-L
  - subscribe to discussion list
- NLM Customer Service:
  - [custserv@nlm.nih.gov](mailto:custserv@nlm.nih.gov)



# Additional training

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- UMLS Basics
  - NLM
  - American Medical Informatics Association (AMIA) tutorials
  - Medical Library Association (MLA) CE class
  - American Health Information Management Association (AHIMA)
- More SNOMED CT content coming



Center  
Drive

Library  
of  
Medicine

**Thank  
you!**