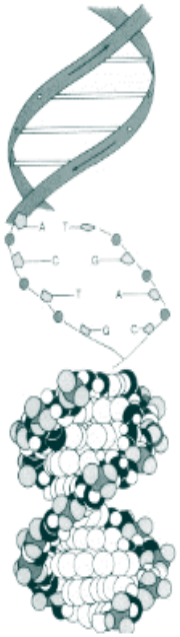


i2b2 – NCBO Collaboration to Provide i2b2 Ontology Services

Shawn Murphy MD, Ph.D.

Lori Phillips MS

What are the pressing problems in i2b2 ontologies? – what we have heard

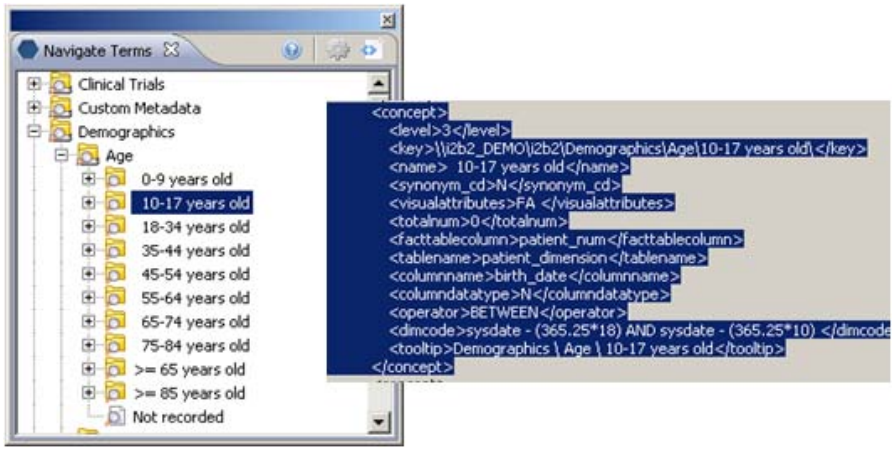
- Creation of i2b2 ontologies that represent the standard ontologies
- Support the creation of custom (local) ontologies
- Versioning of ontologies
  - Necessary for backward compatibility of queries
- Standards across institutions
  - Mapping two ontologies
  - [patient/visit/fact table choices]
  - [concept vs. modifier]
  - Creating new global ontologies

how are we solving some of these problems?

- Creation of i2b2 ontologies that represent the standard ontologies – NCBO-linked tools
- Support the creation of custom (local) ontologies – Ontology editor in i2b2 Workbench
- Versioning of ontologies – Version awareness when using NCBO web services, Guidance
- Standards across institutions
  - Mapping two ontologies – Mapping Cell that will be discussed in SMART presentation, SHRINE tools
  - [patient/visit/fact table choices] – Guidance, community discussion
  - [concept vs. modifier] – Guidance, community discussion
  - Creating new global ontologies – Out of Scope

Patient and Visit dimension table

- Patient and Visit table can contain data, what data should be in these tables rather than the observation_fact table?
  - Guidance
    - Data that will be used in a computation (birth date, visit date) – because rules can be created in the ontology tables
    - Patient dimension table can hold data with no valid date of observation



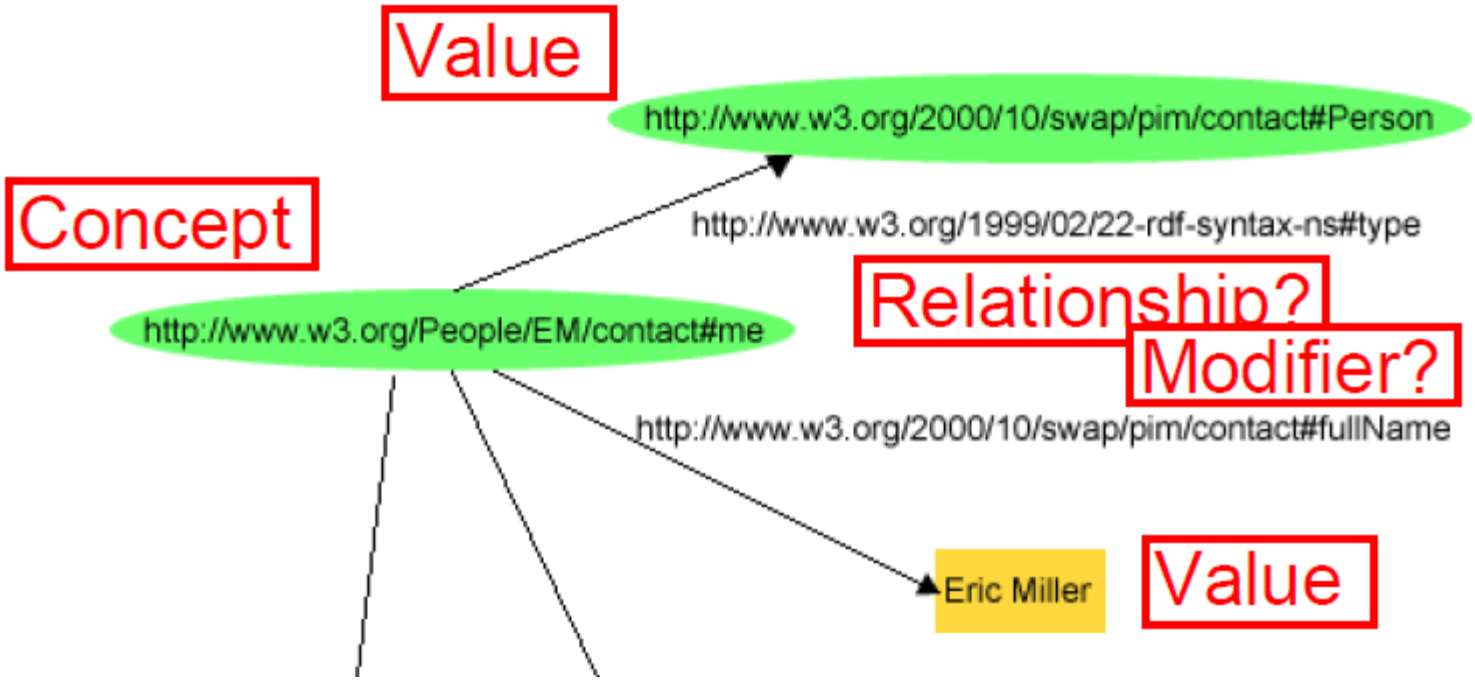
select patient_num from observation_fact where patient_num in (select patient_num from patient_dimension where birth_date BETWEEN sysdate – (365.25*18) AND sysdate – (365.25*10))

Concept vs. Modifier

- Occasionally it is not clear what is the concept and what is the modifier
  - Staph pneumonia
- Guidance
  - Pick what is closest to the patient = pneumonia

RDF Underpinnings

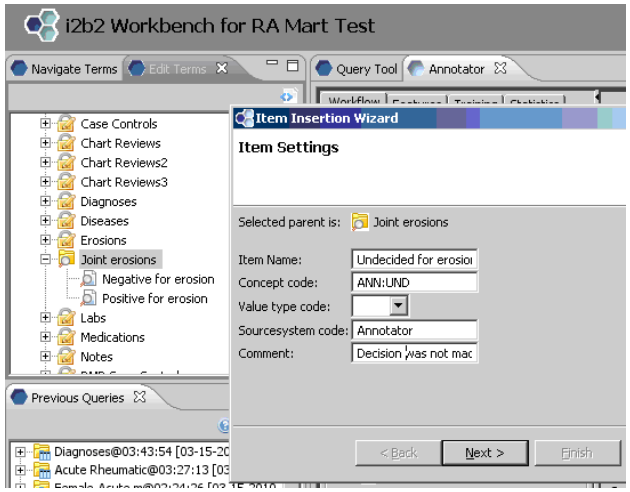
- RDF Graph from W3C document
  - Note that metadata relationships and data relationships are not distinguished
  - I2b2 does distinguish, metadata relationships in terminology hierarchies, data relationships with modifiers



I2b2 metadata relationships – expressed in hierarchies

- ISA – most common relationship in diagnoses, medication, procedure, laboratory test hierarchies
  - Other hierarchies could be expressed in separate hierarchies, but usually aren't
  - Could add as part of Big Parent title – Diagnoses (ISA relationships), Anatomy (PART OF relationships), but would likely confuse more than clarify, relationships are implied.

- ORGANIZEDBY – organization of your desktop, very popular with small, custom terminologies



I2b2 concept relationships – expressed in modifiers

observation _fact	
PK	**Patient_Num**
PK	**Encounter_Num**
PK	**Concept_CD**
PK	**Observer_CD**
PK	**Start_Date**
PK	**Modifier_CD**
PK	**Instance_Num**
	ValType _CD TVal_Char NVal_Num ValueFlag _CD Observation _Blob

Patient_num

Encounter_num

Start_date

Observer_cd

Context

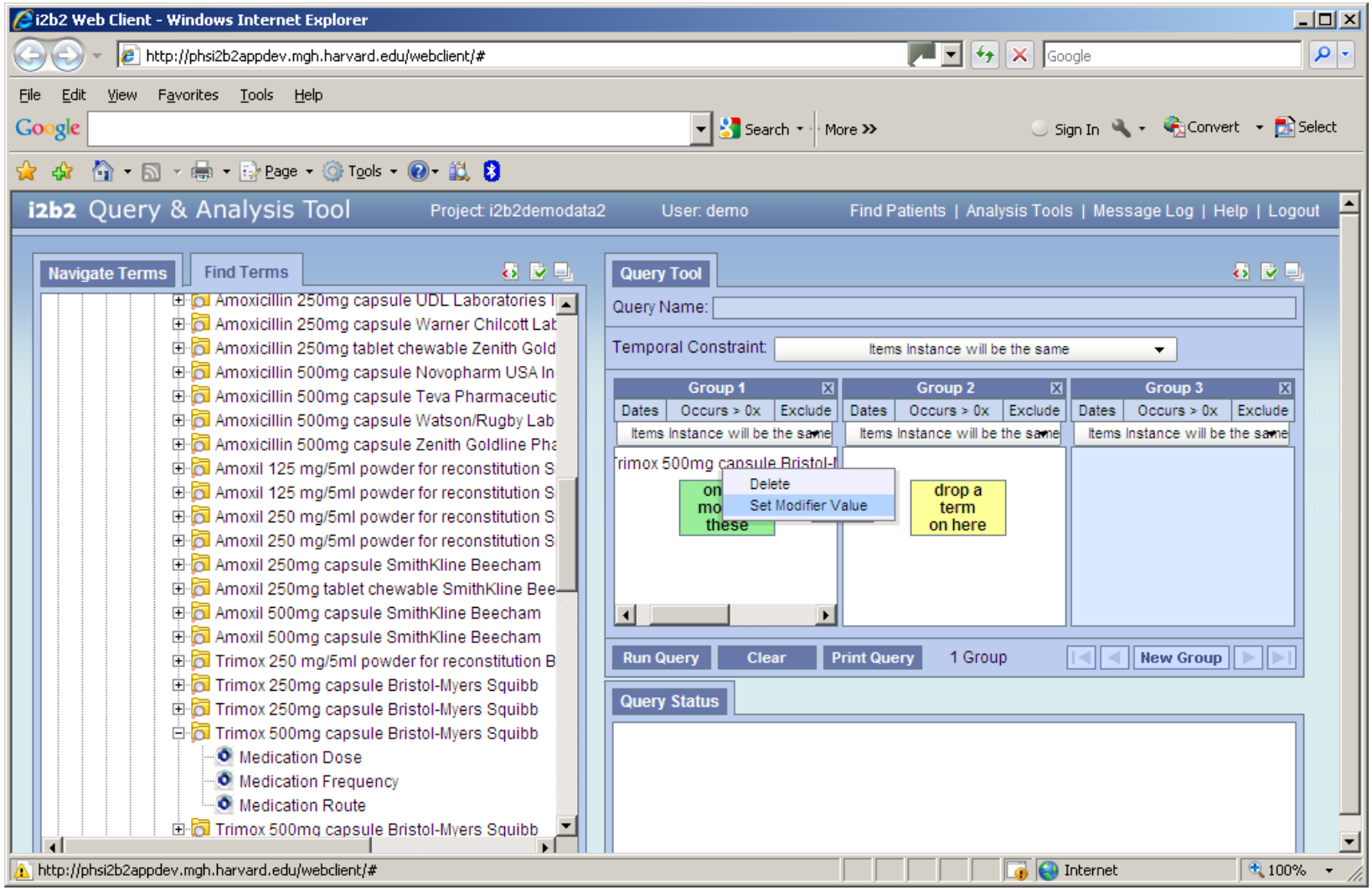
Subject **Predicate** **Object**

Concept_cd	Modifer_cd	[VALUE]

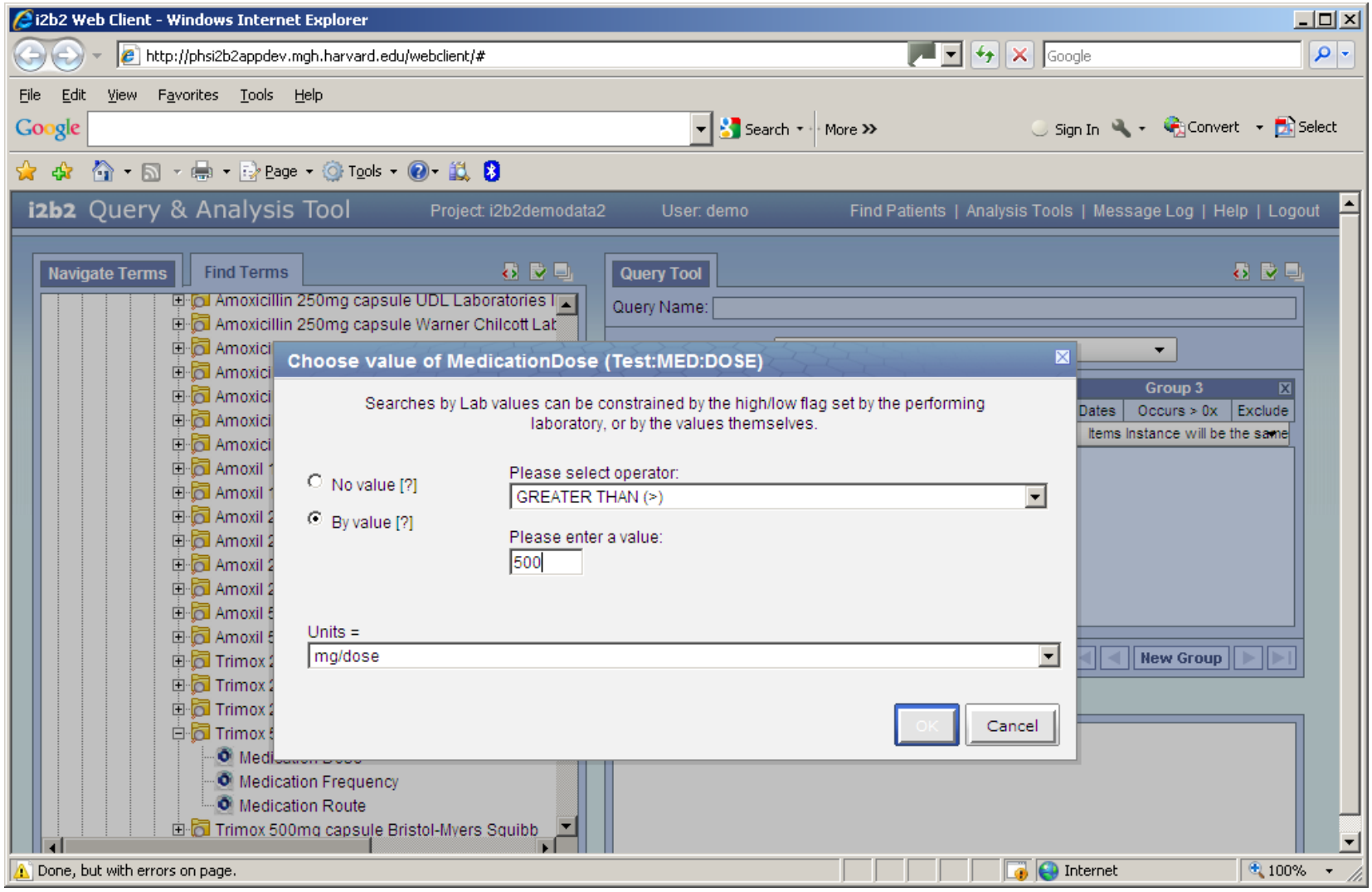
Expression of Modifiers in i2b2 data model

P_num	E_num	**Instance_num**	C_CD	S_d	**Modifier_CD**	ValType_CD	TVal	NVal
123	107	**1**	cpt:59622	20060304	@	<null>	<null>	<null>
123	107	**1**	cpt:59622	20060304	**cptmod:62**	<null>	<null>	<null>
123	107	**1**	cpt:59622	20060304	**cptmod:AA**	<null>	<null>	<null>
123	107	**1**	cpt:59622	20060304	**cptmod:TH**	<null>	<null>	<null>
123	567	**1**	med:aspirin	20100404	@	<null>	<null>	<null>
123	567	**1**	med:aspirin	20100404	**MED:DOSE**	N	E	325
123	567	**1**	med:aspirin	20100404	**MED:FREQ**	T	QD	<null>
123	567	**1**	med:aspirin	20100404	**MED:ROUTE**	T	PO	<null>
123	567	**2**	med:aspirin	20100404	@	<null>	<null>	<null>
123	567	**2**	med:aspirin	20100404	**MED:DOSE**	N	E	83
123	567	**2**	med:aspirin	20100404	**MED:FREQ**	T	BID	<null>
123	567	**2**	med:aspirin	20100404	**MED:ROUTE**	T	PO	<null>

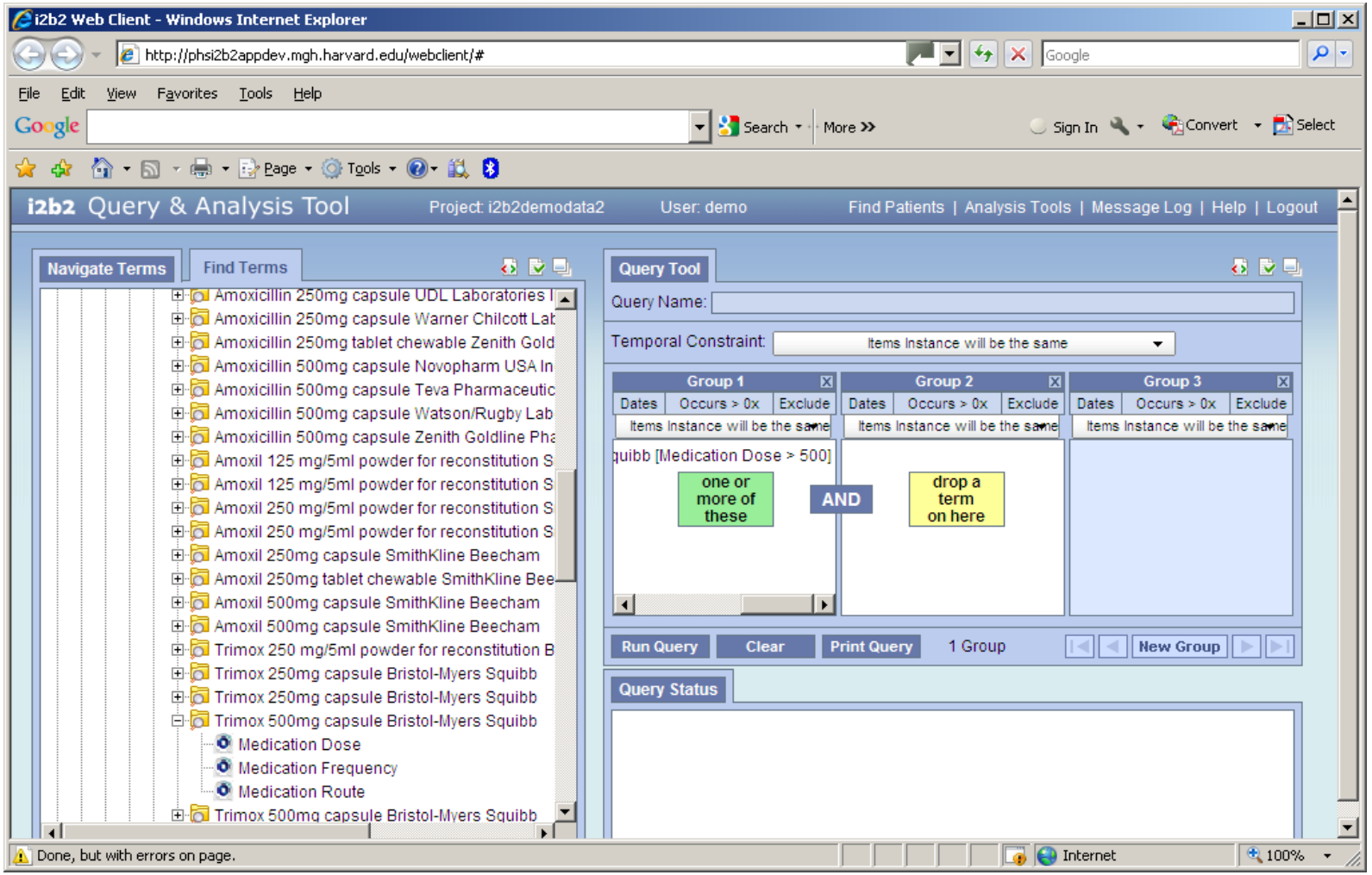
Modifiers in UI



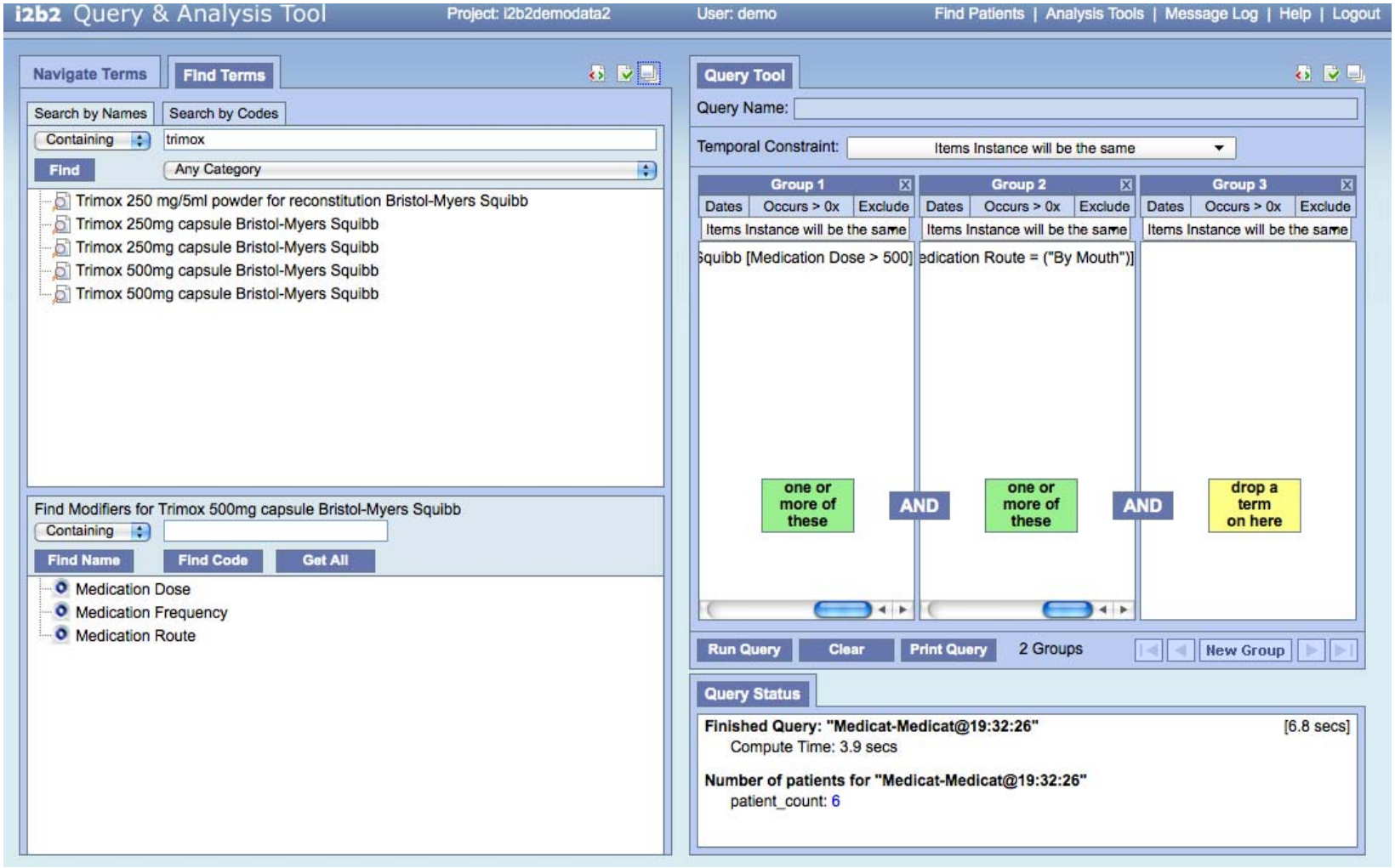
Modifiers in UI



Modifiers in UI



Modifiers in UI



Structure of Metadata Table

METADATA	
C_HLEVEL	INT NULL
C_FULLNAME	VARCHAR(900) NULL
C_NAME	VARCHAR(2000) NULL
C_SYNONYM_CD	CHAR(1) NULL
C_VISUALATTRIBUTES	CHAR(3) NULL
C_TOTALNUM	INT NULL
C_BASECODE	VARCHAR(450) NULL
C_METADATAXML	TEXT NULL
C_FACTTABLECOLUMN	VARCHAR(50) NULL
C_TABLENAME	VARCHAR(50) NULL
C_COLUMNNAME	VARCHAR(50) NULL
C_COLUMNDATATYPE	VARCHAR(50) NULL
C_OPERATOR	VARCHAR(10) NULL
C_DIMCODE	VARCHAR(900) NULL
C_COMMENT	TEXT NULL
C_TOOLTIP	VARCHAR(900) NULL
UPDATE_DATE	DATETIME NULL
DOWNLOAD_DATE	DATETIME NULL
IMPORT_DATE	DATETIME NULL
SOURCESYSTEM_CD	VARCHAR(50) NULL
VALUETYPE_CD	VARCHAR(50) NULL

XML to direct value queries

```
<ValueMetadata>
        <DataType/>
        <Flagstouse/>
        <Oktousevalues/>
        <UnitValues>
            <NormalUnits/>
            <EqualUnits/>
            <ConvertingUnits/>
                    <Units/>
                    <MultiplyingFactor/>
            <ConvertingUnits/>
            <ExcludingUnits/>
        </UnitValues>
        <EnumValues>
                <Val description=""/>
        </EnumValues>
        <MaxStringLength/>
        <LowofLowReference/>
        <HighofLowReference/>
        <LowofHighReference/>
        <HighofHighReference/>
</ValueMetadata>
```

[Also includes ETL directives]

```
<ValueMetadata>
        <Version>3.02</Version>
        <CreationDateTime>
        <TestID/>
        <TestName/>
        <DataType></DataType>
        <Flagstouse/>
        <Oktousevalues/>
        <UnitValues>
                <NormalUnits/>
                <EqualUnits/>
                <ConvertingUnits/>
                        <Units/>
                        <MultiplyingFactor/>
                <ConvertingUnits/>
                <ExcludingUnits/>
        </UnitValues>
        <EnumValues>
                <Val description=""/>
                <ExcludingVal description=""/>
        </EnumValues>
        <MaxStringLength/>
        <CommentsDeterminingExclusion>
                <Com></Com>
        </ CommentsDeterminingExclusion >
        <LowofLowReference/>
        <HighofLowReference/>
        <LowofHighReference/>
        <HighofHighReference/>
        <LowofToxicReference/>
        <HighofToxicReference/>
        <Analysis>
                <Enums/>
                <Counts/>
                <New/>
        </Analysis>
</ValueMetadata>
```

c_metadataxml

DataType will contain the code for what kind of data to expect for this test. Possible values are:

PosInteger – domain of all positive integers

Integer – domain of all integers

PosFloat – domain of all positive real numbers

Float – domain of all real numbers

Enum – domain of enumerated values

String – domain of free text, NOT enumerated text values, which would be the Enum data type.

Flagstouse is a string of concatinated flags that are valid for this concept_cd. For example, for most PosIntegers it would be “LNH” Some acceptable values are L (low), N (normal), H (high), A (abnormal), T (toxic)

Oktousevalues will contain a “Y” or a message, which indicates why it is not OK to use values. Nothing indicates that values cannot be used and the user may only specify values using flags.

PosInteger, PosFloat, Integer, Float XML

UnitValues is the parent tag of a set of possibly repeating tags. It contains data when the datatype is PosInteger, Integer, Float, and PosFloat. All units are always LOWER CASE.

NormalUnits can exist only once, it contains a string that a user would recognize which represents the units of the value as we have it in the data warehouse.

EqualUnits can repeat, it contains other strings that are numerically equal to the NormalUnits string.

ConvertingUnits can repeat, it contains other strings, Units, and the factor, MultiplyingFactor, such that values in theses units need to be multiplied by the multiplyingfactor to convert them into values of NormalUnits. For example, if NormalUnits was in feet, and ConvertingUnits was in yards, the MultiplyingFactor would be 0.333.

ExcludingUnits can repeat, it contains units that will cause the test with these units to be excluded from the query (and in versions 1.5 and prior, should not be included in the data load). These are units that can not be converted with a simple multiplier to NormalUnits. These concepts will need a new code, or if grouped will need to go into their own group, in order to be queried by value.

PosInteger, PosFloat, Integer, Float XML

LowofLowReference specifies the lowest of the low range values for PosInteger, Integer, Float, and PosFloat datatypes.

HighofLowReference specifies the highest of the low range values for PosInteger, Integer, Float, and PosFloat datatypes.

LowofHighReference specifies the lowest of the high range values for PosInteger, Integer, Float, and PosFloat datatypes.

HighofHighReference specifies the highest of the high range values for PosInteger, Integer, Float, and PosFloat datatypes.

LowofToxicReference specifies the lowest of the toxic range values for PosInteger, Integer, Float, and PosFloat datatypes.

HighofToxicReference specifies the highest of the toxic range values for PosInteger, Integer, Float, and PosFloat datatypes (rarely used).

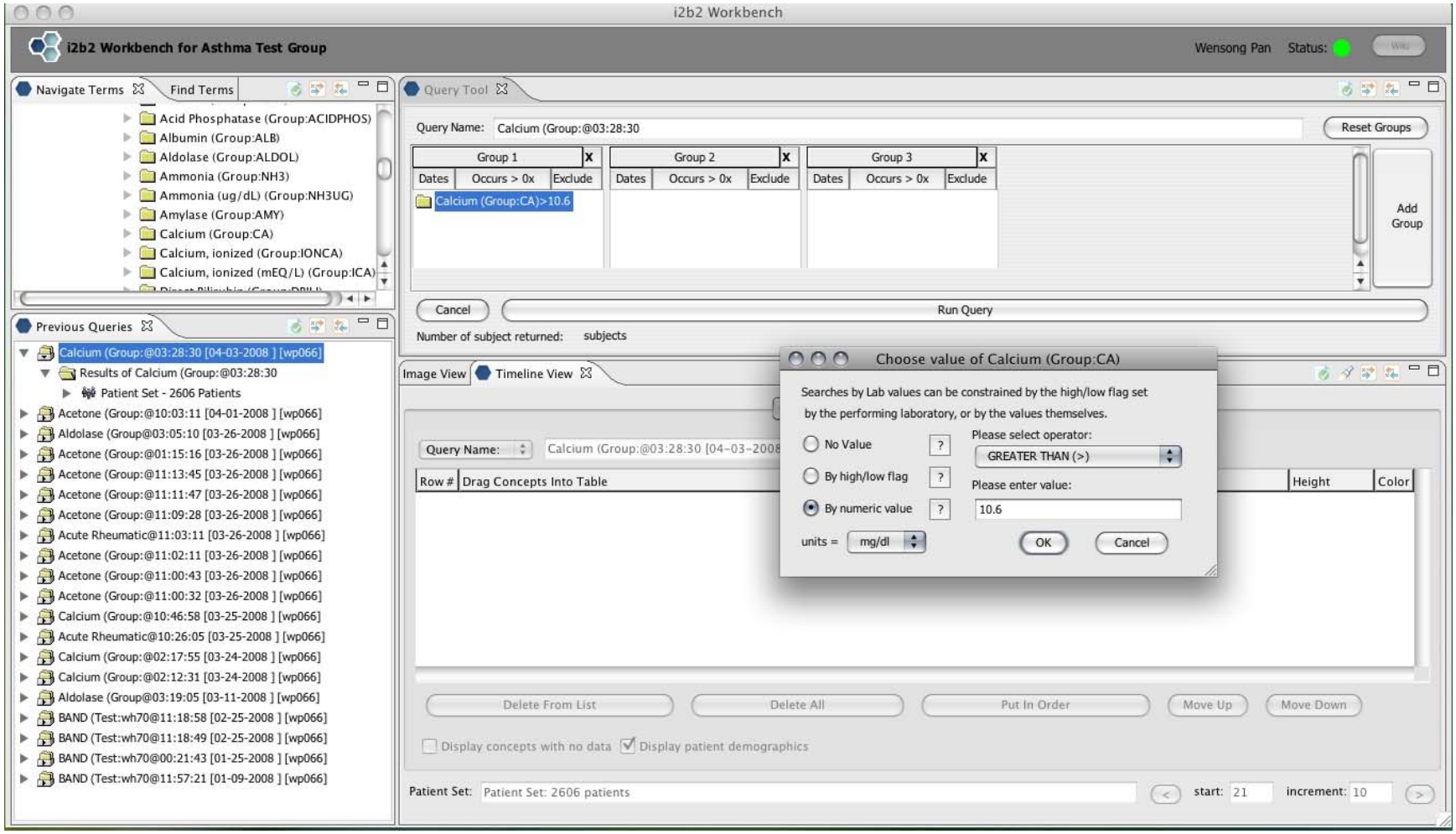
Enum XML

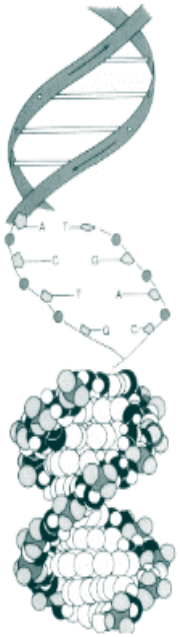
EnumValues is used to specify the list of acceptable enumerated values, each enclosed in the Val tag. Enumerated values that indicate an invalid test result (for the enum datatype) can be enclosed in the ExcludingVal tag. The “descriptions” parameter exists to allow a humanly readable value to be presented for the enumerated value in choice boxes of user intergaces. ExcludingVal is directed to loading processes, and specifies values not to lead into the database or display in a user interface (for example, “pending”).

String XML

- MaxStringLength will contain a postitive integer, representing the longest acceptable string length, if the datatype is “string”.

Query by values





i2b2 Ontology Services

Lori Phillips MS

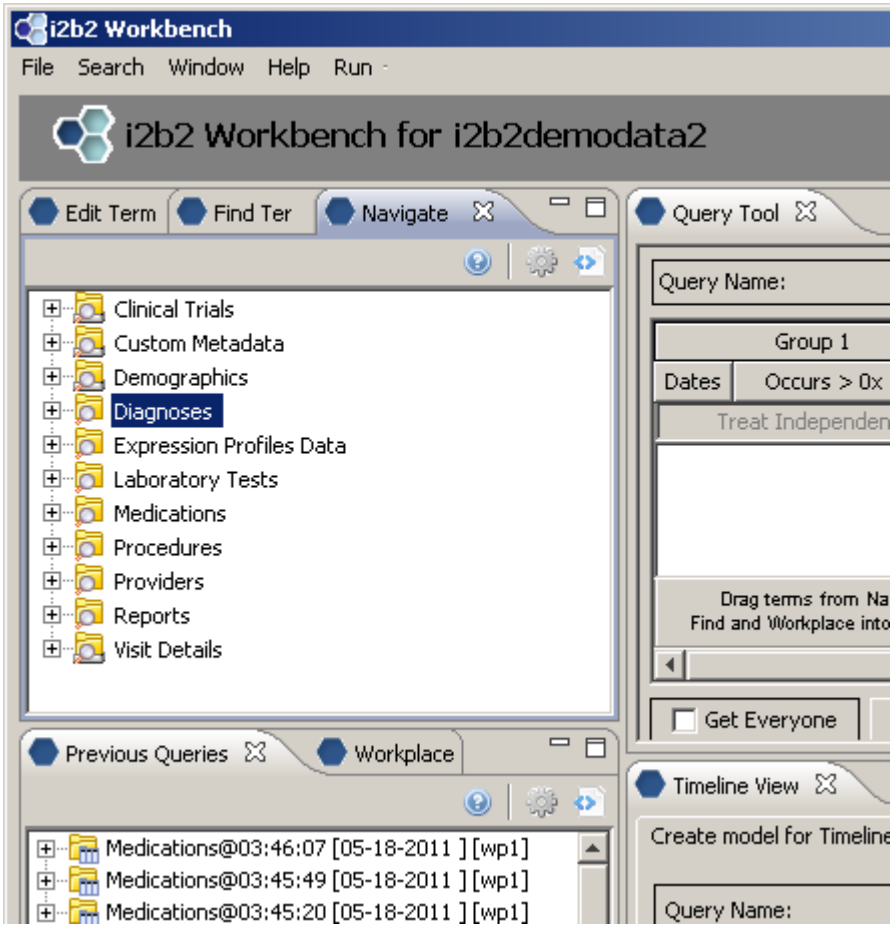
i2b2 AUG

June 29, 2011

Overview

- Basic Ontology features
  - UI
  - Organization
- Advanced topics
  - Support for modifiers
  - NCBO Ontology extraction tool
- Query building
  - Concept_dimension based queries
  - Non-concept_dimension based queries

i2b2 Navigate Terms View



Creating the root level nodes

Editing: i2b2demodata2.dbo.TABLE_ACCESS

File Edit

Max Results: 1000

Table Data | Primary Key | Preview SQL | Messages

	C_TABLE_CD	C_TABLE_NAME	C_HLEVEL	C_FULLNAME	C_NAME
1	BIRN	BIRN	0	\BIRN\	Clinical Trials
2	CUST	CUSTOM_META	0	\Custom Metadata\	Custom Metadata
3	i2b2_DEMO	I2B2	1	\i2b2\Demographics\	Demographics
4	i2b2_DIAG	I2B2	1	\i2b2\Diagnoses\	Diagnoses
5	i2b2_EXPR	I2B2	1	\i2b2\Expression Profiles Data\	Expression Profiles Data
6	i2b2_LABS	I2B2	1	\i2b2\Labtests\	Laboratory Tests
7	i2b2_MEDS	I2B2	1	\i2b2\Medications\	Medications
8	i2b2_PROC	I2B2	1	\i2b2\Procedures\	Procedures
9	i2b2_PROV	I2B2	1	\i2b2\Providers\	Providers
10	i2b2_REP	I2B2	1	\i2b2\Reports\	Reports
11	i2b2_VISIT	I2B2	1	\i2b2\Visit Details\	Visit Details

- One to one mapping between the entries of the table_access table and the root level nodes for a given project.

Building local metadata

- Concept key == \\c_table_cd\c_fullname\

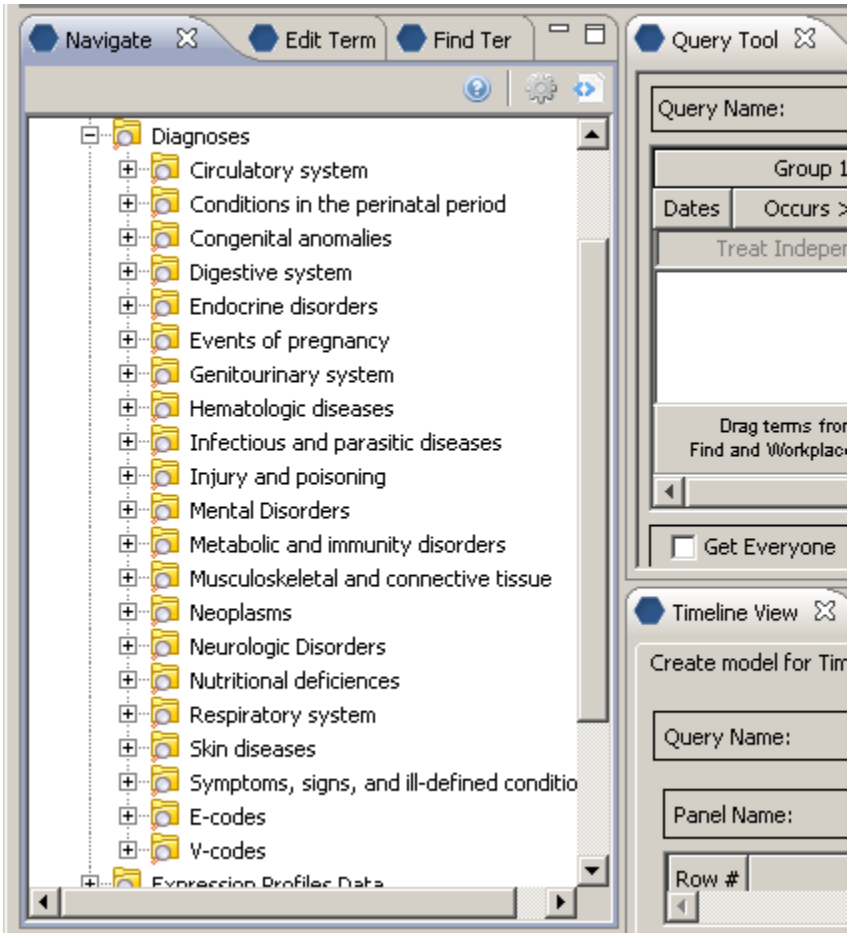
```
<concept>
    <level>1</level>
    <key>\\i2b2_DIAG\i2b2\Diagnoses\</key>
    <name>Diagnoses</name>
        ...
</concept>
```

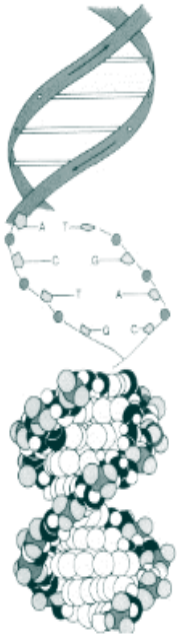
	C_TABLE_CD	C_TABLE_NAME	C_HLEVEL	C_FULLNAME	C_NAME
1	BIRN	BIRN	0	\BIRN\	Clinical Trials
2	CUST	CUSTOM_META	0	\Custom Metadata\	Custom Metadata
3	i2b2_DEMO	I2B2	1	\i2b2\Demographics\	Demographics
4	i2b2_DIAG	I2B2	1	\i2b2\Diagnoses\	Diagnoses
5	i2b2_EXPR	I2B2	1	\i2b2\Expression Profiles Data\	Expression Profiles Data
6	i2b2_LABS	I2B2	1	\i2b2\Labtests\	Laboratory Tests
7	i2b2_MEDS	I2B2	1	\i2b2\Medications\	Medications

Children of concept Diagnoses [\i2b2\Diagnoses\]

C_HLEVEL	C_FULLNAME	C_NAME
2	\i2b2\Diagnoses\Circulatory system (390-459)\	Circulatory system
2	\i2b2\Diagnoses\Conditions in the perinatal period (760-779)\	Conditions in the perinatal period
2	\i2b2\Diagnoses\Congenital anomalies (740-759)\	Congenital anomalies
2	\i2b2\Diagnoses\Digestive system (520-579)\	Digestive system
2	\i2b2\Diagnoses\Endocrine disorders (240-259)\	Endocrine disorders
2	\i2b2\Diagnoses\Events of pregnancy (630-677)\	Events of pregnancy
2	\i2b2\Diagnoses\Genitourinary system (580-629)\	Genitourinary system
2	\i2b2\Diagnoses\Hematologic diseases (280-289)\	Hematologic diseases
2	\i2b2\Diagnoses\Infectious and parasitic diseases (001-139)\	Infectious and parasitic diseases
2	\i2b2\Diagnoses\Injury and poisoning (800-999)\	Injury and poisoning
2	\i2b2\Diagnoses\Mental Disorders (290-319)\	Mental Disorders
2	\i2b2\Diagnoses\Metabolic and immunity disorders (270-279)\	Metabolic and immunity disorders
2	\i2b2\Diagnoses\Musculoskeletal and connective tissue (710-739)\	Musculoskeletal and connective tissue
2	\i2b2\Diagnoses\Neoplasms (140-239)\	Neoplasms
2	\i2b2\Diagnoses\Neurologic Disorders (320-389)\	Neurologic Disorders
2	\i2b2\Diagnoses\Nutritional deficiences (260-269)\	Nutritional deficiences
2	\i2b2\Diagnoses\Respiratory system (460-519)\	Respiratory system
2	\i2b2\Diagnoses\Skin diseases (680-709)\	Skin diseases
2	\i2b2\Diagnoses\Symptoms, signs, and ill-defined conditions (780-799)\	Symptoms, signs, and ill-defined conditions
2	\i2b2\Diagnoses\zz E-codes\	E-codes
2	\i2b2\Diagnoses\zz V-codes\	V-codes

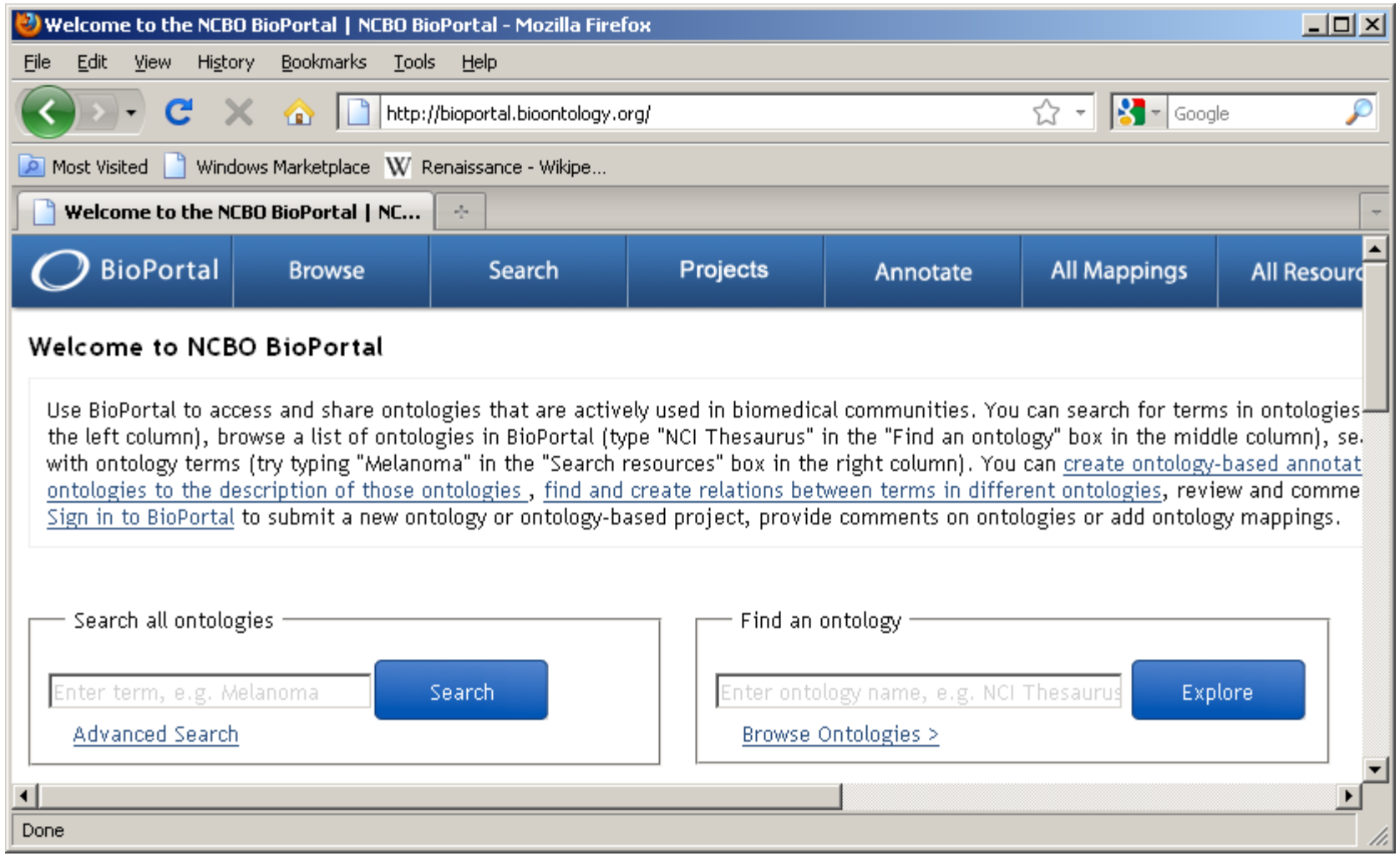
Children of concept Diagnoses display





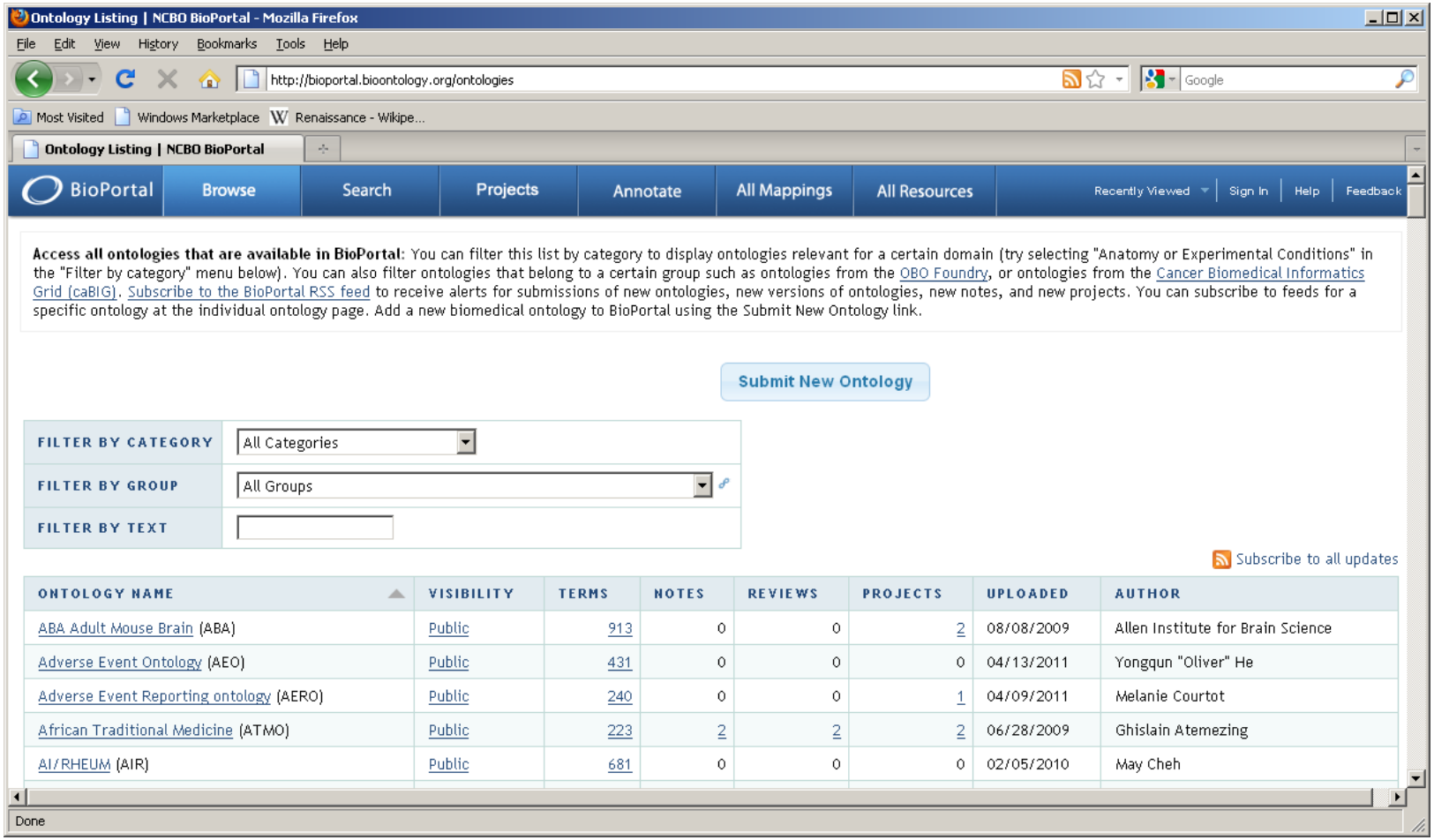
NCBO Ontology Tools

Creating metadata for standard ontologies using BioPortal

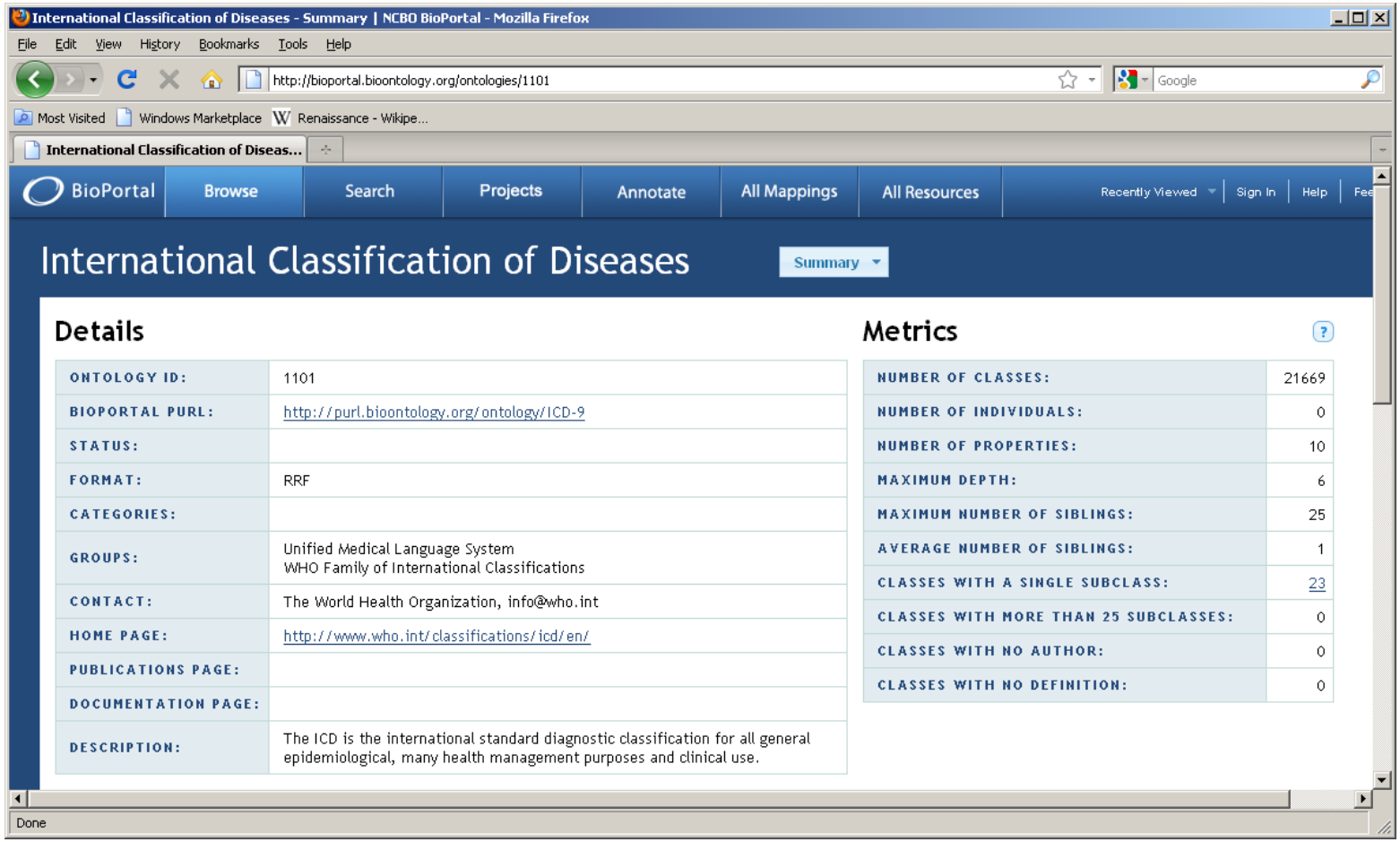


NCBO BioPortal

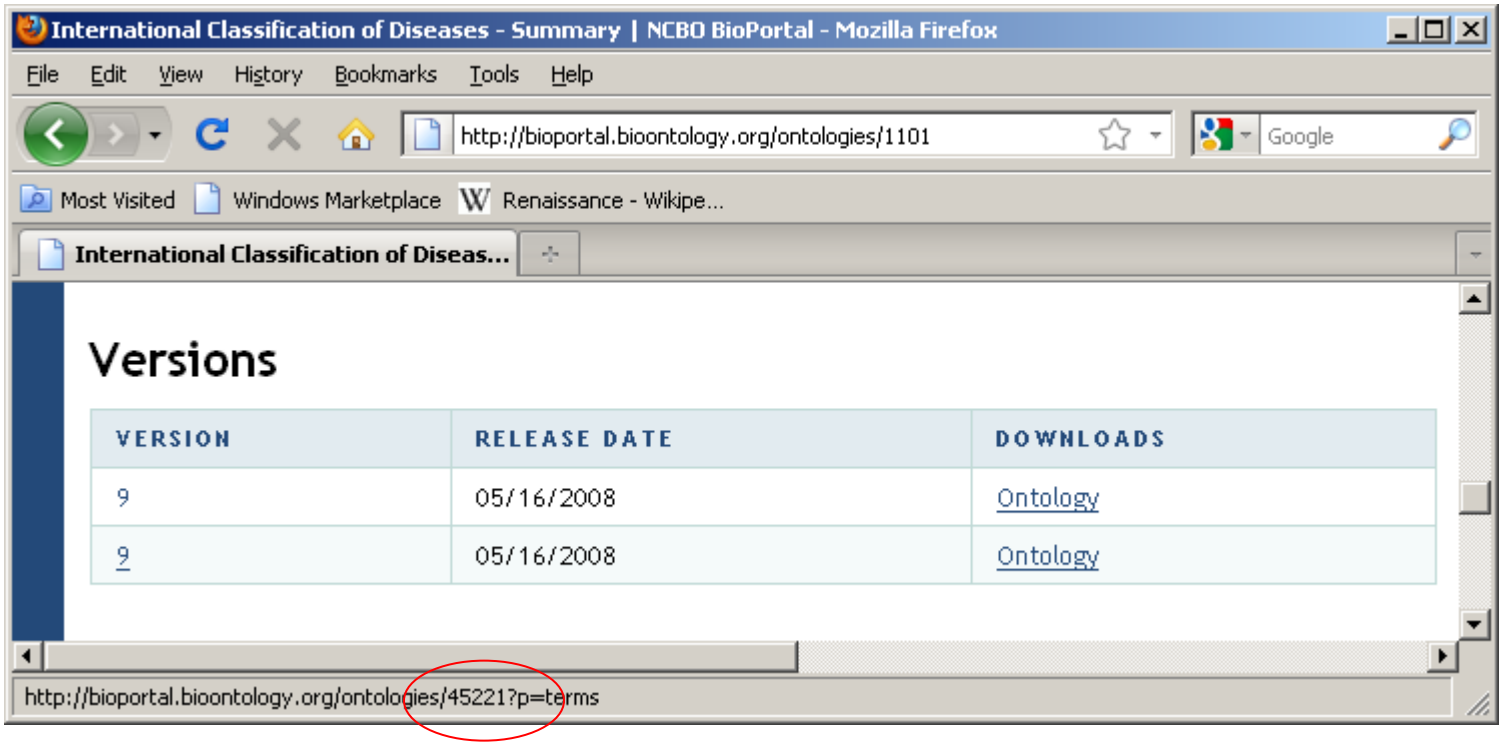
- Hosts over 250 ontologies



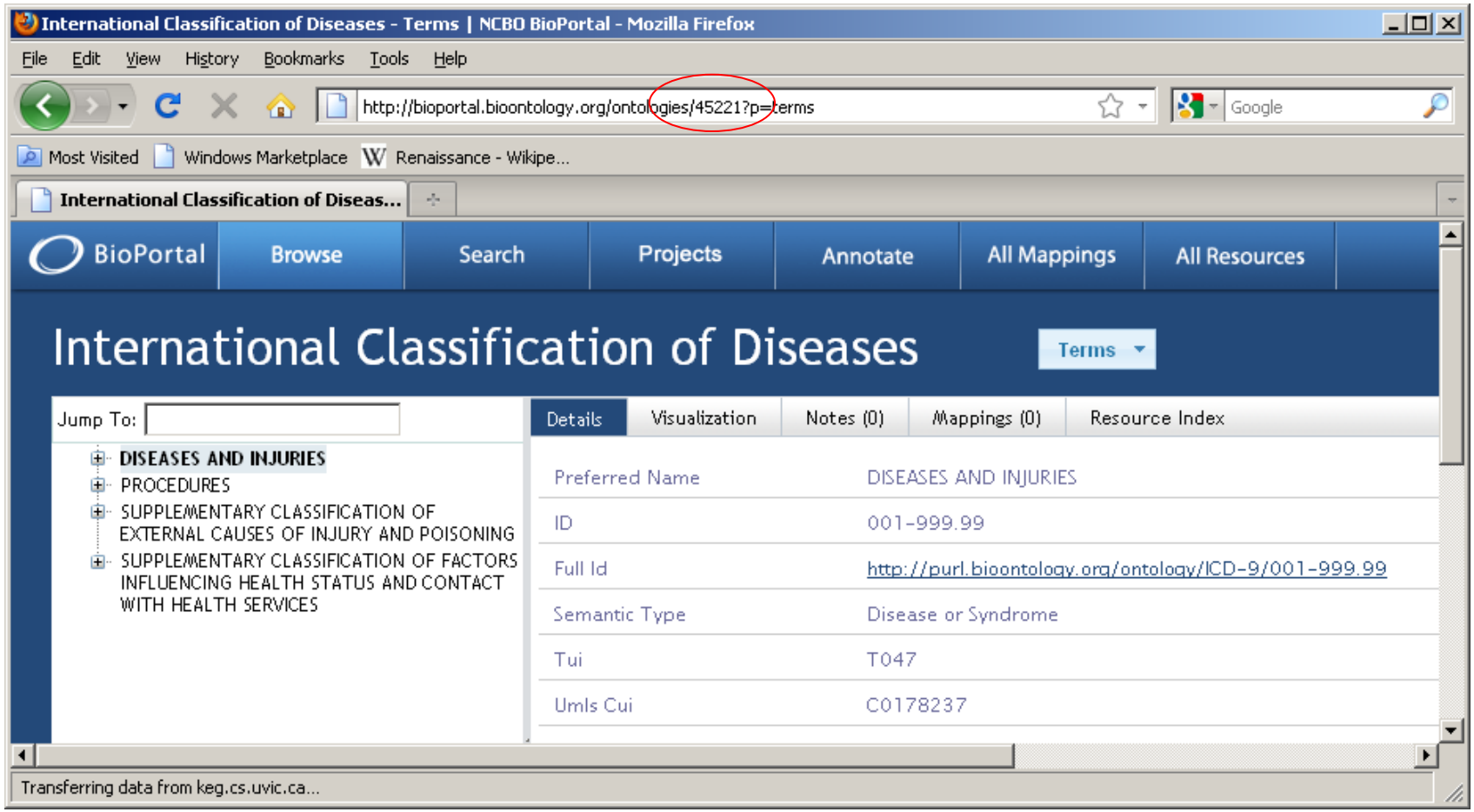
Details summary page



Locate ontology id for version of interest [45221]



BioPortal – ICD9



NCBO Ontology Extraction Strategy

- Pull data from NCBO via REST services.
- Reorganize information into format used by i2b2 Ontology cell

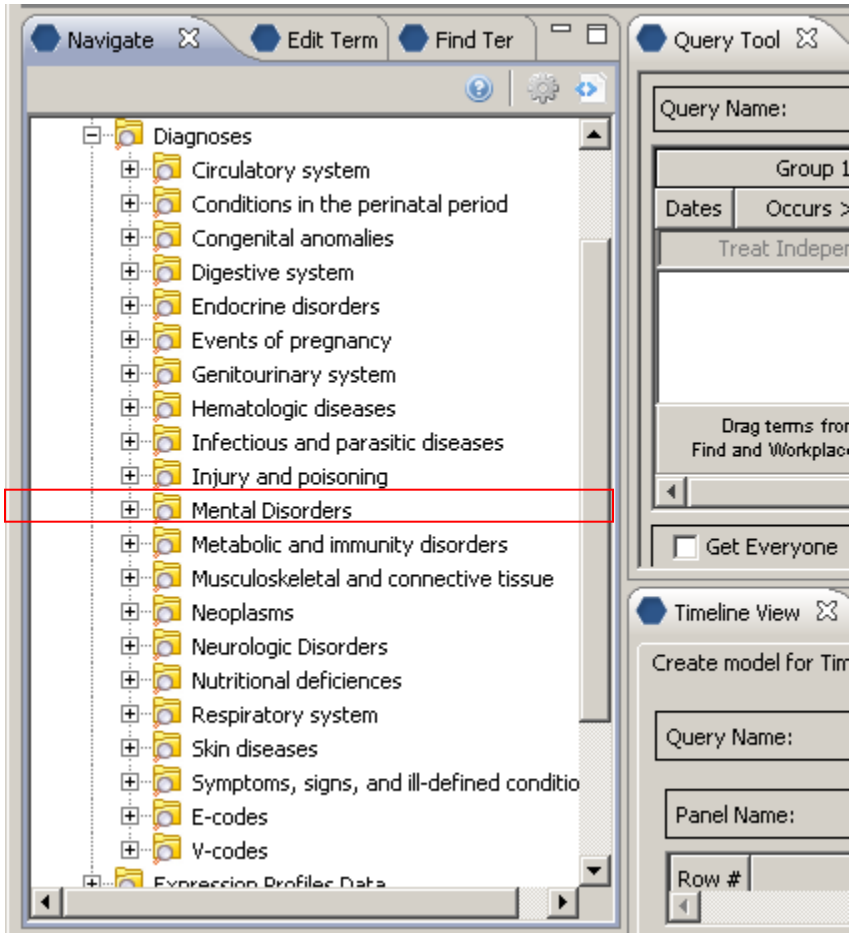
```
<data>
  <pageNum>1</pageNum>
   <numPages>1934</numPages>
   <pageSize>50</pageSize>
   <numResultsPage>50</numResultsPage>
   <numResultsTotal>96677</numResultsTotal>
   <contents
class="org.ncbo.stanford.bean.concept.
ClassBeanResultListBean">
     <classBeanResultList>
       <classBean>
         <id>http://ihtsdo.org/snomedct/
clinicalFinding#10000006</id>
         <fullId>http://ihtsdo.org/snomedct/
clinicalFinding#10000006</fullId>
        <label>Radiating chest pain</label>
        <type>class</type>
       <relations>.....
          <entry>
            <string>CONCEPTSTATUS</string>
            <list>
               <string>0</string>
            </list>
          </entry>
          <entry>
            <string>SubClass</string>
             <list/>
          </entry>    ......
```

METADATA COLUMN	DATA TYPE (ORACLE)	DATA TYPE (SQL)
C_HLEVEL	INT	INT
C_FULLNAME	VARCHAR2(700)	VARCHAR(700)
C_NAME	VARCHAR2(2000)	VARCHAR(2000)
C_SYNONYM_CD	CHAR(1)	CHAR(1)
C_VISUALATTRIBUTES	CHAR(3)	CHAR(3)
C_BASECODE	VARCHAR2(50)	VARCHAR(50)
C_METADATAXML	CLOB	TEXT
C_FACTTABLECOLUMN	VARCHAR2(50)	VARCHAR(50)
C_TABLENAME	VARCHAR2(50)	VARCHAR(50)
C_COLUMNNAME	VARCHAR2(50)	VARCHAR(50)
C_COLUMNDATATYPE	VARCHAR2(50)	VARCHAR(50)
C_OPERATOR	VARCHAR2(10)	VARCHAR(10)
C_DIMCODE	VARCHAR2(700)	VARCHAR(700)
C_TOOLTIP	VARCHAR2(900)	VARCHAR(900)
UPDATE_DATE	DATE	DATETIME
DOWNLOAD_DATE	DATE	DATETIME
IMPORT_DATE	DATE	DATETIME
SOURCESYSTEM_CD	VARCHAR2(50)	VARCHAR(50)
VALUETYPE_CD	VARCHAR2(50)	VARCHAR(50)

Primary challenges

- i2b2 Ontology cell depends upon hierarchical information
  - c_fullname, c_tooltip maintain the hierarchy from root to leaves

\ Diagnoses \
Mental Disorders \

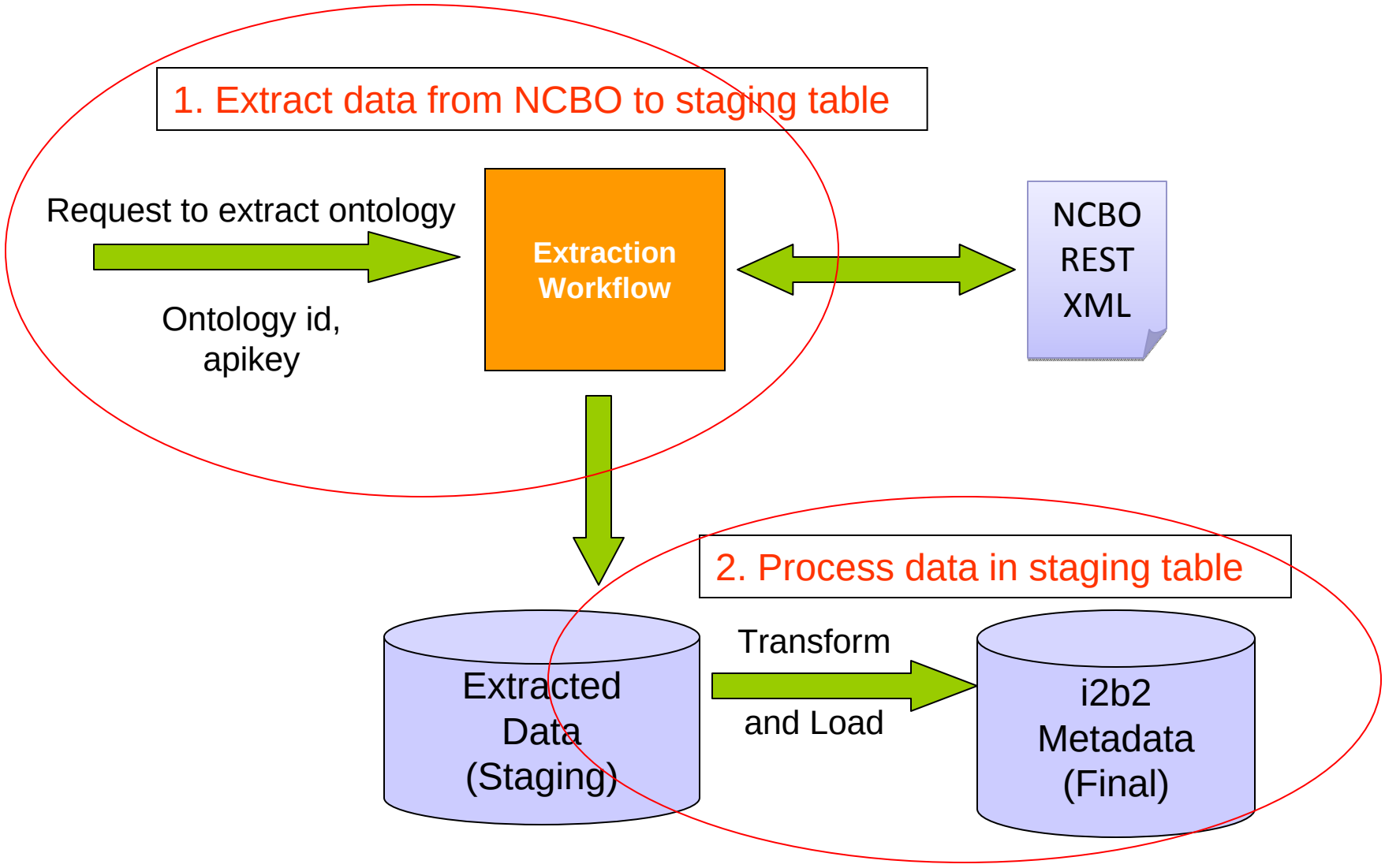


Challenges..

- BioPortal REST service that enables pull of concepts includes immediate parent/child info only
  - **i2b2 c_fullname , c_tooltip must be computed**

```
<data>
 <classBean>
   <id>001-999.99 </id>
  <label>Diseases and injuries</label>
  <relations>
   <entry>
     <string>SuperClass</string>
     <list>
       <classBean>
         <id>290-319.99</id>
         <label>Mental disorders</label>
       </classBean>
     </list>
    </entry>
   </relations>
  </classBean>
</data>
```

NCBO Ontology Extraction Workflow



Display extracted ontology

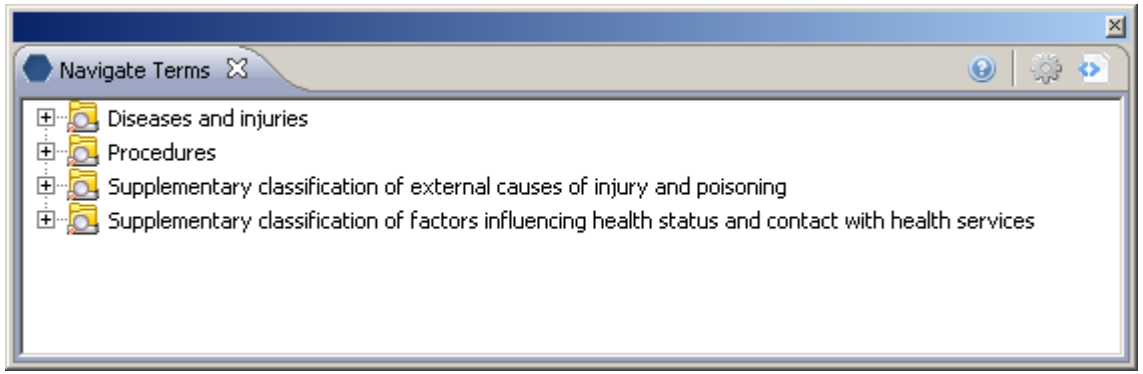
Editing: xe.I2B2HIVE.TABLE_ACCESS

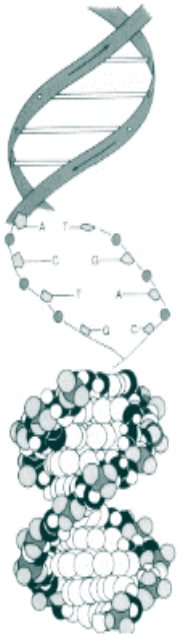
File Edit

Max Results: 1000

Table Data | Primary Key | Preview SQL | Messages

	C_TABLE_CD	C_TABLE_NAME	C_PROTECTED_ACCESS	C_HLEVEL	C_FULLNAME
1	ICD9_PROC	NCBO_ICD9	N	1	\(00-99.99) Procedures\
2	ICD9_DIS	NCBO_ICD9	N	1	\(001-999.99) Diseases and injuries\
3	ICD9_SUPP_E	NCBO_ICD9	N	1	\(E800-E999.9) Supplemen~\
4	ICD9_SUPP_V	NCBO_ICD9	N	1	\(V01-V89.99) Supplement~\

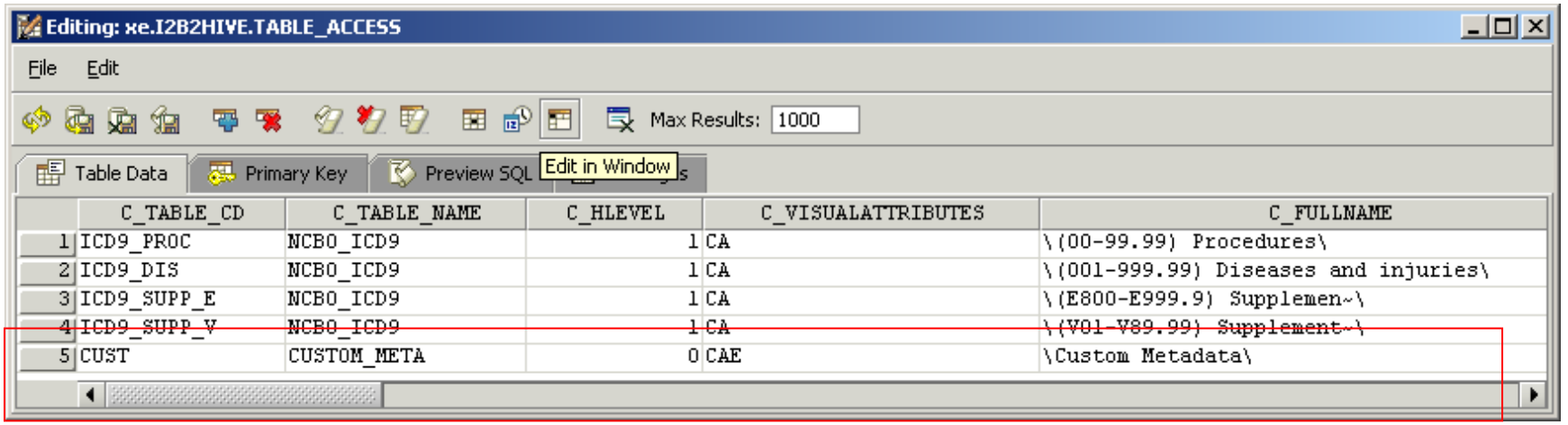




Ontology Support for Modifiers

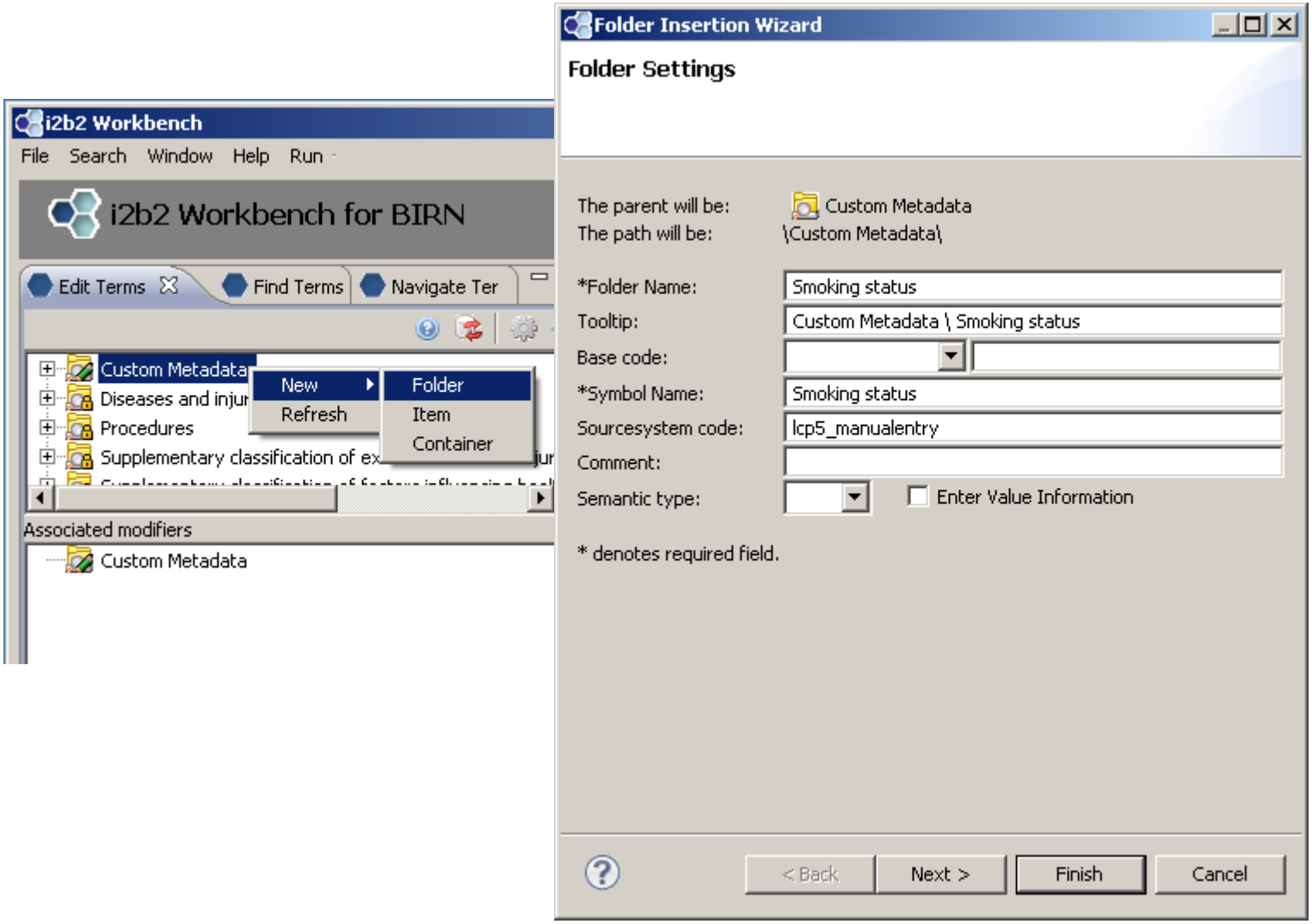
Creating project-specific (localized) metadata

- Table CUSTOM_META is provided for creating metadata within the Edit Terms View
  - Great for small, non-standard ontologies
  - Visual attribute ends in ‘E’ (editable)

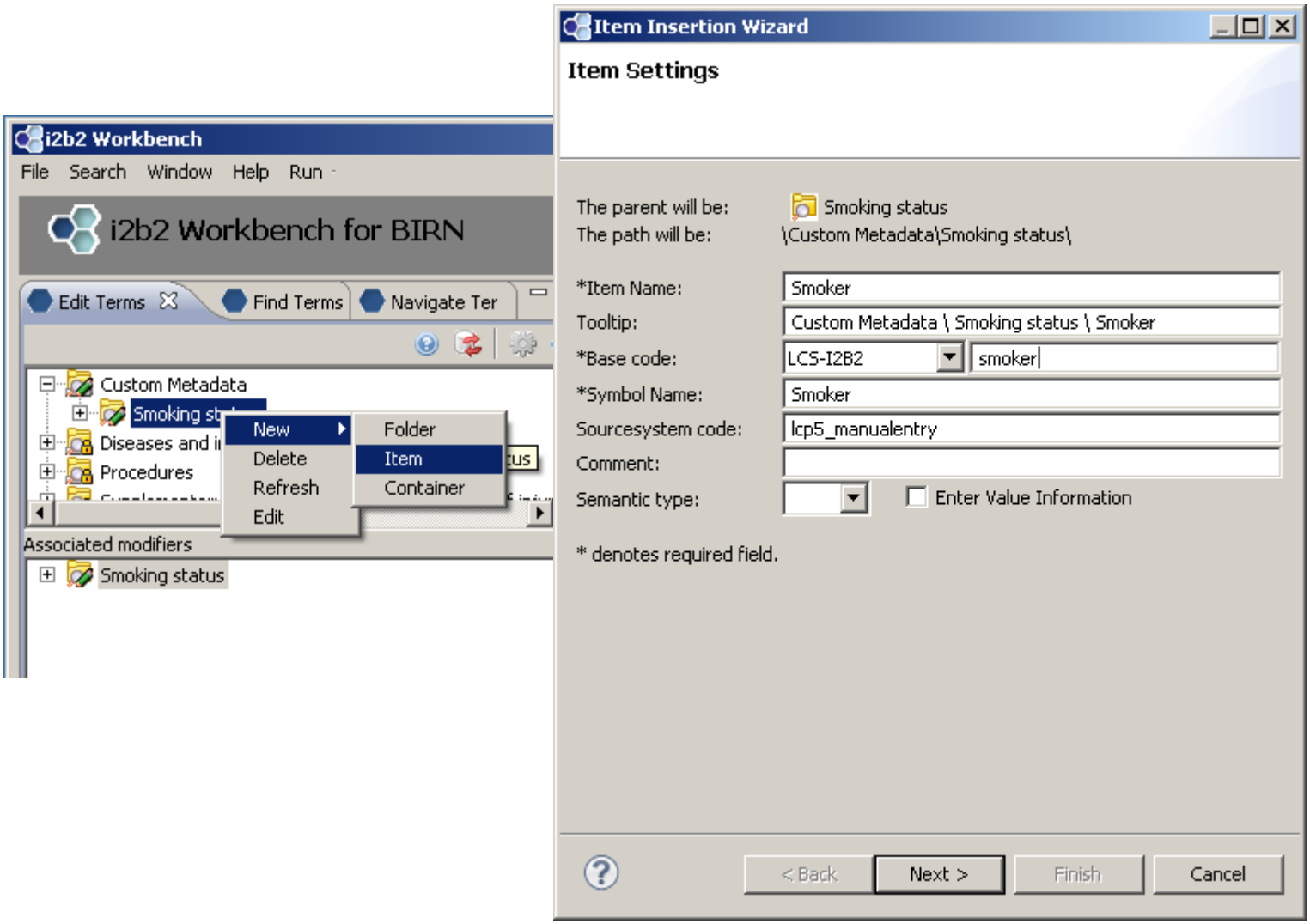


	C_TABLE_CD	C_TABLE_NAME	C_HLEVEL	C_VISUALATTRIBUTES	C_FULLNAME
1	ICD9_PROC	NCBO_ICD9	1	CA	\(00-99.99) Procedures\
2	ICD9_DIS	NCBO_ICD9	1	CA	\(001-999.99) Diseases and injuries\
3	ICD9_SUPP_E	NCBO_ICD9	1	CA	\(E800-E999.9) Supplemen~\
4	ICD9_SUPP_V	NCBO_ICD9	1	CA	\(V01-V89.99) Supplement~\
5	CUST	CUSTOM_META	0	CAE	\Custom Metadata\

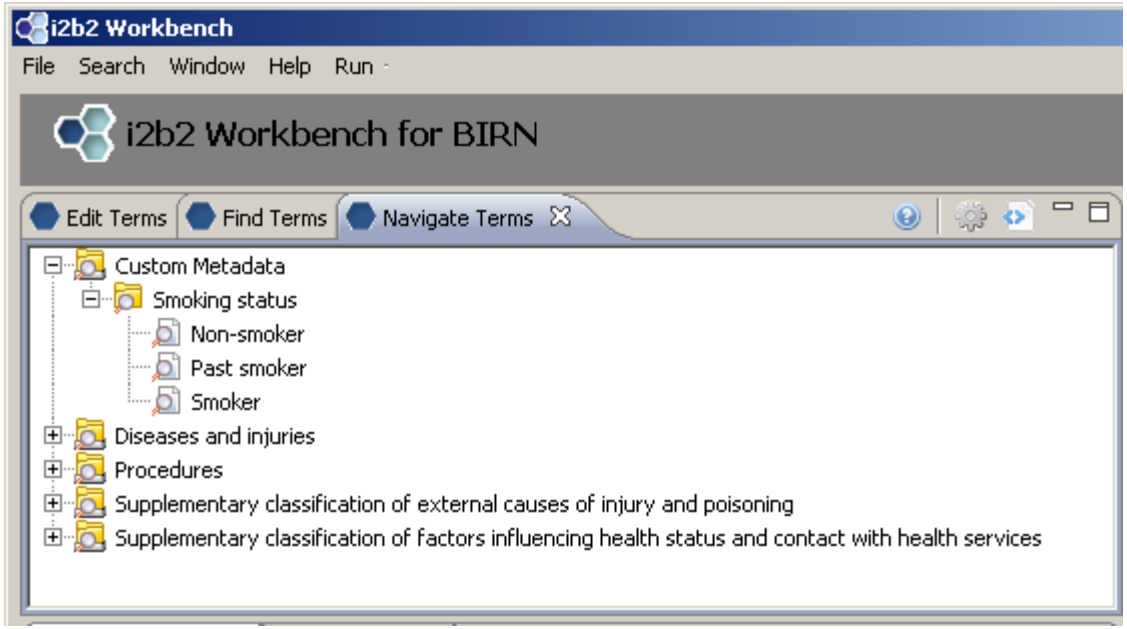
Create a ‘Smoking Status’ concept folder



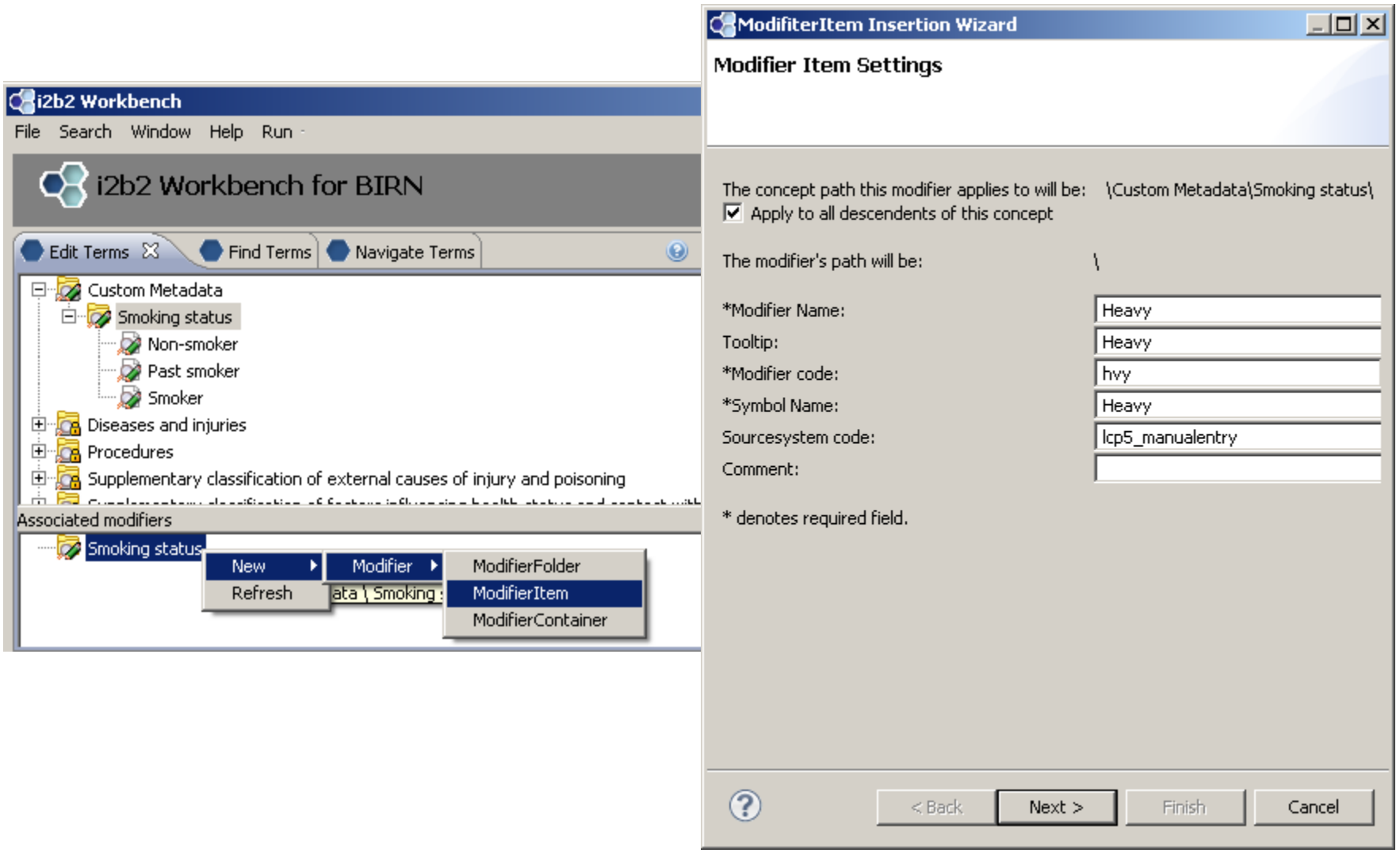
Add three concepts…



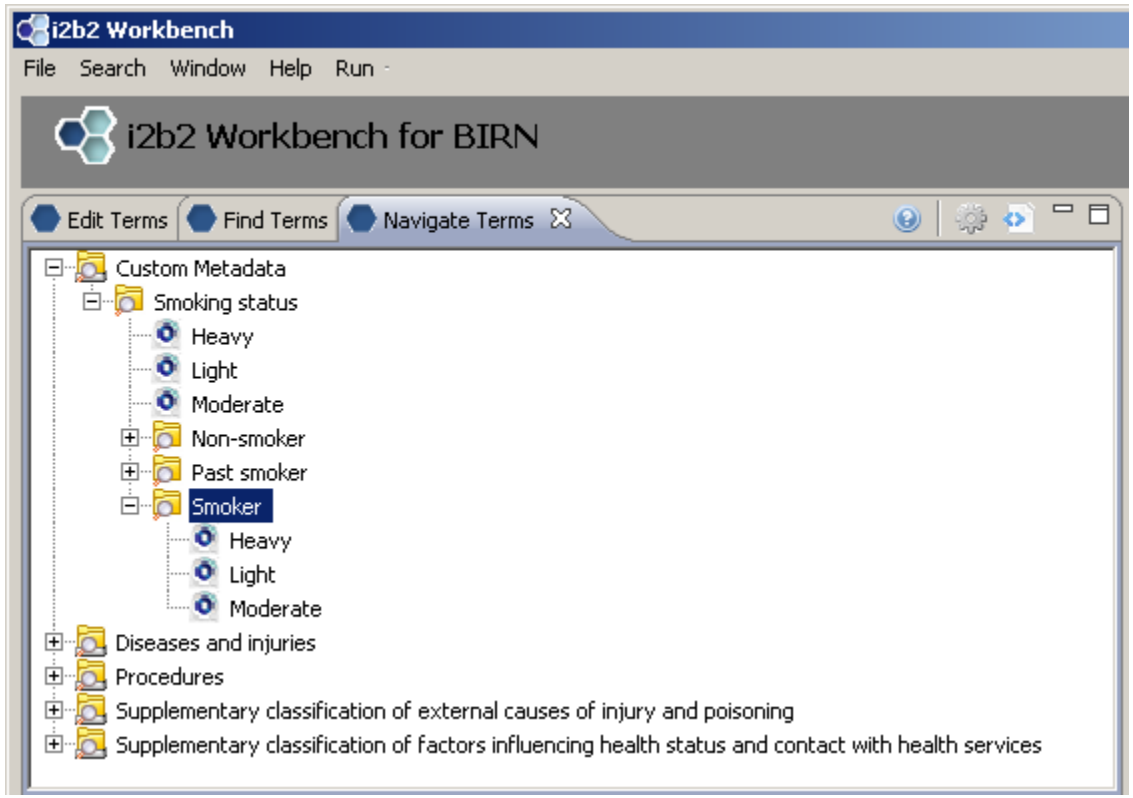
New folder with three new concepts:



Creating modifiers for existing terms

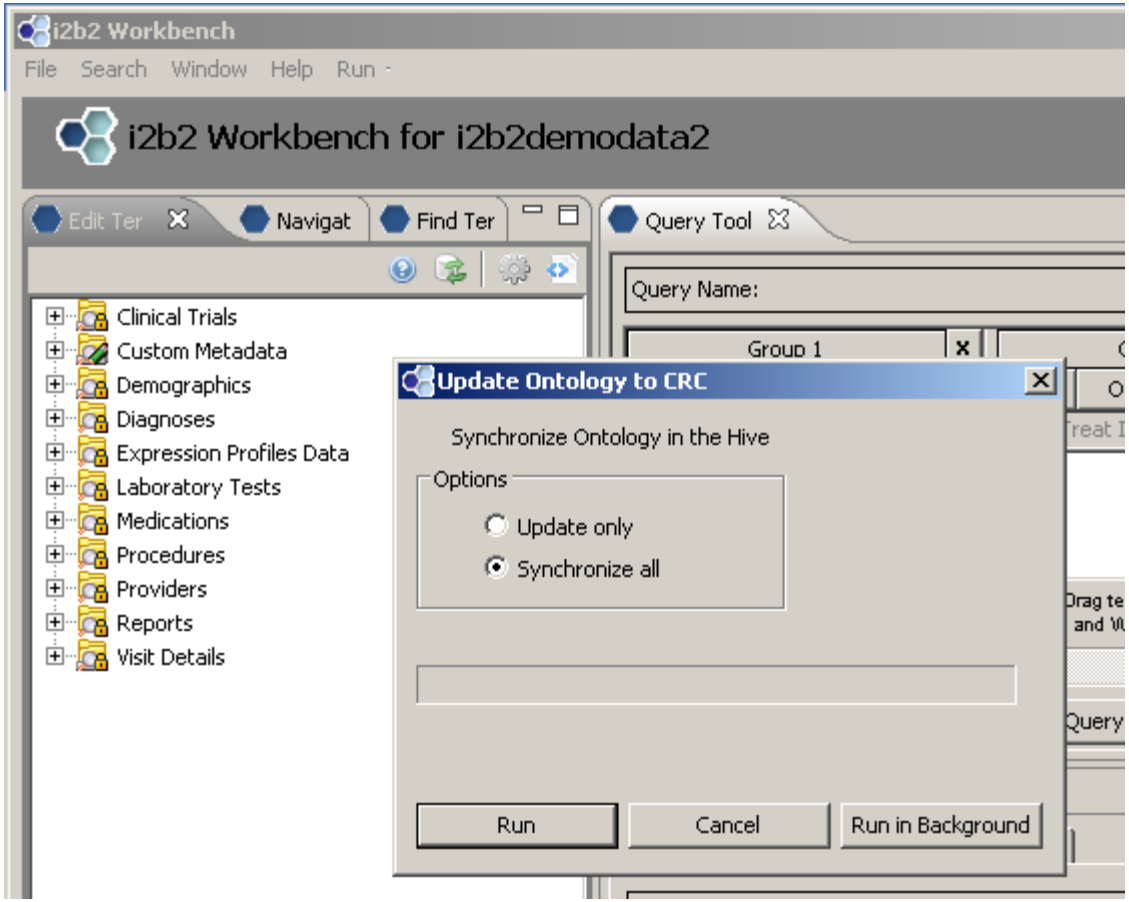


Updated ‘Smoker’ concept (with modifiers)

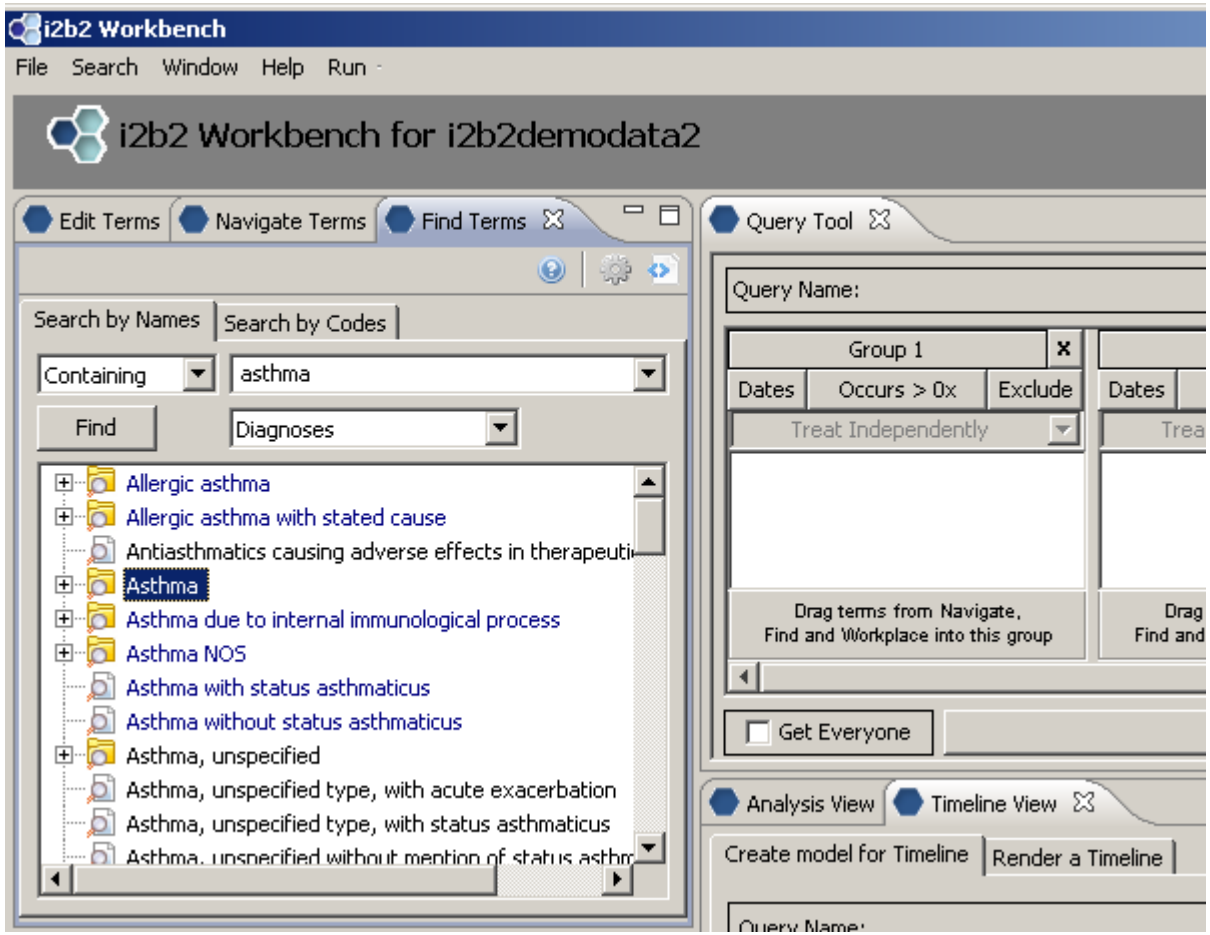


Synchronize metadata with dimension tables

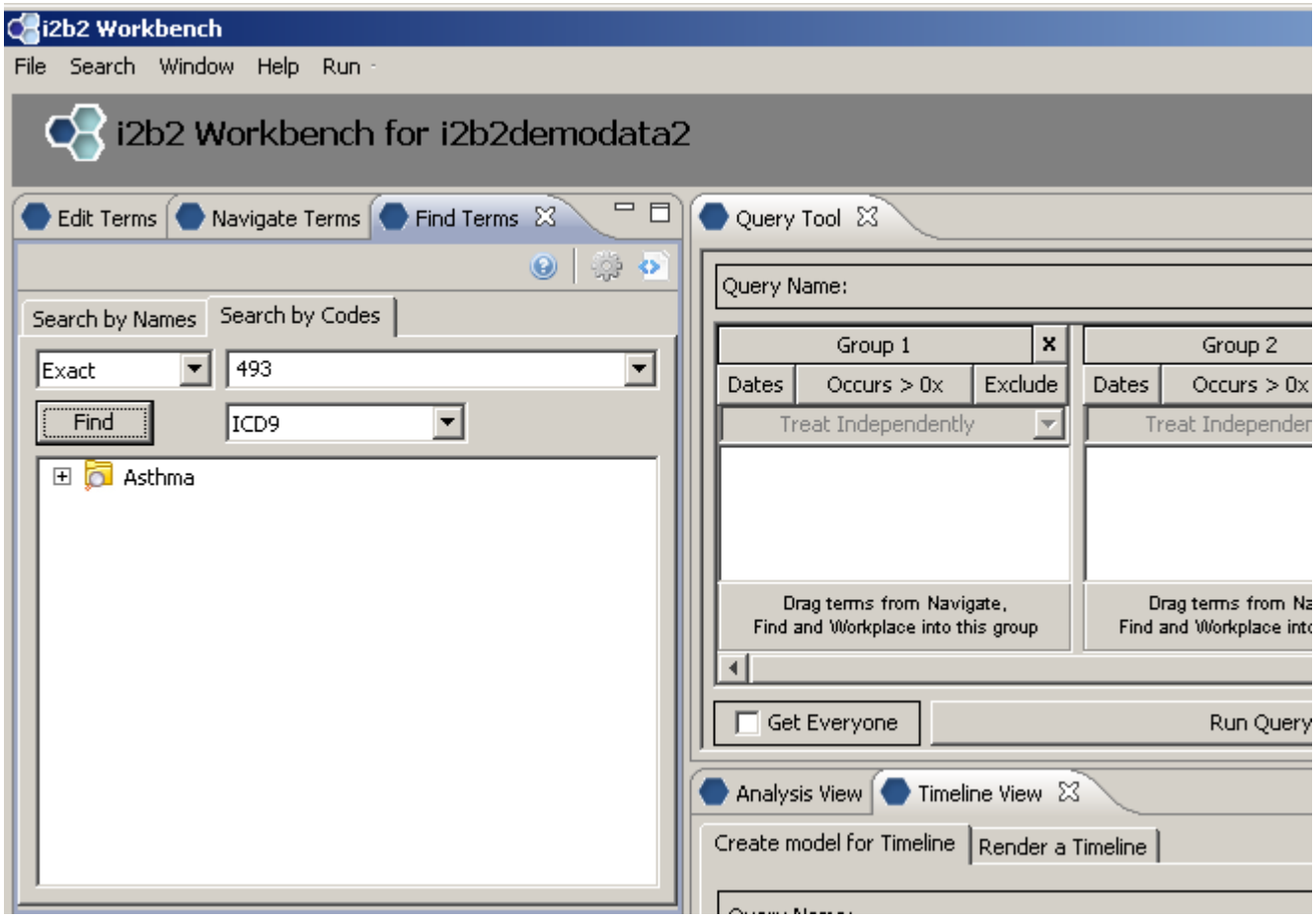
- Concept_dimension
- Modifier_dimension
- Provider_dimension



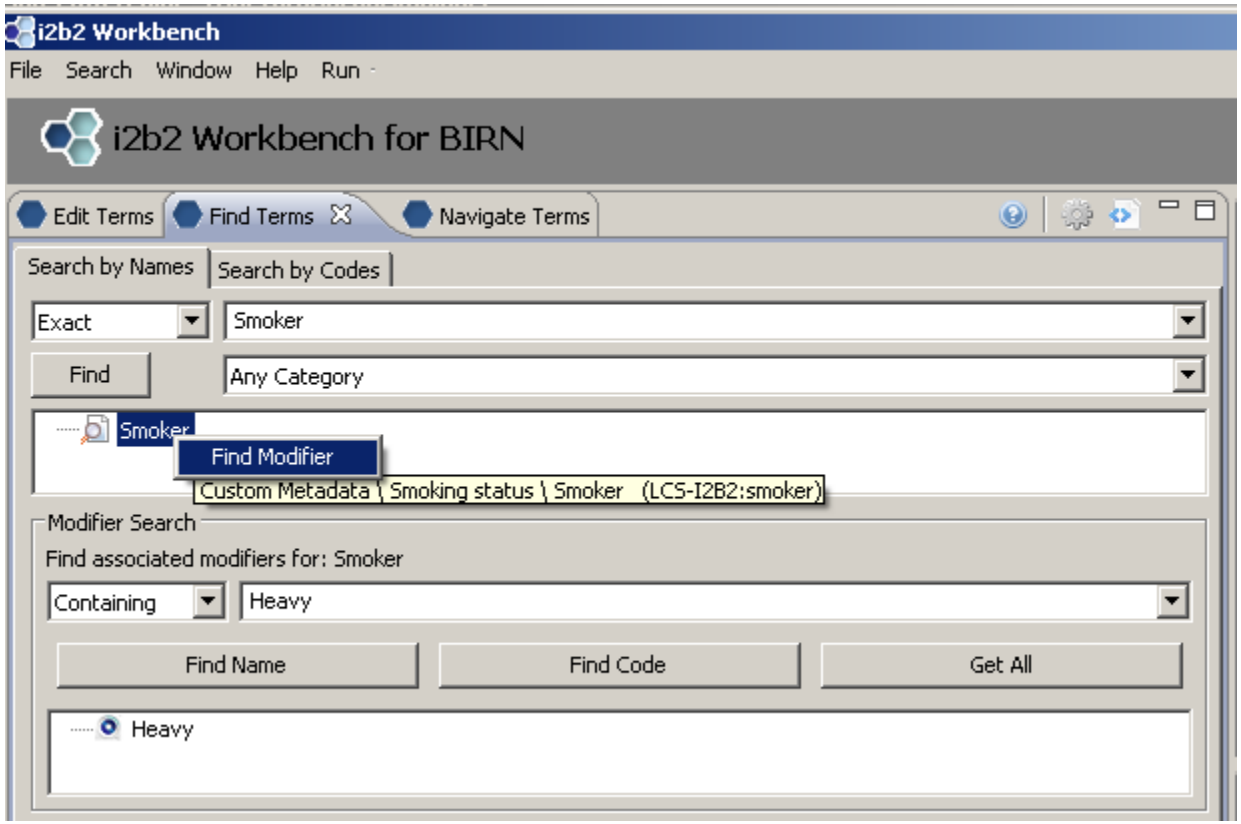
Using Find Terms Search by Names Tab



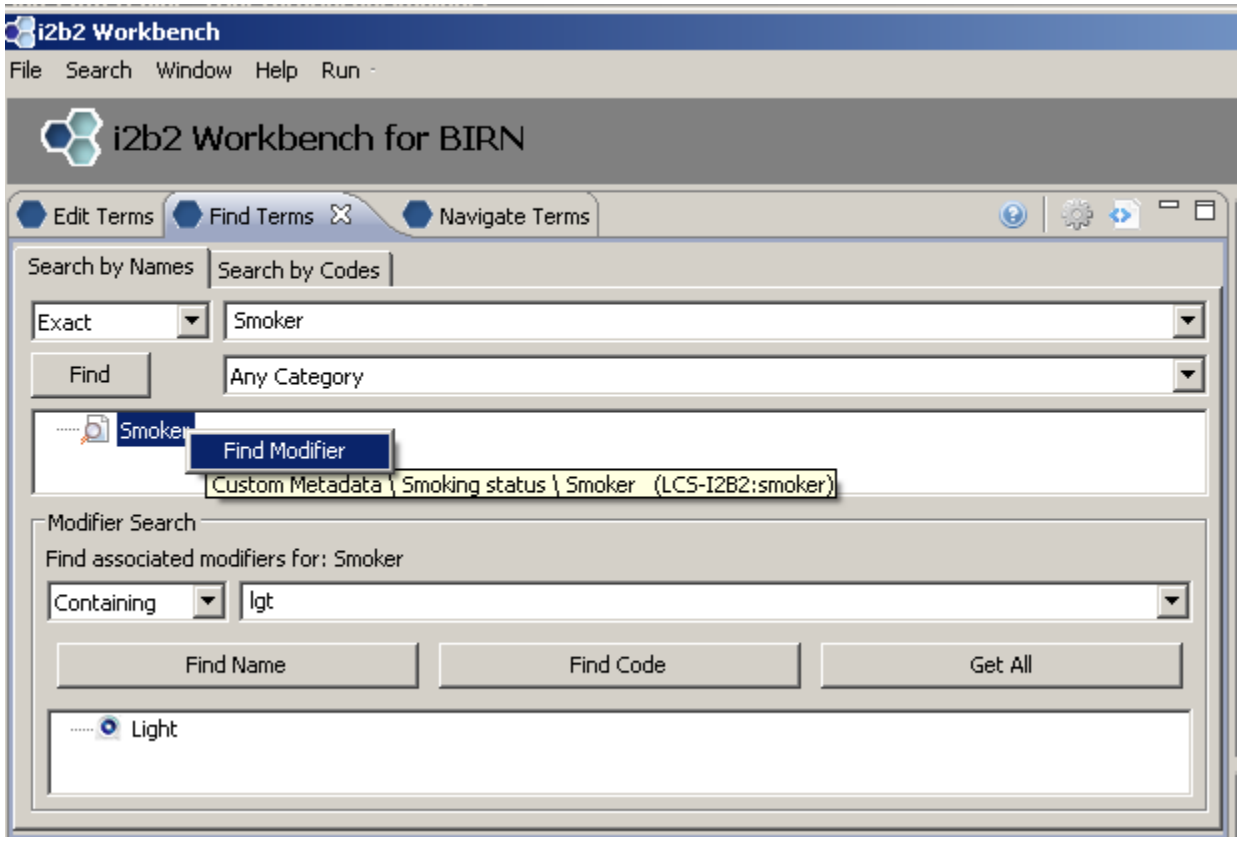
Using Find Terms Search by Codes Tab



Using Find Terms to Locate Modifier by Name

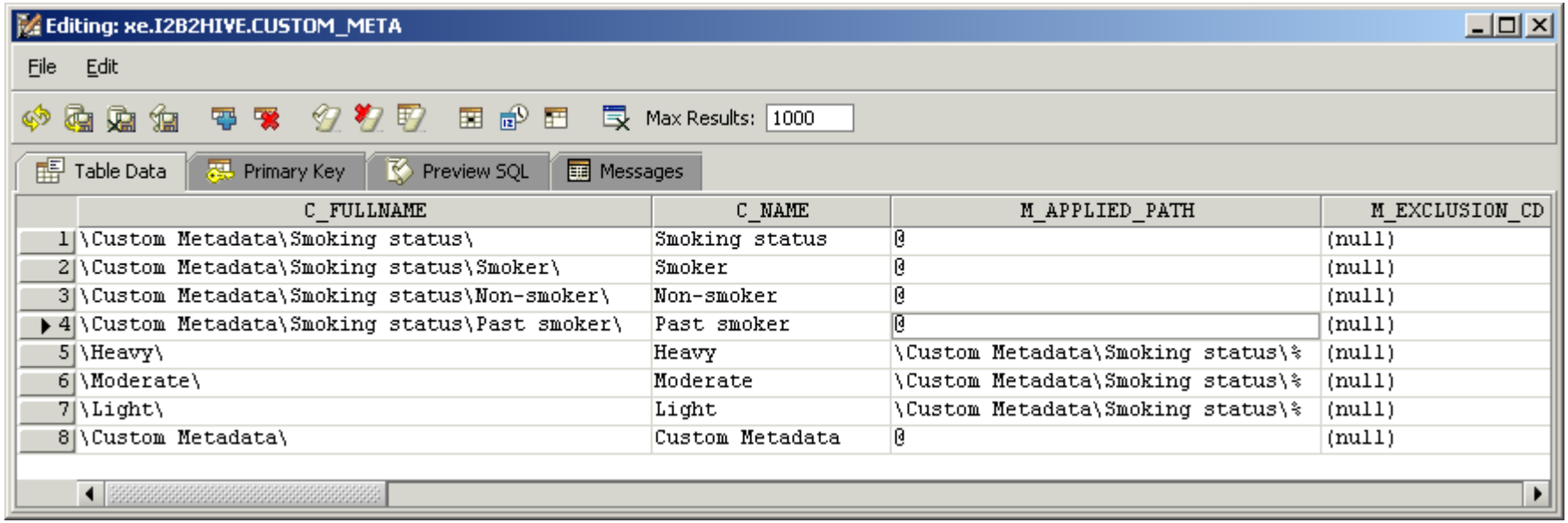


Using Find Terms to Locate Modifier by Code



Metadata db changes to support modifiers

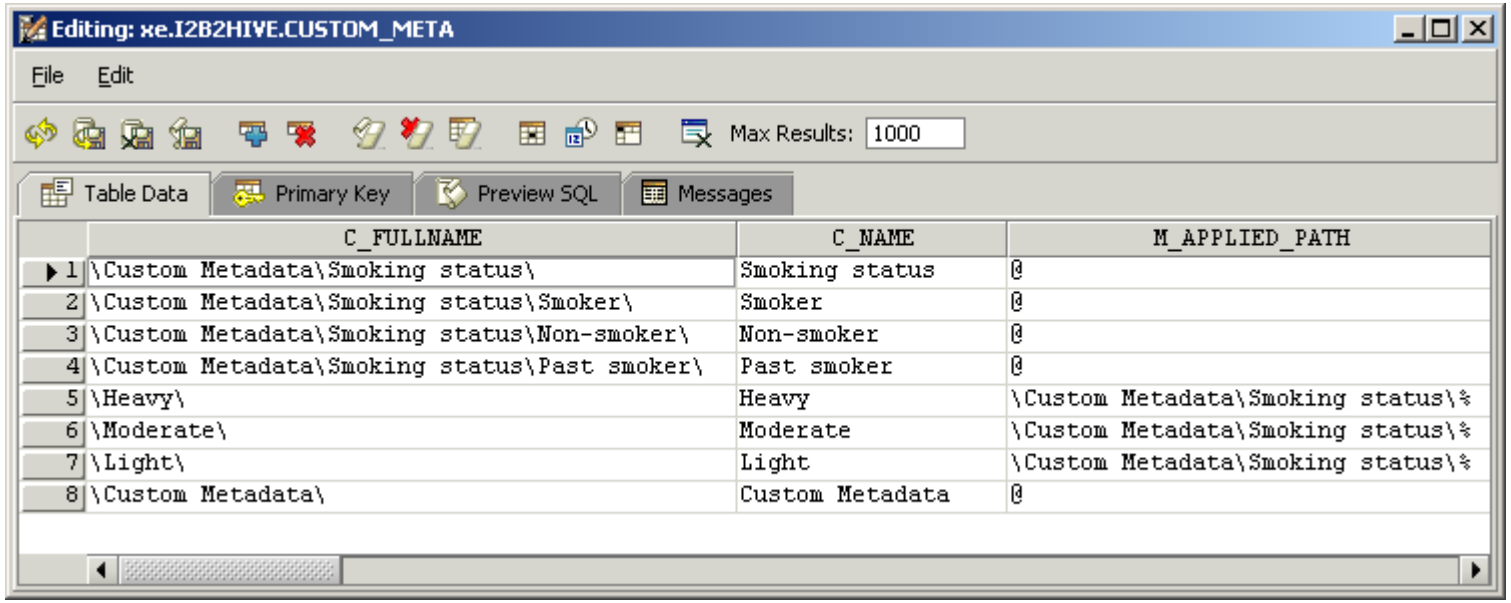
- Modifiers are stored in same metadata table as the terms they apply to.
- Two new columns:
  - m_applied_path
  - m_exclusion_cd



	C_FULLNAME	C_NAME	M_APPLIED_PATH	M_EXCLUSION_CD
1	\Custom Metadata\Smoking status\	Smoking status	@	(null)
2	\Custom Metadata\Smoking status\Smoker\	Smoker	@	(null)
3	\Custom Metadata\Smoking status\Non-smoker\	Non-smoker	@	(null)
4	\Custom Metadata\Smoking status\Past smoker\	Past smoker	@	(null)
5	\Heavy\	Heavy	\Custom Metadata\Smoking status\%	(null)
6	\Moderate\	Moderate	\Custom Metadata\Smoking status\%	(null)
7	\Light\	Light	\Custom Metadata\Smoking status\%	(null)
8	\Custom Metadata\	Custom Metadata	@	(null)

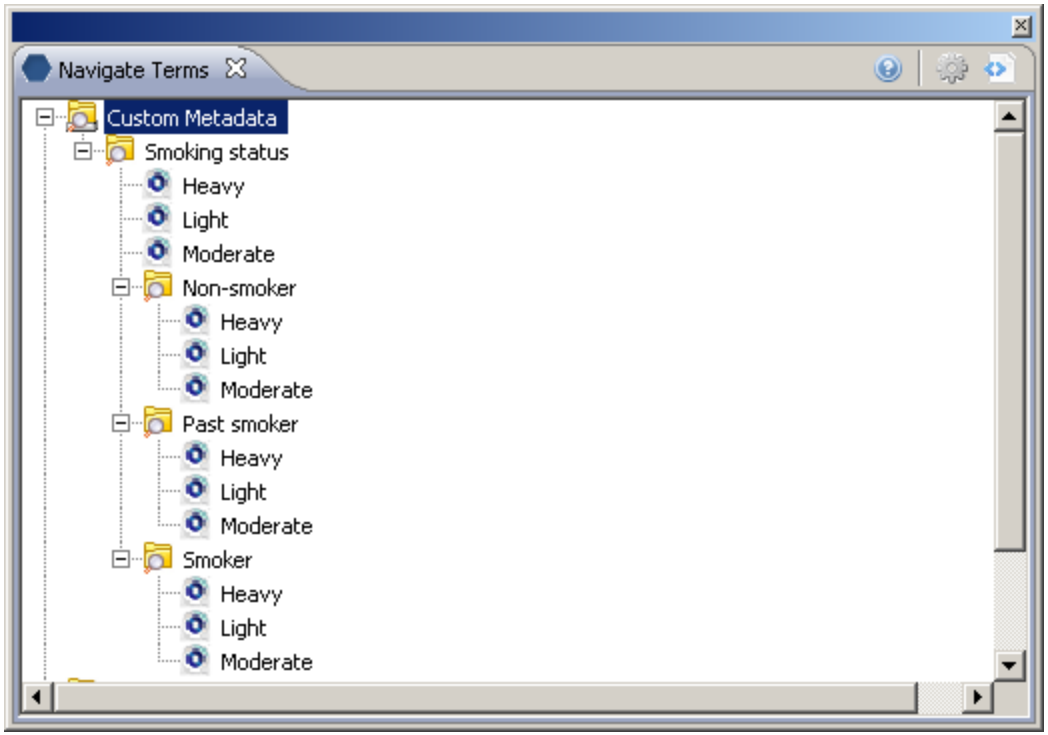
m_applied_path

- Specifies the concept_path of the term the modifier applies to:
  - \Custom Metadata\Smoking status\Smoker\
- Can also be specified to apply to children of the path:
  - \Custom Metadata\Smoking status\%
- Set to '@' for non-modifier (term) metadata entries

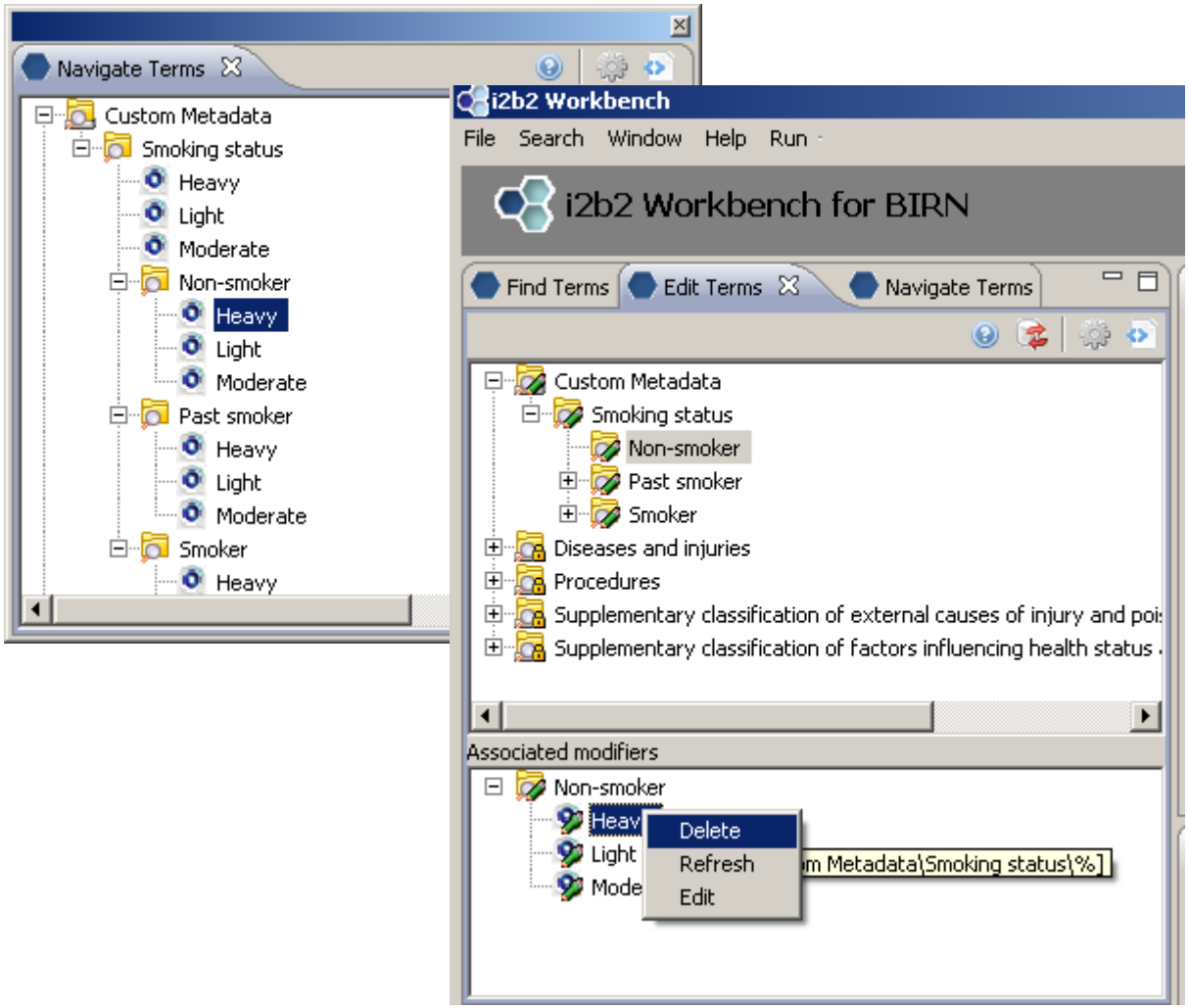


	C_FULLNAME	C_NAME	M_APPLIED_PATH
1	\Custom Metadata\Smoking status\	Smoking status	@
2	\Custom Metadata\Smoking status\Smoker\	Smoker	@
3	\Custom Metadata\Smoking status\Non-smoker\	Non-smoker	@
4	\Custom Metadata\Smoking status\Past smoker\	Past smoker	@
5	\Heavy\	Heavy	\Custom Metadata\Smoking status\%
6	\Moderate\	Moderate	\Custom Metadata\Smoking status\%
7	\Light\	Light	\Custom Metadata\Smoking status\%
8	\Custom Metadata\	Custom Metadata	@

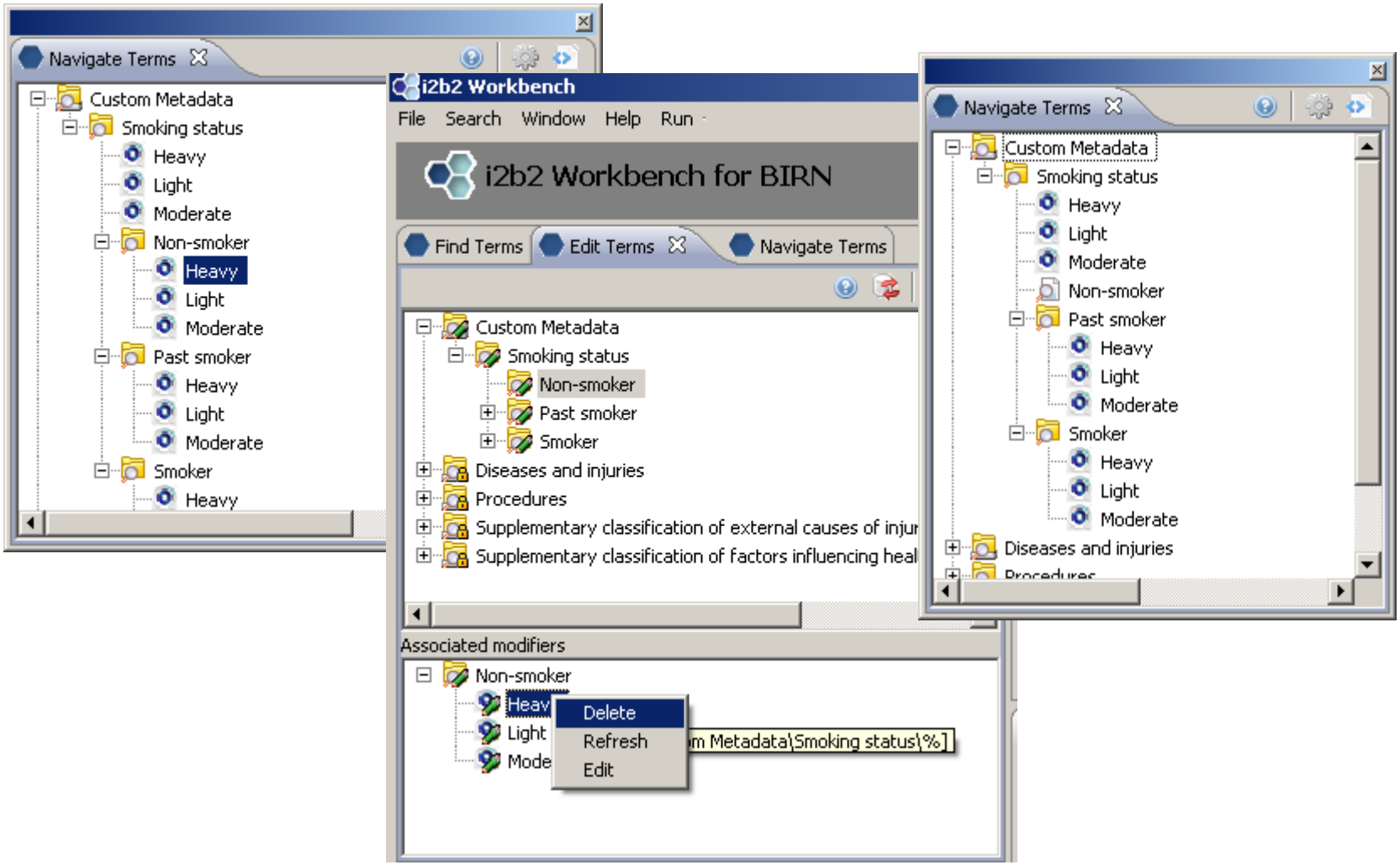
Excluding a modifier



Excluding a modifier



Excluding a modifier



m_exclusion_cd

- If non-null (‘X’) the modifier is excluded from the concept_path specified in m_applied_path

Editing: xe.I2B2HIVE.CUSTOM_META

File Edit

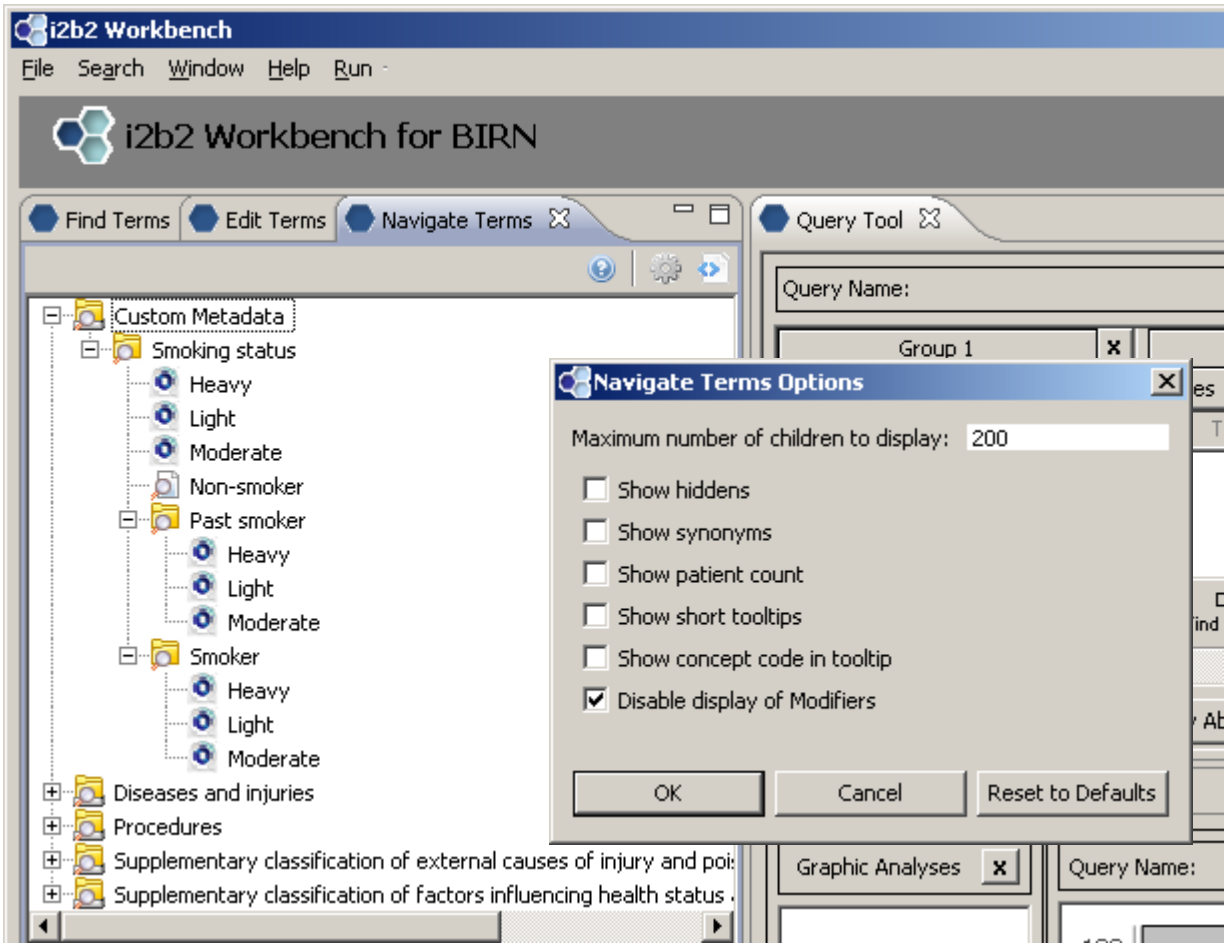
Max Results: 1000

Table Data | Primary Key | Preview SQL | Messages

	C_FULLNAME	C_NAME	M_APPLIED_PATH	M_EXCLUSION_CD
1	\Custom Metadata\Smoking status\	Smoking status	@	(null)
2	\Custom Metadata\Smoking status\Smoker\	Smoker	@	(null)
3	\Custom Metadata\Smoking status\Non-smoker\	Non-smoker	@	(null)
4	\Custom Metadata\Smoking status\Past smoker\	Past smoker	@	(null)
5	\Heavy\	Heavy	\Custom Metadata\Smoking status\%	(null)
6	\Moderate\	Moderate	\Custom Metadata\Smoking status\%	(null)
7	\Light\	Light	\Custom Metadata\Smoking status\Non-smoker\	X
8	\Light\	Light	\Custom Metadata\Smoking status\%	(null)
9	\Heavy\	Heavy	\Custom Metadata\Smoking status\Non-smoker\	X
10	\Moderate\	Moderate	\Custom Metadata\Smoking status\Non-smoker\	X
11	\Custom Metadata\	Custom Metadata	@	(null)

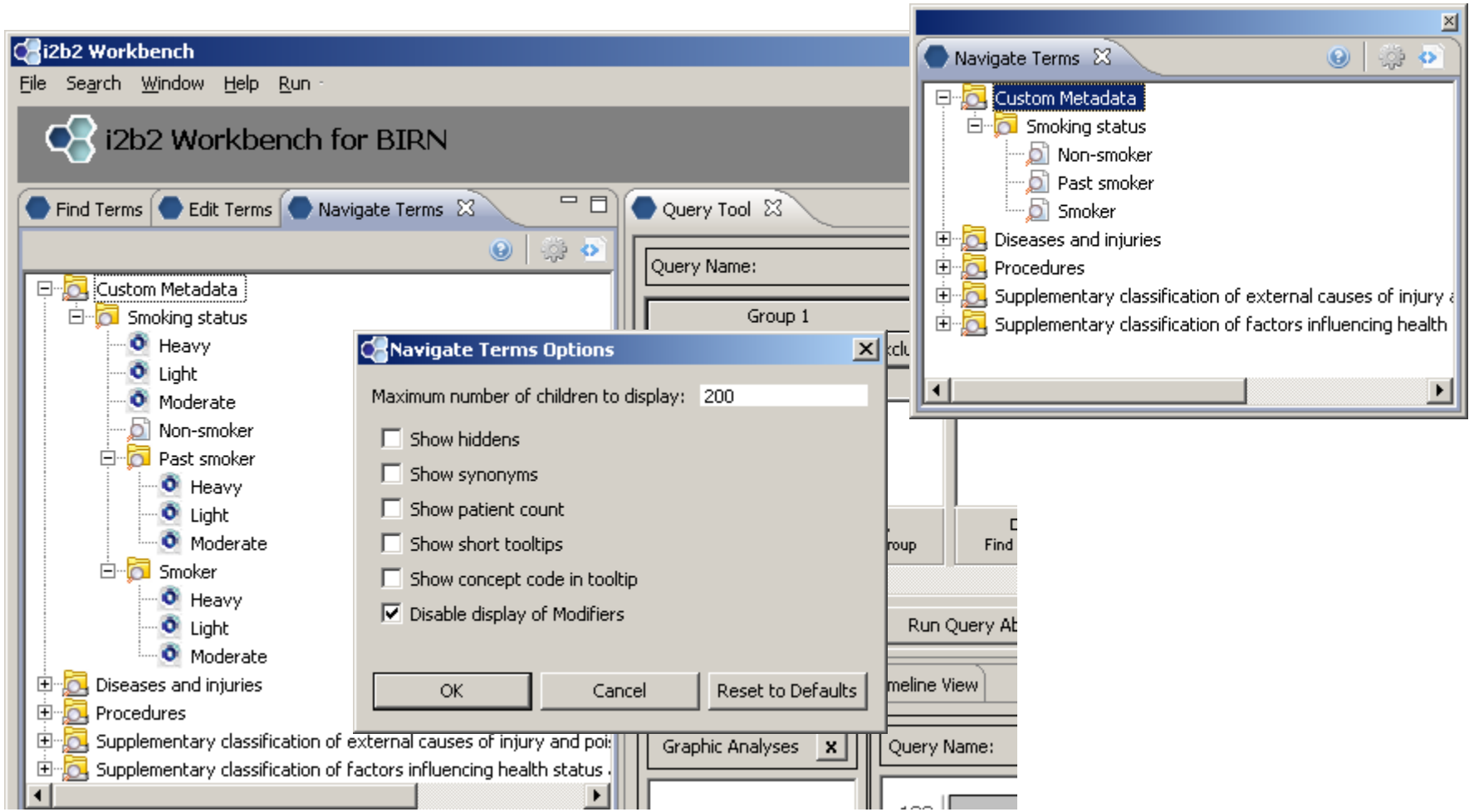
Disabling modifiers

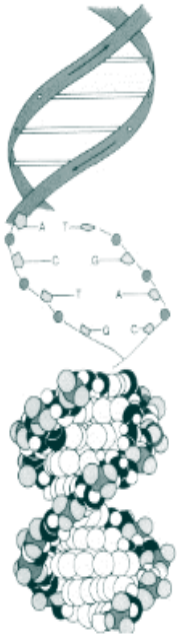
- Mechanism to disable the display and acquisition of modifiers.



Disabling modifiers

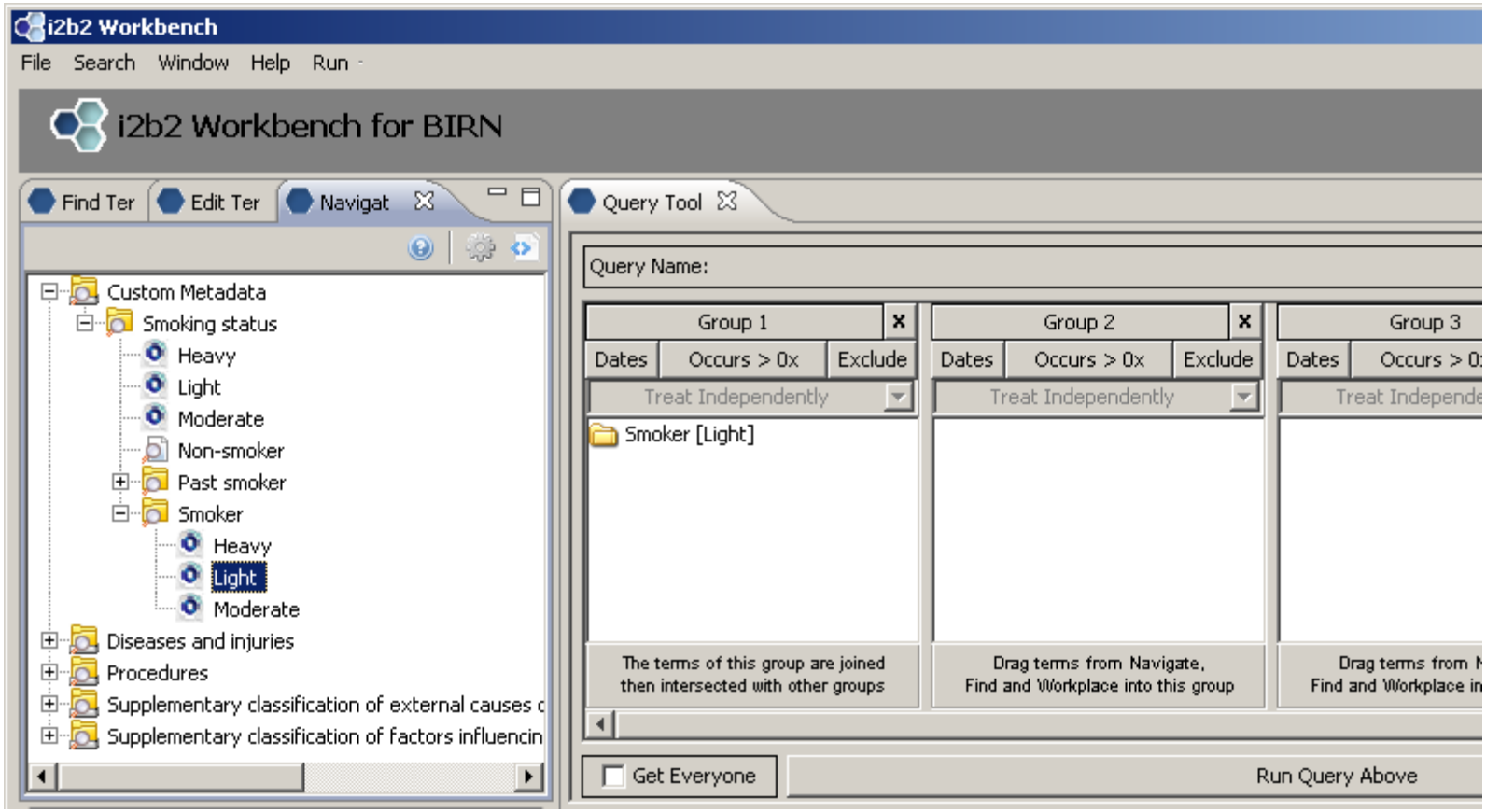
- Refresh navigate tree





Ontology Query Building

Using modifiers in a query



Dragging a modifier to Query tool

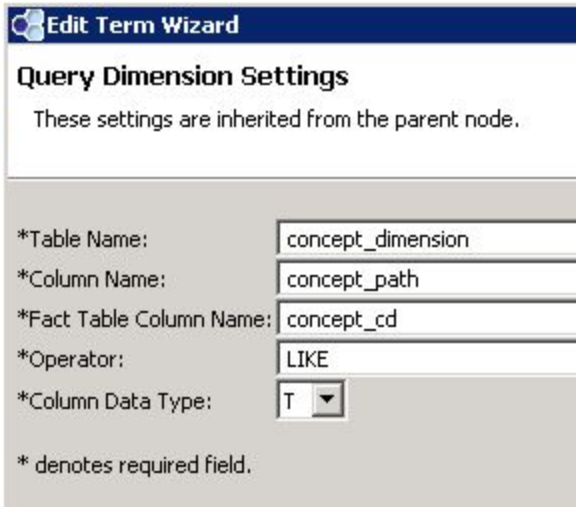
- When you drag a modifier, you are really dragging a concept term / modifier pair.

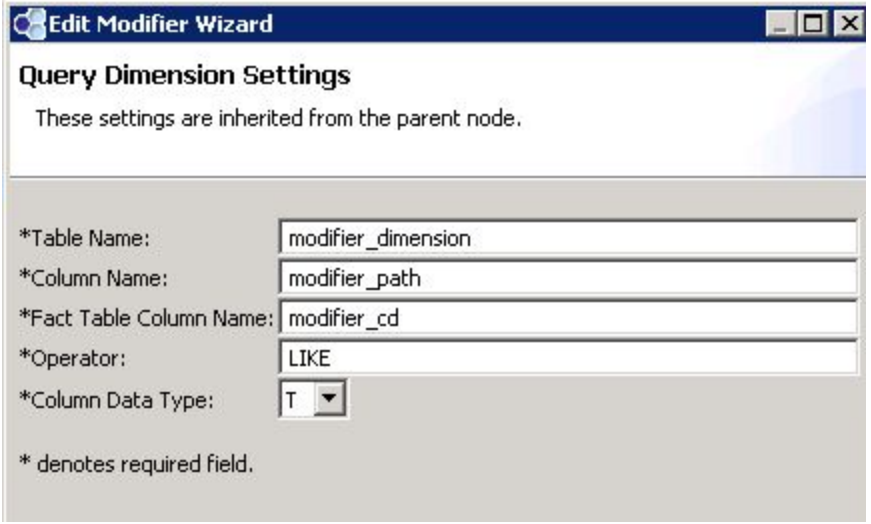
```
<concept>
        <level>2</level>
        <key>\\CUST\Custom Metadata\Smoking status\Smoker\</key>
        <name>Smoker</name>
        <synonym_cd>N</synonym_cd>
        <visualattributes>FAE</visualattributes>
        <basecode>LCS-I2B2:smoker</basecode>
        <tooltip>Custom Metadata \ Smoking status \ Smoker</tooltip>
        <modifier>
           <level>1</level>
           <applied_path>\Custom Metadata\Smoking status\%</applied_path>
           <key>\\CUST\Light\</key>
           <fullname>\Light\</fullname>
           <name>Light</name>
           <visualattributes>RAE</visualattributes>
           <synonym_cd>N</synonym_cd>
           <basecode>lgt</basecode>
           <tooltip>Light [\Custom Metadata\Smoking status\%]</tooltip>
        </modifier>
  </concept>
```

Putting it all together to form a query

```
select patient_num from observation_fact
    where concept_cd IN (select concept_cd
    from concept_dimension where concept_path
    like '\Custom Metadata\Smoking status\Smoker\%'

 and modifier_cd IN (select modifier_cd from
        modifier_dimension where modifier_path
        like '\Light\%')
```





Extending queries beyond concept_dimension

- Provider_dimension
  - select patient_num from observation_fact where provider_id in

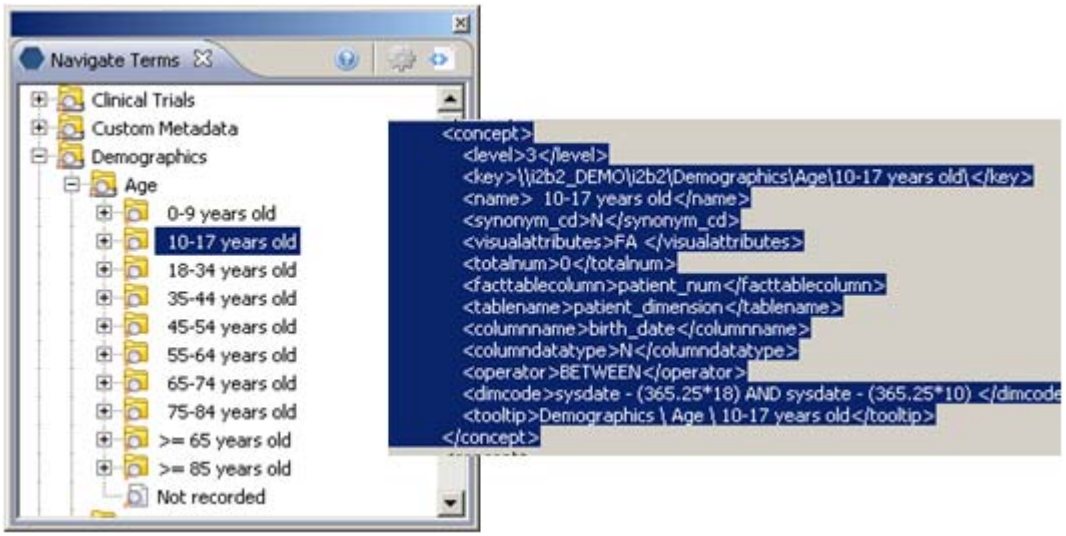
    (select provider_id from provider_dimension where provider_path like '\i2b2\Providers\Emergency\%')

- Patient_dimension
  - select patient_num from observation_fact where patient_num in

    (select patient_num from patient_dimension where race_cd = ‘white‘)

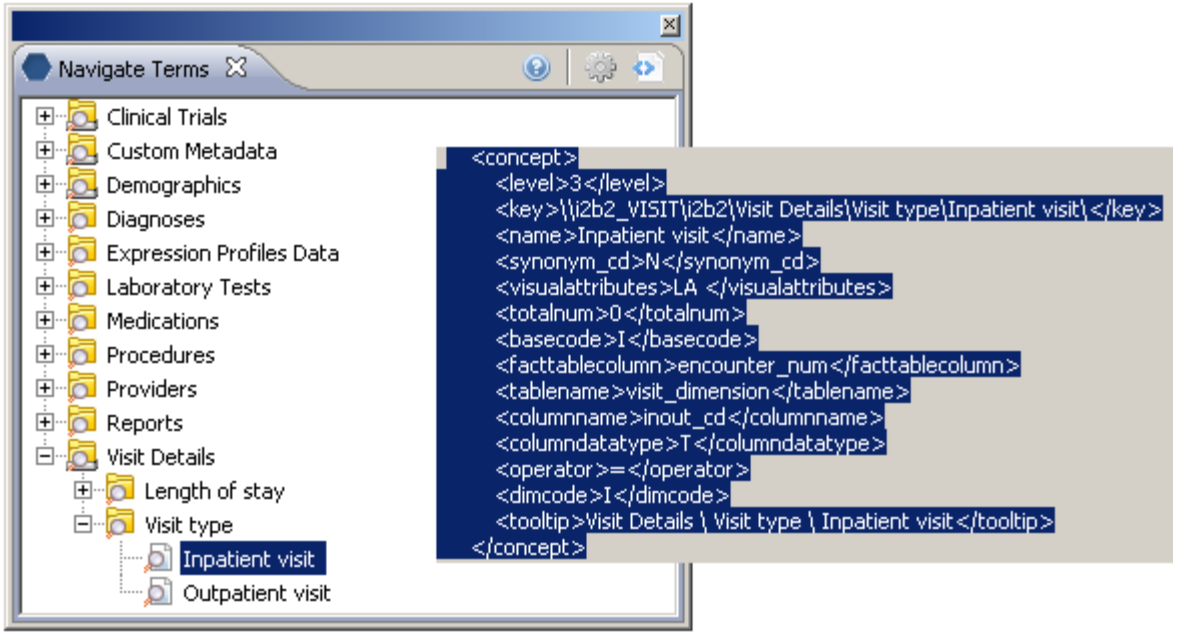
- Visit_dimension
  - select patient_num from observation_fact where encounter_num in (select encounter_num from visit_dimension where length_of_stay = 2)

Patient_dimension based queries



select patient_num from observation_fact where patient_num in
(select patient_num from patient_dimension where birth_date BETWEEN
sysdate – (365.25*18) AND sysdate – (365.25*10))

Visit_dimension based queries



select patient_num from observation_fact where encounter_num in
(select encounter_num from visit_dimension where inout_cd = 'I‘)

Where are we going from here?

- Stand alone ontology creation tool that uses NCBO services
  - Likely to be Protégé plug-in
- Advocate for uniform representation of SNP's
- Develop Ontology Mapping Cell
- Community guideline development on Wiki for
  - Most useful ontologies and versions of ontologies
  - Use of modifiers
  - Value representations