

Collaborative Ontology Development

Tania Tudorache

Protégé Short Course

Stanford University

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Collaborative Ontology Development

- **Collaboration**: a process in which a community of users contribute to the development of one or more ontologies
- Ontologies vary quite a lot: from simple taxonomies to fully fledged OWL
- Usually the community is made of (some) ontology experts and (several) domain experts with varying expertise
- Common concern: how to get the domain experts to contribute without overloading them with representation details
- Think how you author a Word document with your colleagues: same and more challenges apply to ontologies!

2 parts: Editing and Publishing

Editing



- “Internal” development team
- Tools for editing ontologies
- Short development cycles

What your team does

Publishing



- External release of ontologies for public/production use
- Tools for supporting versioning, public feedback and reviewing
- Set release cycles

How others use your ontology

Outline

- Use cases of collaborative development
- Collaboration infrastructures and more use cases
- Collaboration support in WebProtégé

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Use case: The NCI Thesaurus collaborative development process

NCI Thesaurus: Reference ontology for cancer biology, translational science, and clinical oncology



WebProtégé NCI Thesaurus

Classes Properties Individuals Notes and Discussions Changes By Entity Project Dashboard

Classes

Create Delete Watch Branch Search: Type search

- owl:Thing
 - Abnormal Cell
 - Activity
 - Anatomic Structure, System, or Substance
 - Biochemical Pathway
 - Biological Process
 - Chemotherapy Regimen or Agent Combination
 - Conceptual Entity
 - Diagnostic or Prognostic Factor
 - DIRECTED-BINARY-RELATION
 - Disease, Disorder or Finding
 - Drug, Food, Chemical or Biomedical Material
 - Experimental Organism Anatomical Concept
 - Experimental Organism Diagnosis
 - Gene 2**
 - Gene Product
 - Manufactured Object
 - Molecular Abnormality
 - NCI Administrative Concept
 - Organism
 - PAL-CONSTRAINT
 - Property or Attribute

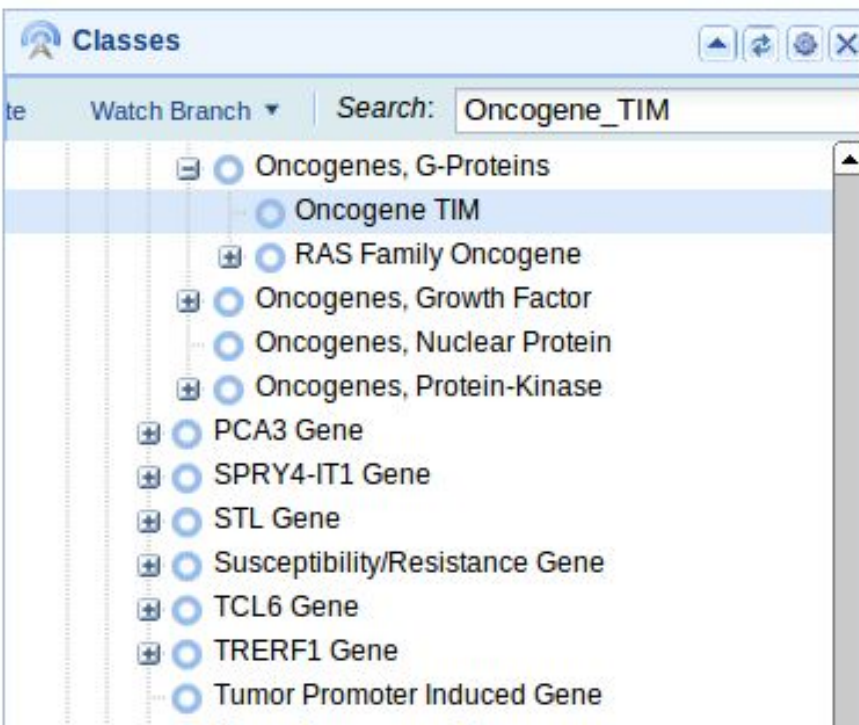
Class description for Gene

Display name: Gene
IRI: <http://ncicb.nci.nih.gov/xml/owl/EVS/Thesaurus.owl#C16612>

| Annotations | | |
|----------------|---|--|
| rdfs:label | Gene | |
| ALT_DEFINITION | <p><ncicp:ComplexDefinition><ncicp:def-definition>The functional and physical unit of heredity passed from parent to offspring. Genes are pieces of DNA, and most genes contain the information for making a specific protein.</ncicp:def-definition><ncicp:def-source>NCI-GLOSS</ncicp:def-source></ncicp:ComplexDefinition></p> | |
| code | C16612 | |
| DEFINITION | <p><ncicp:ComplexDefinition><ncicp:def-definition>A functional unit of heredity which occupies a specific position on a particular chromosome and serves as the template for a product that contributes to a phenotype or a biological function.</ncicp:def-definition><ncicp:def-source>NCI</ncicp:def-source></ncicp:ComplexDefinition></p> | |
| DesignNote | <p>The gene as a functional unit consists of a discrete segment of a giant DNA molecule containing the purine (adenine and guanine) and pyrimidine (cytosine and thymine) bases in the ordered and correct sequence that encodes a specific functional product (i.e., a protein or RNA molecule).</p> | |

Use case: The NCI Thesaurus collaborative development process (cont.)

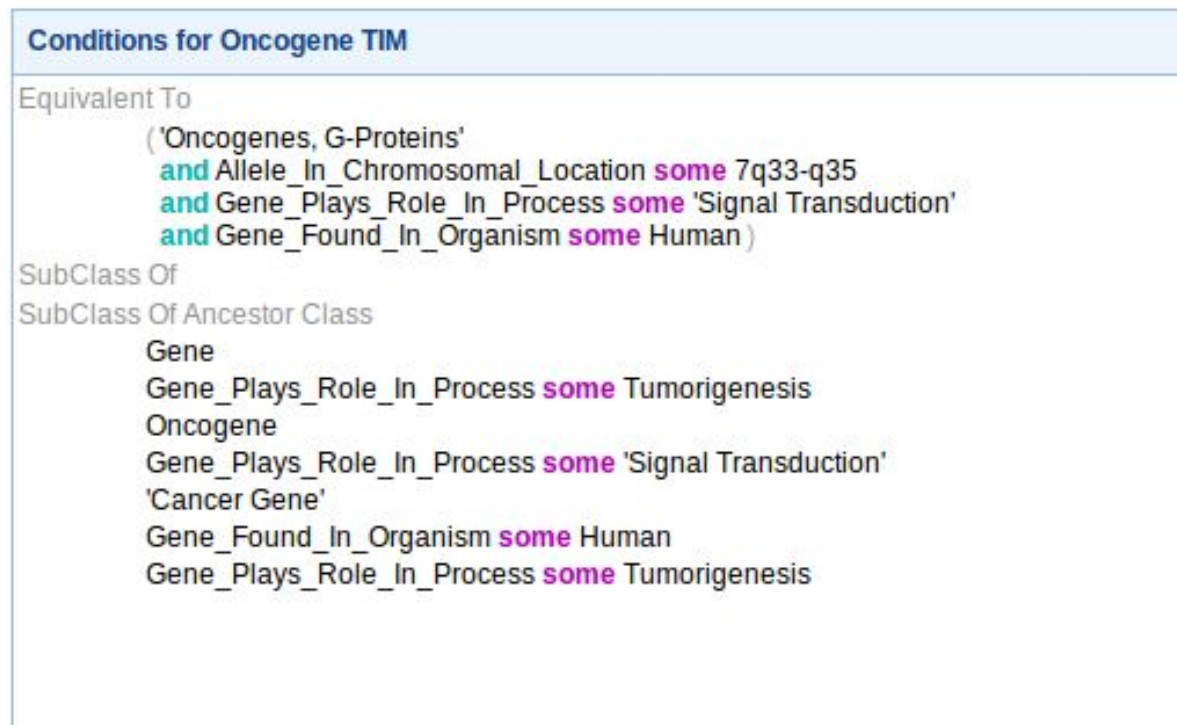
NCI Thesaurus: Reference ontology for cancer biology, translational science, and clinical oncology



Classes

Watch Branch Search: Oncogene_TIM

- Oncogenes, G-Proteins
 - Oncogene TIM
- RAS Family Oncogene
- Oncogenes, Growth Factor
- Oncogenes, Nuclear Protein
- Oncogenes, Protein-Kinase
- PCA3 Gene
- SPRY4-IT1 Gene
- STL Gene
- Susceptibility/Resistance Gene
- TCL6 Gene
- TRERF1 Gene
- Tumor Promoter Induced Gene



Conditions for Oncogene TIM

Equivalent To

('Oncogenes, G-Proteins'
and Allele_In_Chromosomal_Location some 7q33-q35
and Gene_Plays_Role_In_Process some 'Signal Transduction'
and Gene_Found_In_Organism some Human)

SubClass Of

SubClass Of Ancestor Class

Gene

Gene_Plays_Role_In_Process some Tumorigenesis

Oncogene

Gene_Plays_Role_In_Process some 'Signal Transduction'

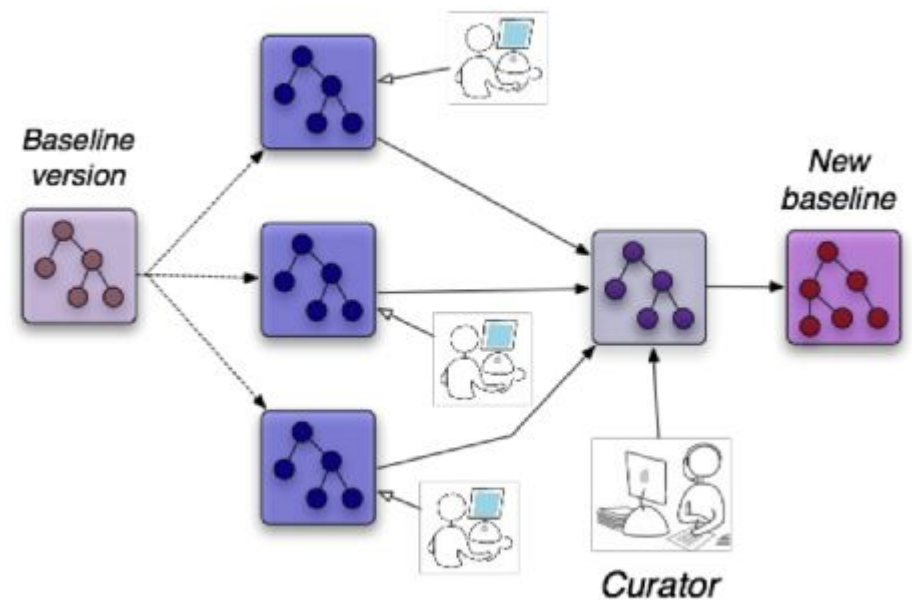
'Cancer Gene'

Gene_Found_In_Organism some Human

Gene_Plays_Role_In_Process some Tumorigenesis

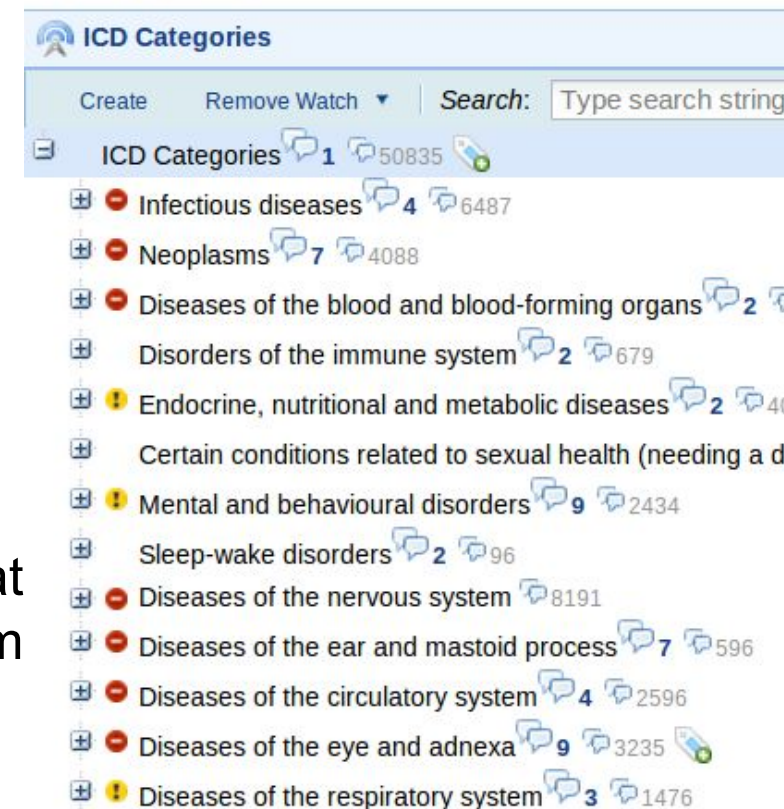
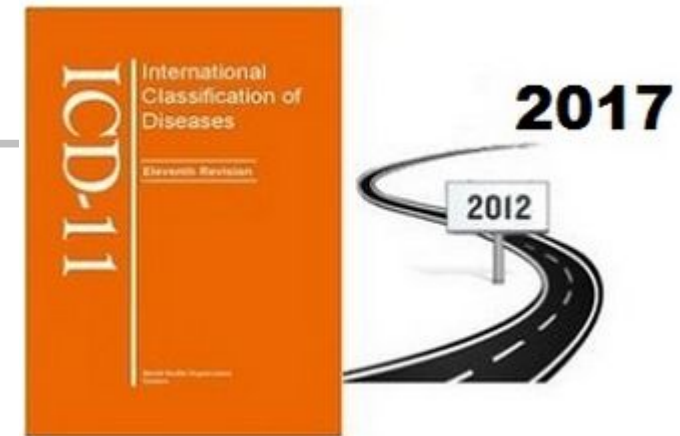
Use case: The NCI Thesaurus collaborative development process (cont.)

- Simultaneous editing in Protégé clients
- Custom UI for restricting user input and enforcing business rules
- Development cycle begins after baseline
- ~20 full-time editors making changes; 1 lead editor approves the changes, and assigns new tasks
- Released version on NCI website and BioPortal



Use case: WHO's ICD

- ICD – International Classification of Diseases
- Developed by the World Health Organization (WHO)
- Current revision in use: ICD-10, development work on ICD-11
- Over 10.000 categories used for coding, billing, statistics, policy making all over the world
- Collaborative and international effort
- Current version: published as books
- Goal for the new version: use a more formal representation and published in electronic format use Web-based collaboration and social platform for editing

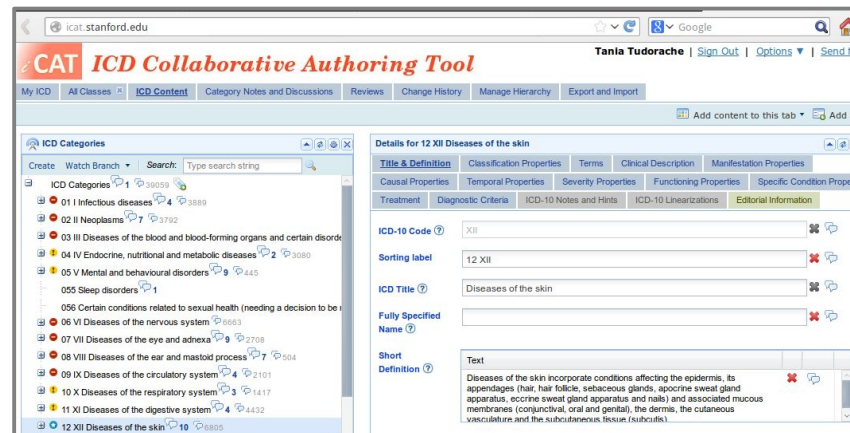


Construction of ICD-10: Revision Process in the 20th Century

- 8 Annual Revision Conferences (1982 - 89)
 - 17 – 58 countries participated
 - 1- 5 person delegations
 - Mainly health statisticians
- Manual curation
 - List exchange
 - Index was done later
- "Decibel" Method of discussion
- Output: Paper Copy
- Work in English only
- Limited testing in the field



ICD-11 process today



- ICD-11 is an OWL ontology edited collaboratively in WebProtégé
- Over 250 domain experts from around the world
- Organized in groups, which edit different parts of the ontology

ICD-11 process today (cont.)

- Each night a snapshot of the commonly edited ontology is published in a public platform to encourage feedback from the larger community
<http://apps.who.int/classifications/icd11/browse/f/en>
- Editorial workflow
- Centrally overseen by WHO
- Peer-reviewed process for the content and structure
- WebProtégé used as the collaborative ontology development platform

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- Collaboration infrastructures and more use cases
- Collaboration support in WebProtégé

Collaboration Infrastructures: Wikis

- Wikis are well known; Wikipedia
- Semantic Wikis – add semantic extensions to the wiki platforms
- Assign a wiki page to an entity in the ontology
- Usually focused on filling in a knowledge base, less on the classes
- Export/import RDF

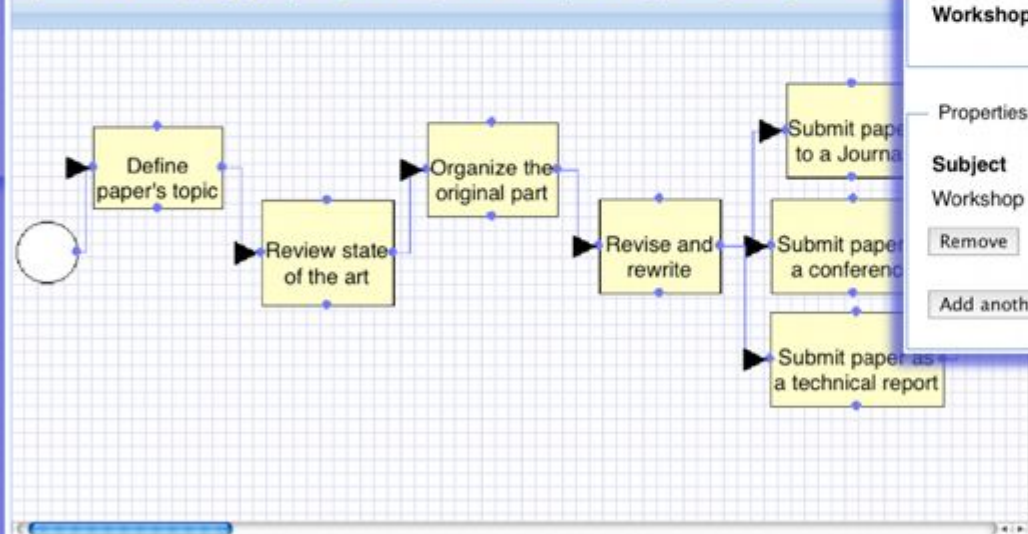
Semantic Wiki: MoKi

Domain Model IsA Browser



Write a paper

Export to eRDF format (for Oryx) Only this process | Sub processes in separate file(Zip Archive) | Sub processes in sa



Description: The process of writing a scientific paper

Required concept: Publication, ResearchTopic, Event, Person

Modify Concept: Workshop

Annotations

Description: An educational seminar or series of meetings emphasizing interaction and exchange of information among a usually small number of participants

Synonyms:

Hierarchical Structure

Workshop is a:

Workshop is part of:

Properties

| Subject | Property | Object(s) |
|--|-------------|-------------------------------------|
| Workshop | participant | <input type="text" value="Person"/> |
| <input type="button" value="Remove"/> | | |
| <input type="button" value="Add another"/> | | |

The challenge with wikis

BOWiki syntax

Examples

1 on page Apoptosis: `[[OType:Category]]`

2 on page Apoptosis: `[[CC-isa::Biological_process]]`

3 on page HvSUT2: `[[Realizes:: function = Sugar_transporter_activity;
process = Glucose_transport]]`

4 on page Realizes: `[[has-argument:: name = function; type =
OType:Function_category]]`

OWL abstract syntax

`Individual(Apoptosis, type(Category))`

`Individual(Apoptosis value(CC-isa Biological_process))`

`Individual(Realizes-0 type(Realizes))`

`Individual(Realizes-0 value(Realizes-subject HvSUT2))`

`Individual(Realizes-0 value(Realizes-process Glucose_transport))`

`SubClassOf(Realizes gfo:Relator))`


`ObjectProperty(Realizes-function domain(Realizes)
range(Function_category))`




| | | |
|------------------|---|---------------------------------------|
| Function Name: | <input type="text" value="Sugar_transporter_activity"/> | <input type="button" value="Load"/> |
| Functional Item: | <input type="text" value="[[Sugar_transporter]]"/> | |
| Goal: | <input type="text" value="Sugar located_in B"/> | |
| Requirements: | <input type="text" value="Sugar present AND Sugar located_in A"/> | |
| | <input type="button" value="Store"/> | <input type="button" value="Update"/> |







Project management platforms, content management platforms or issue trackers

- Some collaboration projects reuse Web-based platforms built for software and other types of projects
- Example: GitHub, SourceForge, GForge, RedMine, WordPress
- Issue trackers: Mostly for managing change proposals or reviews
- Content Management platforms: tagging articles with existing vocabularies (WordPress has some semantic extensions)

Gene Ontology Issue Tracker in GitHub

 geneontology / go-ontology


 Watch 27  Star 7  Fork 1

 Code  Issues 364  Pull requests 0  Projects 1  Pulse  Graphs

Labels

Milestones

New issue

 364 Open ✓ 12,403 Closed



Author ▾



Labels ▾




Milestones ▾



Assignee ▾




Sort ▾




 maintenance of blood-brain barrier and regulation terms
#12767 opened 2 days ago by tberardini  1

 Review MF term GO:0050827 'toxin receptor binding'
#12766 opened 2 days ago by vanaukenk 

 ZFIN GO file load is failing **blocker**
#12765 opened 3 days ago by paolaroncaglia   3

 basal pole of outer hair cell
#12764 opened 3 days ago by slaulederkind 

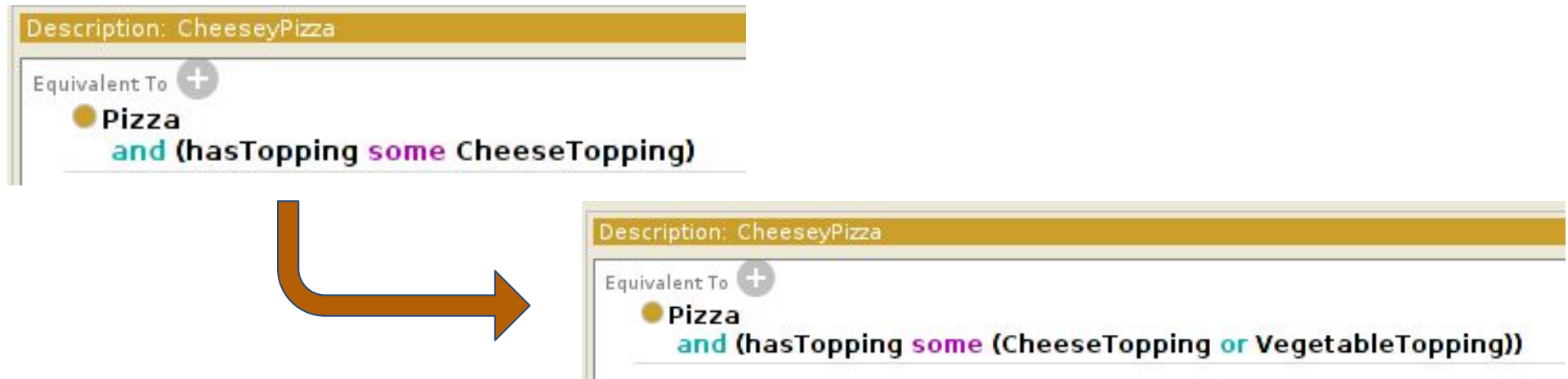
 erroneous links involving spindle pole body terms **parent relationship query** **PomBase**
#12761 opened 6 days ago by mah11   4

 Add is_a link between mitochondrial tRNA modification and mitochondrial tRNA processing
dictyBase **Other term-related request** **parent relationship query**
#12757 opened 10 days ago by pfey03   2

Other collaboration processes

- Use source control repositories (e.g., SVN)
 - Text based mechanisms
 - Hard to merge local copies in the shared copy
- Locking mechanisms (lock parts of an ontology for editing)
- Use specialized (domain dependent) ontology repositories, e.g., BioPortal

Why using textual diffs doesn't work



Textual diff: 588 lines, including the “only” change:

```
648c648,655
< <owl:someValuesFrom rdf:resource="http://www.co-ode.org/ontologies/pizza/2005/10/18/pizza.owl#CheeseTopping"/>
...
> <owl:someValuesFrom>
>   <owl:Class>
>     <owl:unionOf rdf:parseType="Collection">
>       <rdf:Description rdf:about="http://www.co-ode.org/ontologies/pizza/2005/10/18/pizza.owl#CheeseTopping"/>
>       <rdf:Description rdf:about="http://www.co-ode.org/ontologies/pizza/2005/10/18/pizza.owl#VegetableTopping"/>
>     </owl:unionOf>
>   </owl:Class>
> </owl:someValuesFrom>
```

Protégé diff support:

Tools menu → Compare Ontologies

The screenshot shows the Protégé ontology editor interface. The 'Tools' menu is highlighted with a red circle. The 'Ontology Differences' dialog is open, showing a comparison between two versions of the 'pizza' ontology. The dialog has a 'Find' search bar and a table with three columns: 'Description', 'Baseline Axiom', and 'New Axiom'. The 'Baseline Axiom' and 'New Axiom' columns are circled in red.

File Edit View Reasoner **Tools** Refactor Window Help

← → pizza (http://www.co-ode.org/ontologies/pizza/2005/10/18/pizza.owl)

Data Properties Annotation Properties Individuals OWLViz DL Query OntoGraf Ontology Differences SPARQL Query Rules

Active Ontology Entities Classes

Class hierarchy Class hierarchy (inferred)

Class hierarchy: CheeseyPizza Annotations: CheeseyPizza

Thing

- DIRECTED-BINARY-RELATIONSHIP
- DomainConcept
 - Country
 - IceCream
 - Pizza
 - CheeseyPizza
 - InterestingPizza
 - MeatyPizza
 - NamedPizza
 - NonVegetarianPizza
 - RealItalianPizza
 - SpicyPizza

Ontology Differences

Find

Created: defaultLanguage
Created: versionInfo
Modified: CheeseyPizza

Source and target entities aligned because they have the same IRI

| Description | Baseline Axiom | New Axiom |
|--------------------|---|---|
| Definition changed | CheeseyPizza EquivalentTo Pizza and (hasTopping some CheeseTopping) | CheeseyPizza EquivalentTo Pizza and (hasTopping some (CheeseTopping or VegetableTopping)) |

See demo screencast at: <https://www.youtube.com/watch?v=JzMNDfy4jcg>

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WebProtégé – quick overview

- **Free, open source collaborative ontology development environment for the Web**
- *Google docs* for ontologies; over 27,000 ontologies submitted or created by users
- OWL 2 ontologies
- A default *simple editing interface*
- *Full change tracking* and revision history
- *Collaboration* tools such as, sharing and permissions, threaded notes and discussions, watches and email notifications
- *Customizable user interface*
- *Customizable Web forms* for application/domain specific editing
- *Multiple formats* for upload and download of ontologies (supported formats: RDF/XML, Turtle, OWL/XML, OBO, and others)

WebProtégé – simplified editing interface

WebProtégé - Mozilla Firefox

File Edit View History Bookmarks Tools Help

WebProtégé

webprotege-beta.stanford.edu/

Tania Tudorache | [Sign Out](#) | [Options](#) | [Send feedback](#)

My WebProtégé **Gene Ontology (GO)**

Classes Properties Individuals Notes and Discussions Change history Watches Reviews Revisions

Add content to this tab Add tab

Classes

Create Delete Watch Branch Search: Type search string

- binding unfolded ER proteins
- biological_process
 - biological adhesion
 - biological regulation
 - cell killing
 - cellular component organization or biogenesis
 - cellular process**
 - cellular metabolic process
 - cellular process involved in reproduction
 - multi-organism cellular process
 - phenotypic switching
 - single-organism cellular process
 - developmental process
 - establishment of localization
 - growth
 - immune system process
 - localization
 - locomotion
 - metabolic process
 - multi-organism process
 - multicellular organismal process
 - reproduction
 - reproductive process
 - response to stimulus
 - rhythmic process
 - signaling
 - single-organism process
 - bleomycin hydrolase activity

Class description for cellular process

Display name: cellular process

IRI: http://purl.obolibrary.org/obo/GO_0009987

Annotations

| | | | |
|------------------|--|------|---|
| rdfs:label | cellular process | lang | x |
| hasAlternativeId | http://purl.obolibrary.org/obo/GO_0008151 | | x |
| hasAlternativeId | http://purl.obolibrary.org/obo/GO_0050875 | | x |
| def | Any process that is carried out at the cellular level, but not necessarily restricted to a single cell. For example, cell communication occurs among more than one cell, but occurs at the cellular level. | lang | x |

namespace: biological_process

hasNarrowSynonym: cell growth and/or maintenance

hasExactSynonym: cell physiology

hasExactSynonym: cellular physiological process

inSubset: goslim_pir

inSubset: goslim_plant

inSubset: gosubset_prok

Properties

Notes Tree for cellular process


New Topic Expand All Collapse

<http://webprotege.stanford.edu>

Custom entry forms for editing the ontology content

- Easy to create user interfaces for the domain experts
- Use common entry forms, but still keep the ontology “intelligence” behind it
- A form widget (e.g., text field) is linked to a property in the ontology
- Easy to create custom forms with different views for different users
- Hides complex ontology stuff

Form configuration in WebProtégé

 **ICD Collaborative Authoring Tool**

Tania Tudorache | [Sign Out](#) | [Options](#) ▼ | [Send feedback](#)

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

ICD Categories

Create Remove Watch ▼ Search:

ICD Categories 1 27395

01 I Certain infectious and parasitic diseases 4 2801

02 II Neoplasms 5 1325

03 III Diseases of the blood and blood-forming organs and c

04 IV Endocrine, nutritional and metabolic diseases 2 2

05 V Mental and behavioural disorders 9 344

06 VI Diseases of the nervous system 2868

07 VII Diseases of the eye and adnexa 9 1411

08 VIII Diseases of the ear and mastoid process 7 398

09 IX Diseases of the circulatory system 4 935

10 X Diseases of the respiratory system 3 590

11 XI Diseases of the digestive system 4 3569

12 XII Diseases of the skin 10 5397

13 XIII Diseases of the musculoskeletal system and connecti

14 XIV Diseases of the genitourinary system 3 2327

Details for 12 XII Diseases of the skin

Title & Definition

Classification Properties

Terms

Clinical Description

Manifestation Properties

Causal Properties

Temporal Properties

Severity Properties

Functioning Properties

Specific Condition Properties

Treatment

Diagnostic Criteria

ICD-10 Notes and Hints

ICD-10 Linearizations

Editorial Information

ICD-10 Code ?

XII

✕

💬

Sorting label

12 XII

✕

💬

ICD Title ?

Diseases of the skin

✕

💬

Fully Specified Name ?

✕

💬

Short Definition ?

Text

Diseases of the skin incorporate conditions affecting the epidermis, its appendages (hair, hair follicle, sebaceous glands, apocrine sweat gland apparatus, eccrine sweat gland apparatus and nails), the dermis, the cutaneous vasculature and the subcutaneous tissue (subcutis).

✕

💬

Examples of form-based editing

Cold or Heat 寒熱

- ☐ Cold 寒證
- ☐ Between heat and cold 寒中間証
- ☐ Upper body heat and lower body cold 寒上熱下
- ☐ Irritable heat sensation in hand and foot 手足煩熱
- ☐ Severe coldness of extremities 厥冷
- ☐ Cold abdominal colic 寒疝

Understanding

- ☐ Watching
- ☒ Listening
- ☐ Learning
- ☐ Focusing attention
- ☐ Reading
- ☐ Writing
- ☐ Calculating
- ☐ Solving Problems

Prefilled

Under Discussion

In Conflict

TAG Approved

RSG Approved




WHO Approved

Editorial Status

Body Part?

+ Find term

+ Add term

| label | Term ID | Link | | |
|----------------|----------|---|---|---|
| Lung structure | 39607008 |  |  |  |

Collaboration Features in WebProtégé

- Sharing ontologies
- Simultaneous editing
- Change tracking
- Threaded discussions for ontology entities and changes (notes, discussions, proposals, reviews)
- Watching ontology entities and branches and notifications
- Upload and sharing of ontologies
- Download any revision of the ontology
- Access policies
- User interface customization for domain experts
- Change analysis and statistics

Uploading and Sharing an ontology – similar to Google Docs

Upload ontology

Project name:

Project description:

File:

Sharing settings

☐ Public
Appears in list of ontologies. No sign-in required.

☒ Private
Does not appear in the list of ontologies. Sign-in required.

Access is restricted to the people in the list below

Who has access

| | | |
|-----------------------|------------|----------------------------------|
| Tania Tudorache (you) | Can edit ▼ | |
| Csongor Nyulas | Can view ▼ | <input type="button" value="✕"/> |

Add people who Can view ▼

- Matthew LeVine
- MattCordell
- Matthew Dudziak
- Matthew Horridge
- matthewhorridge
- Matthias Imhof
- Matthew M Kaufman

Project feed: see what other online users are changing in the ontology

The screenshot displays three panels from the Protege ontology editor:

- Classes Panel:** Shows a hierarchy starting with `owl:Thing`, which includes `Pizza`, `PizzaTopping`, and `PizzaBase`.
- Class description for Pizza:** Shows the `Display name` as "Pizza" and the `IRI` as `http://webprotege.stanford.edu/RBIUqC0ovnJzrXTIil3zb7x`. It also lists annotations (e.g., `rdfs:label` with value "Pizza") and properties (e.g., `hasBase` with value `PizzaBase`, and `hasTopping` with value `PizzaTopping`).
- Project feed:** A list of recent edits by user `ttania`:
 - Class: **Pizza**, Class: **PizzaBase**, ObjectProperty: **hasBase**, Less than one minute ago
 - Class: **Pizza**, ObjectProperty: **hasTopping**, Class: **PizzaTopping**, Less than one minute ago
 - Class: **Pizza**, Less than one minute ago
 - Class: **RrjqezabS4HP0sBCFTvjI**, one minute ago

Feed updates as new changes are happening

Notes and Discussions

The screenshot shows the Protégé web interface. At the top, the 'protégé' logo is on the left, and 'ttania' and 'Help' are on the right. Below the logo, there are tabs for 'WebProtégé' and 'Aero'. A horizontal bar contains several tabs: 'Classes', 'Properties', 'Individuals', 'Notes and Discussions' (which is active), 'Changes By Entity', and 'Project Dashboard'. To the right of these tabs are two buttons: 'Add content to this tab' and 'Add tab'.

The main area is divided into two panels. The left panel, titled 'Classes', shows a hierarchical tree of classes. The right panel, titled 'Discussions for A380', shows a discussion thread.

Classes Panel:

- owl:Thing
 - Aircraft Manufacturer
 - http://stuff.com/AAA
 - FABC
 - Airliner Role
 - Narrow Body Airliner Role
 - Narrow Body Corporate Jet Role
 - Wide Body Airliner Role
 - Vehicle
 - Aircraft
 - Airbus Aircraft
 - A300
 - A310
 - A320 Family Aircraft
 - A330
 - A340
 - A350
 - A380** (selected)
 - A380-800
 - Boeing Aircraft
 - BritishAerospaceAircraft
 - Lockheed Aircraft

Discussions for A380 Panel:

Post new topic...

Add properties
started by ttania
unresolved [Resolve](#)

ttania Less than one minute ago

[Reply](#) [Delete](#)

| | |
|-----------------|---|
| Role | Wide-body, double-deck jet airliner |
| National origin | Multi-national ^[1] |
| Manufacturer | Airbus |
| First flight | 27 April 2005 |
| Introduction | 25 October 2007 with Singapore Airlines |
| Status | In service |
| Primary users | Emirates Singapore Airlines Qantas Lufthansa Others in <i>Operators</i> below |
| Produced | 2004–present |
| Number built | 124 as of February 2014 ^[2] |
| Unit cost | US\$403.9 million ^[3] (approx. €300 million or GB£252 million) |

Change tracking in WebProtégé

| Change history for Pizza | | |
|---|-----------------|---|
| Description | Author | Timestamp |
| Created class Pizza Details: Added: Class: Pizza Added: rdfs:label "Pizza"^^xsd:string Added: Pizza SubClassOf owl:Thing | Tania Tudorache | Mon Mar 25 2013 00:04:48 GMT-0700 (PDT) |
| Edited property values Details: Added: Pizza SubClassOf hasTopping some PizzaTopping Added: Pizza SubClassOf hasBase some | Tania Tudorache | Mon Mar 25 2013 00:05:21 GMT-0700 (PDT) |
| Edited property values Details: Removed: Pizza SubClassOf hasBase some Added: Pizza SubClassOf hasBase some BaseDaPizza | Tania Tudorache | Mon Mar 25 2013 00:06:30 GMT-0700 (PDT) |
| Edited property values Details: Added: Pizza SubClassOf hasCountryOfOrigin value Italy | Tania Tudorache | Mon Mar 25 2013 00:08:19 GMT-0700 (PDT) |
| Edited property values Details: Removed: Pizza SubClassOf hasCountryOfOrigin value Italy | Tania Tudorache | Mon Mar 25 2013 00:12:06 GMT-0700 (PDT) |

Page 1 of 1 Displaying records 1 - 5 of 5

- All changes are tracked on the server side
- User friendly description of changes:
 - *Who did what, when and on what* entity
- Changes are stored in a structured log that can be automatically processed







Watching entities and branches

The screenshot illustrates the process of watching entities and branches in the Bioportal interface. The top panel, titled 'Classes', shows a list of classes including 'owl:Thing', 'entity', 'Obsolete Class', and 'owl:NamedIndividual'. A dropdown menu is open for the 'entity' class, showing options: 'Watch Class', 'Watch Branch', and 'Remove Watch'. An orange arrow points from the 'Watch Branch' option to the 'Watched Entities for Tania Tudorache' panel below.

The 'Watched Entities for Tania Tudorache' panel displays a table of changes. The table has three columns: 'Author', 'Change Description', and 'Timestamp'.

| Author | Change Description | Timestamp |
|--|--|---------------------------------|
| Entity: 'human parasite role' | | |
| jezheng | Replaced of human parasite role. Old value: CS . New value: Chris Stoeckert | Fri Sep 23 2011 07:17:48 GMT... |
| jezheng | Replaced of human parasite role. Old value: Chris Stoeckert . New value: Priti Parikh, Chris Stoeckert | Fri Sep 23 2011 07:19:49 GMT... |
| jezheng | New note with subject: dc:creator | Fri Sep 23 2011 07:21:44 GMT... |
| stoeckrt | Replaced Definition of human parasite role. Old value: A parasite naturally infecting humans and usin... | Tue Aug 16 2011 13:22:25 GM... |
| stoeckrt | Added a new to human parasite role. Added value: CS | Tue Aug 16 2011 13:22:30 GM... |
| stoeckrt | Added a new Editor Note to human parasite role. Added value: previous def was not about a role. | Tue Aug 16 2011 13:24:21 GM... |
| stoeckrt | New note with subject: definition needs improvement | Tue Aug 16 2011 12:49:25 GM... |
| Entity: 'Leishmania major amastigote' | | |
| priti | Replaced Definition of Leishmania major amastigote. Old value: Leishmania major in amastigote stage... | Mon Aug 22 2011 19:17:12 GM... |
| priti | Added a new to Leishmania major amastigote. Added value: http://dna.kdna.ucla.edu/parasite_course... | Mon Aug 22 2011 19:17:24 GM... |
| priti | Added a new to Leishmania major amastigote. Added value: L. major amastigote | Mon Aug 22 2011 19:17:58 GM... |
| priti | Replaced Definition of Leishmania major amastigote. Old value: Leishmania major amastigote is the in... | Mon Aug 22 2011 20:15:52 GM... |

Downloading revisions

| Revisions | | | | |
|-----------|-----------------|------------------|------------|---|
| Revision | Date | Number of change | Author | Download |
| 116 | 26th March | 2 | M Horridge |  |
| 115 | 26th March | 2 | M Horridge |  |
| 114 | 10th March | 1 | M Horridge |  |
| 113 | 17th March | 2 | M Horridge |  |
| 112 | 17th March | 3 | M Horridge |  |
| 111 | 7th March | 1 | guest |  |
| 110 | 12th March 2013 | 1 | M Horridge |  |

Download any snapshot in time of the ontology

Resources

- Online WebProtégé server: <http://webprotege.stanford.edu>
- Mailing list: <http://protege.stanford.edu/support.php>
- WebProtege on GitHub (sources and issue tracker):
<https://github.com/protegeproject/webprotege/>
- WebProtégé documentation: <http://protegewiki.stanford.edu/wiki/WebProtege>
- WebProtégé simplified user interface: "Simplified OWL Ontology Editing for the Web: Is WebProtégé Enough?" Horridge, Matthew, et al., The Semantic Web–ISWC 2013. Springer Berlin Heidelberg, 2013. 200-215.
- WebProtégé paper: "WebProtégé: A Collaborative Ontology Editor and Knowledge Acquisition Tool for the Web", Tania Tudorache, Csongor Nyulas, Natalya F. Noy, Mark A. Musen, Semantic Web Journal (SWJ) 4 (Number 1 / 2013), 89 - 99
- WebProtégé in use: "Will Semantic Web Technologies Work for the Development of ICD-11?", T. Tudorache, S. M. Falconer, C. I. Nyulas, N. F. Noy, M. A. Musen. The 9th International Semantic Web Conference, ISWC 2010 (In-Use track), Shanghai, China, Springer. Published in 2010.
http://bmir.stanford.edu/file_asset/index.php/1646/BMIR-2010-1427.pdf
- Other References: <http://protegewiki.stanford.edu/wiki/WebProtege#References>