

Ontology Browser

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December 2013



VectorBase

Bioinformatics Resource for Invertebrate Vectors of Human Pathogens

Outline

1. What is an ontology?
2. Advantages of using ontologies
3. Ontologies and vector biology
4. VectorBase ontologies
5. Ontology Browser
6. Use cases

1. What is an ontology ?

- The term ontology has its origin in philosophy and has been applied in many different ways.
- In science an ontology represents knowledge as a set of universal terms within a domain, using a vocabulary to denote types, properties and relationships of those concepts.
- Ontologies are the structural framework for organizing information and are used in VectorBase Expression Browser and VectorBase Population Biology Browser (PopBio).
- VectorBase ontologies are built according to the guidelines of The Open Biomedical Ontologies (OBO) Foundry (now The Open Biological and Biomedical Ontologies (OBO) Foundry).



2. Advantages of using ontologies

- Meaning is explicit.
- Meaning is human and computer readable.
- Ease of updating, no need to find terms in free text and change them.
- Data transfer possible without loss of meaning.
- Reasoning to aid annotation.
- Reasoning to aid queries.
- Annotation of multiple bodies of data based on underlying ontologies facilitates its integration to build level of complexity.



3. Ontologies and vector biology

... ontologies will enable vector biologist to achieve computer-comprehensible annotation of genes and genomes, of various experimental, clinical and surveillance data ...

Topalis *et al.* 2008. How can ontologies help vector biology? *Trends in Parasitology*. 24: 249-52.

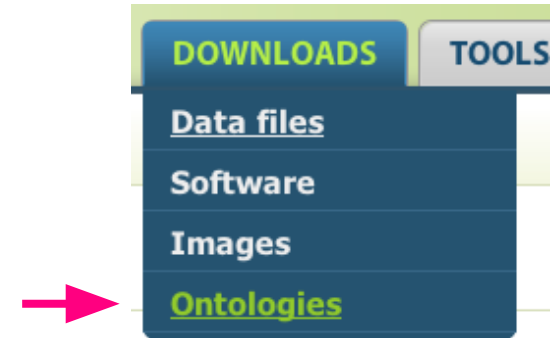
... the aim is to develop ontologies that will help the infectious disease community in general, in the fight against vector-borne diseases ...

Topalis *et al.* 2011. A set of ontologies to drive tools for the control of vector-borne diseases. *Journal of Biomedical Informatics*. 44: 42-7.



4. VectorBase ontologies

- Dengue – IDODEN v0.12
- Gazetteer – GAZ v1.512 *
- Gene Ontology – GO 2013-11-18 *
- Malaria Ontology – IDOMAL v1.35
- Mosquito Insecticide Resistance Ontology – MIRO v2.1
- Mosquito Anatomy – TGMA v1.12
- Tick Anatomy – TADS v1.22



* These two ontologies are available on VectorBase but have not been created by members of our team.

4. VectorBase ontologies

Dengue – IDODEN v0.12

Contains ontological descriptions covering dengue:

- disease itself (clinical aspects)
- vertebrate host biology
- vector biology
- virus biology
- epidemiology
- interventions and attempts to control the disease (including natural therapies and remedies)

According to the OBO Foundry rules, IDODEN imports terms from existing ontologies such as IDOMAL instead of creating duplicates of terms in other ontologies.



4. VectorBase ontologies

Gazetteer – GAZ v1.512

- Contains ontological terms covering geographical names from all over the world.
- Describes places and place names and the relations between them.
- GAZ is used in VectorBase to describe the sampling locations in the Population Biology Browser.
- For more information please follow this link: <http://bioportal.bioontology.org/ontologies/GAZ>



4. VectorBase ontologies

Gene Ontology – GO 2013-11-18

- Contains ontological descriptions to represent gene and gene product attributes.
- The GO is used in VectorBase Genome Browser (transcript tab) and data can be queried using BioMart.
- For more information please follow this link:
www.geneontology.org

4. VectorBase ontologies

Malaria Ontology – IDOMAL v1.35

Contains ontological descriptions covering malaria:

- disease itself (clinical aspects)
 - vector biology
 - parasite biology
 - Epidemiology
-
- **Reference**: Topalis, P. *et al.* 2010. IDOMAL: an ontology for malaria. *Malaria Journal*. 9: 230.

4. VectorBase ontologies

Mosquito Insecticide Resistance Ontology – MIRO v2.1

Contains ontological descriptions covering:

- mosquito populations
- insecticide substance
- resistance
- methods and mechanisms that are used to identify/monitor insecticide resistance
- **Reference**: Dialynas *et al.* 2009. MIRO and IRbase: IT Tools for the epidemiological monitoring of the insecticide resistance in mosquito disease vectors. PLoS Negl Trop Dis 3(6): e465.



4. VectorBase ontologies

Mosquito Anatomy – TGMA v1.12

- Contains ontological descriptions covering the anatomy of mosquitoes.
- The terms and images are based on Harbach & Knight (1980) and Jobling & Lewis (1987):

Harbach, R.E. and Knight, K.L. 1980. Taxonomists' Glossary of Mosquito Anatomy. Plexus Publishing INC., Marlton, NJ.

Jobling, B. and Lewis, D.J. 1987. Anatomical drawings of biting flies. British Museum of Natural History and Wellcome Foundation, London, UK.

- **Reference**: Topalis *et al.* 2008. Anatomical ontologies of mosquitoes and ticks, and their web browsers in VectorBase. *Insect Molecular Biology*. 17(1): 87-89.



4. VectorBase ontologies

Tick Anatomy – TADS v1.22

- Contains ontological descriptions covering the anatomy of ticks.
- The terms, synonyms and their descriptions are fully based on Sonenshine (1991) with small modifications:

Sonenshine, D.E. 1991. Biology of Ticks. Vol. 1. Oxford University Press, New York, NY.

- **Reference**: Topalis *et al.* 2008. Anatomical ontologies of mosquitoes and ticks, and their web browsers in VectorBase. *Insect Molecular Biology*. 17(1): 87-89.



5. Ontology Browser

[Home](#) » [Tools](#) » [Ontology Browser](#)

Ontology Browser

Please select an ontology:

Search:

Browsing

Please select a CV from the drop down list on the left panel. seconds, depending on the size of the ontology and network sp ontology tree should appear on the central panel. To expand or collapse branches click on the + or - signs. To view more information about a specific term click on the term's name. Detailed information (including expression data, if any) for the selected term should appear on the right panel.

Searching

To search for a term start typing the term's name into the text box on the far left panel. After having typed 3 or more characters a list of the first 10 matching terms should appear. You may click on the desired term or use the up and down arrow keys to move up and down. As soon as a term on the suggestion list is selected the CV tree should expand and the term will be highlighted. At the bottom of the list synonym terms will appear. The matching term's name is printed first followed by the synonym in parenthesis.

- BLAST
- ClustalW
- HMMer
- BioMart
- Genome browser
- Ontology browser**
- Expression browser
- Population biology browser
- Insecticide resistance

- Gene Ontology
- Malaria Organism
- Mosquito Life Cycle
- Mosquito Anatomy
- Tick Anatomy

The tutorial can be found in the home page of the Ontology Browser.



5. Ontology Browser

Sample entry

Ontology Browser

Please select an ontology:

Mosquito Anatomy


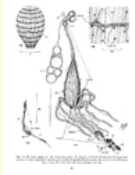

Search:

malp

- adult Malpighian tubules
- adult malpighian tubules lumen
- larval malpighian tubule lumen
- larval Malpighian tubules

- anatomical entity
 - immaterial anatomical entity
- material anatomical entity
 - portion of organism substance
- anatomical structure
 - multi-tissue structure
 - anatomical group
- portion of tissue
 - fat body
 - prosophallic sclerite
- adult Malpighian tubules
 - leaflet of aedeagus
 - ventral aedeagal bridge
- paraproct
 - aedeagal sclerite
- adult intersegmental membrane
 - adult antennal socket
- extraembryonic structure
- acellular anatomical structure
- organism subdivision
- compound organ
 - cell component
- cells
- multi-cellular organism
- egg

Term information	
ID	TGMA:0001038
Name	adult Malpighian tubules
Definition	There are five Malpighian tubules to the alimentary canal posterior
Source	ISBN:0-412-40180-0
Comment	adult alimentary canal in ISBN:058,60,6265,66 Abbr: Mal. tu in IS
Relationship(s)	is_a portion of tissue, part_of ad

Images	
	
	

Expression Data	
Title	Adult tissues (Baker et al., 2011)
Type	Experiment
Summary	This is the MozAtlas dataset. A number of adult male and female mosquitoes are assayed on the Affymetrix Plasmodium/Anopheles microarray. GE

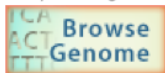


6. Use cases

AGAP001111 → Multiple Reporters




Gene links:

Anopheles gambiae



Reporter information [show details](#):

Expression summary:

Experiment	P-value	Test	Experimental factor	Summary
Adult tissues (Baker et al., 2011) experiment info ⓘ plots and data  Multiple reporters: show details	0.0	ANOVA	Organism part and sex  	Significant differential expression ↑ Malpighian tubules [TGMA:0001038]:male ↓ male accessory gland [TGMA:0001862]:male details

- This experiment in VectorBase Expression Browser, adult tissues (Baker *et al.* 2011), is annotated using the Mosquito Anatomy – TGMA.
- The ontology links go to the Ontology Browser.



6. Use cases

Sample entry of the GO ontology in VectorBase Genome Browser.

Anopheles gambiae ▾ Location: 2L:48,060,644-48,082,917 Gene: AGAP007592 Transcript: AGAP007592

Gene-based displays

- Gene summary
- Splice variants (1)
- Transcript comparison
- Supporting evidence
- Sequence
- External references
- Regulation
- Gene Expression
 - Reporters (29)
- Expression
- Pathways
- PubMed
- Ontology**
 - GO: molecular function (5)
 - GO: cellular component (2)
 - GO: biological process (1)**
- Comparative Genomics
 - Genomic alignments (image)
 - Genomic alignments (text)
- Gene tree (image)
 - Gene tree (text)
 - Gene tree (alignment)
 - Gene gain/loss tree
- Orthologues (18)
- Paralogues (18)
- Protein families
- Phenotype
- Genetic Variation
 - Variation table
 - Structural variation
 - Variation image

Gene: AGAP007592

Description kinesin family member [Source:VB External Description;Acc:AGAF]

Location [Chromosome 2L: 48,060,644-48,082,917](#) reverse strand.

Transcripts This gene has 1 transcript (splice variant) [Show transcript table](#)

GO: biological process

Ancestry chart of GO:0007018

Terms:

- Annotated terms
- Generic GO slim terms

Relations:

- ↑ is_a
- ↑ part_of

biological process

single organism process

cellular process

single organism cellular process

cellular component movement

microtubule based process

microtubule based movement



6. Use cases

BioMart can be used to query VectorBase genes and their GO info.

Dataset
Anopheles gambiae genes (AgamP3 (AgamP3.7))

Filters
[None selected]


Attributes
Gene stable ID
Transcript stable ID

Dataset
[None Selected]

Please restrict your query using criteria below

REGION:

GENE:

GENE ONTOLOGY: 


☐ GO term accession [e.g. GO:0050789]

☐ GO term name [e.g. regulation of biological process]

☐ GO evidence code

Dataset
Anopheles gambiae genes (AgamP3 (AgamP3.7))

Filters
[None selected]

Attributes 
Gene stable ID
Transcript stable ID

Dataset
[None Selected]


GENE:

EXTERNAL:

External References (max 3)

☐ Anoxcel ID
☐ Celera gene ID(s)
☐ Celera protein ID(s)
☐ Celera transcript ID(s)
☐ ENA/GenBank ID
☐ ENA/GenBank (predicted) ID
☐ ENA/GenBank protein ID
☐ ENA/GenBank protein (predicted) ID
☐ EntrezGene ID
☐ ImmunoDB ID
☐ KEGG ID
☐ KEGG description
☐ MEROPS ID
☐ PDB ID
☐ Pubmed ID
☐ RefSeq DNA (predicted) ID
☐ RefSeq mRNA (predicted) ID

☐ RefSeq protein ID
☐ RefSeq protein (predicted) ID
☐ RefSeq RNA (predicted) ID
☐ Rfam ID
☐ Ribosomal Protein Gene Database ID
☐ Unigene ID
☐ UniParc ID
☐ UniProtKB/SwissProt ID
☐ UniProtKB/TrEMBL ID
☐ UniProtKB/TrEMBL (predicted) ID
☐ VectorBase community annotation ID
☐ VectorBase external description ID
☐ VectorBase RNA description ID
☐ WikiGene ID
☐ WikiGene name
☐ WikiGene description

GO 

☐ GO term accession
☐ GO term name
☐ GO term definition

☐ GO term evidence code
☐ GO domain

VectorBase
<http://www.vectorbase.org>

How to search for more information or help?

E-mail us at
info@vectorbase.org

If you would like to know more about biomedical ontologies you
could read this assay:

Smith, B. 2004. Beyond Concepts: Ontology as Reality
Representation. *International Conference on Formal Ontology and
Information Systems* [http://ontology.buffalo.
edu/bfo/BeyondConcepts.pdf](http://ontology.buffalo.edu/bfo/BeyondConcepts.pdf)

