Ontology Browser

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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

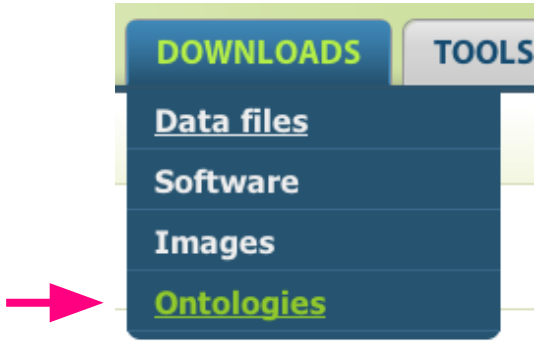
… ontologies will enable vector biologist to achieve computer-comprehensible annotation of genes and genomes, of various experimental, clinical and surveillance data …

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

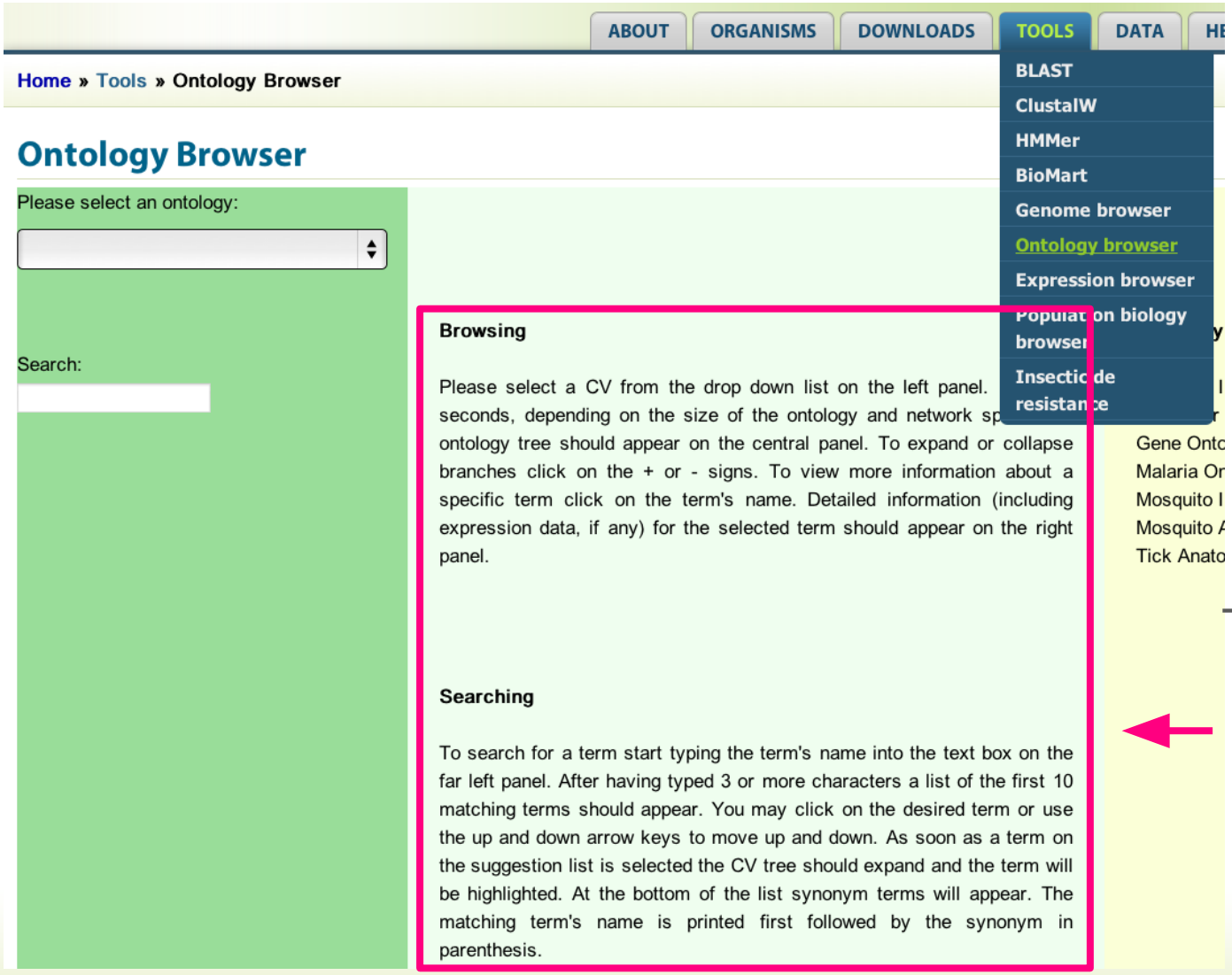
- Contains ontological descriptions covering the anatomy of ticks.

- 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.

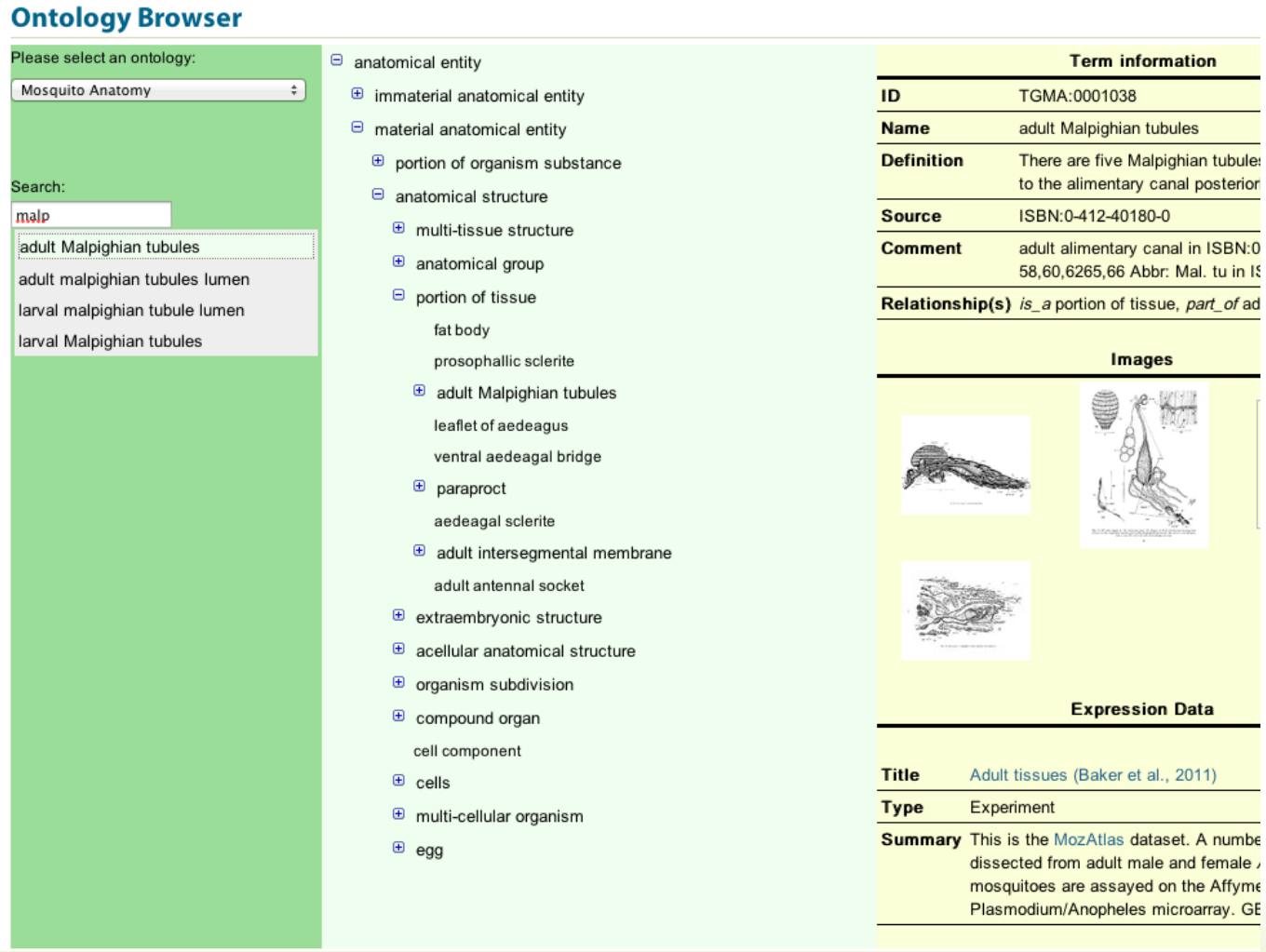
5. Ontology Browser



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

5. Ontology Browser

Sample entry



6. Use cases

AGAP001111 → Multiple Reporters

Gene links:

Anopheles gambiae

Browse Genome

Expression Map

Reporter information show details:

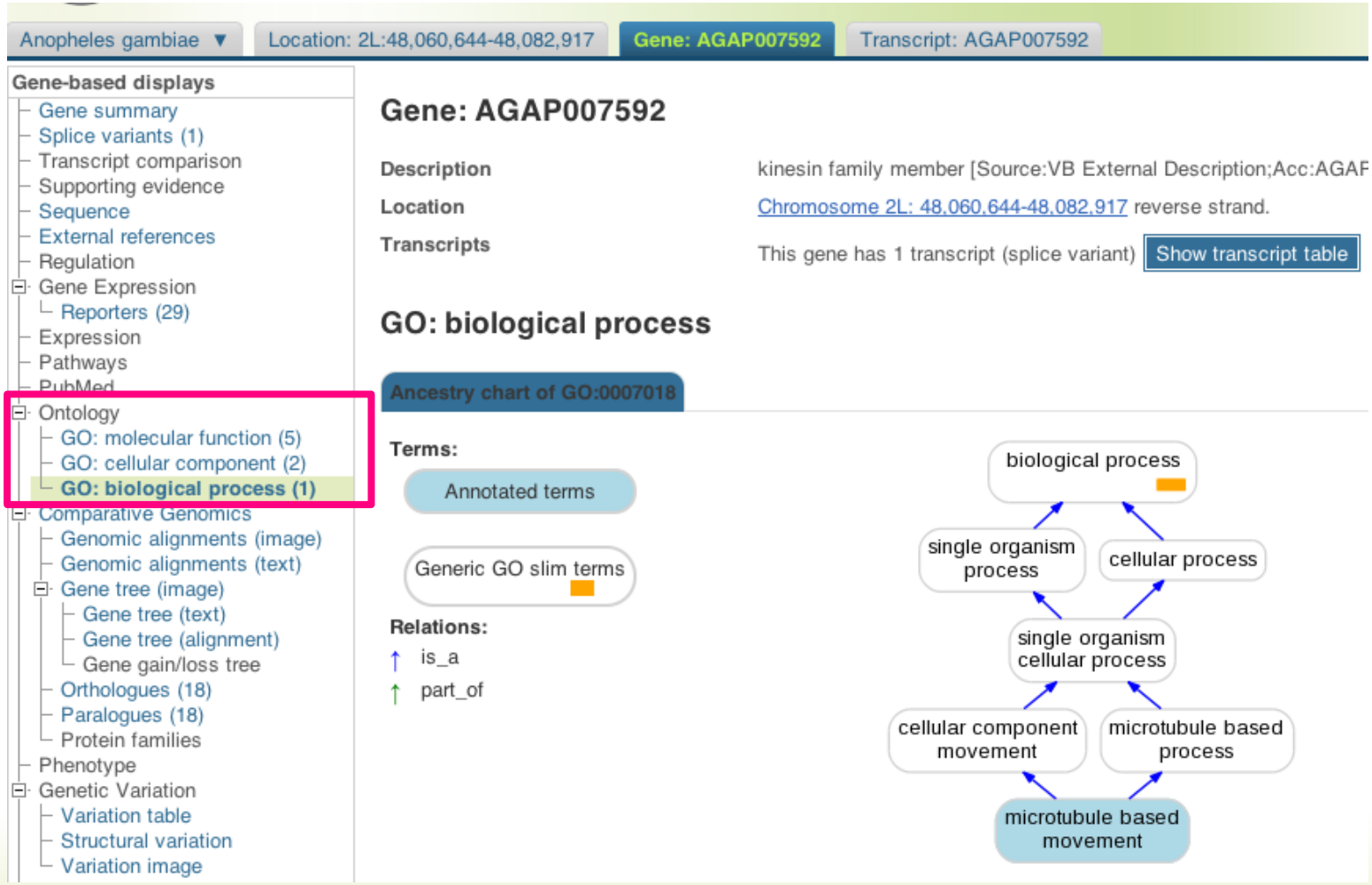
Expression summary:

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.

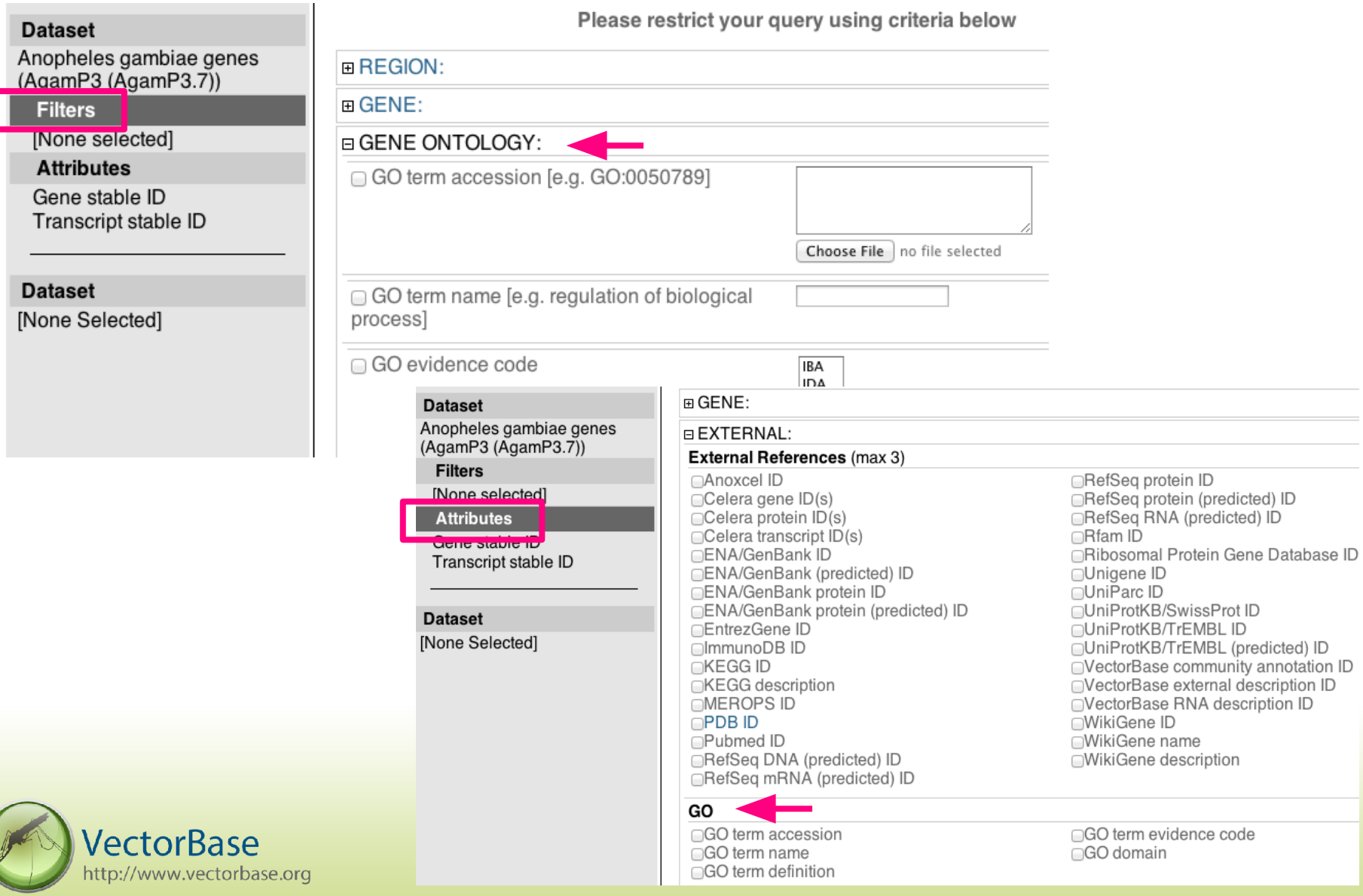
6. Use cases

Sample entry of the GO ontology in VectorBase Genome Browser.



6. Use cases

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



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