

# **The case for community ontologies**

·

**European Bioinformatics Institute**  
**June 19<sup>th</sup> 2008**







the Gene Ontology

Search

gene or protein name  go!

- Open menus
- Home
- FAQ
- Downloads**
- Tools**
- Documentation**
- About GO**
- Contact GO
- Site Map

## Gene Ontology Home

The Gene Ontology project provides a controlled vocabulary to describe gene and gene product attributes in any organism. [Read more about the Gene Ontology...](#)

### Search the Gene Ontology Database

Search for genes, proteins or GO terms using [AmiGO](#) :

gene or protein name     GO term or ID

[AmiGO](#) is the official GO browser and search engine. [Browse the Gene Ontology with AmiGO.](#)

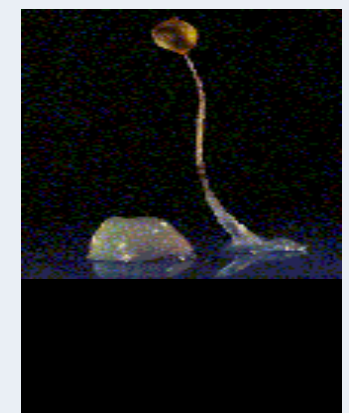
www.geneontology.org



# Gene Ontology Consortium

<http://www.geneontology.org>

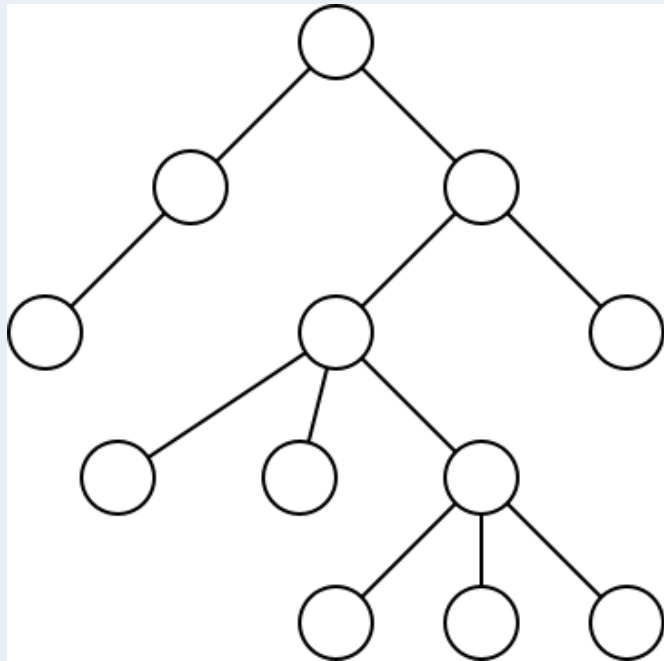
QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.



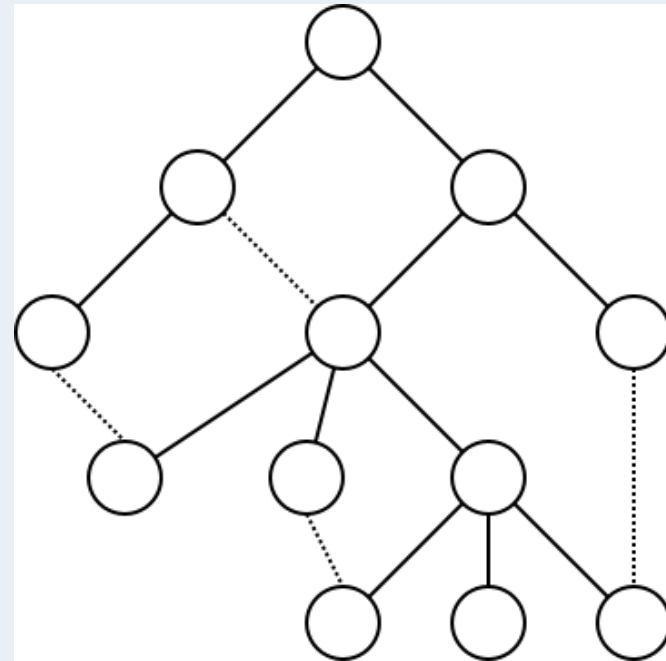
# Gene Ontology - 2008

- Flies - *Drosophila* & *Glossina* [FlyBase](#) [GeneDB](#)
- Yeasts - *Saccharomyces*, *Schizosaccharomyces* & *Candida* [SGD](#), [GeneDB](#) & [CGD](#)
- Mouse - [Mouse Genome Database \(MGD & GXD\)](#)
- Rat - [Rat Genome Database \(RGD\)](#)
- Weed - [The Arabidopsis Information Resource \(TAIR\)](#)
- Worm - [WormBase](#)
- *Dictyostelium* - [dictyBase](#)
- InterPro/UniProt at EBI - [InterPro](#)
- Human - [UniProt](#), [Ensembl](#), [NCBI](#), [Incyte](#), [Celera](#), [Compugen](#)
- Parasites - *Plasmodium*, *Trypanosoma*, *Leishmania* - [GeneDB](#)
- Microbes - *Vibrio*, *Shewanella*, *B. anthracus*, ... - [ex-TIGR](#)
- Grasses - rice & maize - [Gramene database](#)
- zebra fish - [ZFIN](#)
- Chicken, cow - [Agbase](#)
- *Tetrahymena* - [Tetrahymena DataBase \(TGD\)](#)
- Coming: *Xenopus*, *Aspergillus*, *Chlamydomonas*, & more.

**tree**



**directed  
acyclic graph**



# Classes of parent-child relationship.

- **ISA (hypernymy/hyponymy)**
  - as in: an elephant is a mammal
- **PARTOF (meronymy/holonymy)**
  - as in: a trunk is part of an elephant

[GOst Search](#)[Get this GO term as RDF XML.](#)[Get this data as a GO flat file.](#)

## O-linked glycosylation

Accession:GO:0006493

Synonyms: None.

**Definition:** The formation of O-glycans by addition of glycosyl groups either to the hydroxyl group of peptidyl-serine, peptidyl-threonine, peptidyl-hydroxylysine, or peptidyl-hydroxyproline, or to the phenol group of peptidyl-tyrosine. definition\_

**Term Lineage**

[Graph view.](#)

[GO:0003673 : Gene\\_Ontology \(46199\)](#)

④ [GO:0008150 : biological\\_process \(30188\)](#)

④ [GO:0008151 : cell growth and/or maintenance \(20547\)](#)

④ [GO:0008152 : metabolism \(14693\)](#)

④ [GO:0009058 : biosynthesis \(3578\)](#)

④ [GO:0009059 : macromolecule biosynthesis \(2106\)](#)

④ [GO:0006412 : protein biosynthesis \(2099\)](#)

④ [GO:0009101 : glycoprotein biosynthesis \(171\)](#)

④ [GO:0006486 : protein amino acid glycosylation \(168\)](#)

④ **[GO:0006493 : O-linked glycosylation \(41\)](#)**

④ [GO:0019538 : protein metabolism \(5648\)](#)

④ [GO:0009100 : glycoprotein metabolism \(178\)](#)

④ [GO:0009101 : glycoprotein biosynthesis \(171\)](#)

④ [GO:0006486 : protein amino acid glycosylation \(168\)](#)

④ **[GO:0006493 : O-linked glycosylation \(41\)](#)**

④ [GO:0006412 : protein biosynthesis \(2099\)](#)

④ [GO:0009101 : glycoprotein biosynthesis \(171\)](#)

④ [GO:0006486 : protein amino acid glycosylation \(168\)](#)

④ **[GO:0006493 : O-linked glycosylation \(41\)](#)**

④ [GO:0006464 : protein modification \(1549\)](#)

④ [GO:0006486 : protein amino acid glycosylation \(168\)](#)

④ **[GO:0006493 : O-linked glycosylation \(41\)](#)**

**Extending the GO model.**

**OBO**

**Open Biomedical Ontologies.**

***<http://obo.sf.net/>***

**aka - extended go - (ego)**







## The Open Biomedical Ontologies

[Ontologies](#)[Resources](#)[Participate](#)[About](#)

The OBO Foundry is a collaborative experiment involving developers of science-based ontologies who have established a set of principles for ontology development with the goal of creating a suite of orthogonal interoperable reference ontologies in the biomedical domain. Currently the OBO Foundry ontologies form a part of the wider Open Biomedical Ontologies family, as listed below. In the longer term it is intended that the OBO Foundry will form one collection of ontologies alongside other such collections within the NCBO Bioportal.

In addition to a listing of OBO ontologies, this site also provides a statement of the OBO Foundry principles, discussion fora, technical infrastructure, and other services to facilitate ontology development. We welcome feedback and encourage participation.

Click any column header to sort the table by that column. The s link to the request trackers for the listed ontologies.

<u>Domain</u>	<u>Prefix</u>	<u>File</u>	<u>Format</u>
<a href="#">Biological imaging methods</a>	FBbi	<a href="#">image.obo</a>	obo
<a href="#">Biological process</a>	GO	<a href="#">gene_ontology.obo</a> 	obo
<a href="#">BRENDA tissue / enzyme source</a>	BTO		obo
<a href="#">C. elegans development</a>	WBIs	<a href="#">worm_development.obo</a>	obo
<a href="#">C. elegans gross anatomy</a>	WBbt		obo
<a href="#">C. elegans phenotype</a>	WBPhenotype	<a href="#">phenotype_ontology_obo.cql</a>	obo
<a href="#">Cell type</a>	CL	<a href="#">cell.obo</a> 	obo
<a href="#">Cellular component</a>	GO	<a href="#">gene_ontology.obo</a> 	obo
<a href="#">Cereal plant development</a>	GRO	<a href="#">cereals_development.obo</a>	obo

obo.sf.net

## ***Cellular component***

Provides structured controlled vocabularies for the annotation of gene products with respect to their cellular location. One of the three vocabularies of the Gene Ontology.

namespace	GO
current activity	Production and review
source	<a href="#">gene_ontology_edit.obo</a>
home	<a href="http://www.geneontology.org">www.geneontology.org</a>
documentation	<a href="#">Gene Ontology documentation</a>
contact	<a href="#">Gene Ontology</a>
<a href="#">OBO format</a>	<a href="#">gene_ontology_edit.obo</a>
<a href="#">OWL format</a>	<a href="http://purl.org/obo/owl/GO">http://purl.org/obo/owl/GO</a>
tracker	<a href="http://sourceforge.net/tracker/?atid=440764&amp;group_id=36855">http://sourceforge.net/tracker/?atid=440764&amp;group_id=36855</a>
relevant_organism	all
domain	anatomy

This ontology is available from the OBO CVS repository.

## Gene Ontology

Trackers  Search [Advanced](#)

[Project](#) [Tracker](#) [Mailing Lists](#) [Forums](#) [Code](#) [Services](#) [Download](#) [Documentation](#) [Tasks](#)

[Project Web Site](#)

[Login and Submit New](#) [Browse](#) [Admin](#)

[Stats](#) [RSS](#)

Assignee: [\(?\)](#) Status: [\(?\)](#) Category: [\(?\)](#) Group: [\(?\)](#)  
Any Open Any Any

Show only: Submitter username:  Summary keyword:

Sort By: [\(?\)](#) ID Descending Browse

Browse the term requests currently under consideration.

Request ID	Summary	Open Date	Priority	Assigned To	Submitted By
1996807	<a href="#">pseudouridine synthase activity</a>	2008-06-18 08:36	5	nobody	<a href="#">val_wood</a>
1996264	<a href="#">MAP kinase tree</a>	2008-06-17 16:25	5	nobody	<a href="#">vkhodiyar</a>
1995896	<a href="#">Parent/def mitochondrial respiratory chain complex IV</a>	2008-06-17 10:25	5	nobody	<a href="#">val_wood</a>
1995835	<a href="#">electron carrier activity</a>	2008-06-17 09:02	9	<a href="#">jenclark</a>	<a href="#">jenclark</a>
1995254	<a href="#">obsolete GO:0010320</a>	2008-06-16 15:22	4	<a href="#">gomidori</a>	<a href="#">gomidori</a>
1995138	<a href="#">definition of translation needs tightening</a>	2008-06-16 13:25	5	nobody	<a href="#">jj242</a>

# OBO Foundry Principles

1. Open Source
2. Common syntax
3. Unique ID space
4. Versioned
5. Delineated content
6. Terms have textual definitions
7. Relations from the Relations Ontology
8. Well documented
9. Community of users
10. Collaboratively developed

**The glue - an ontology of relations.**

☐ Relations

— disjoint from

— inverse of

— is\_a

☐ relationship

← is\_a adjacent\_to

☐ ← is\_a agent\_in

☐ ← inverse of has\_agent

☐ ← is\_a contained\_in

☐ ← inverse of contains

☐ ← is\_a contains

☐ ← inverse of contained\_in

☐ ← is\_a derived\_into

☐ ← is\_a derives\_from

☐ ← is\_a has\_agent

☐ ← is\_a has\_part

☐ ← is\_a has\_participant

← is\_a instance\_of

☐ ← is\_a located\_in

☐ ← is\_a location\_of

☐ ← is\_a part\_of

☐ ← is\_a participates\_in

☐ ← is\_a preceded\_by

☐ ← is\_a precedes

☐ ← is\_a transformation\_of

☐ ← is\_a transformed\_into

— union of

— Obsolete

GO is now moving to using cross-products between different OBO ontologies.

[Term]

id: GO:0000273

name: lipoic acid metabolic process

intersection\_of: GO:0008152 ! metabolic process

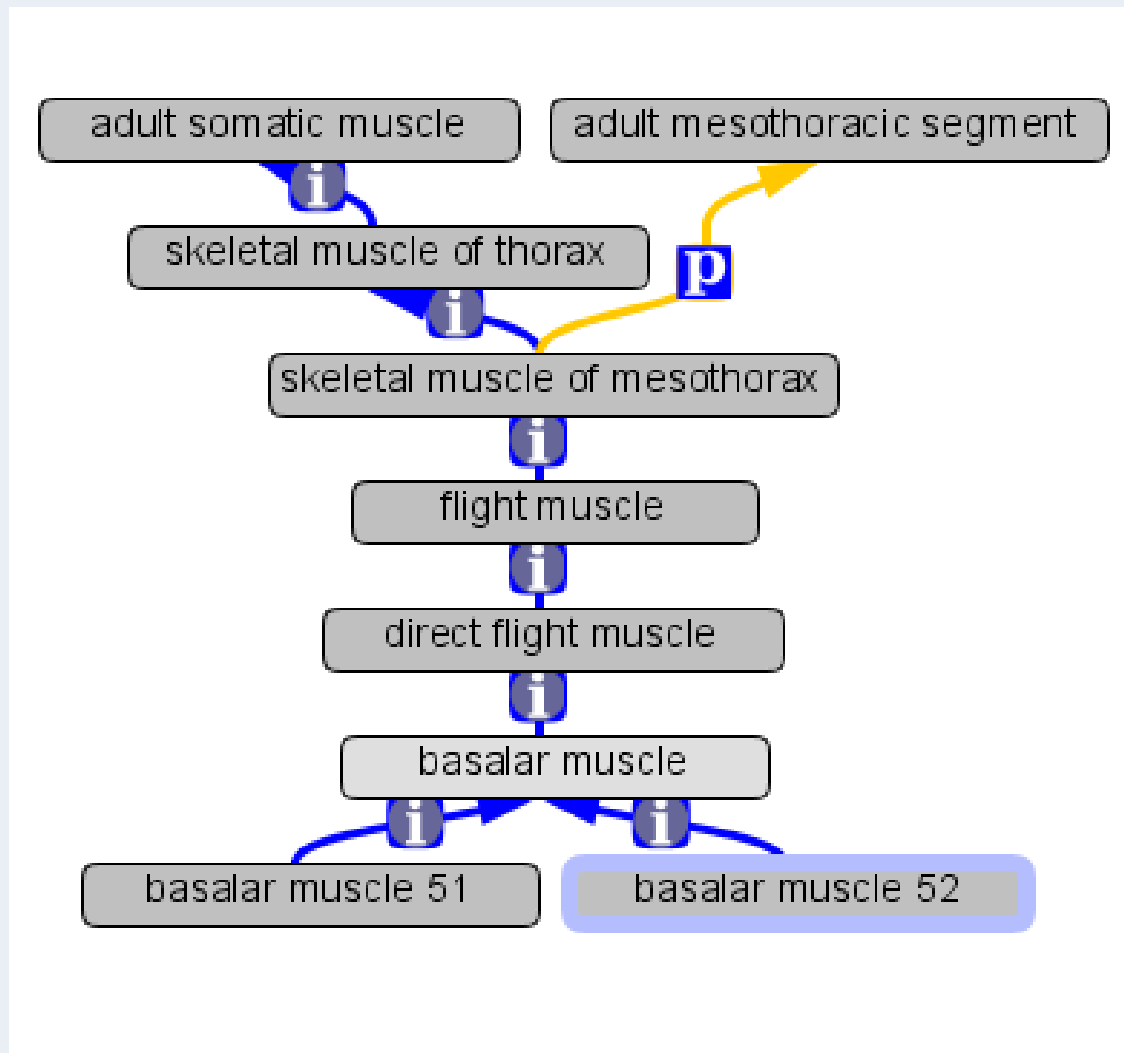
intersection\_of: has\_participant CHEBI:16494 ! lipoic acid

# **OBO Case Studies.**

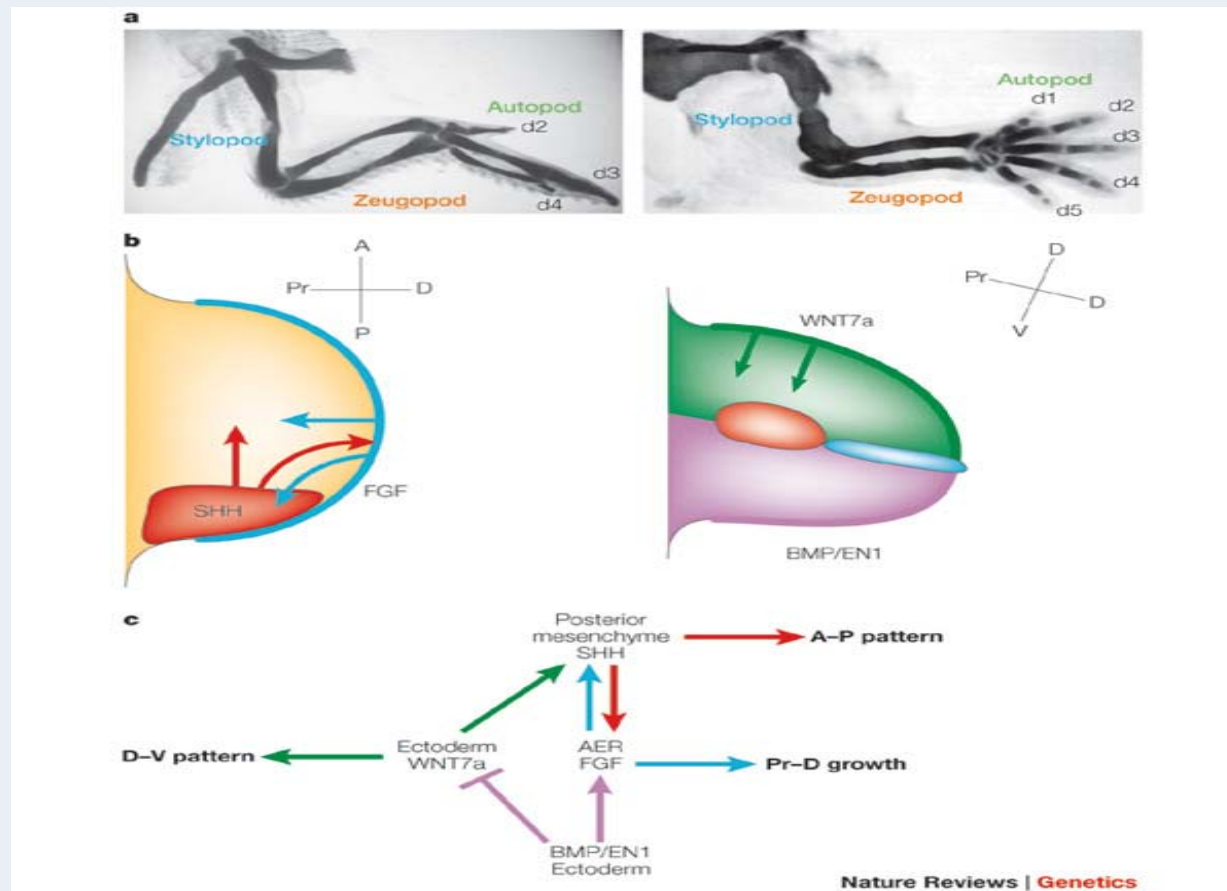
## **ANATOMIES**

**PATO - An ontology for phenotypes.**

**ENVO & GAZ - Ontologies for biological collections.**



# Conservation of gene expression and role in limb development



# Why do we care about homology when building an anatomy ontology?

Consider an anatomy ontology of vertebrates:

skeletal system

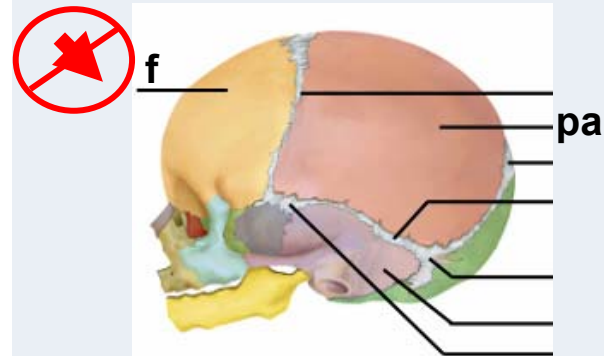
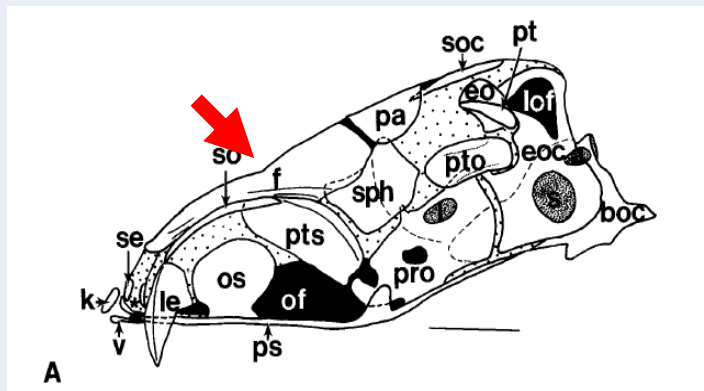
cranial skeletal system

parietal bone (in\_organism human)

parietal bone (in\_organism zebrafish)

frontal bone (in\_organism human)

frontal bone (in\_organism zebrafish)



Homologous : frontal bone (zebrafish) and parietal bone (human)

**Different genes and developmental processes may underlie the development of the zebrafish frontal and the human frontal, even though they have the same name and are similarly located**

**PATO**  
**An ontology for**  
**phenotypes.**

# OMIM

Online Mendelian Inheritance in Man



Johns  
Hopkins  
University

PubMed    Nucleotide    Protein    Genome    Structure

▼ for

Go    Clear

Limits    Preview/Index    History    Clipboard    Details

- Enter one or more search terms.
- Use **Limits** to restrict your search by search field, chromosome, and other criteria.
- Use **Index** to browse terms found in OMIM records.
- Use **History** to retrieve records from previous searches, or to combine searches.

**OMIM™ - Online Mendelian Inheritance in  
Man™**

<b>Query</b>	<b># of records</b>
"large bones"	251
"large bone"	713
"enlarged bones"	75
"enlarged bone"	136
"big bones"	16
"huge bones"	4
"massive bones"	28
"hyperplastic bones"	8
"hyperplastic bone"	34
"bone hyperplasia"	122
"increased bone growth"	543



## Mammalian Phenotype Browser

Term Detail

MP term:	<b>abnormal digestive system morphology</b>
Synonym:	<b>digestive system abnormalities</b>
Synonym:	<b>digestive system defects</b>
Synonym:	<b>digestive system dysplasia</b>
Synonym:	<b>digestive system: dysmorphology</b>
MP id:	<b>MP:0000462</b>
Definition:	<b>any structural anomaly of the system dedicated to the mechanical, chemical, and enzymatic processing of food</b>
Number of paths to term:	<b>1</b>

①denotes an 'is-a' relationship

Ⓜdenotes a 'part-of' relationship















### Phenotype Ontology

①[digestive/alimentary phenotype](#)

①[abnormal digestive system morphology \[MP:0000462\]](#) (1047 genotypes, 1888 annotations)

- ①[abnormal anus morphology](#) +
- ①[abnormal digestive organ placement](#) +
- ①[abnormal digestive system development](#) +
- ①[abnormal esophagus morphology](#) +
- ①[abnormal intestine morphology](#) +
- ①[abnormal mucosal lining of the mouth](#) +
- ①[abnormal palate morphology](#) +
- ①[abnormal pancreas morphology](#) +
- ①[abnormal perineum morphology](#) +
- ①[abnormal salivary gland morphology](#) +
- ①[abnormal stomach morphology](#) +
- ①[abnormal tongue morphology](#) +
- ①[gastrointestinal ulcer](#) +
- ①[lymphomesenteric cysts](#)
- ①[abnormal digestive system physiology](#) +

# The Plant Trait Ontology

- [www.gramene.org/plant\\_ontology/trait.ontology](http://www.gramene.org/plant_ontology/trait.ontology)
- **all (all) #705606** 
    - **[i] trait ontology (TO:0000387) #13846** 
      - **[i] stress trait (TO:0000164) #2567** 
        - **[i] abiotic stress trait (TO:0000168) #1784** 
          - **[i] stem length (TO:0000576) #243** 
            - **[i] basal tiller length (TO:0001005) #8**
      - **[i] growth and development trait (TO:0000357) #3255** 
        - **[i] shoot development trait (TO:0000654) #813** 
          - **[i] stem length (TO:0000576) #243** 
            - **[i] basal tiller length (TO:0001005) #8**
      - **[i] anatomy and morphology related trait (TO:0000017) #5234** 
        - **[i] shoot anatomy and morphology trait (TO:0000077) #4117** 
          - **[i] plant height (TO:0000207) #1596** 
            - **[p] stem length (TO:0000576) #243** 
              - **[i] basal tiller length (TO:0001005) #8**
          - **[i] stem anatomy and morphology trait (TO:0000361) #427** 
            - **[i] stem length (TO:0000576) #243** 
              - **[i] basal tiller length (TO:0001005) #8**

[www.gramene.org/plant\\_ontology/trait.ontology](http://www.gramene.org/plant_ontology/trait.ontology)

**These are both *pre-composed ontologies*.**

**They can, however, be de-composed into *entities*, the things being described, and their *qualities*, that is as EQ statements:**

**EQ = Entity + Quality**

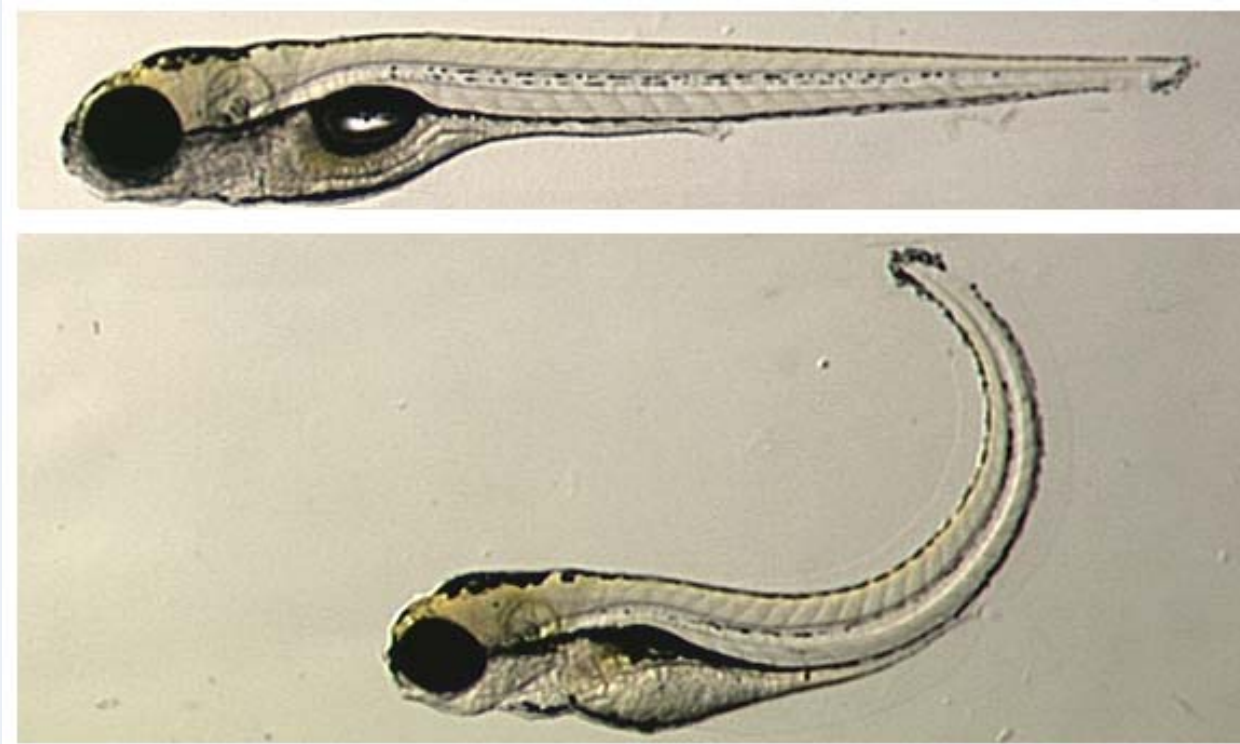
- Entity = Anatomy, GO process, Disease.
- Quality = PATO, the ontology of qualities.

## **Pre-composed-phenotype statement:**

<b>MP term:</b>	<b>kinked tail</b>
<b>Synonym:</b>	<b>crooked tail</b>
<b>Synonym:</b>	<b>kinky tail</b>
<b>Synonym:</b>	<b>tail kinks</b>
<b>MP id:</b>	<b>MP:0000585</b>
<b>Definition:</b>	<b>a sharp bend or zigzag in the tail.</b>

## **Post-composed-phenotype statement:**

**Entity = tail; Quality = kinked.**



## **Entity**

ZAO:head

ZAO:liver

ZAO:tail

GO:swim bladder inflation

## **Quality**

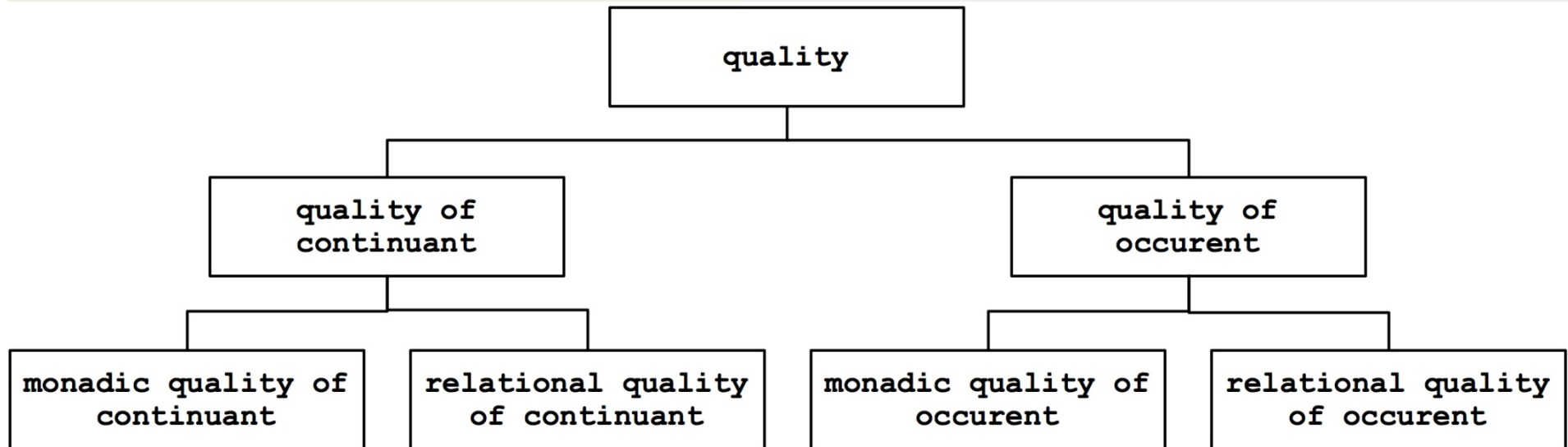
PATO:decreased size

PATO:aplastic

PATO:curved up

PATO:arrested

# PATO's Top level divisions



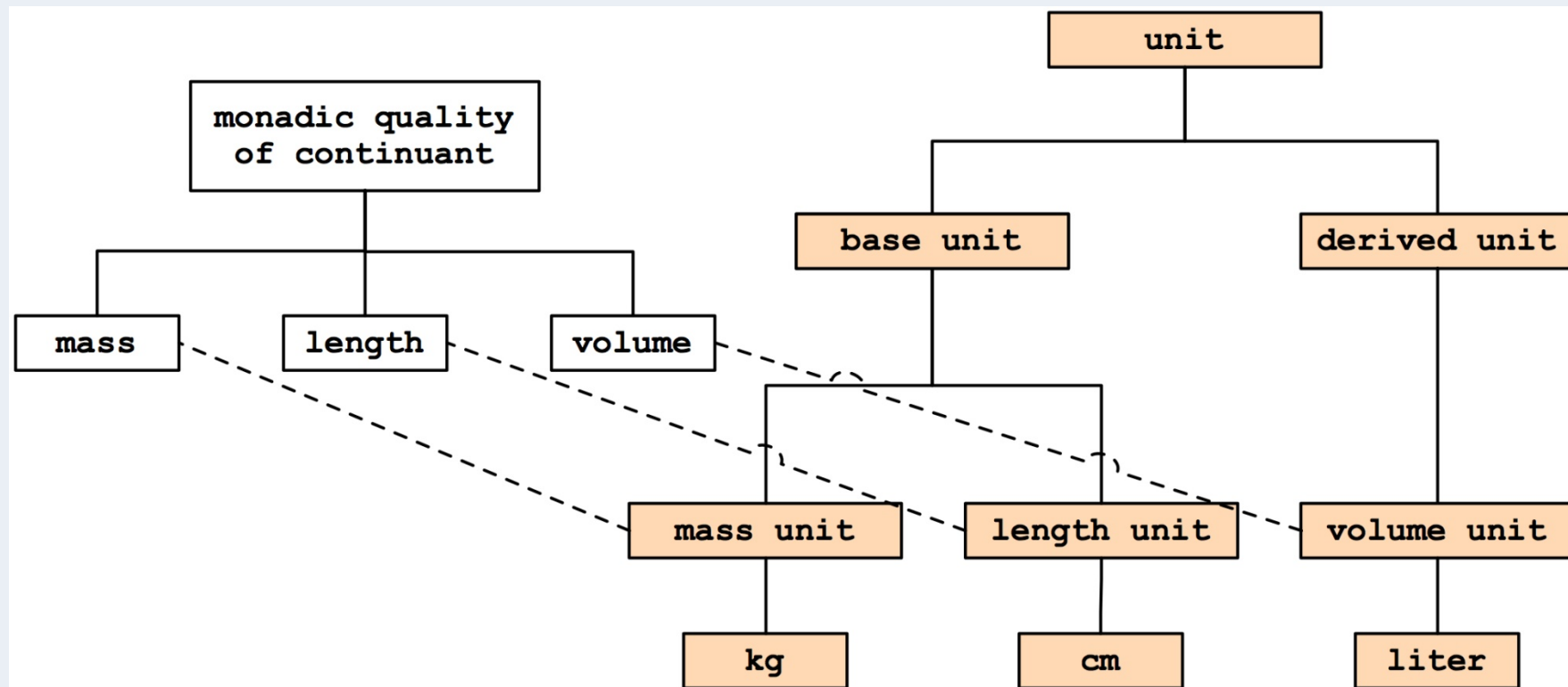
- ☐— quality
  - ☒←1 qualitative
  - ☐←1 quality of continuant
    - ☒←1 monadic quality of continuant
    - ☐←1 relational quality of continuant
      - ☒←1 adhesivity
      - ☒←1 concentration of
      - ☒←1 discrimination
      - ☒←1 disposition
      - ☒←1 distance
      - ☒←1 extra or missing physical and functional parts
      - ☒←1 flavor
      - ☒←1 odor
        - ←1 proportionality to
      - ☒←1 relational behavioral quality
      - ☒←1 relational shape quality
      - ☒←1 relational spatial quality
      - ☒←1 relational structural quality
      - ☒←1 resistance to
      - ☒←1 response to
      - ☒←1 sensitivity toward
      - ☒←1 solubility
  - ☐←1 quality of occurrent
    - ←1 acute
    - ←1 chronic
    - ☐←1 monadic quality of occurrent
      - ←1 abolished
      - ←1 amplitude
      - ☒←1 behavioral quality of a process
      - ☒←1 cellular spatiotemporal quality
        - ←1 disrupted
      - ☒←1 duration
      - ☒←1 growth quality of occurrent
      - ☒←1 necessity of occurrent
      - ☒←1 occurrence quality
      - ☒←1 rate
      - ☒←1 rhythm quality
      - ☒←1 variability
    - ☒←1 relational quality of occurrent
  - ☒←1 quantitative

# Measurements

- PATO – part of a representation of *qualitative* phenotypic information
- More often than not it is important to record *quantitative* information that results from a specific measurement of a quality

The tail of my mouse is 2.1 cm

# Mapping PATO to the UO



# Entities are drawn from other OBO ontologies.

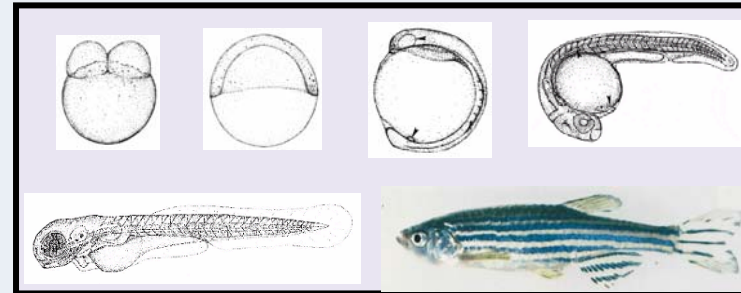
## Anatomy ontologies

Cardiovascular system

heart

atrium

ventricle



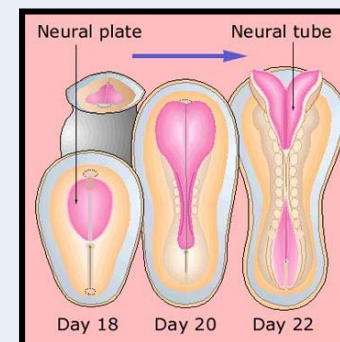
## Gene Ontology

CNS development

brain development

forebrain development

hindbrain development

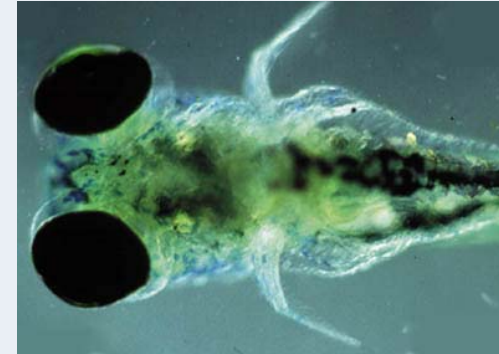


# Human and zebrafish SOX9 mutations in PATO syntax.

## Human, *SOX9* (Campomelic dysplasia)



## Zebrafish, *sox9a* (jellyfish)



Scapula: hypoplastic	↔	Scapulocorocoid: aplastic
Lower jaw: decreased size	↔	Cranial cartilage: hypoplastic
Heart: malformed	↔	Heart: edematous
Phalanges: decreased length	↔	Pectoral fin: decreased length
Long bones: bowed	↔	Cartilage development: disrupted

**Curation of mutant phenotypes and human diseases using a common vocabulary can provide candidate genes and mutant models of disease.**

# What is an annotation?

**An assertion defining the relationship between a *type* and an *instance*.**

- **My heart is an *instance* of the *type* heart.**
- **My hair is an *instance* of the *type* hair with the *quality* brown(ish).**

**Ontologies contain *types*. Annotations link *types* and *instances*.**



## Welcome to Phenote

Phenote is both a complete piece of software and a software toolkit designed to facilitate the **annotation of biological phenotypes using ontologies**. It provides an interface and infrastructure to record genotype-phenotype pairs, together with the provenance for the annotation. Typical users of Phenote include literature curators, laboratory researchers, and clinicians looking for a method to record data in a **user-friendly** and **computable** way.

Data annotated with Phenote is based on the [EQ model](#) for representing phenotypes, combining entities from any ontology with qualities (such as PATO).

### Features include:

- Friendly spreadsheet-like interface
- Type-ahead-suggest (autocompletion) for terms within ontologies
- Use of any OBO-format ontology (or OWL->OBO converted)
- Ontology navigation and all-in-one term information display
- Bulk copy/edit/delete/sort of phenotype-genotype character entries
- Excel-compatible output format (tab-delimited)
- Additional export formats: phenosyntax, xml
- configurable input fields to allow custom data entry and user-specified ontologies
- Preconfigurations available for different communities
- Customized configurations easily added

# www.phenote.org

### Frequently Used Links

- ★ [Launch Phenote via Webstart](#)
- ★ [Frequently asked questions \(FAQ\)](#)

### Upcoming Events

#### Phenote User's Group IRC

- ★ [User's Group Monthly Meeting](#), November 1, 9:00am, Online

#### Meetings/Demos

- ★ [BioCurator meeting](#), October 23-25, San Jose, CA

### News

10.10.2007 - **New Phenote Release - [version 1.4](#)**

10.02.2007 - Phenote user's group to be moved to first Thursday of each month, 9am. Join us for our next meeting on November 1st over WebEx!

09.17.2007 - New website rolled out! The website has the same content as the old one, just with a new look-and-feel.

Phenote

### Phenote Editor

PUB: PMID:7990924

Genotype: OMIM:608160.0001

Genetic Context:

Entity: FMA Long bone

Quality: PATO increased curvature

Add'l Entity: ALL

Abnormal: abnormal

Description: CAMPOMELIC DYSPLASIA

### Term Info: Long bone

Term: Long bone

ID: FMA:7474

Ontology: fma

Definition: (no definition provided)

External Annotations:

**Links (21)**

**Parents**

is\_a [Bone organ](#)  
[Appendicular skeleton](#)

**Children**

is\_a [Fibula](#), [Phalanx of finger](#), [Tibia](#), [Femur](#), [Rib](#), [Metatarsal bone](#), [Radius](#), [Humerus](#), [Clavicle](#), [Metacarpal bone](#), [Phalanx of toe](#), [Ulna](#), [Cartilage of long bone](#), [Compact bone of long bone](#), [Medullary cavity of long bone](#), [Trabecular bone of long bone](#), [Epiphysis](#), [Diaphysis](#), [Periosteum of long bone](#)

### Article: Campomelic dysplasia ...

JW Foster, MA Dominguez-Steglich, S Guioli, G Kowk, PA Weller, M Stevanović, J Weissenbach, S Mansour, ID Young, PN Goodfellow. 1994.

**Campomelic dysplasia and autosomal sex reversal caused by mutations in an SRY-related gene.** *Nature* 372:525-30

**Abstract:** Induction of testis development in mammals requires the presence of the Y-chromosome gene SRY. This gene must exert its effect by interacting with other genes in the sex-determination pathway. Cloning of a translocation chromosome breakpoint from a sex-reversed patient with campomelic dysplasia, followed by mutation analysis of an adjacent gene, indicates that SOX9, an SRY-related gene, is involved in both bone formation and control of testis development. (PMID: 7990924)

### Annotation Table

PUB	Genotype	Entity	Quality	Add'l Entity	Genetic Context	Abnormal	Description
PMID:10951468	OMIM:608160.0006	Long bone	curvature			normal	absence of curvature - characteristic of
PMID:10951468	OMIM:608160.0006	Long bone	deformed			abnormal	angulation of long bones
PMID:10951468	OMIM:608160.0006	Skeletal system	deformed			abnormal	together with other skeletal and extrask
PMID:10951468	OMIM:608160.0006	development of secondary female sexual	present		penetrance_incomplete	abnormal	two-thirds of affected XY individuals ma
PMID:10951468	OMIM:608160.0006	development of primary female sexual characteristics	present		penetrance_incomplete	abnormal	two-thirds of affected XY individuals ma
PMID:10951468	OMIM:608160.0006	Genital system	decreased functionality		penetrance_incomplete	abnormal	Up to two-thirds of affected XY individua
PMID:10951468	OMIM:608160.0006	Respiratory system	decreased functionality			abnormal	severe respiratory distress
PMID:10951468	OMIM:608160.0006	Renal pelvis	dilated			abnormal	renal pelvis dilation
PMID:10951468	OMIM:608160.0006	Nasal bone	flat			abnormal	flattened nasal bridge
PMID:10951468	OMIM:608160.0006	Lower jaw	decreased size			abnormal	micrognathia - abnormally small lower j
PMID:10951468	OMIM:608160.0006	Palate	cleft			abnormal	midline cleft palate
PMID:10951468	OMIM:608160.0006	Philtrum	deep			abnormal	long deep philtrum
PMID:10951468	OMIM:608160.0006	Mouth	decreased size			abnormal	small mouth
PMID:10951468	OMIM:608160.0006	Face	round			abnormal	round face
PMID:10951468	OMIM:608160.0006	External genitalia	deformed			abnormal	ambiguous external genitalia
PMID:10951468	OMIM:608160.0006	Scrotum	bifid			abnormal	bifid scrotum
PMID:10951468	OMIM:608160.0006	Urethra	malformed			abnormal	perineal hypospadias
PMID:10951468	OMIM:608160.0006	External urethral orifice	ventral to	Glans penis		abnormal	perineal hypospadias
PMID:10951468	OMIM:608160.0006	Right testis	underdeveloped			abnormal	right testis undescended
PMID:10951468	OMIM:608160.0006	Plantar that has part Groove	deep			abnormal	deep plantar creases
PMID:10951468	OMIM:608160.0006	Little finger	curved			abnormal	mild clinodactyly
PMID:10951468	OMIM:608160.0006	Nail	convex			abnormal	hyperconvex nails
PMID:10951468	OMIM:608160.0006	Nail	decreased size			abnormal	small nails
PMID:10951468	OMIM:608160.0006	Elbow joint	decreased flexibility			abnormal	limited elbow extension

Simple Filter

Exact  
 Inexact

# Allows on-the-fly composition of compound terms.

- **“apoptosis” of “neuron” in the “fly epidermis” (GO,Cell Ontology, FlyBase)**
- **“S-phase” of “neuroblast” (GO,Cell Ontology)**
- **“aster” of “human spermatocyte” (GO, Foundational Model for [Human] Anatomy)**

**The environment and geography:  
envo and gaz.**

**Provide me a list of all samples collected in, or records of, higher plants recorded in, Berkeley, or the County of Alameda, or the State of California, or the coterminal States of the United States of America, or North America, or the Nearctic Region, or the Holarctic Region.**

**Provide me a list of all samples collected in a watercourse in Matto Grosso do Sol.**

**Provide me a list of all samples collected in, or records of, Diatoms from, a saline environment that is neither an ocean nor a sea.**



# EnvO Project

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### 6 Case Studies

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### 8 References

[http://gensc.org/gc\\_wiki/index.php/EnvO\\_Project](http://gensc.org/gc_wiki/index.php/EnvO_Project)

- [-] Classes
  - [-] biome
    - [+] ← ⓘ aquatic biome
    - [+] ← ⓘ terrestrial biome
  - [-] environmental feature
    - [+] ← ⓘ geographic feature
    - [+] ← ⓘ habitat
    - [+] ← ⓘ mesoscopic physical object
  - [+] environmental substrate
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## GAZ Project

Homepage for the GAZ ontology project

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- [GAZ Sourceforge site](#)
- [Gazetteer Tracker](#)
- [GAZ-Working Plan](#)

## Related Sites

- [EnvO Project](#)
- [The Open Biomedical Ontologies](#)

## Data Links

- [CIA World Fact Book](#)
- [Statoids: Administrative Divisions of Countries](#)
- [United States Counties](#)
- [Wikipedia Table of Administrative Divisions](#)



[http://gensc.org/gc\\_wiki/index.php/GAZ\\_Project](http://gensc.org/gc_wiki/index.php/GAZ_Project)

- [-] Classes
  - [-] gazetteer
    - [+] ← ⓘ biogeographic location
    - [-] ← ⓘ geographic region
      - [+] ← ⓘ British Overseas Territory
      - [-] ← ⓘ continental region
        - [+] ← ⓘ Africa
        - [+] ← ⓘ Antarctica
        - [+] ← ⓘ Eurasia
        - [+] ← ⓘ North America
        - [+] ← ⓘ South America
      - [+] ← ⓘ Denmark
      - [+] ← ⓘ Egypt
      - [+] ← ⓘ France
      - [+] ← ⓘ Netherlands
      - [+] ← ⓘ Norway
      - [+] ← ⓘ Oceania
      - [+] ← ⓘ Oceans and Seas
      - [+] ← ⓘ Portugal
      - [+] ← ⓘ Spain
      - [+] ← ⓘ Turkey
      - [+] ← ⓘ United States of America
  - [+] Relations
  - [+] Obsolete

## **Thanks to:**

**The GO Consortium.**

**The Open Biomedical Ontologies community.**

**National Center for Biomedical Ontology.**

**The Genome Standards Consortium.**