

# Gramene's Ontologies Tutorial

This database is a collective resource of structured controlled vocabularies (Ontologies) for knowledge domains and their associations.

## Knowledge Domains:

Plant Ontology (PO)

Plant Structure (morphology, organs, tissue and cell types)\*

Growth stages (plant growth and developmental stages)

Trait Ontology (TO)

Plant traits and phenotypes

Gene Ontology (GO)

Molecular function

Biological process

Cellular component

Environment Ontology (EO)

Gramene's taxonomy ontology (GR\_tax)

## Associations:

Use this database to quickly find Ensembl rice genes (from TIGR's rice genome assembly), proteins from SWISSPROT-TrEMBL representing Poaceae (grass) family, rice genes, QTL and map sets.

*Note: Remember that different ontologies are for different purposes and do not overlap with each other.*

*For more information on each ontology type please visit the current ontologies section at Gramene*

# Tutorial Help



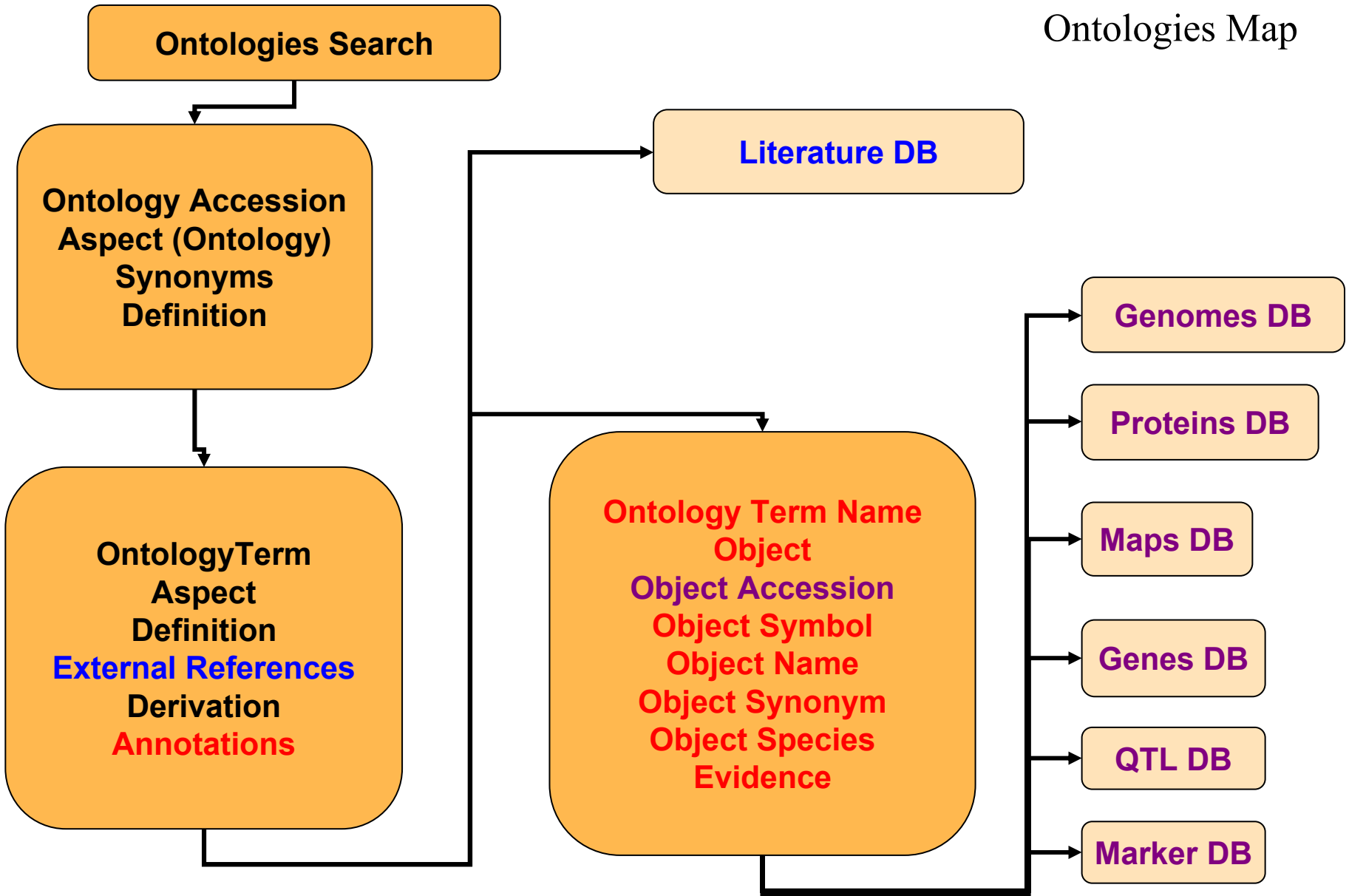
The hand icon indicates a link that allows you to go to the same page in your web browser.



If you are viewing this tutorial with Adobe Acrobat Reader, click the "bookmarks" on the left hand side of the Reader for easier navigation.

Action Options are noted in this type of font.

*Notes or comments use this style font.*





# Gramene Home Page

**GRAMENE**

*A Resource for Comparative Grass Genomics*

v20 (March 2006)

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## Quick Search

Set

## Have Questions?

- Gramene navigation for every module.
- Ask questions through [Feedback](#) or [Email](#)



## Gramene Tips:

The SSR Marker Search is listed under the Marker database.

[All Tips](#)

[Genomes-Ensembl](#)  
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## Quick Start

Access annotated genomes for [Rice](#), [Maize](#) & [Arabidopsis](#); Look for [rice/maize](#) search with [GrameneMart](#); Search for sequence alignment with [BLAST](#) or [BLAT](#).

Search for [Protein](#) or [ProSite](#) or Browse by Gene Ontology using [GO Slim](#).

View [physical maps](#) for [Rice](#), [Maize](#), [Wheat](#), [Barley](#), [Oats](#), [Sorghum](#), and [Others](#) ([Map](#)) to compare maps of different species.

Click here to open ontology search

- **MOLECULAR IDENTIFICATION:** Search for [SSR](#) (Simple Sequence Repeat) at Identification Tool ([SSRIT](#)); or [SSR](#) search by [Species](#) ([SSR Search](#)) for [Rice](#), [Sorghum](#) and [Others](#).
- **TRAITS:** Search the [Genes](#) or [QTL](#) database for important phenotype-related loci such as [Rice Genes](#), [Rice QTL](#), [Maize QTL](#). Don't forget to explore traits in [Ontologies](#).
- **LITERATURE:** Search the literature for your friends and topics of interest.
- **SUBMISSION:** Submit a [Rice Gene](#) or [Ontology Term](#) to Gramene.

## Featured News

- Gramene Release 20 for March 2006. See the [release notes](#).
- [Gramene News Archive](#)
- RTWG [Gramene workshop materials](#) are available.
- [Rice News Worldwide](#) from IRRI

## Visit with us at

- [48th Maize Genetics Conference](#), March 9-12, 2006, Asilomar, Pacific Grove, CA

[Gramene Calendar](#)

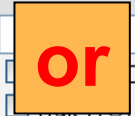


# Ontology Home Page

[Current Ontologies](#) | [Documentation](#) | [Evidence code](#) | [FTP](#) | [Ontology suggestion](#) | [Associations](#) | [Publications](#) | [Tutorial](#) | [FAQ](#) | [HELP](#)

## Ontology Database

Type ID or keyword to search



- Plant structure (PO)
- Growth stage (GRO)
- Environment (ENV)
- Taxonomy (GR\_tax)

Search Clear

[e.g. flower or TO:0000303]

1. Click on "Current Ontologies" to browse terms

2. Type term name and click search. (option- to limit a search, click box of desired ontology type)

Click here if you need more help on Ontology



Searches can be limited by checking any one or more of the ontologies listed below the text search box.

For more information on each ontology type please visit the [current ontologies](#) section. You may like to [browse the tutorial](#) to learn more about the ontologies and how to use the database or may like to seek the [help document](#).

The ontology database aims to provide a collective resource for structured controlled vocabularies (Ontologies) for the following knowledge domains and their associations to various objects such as QTL, phenotype gene, proteins and Ensembl rice genes.

- ◆ Plant Ontology (PO)
  - ◇ Plant Structure (morphology, organs, tissue and cell types)\*
  - ◇ Growth stages (plant growth and developmental stages)
- ◆ Trait Ontology (TO)
  - ◇ Plant traits and phenotypes
- ◆ Gene Ontology (GO)\*\*
  - ◇ Molecular function
  - ◇ Biological process
  - ◇ Cellular component

Click on the links of the ontologies to learn more about their use and key concepts.



# Browsing the Ontology Database

[Current Ontologies](#) | [Documentation](#) | [Evidence code](#) | [FTP](#) | [Ontology suggestion](#) | [Associations](#) | [Publications](#) | [Tutorial](#) | [FAQ](#) | [HELP](#)

Current Ontologies	Browse	Download
<b>Trait Ontology™ (TO)</b> It is a controlled vocabulary to describe each trait as a distinguishable feature, characteristic, quality or phenotypic feature of a developing or mature individual. Examples are glutinous endosperm, disease resistance, plant height, photosensitivity, male sterility, etc.	<a href="#">BROWSE</a>	<a href="#">Ontology</a> <a href="#">Definitions</a>
<b>Gene Ontology™ (GO)</b> Developed by the <a href="#">Gene Ontology Consortium</a> to help annotate information on gene products (not the genes) using the following three organizing principles of molecular function, biological process and cellular component. Copyright © Gene Ontology Consortium. <b>Molecular Function:</b> The tasks performed by individual gene products; example is Rubisco <b>Biological Process:</b> Broad biological goals, such as photosynthesis or ripening, that are accomplished by ordered assemblies of molecular functions. <b>Cellular Component:</b> Subcellular structures, locations, and macromolecular complexes; examples include chloroplast, etc.	<a href="#">BROWSE</a>	<a href="#">Definitions (combined)</a> <a href="#">Ontology</a> <a href="#">Ontology</a> <a href="#">Ontology</a>
<b>Plant Ontology™ (PO)</b> Gramene is collaborating with The Plant Ontology Consortium ( <a href="#">POC</a> ) to develop a controlled vocabulary for plant structure and development. <b>Plant Structure (PO):</b> The controlled vocabulary of plant structures representing organs, tissue and cell types such as leaf, stem, root, seed, fruit, flower, petal, sepal, parenchyma, guard cell, etc. <b>Cereal Plant Growth Stages (GR0):</b> The controlled vocabulary of growth and developmental stages in various cereal crops such as rice, maize, sorghum, wheat, oat and barley.	<a href="#">BROWSE</a>	<a href="#">Ontology</a> <a href="#">Definitions</a> <a href="#">Ontology</a> <a href="#">Definitions</a>
<b>Environment Ontology (E0)</b> It represents a controlled vocabulary to describe different types of supplemental environments that have been reported in the experimental profiles of gene expression and phenotype (mutant and QTL) studies on cereal plants.	<a href="#">BROWSE</a>	<a href="#">Ontology</a>
<b>Taxonomy Ontology (GR_tax)</b> It is a representation of the taxonomy tree in the ontology format. Each term in this ontology can represent subspecies, species, genus, order, class or any rank in the classification. Primarily derived from NCBI Taxonomy, the revisions were made as and when/where required in the rankings. The rank of genome types was added by this project. This taxonomy ontology focuses on the Poaceae (Gramineae) family of plant taxonomy only.	<a href="#">BROWSE</a>	<a href="#">Ontology</a>

3. Click on "BROWSE" to navigate through the desired ontology type.



# Searching the Ontology Database

Type your query  
e.g. Example is a search for  
function alpha-amylase

[Current Ontologies](#) | [Documentation](#) | [Evidence code](#) | [Ontology suggestion](#) | [Associations](#) | [Publications](#) | [Tutorial](#) | [FAQ](#) | [HELP](#)

**Ontology Database**

Type ID or keyword to search

select ontology (optional)

Gene (GO)  Plant structure (PO)  Growth stage (GRO)  
 Trait (TO)  Environment (EO)  Taxonomy (GR\_tax)

[e.g. [flower](#) or [TO:0000303](#)]

Click search

Select "Gene Ontology" to search the GO database (or select one or more others appropriate to your term.) (Molecular Function is part of Gene Ontology)



# Gene Ontology (GO) search results

Exact ontology term

Definition of the ontology term

## Summary for *alpha-amylase*

Items 1 to 4 of 4

#	Term Accession	Aspect	Term Name	Synonym	Definition
1	<a href="#">GO:0004566</a>	Molecular Function	<b>alpha-amylase</b> activity	None	Catalysis of the endohydrolysis of 1,4-alpha-D-glucosidic linkages in polysaccharides containing three or more 1,4-alpha-linked D-glucose units.
2	<a href="#">GO:0004574</a>	Molecular Function	oligo-1,6-glucosidase activity	sucrase-isomaltase	Catalysis of the hydrolysis of 1,6-alpha-D-glucosidic linkages in some oligosaccharides produced from starch and glycogen by <b>alpha-amylase</b> , and in isomaltose.
3	<a href="#">GO:0015066</a>	Molecular Function	<b>alpha-amylase</b> inhibitor activity	None	Stops, prevents or reduces the activity of <b>alpha-amylase</b> .
4	<a href="#">GO:0030157</a>	Biological Process	pancreatic juice secretion	None	The regulated release of pancreatic juice by the exocrine pancreas into the upper part of the intestine. Pancreatic juice is slightly alkaline and contains numerous enzymes and inactive enzyme precursors including <b>alpha-amylase</b> , chymotrypsinogen, lipase, proelastase, propeptidase, procarboxypeptidase, proelastase, prophospholipase A2, ribonuclease, and trypsinogen. Its concentration of bicarbonate ions helps to neutralize the acid from the stomach.

Ontology Accession for the ontology term. Select to view detailed information.

Synonyms (if any)





# Ontology Term Accession Detail

Exact ontology term

Definition of the term

## Summary for GO Term: *alpha-amylase activity* (GO:0004556)

Term Name	alpha-amylase activity
Aspect	Molecular Function
Definition	Catalysis of the endohydrolysis of 1,4-alpha-D-glucosidic linkages in polysaccharides containing
External References	EC:3.2.1.1 EC:3.2.1.1 MetaCyc:3.2.1.1-RXN
Derivation	

External references used for defining or associated to synonyms

The lineage of alpha-amylase activity as a molecular function

Term-term relationship

[i]: IS A (type of)

- [GO:0003674](#) #90530 +
- [Hydrolase activity \(GO:0003824\)](#) #39336 +
- [Hydrolase activity \(GO:0016787\)](#) #12313 +
- [Hydrolase activity, acting on glycosyl bonds \(GO:0016798\)](#) #1400 +
  - [i] [hydrolase activity, hydrolyzing O-glycosyl compounds \(GO:0004553\)](#) #1304 +
    - [i] [amylase activity \(GO:0016160\)](#) #169 +
      - [i] [alpha-amylase activity \(GO:0004556\)](#) #101

+ Expandable tree. Click on term to expand.

Total Number of Annotations:	101 objects, 101 associations
Ensembl maize gene:	1 zea mays Ensembl maize gene
Ensembl gene:	16 oryza sativa Ensembl genes
protein:	84 proteins (oryza sativa(1), oryza sativa subsp. indica(1), oryza sativa subsp. indica cultivar-group)(17), sorghum bicolor(2), triticum aestivum(18), zea mays(10))

Number of database objects associated in the database with this term.

More information can be found at the [GO browser of Gene Ontology Database](#).

Click on link to get a complete list of set of genes/proteins/QTL/maps etc. that may be associated with the given ontology term (see next slide for oryza sativa example.)

Links to source that originally developed this ontology.

Clicking on the active column headers will sort by that column



# Ontology Associations

Term [alpha-amylase activity \(GO:0004556\)](#) Associations

Items 1 to 16 of 16

Download

Term Name	Object Type	Object Accession ID	Object Symbol	Object Name	Object Synonym	Object Species	Evidence
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os01g51760</a>	<a href="#">LOC_Os01g51760</a>	alpha-amylase		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os02g32660</a>	<a href="#">LOC_Os02g32660</a>	1,4-alpha-glucan branching enzyme iib, chloroprecursor (q-enzyme); 1,4-alpha-glucan branching enzyme precursor (rice)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os02g52700</a>	<a href="#">LOC_Os02g52700</a>	Alpha-amylase		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os02g52710</a>	<a href="#">LOC_Os02g52710</a>	Alpha-amylase		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>				alpha-dextrin endo-1,6-alpha-glucosidase		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>				, catalytic domain		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>				beta starch debranching enzyme ISO2		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>				isozyme 2a precursor (ec 3.2.1.1)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>				(1,4-alpha-D-glucanglucanohydrolase)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os06g51080</a>	<a href="#">LOC_Os06g51080</a>	1,4-alpha-glucan branching enzyme iib, chloroprecursor(ec 2.4.1.18) (starch branching enzyme precursor (rice); 1,4-alpha-glucan branching enzyme precursor (rice)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os08g32660</a>	<a href="#">LOC_Os08g32660</a>	1,4-alpha-glucan branching enzyme iib, chloroprecursor (ec 3.2.1.18) (starch branching enzyme precursor (rice); 1,4-alpha-glucan branching enzyme precursor (rice)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os08g32660</a>	<a href="#">LOC_Os08g32660</a>	1,4-alpha-glucan branching enzyme iib, chloroprecursor (ec 3.2.1.18) (starch branching enzyme precursor (rice); 1,4-alpha-glucan branching enzyme precursor (rice)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os08g42660</a>	<a href="#">LOC_Os08g42660</a>	1,4-alpha-glucan branching enzyme iib, chloroprecursor (ec 3.2.1.18) (starch branching enzyme precursor (rice); 1,4-alpha-glucan branching enzyme precursor (rice)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os09g28420</a>	<a href="#">LOC_Os09g28420</a>	alpha-amylase isozyme 3b precursor (ec 3.2.1.1) (1,4-alpha-d-glucanglucanohydrolase)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os09g28430</a>	<a href="#">LOC_Os09g28430</a>	alpha-amylase isozyme 3c precursor (ec 3.2.1.1) (1,4-alpha-d-glucanglucanohydrolase)		Oryza sativa	<a href="#">IEA</a>
<a href="#">alpha-amylase activity</a>	Ensembl gene	<a href="#">LOC_Os09g29410</a>	<a href="#">LOC_Os09g29410</a>	isoamylase-type starch debranching enzyme ISO3		Oryza sativa	<a href="#">IEA</a>

Click to download a zip file with tab delimited list of associations

The term and its children (indirectly associated to parent term if any) for which the object type was annotated

Method used to ascertain this association. Click on code for description.

Links to the original entry in Gramene database. Click for TIGR gene report in Gramene.

## Searching other ontologies

Previous slides presented the gene ontology (GO) example. The same procedure must be followed if you would like to search other ontologies.

The following table suggests the type of objects that are associated with different types of ontologies:

Ontology	Associated object types
Gene Ontology	Ensembl rice genes (from rice genome assembly) Proteins from SWISSPROT-TrEMBL
Plant Ontology Plant structure or anatomy (PO) Cereal plant growth stages (GRO)	phenotype genes phenotype genes
Trait Ontology	Phenotype genes QTL
Environment Ontology	Coming soon
Gramene Taxonomy Ontology	Proteins from SWISSPROT-TrEMBL QTL Map sets

Click to learn about evidence used to make associations of ontology terms with different data types



## Other Options From Ontologies

Click to browse the frequently asked questions or access tutorial or help files.

[Documentation](#) | [Evidence code](#) | [FTP](#) | [Ontology suggestion](#) | [Associations](#) | [Publications](#) | [Tutorial](#) | [FAQ](#) | [HELP](#)

<b>Documentation</b>	More information on ontology, their structure, concepts and help on how to search <a href="#">[VIEW]</a> <a href="#">Release notes</a>
<b>Evidence codes</b>	Defines the <b>evidence codes</b> and explains how they are used for PO annotation of genes/gene products/phenotypes
<b>FTP archive</b>	Anonymous user access to Plant Ontology archive is at <a href="ftp://ftp.gramene.org/pub/gramene/CURRENT_RELEASE/ftp_archive/">ftp://ftp.gramene.org/pub/gramene/CURRENT_RELEASE/ftp_archive/</a> The ontology files are organized by ontology type(s).
<b>Ontology submission</b>	Any suggestions for the addition, replacement or modification of the controlled vocabulary can be made via a web based <a href="#">SUBMISSION FORM</a> or by using a <a href="#">PDF</a> of the form. If you have problems look for Submission help document.
<b>Associations</b>	Gene ontology associations based on Gramene curation and <b>Interpro</b> assignments. Results available at: <ul style="list-style-type: none"> <li>• Gramene <a href="#">[view]</a></li> <li>• Gene Ontology Consortium <a href="#">[view]</a> - <a href="#">[download]</a></li> <li>• Plant Gene Ontology associations <a href="#">[view]</a></li> </ul>
<b>Publications</b>	Gramene development and integration of trait and gene ontologies for rice <a href="#">Genome and Functional Genomics</a> , 2002, Vol 3(2), April, 2002 <a href="#">[Abstract]</a> <a href="#">[Full Text]</a> Gene Ontology™ Consortium and Plant Ontologies <a href="#">Genome and Functional Genomics</a> , 2002, Vol 3(2), April, 2002 <a href="#">[Abstract]</a> <a href="#">[Full Text]</a> Gene ontology resource: design and implementation. <a href="#">Genome Research</a> , 2001, Vol 11(8), 1425-1433 <a href="#">[Abstract]</a> <a href="#">[Full Text]</a> Gene Ontology: tool for the unification of biology. <a href="#">Nature Genetics</a> , 2000, 25: 25-29 <a href="#">[Abstract]</a> <a href="#">[Full Text]</a>

Click to access download instructions

Click to download the associations

*Learn more about Gramene ontologies*

Click to submit your ontology suggestions

*Learn more about ontologies from these publications*



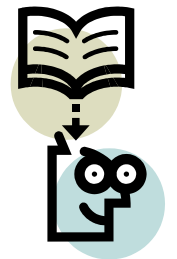
# Action Steps: Things you can do

## 1) Make Suggestions

- Send us your review of the terms, definitions and relationships to ensure accuracy.
- Suggest new terms, definitions, or improvements to current structures.
- If you find incorrect associations, let us know.

## 2) Use Ontologies

- Use current ontology terms in describing your data in publications and databases.
- If your project on cereal plants (especially rice [Oryza]) is generating data sets that may require these kinds of annotations and associations, we will be happy to help guide you through the annotation process and in setting up an Ontology database.



# Contact Gramene



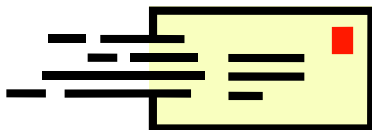
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