Expanding the Plant Ontology to include non-vascular plants:

Linking anatomical structures to *Physcomitrella patens* gene annotations

Plant Ontology Consortium Members and Curators*:

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Maria A. Gandolfo: Department of Plant Biology, Cornell University, Ithaca, NY

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Chris Mungall: Gene Ontology, Lawrence Berkeley National Lab, Berkeley, CA
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www.plantontology.org

Agenda and Goals:

- Overview of the Plant Ontology and its principles (Laurel)

- How to navigate the PO site, download the ontology, request new terms and use editing software- (Ramona)

- Demonstrate new terms and changes that have been made to accommodate mosses- (Ramona)

- Illustrate the annotations and demonstrate the utility of linking to the PO terms (Laurel)

- Encourage continued cooperation and collaboration between our groups (All)

The Plant Ontology

What is the Plant Ontology?

• A controlled vocabulary (ontology) that describes plant anatomical and morphological structures and growth and developmental stages for all plants.

• The goal of the PO is to establish a framework for meaningful cross-species queries across gene expression and phenotype datasets from plant genomics and genetics experiments.

Plant Anatomy Ontology (PAO):

• Botanical terms describing plant structures and other antomical entities and the relationships between them

• eg. plant organ, plant cell, whole plant, portion of plant tissue, vascular system, etc.

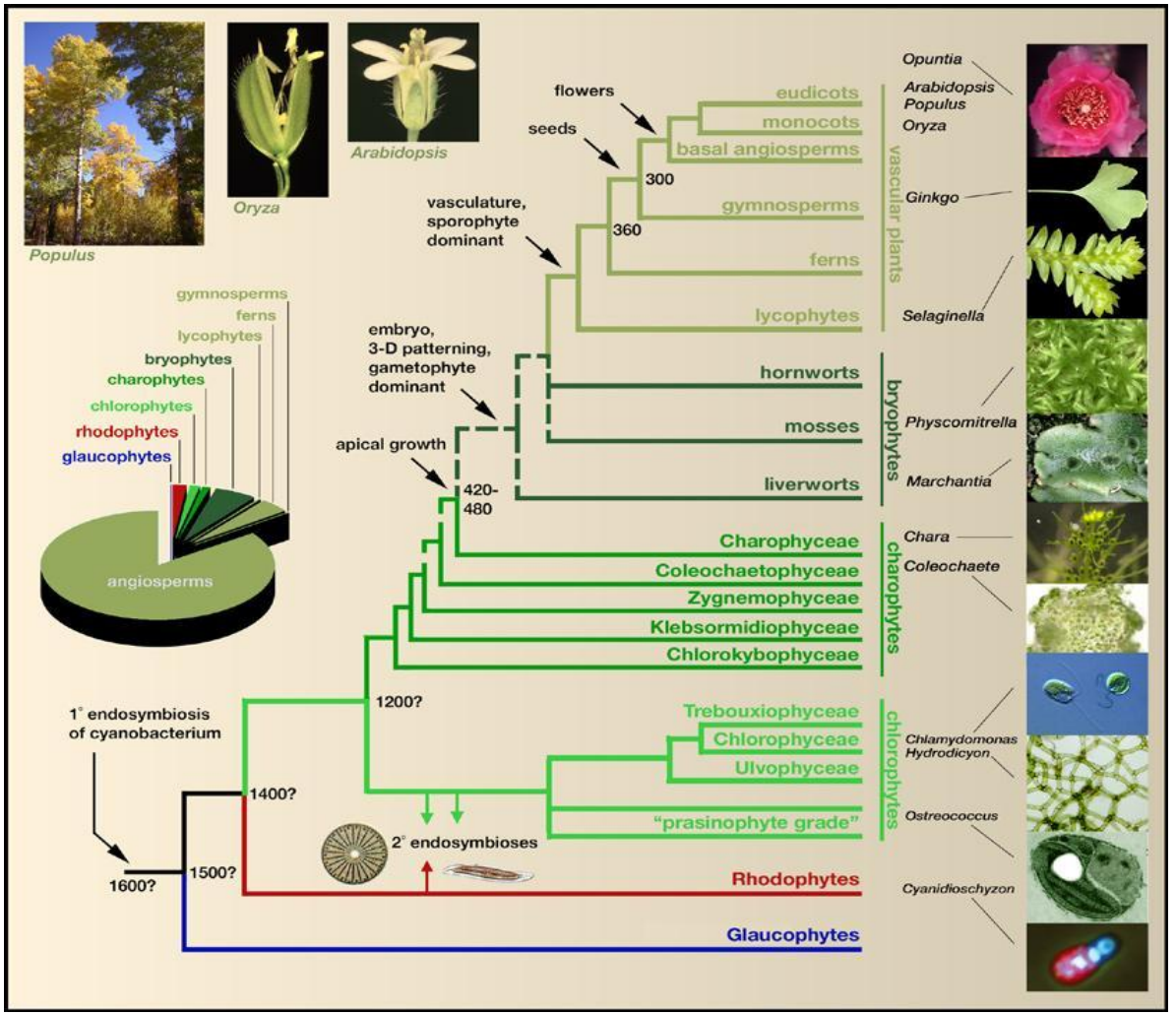
Plant Growth and Developmental Stage Ontology (PGDSO):

•Terms describe (i) whole plant growth stages and (ii) plant structure developmental stages

• eg. seedling growth, rosette growth, leaf development stages, embryo development stages, flower development stages, etc.

Challenges in expanding the Plant Ontology to covers all plants:

Diversity in anatomy, morphology, life cycles, growth patterns



Seed plants
(Angiosperms and Gymnosperms)

Pteridophytes
(Ferns and Lycopods)

Bryophytes
(Mosses, Hornworts and Liverworts)

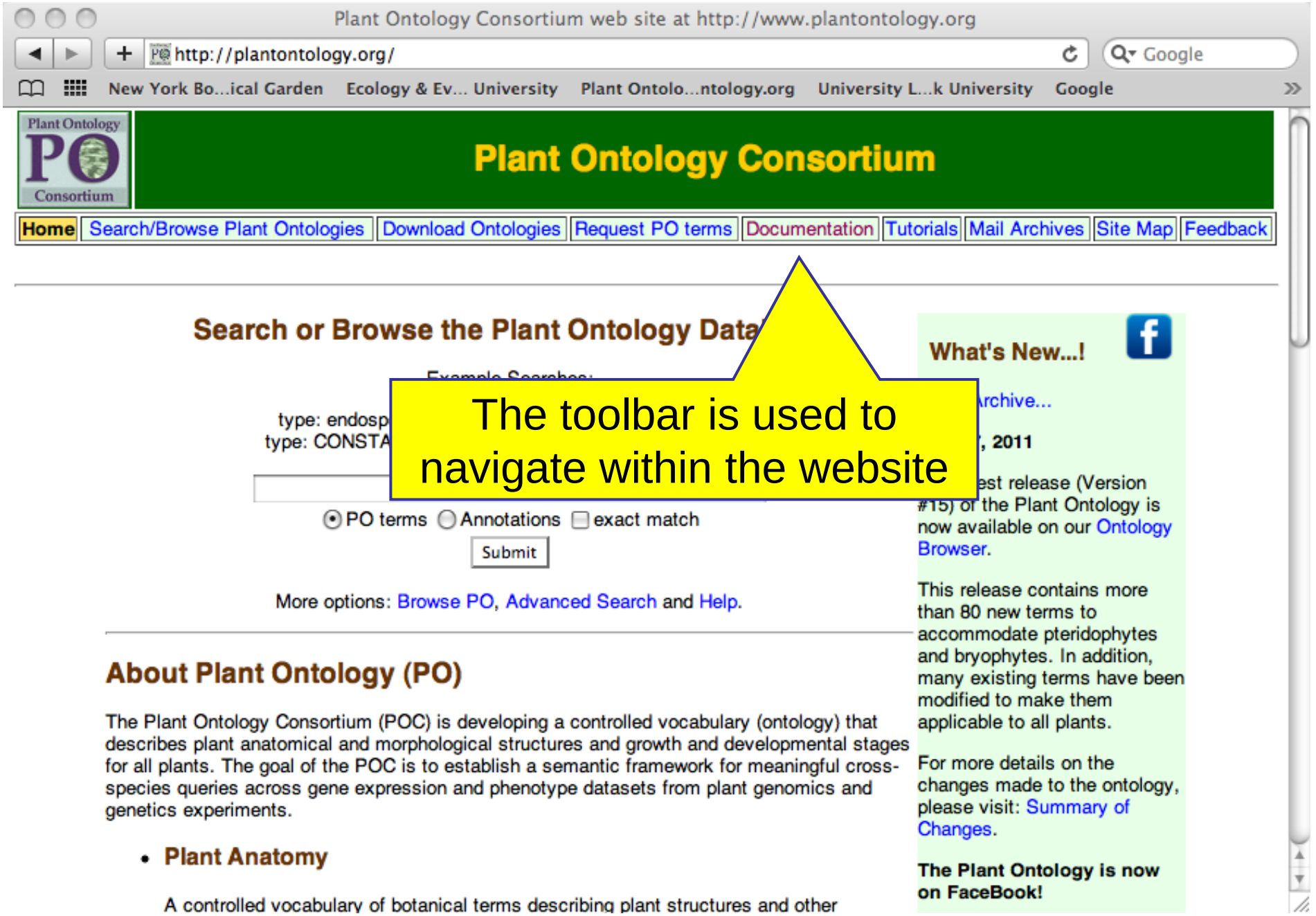
Algae

Bowman et al, Cell, 2007

How to:

- Navigate the PO site
- Download ontology files
- Request new terms
- View the OBO file

Navigation


Plant Ontology Consortium web site at http://www.plantontology.org
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Ecology & Ev... University
Plant Ontolo...ntology.org
University L...k University
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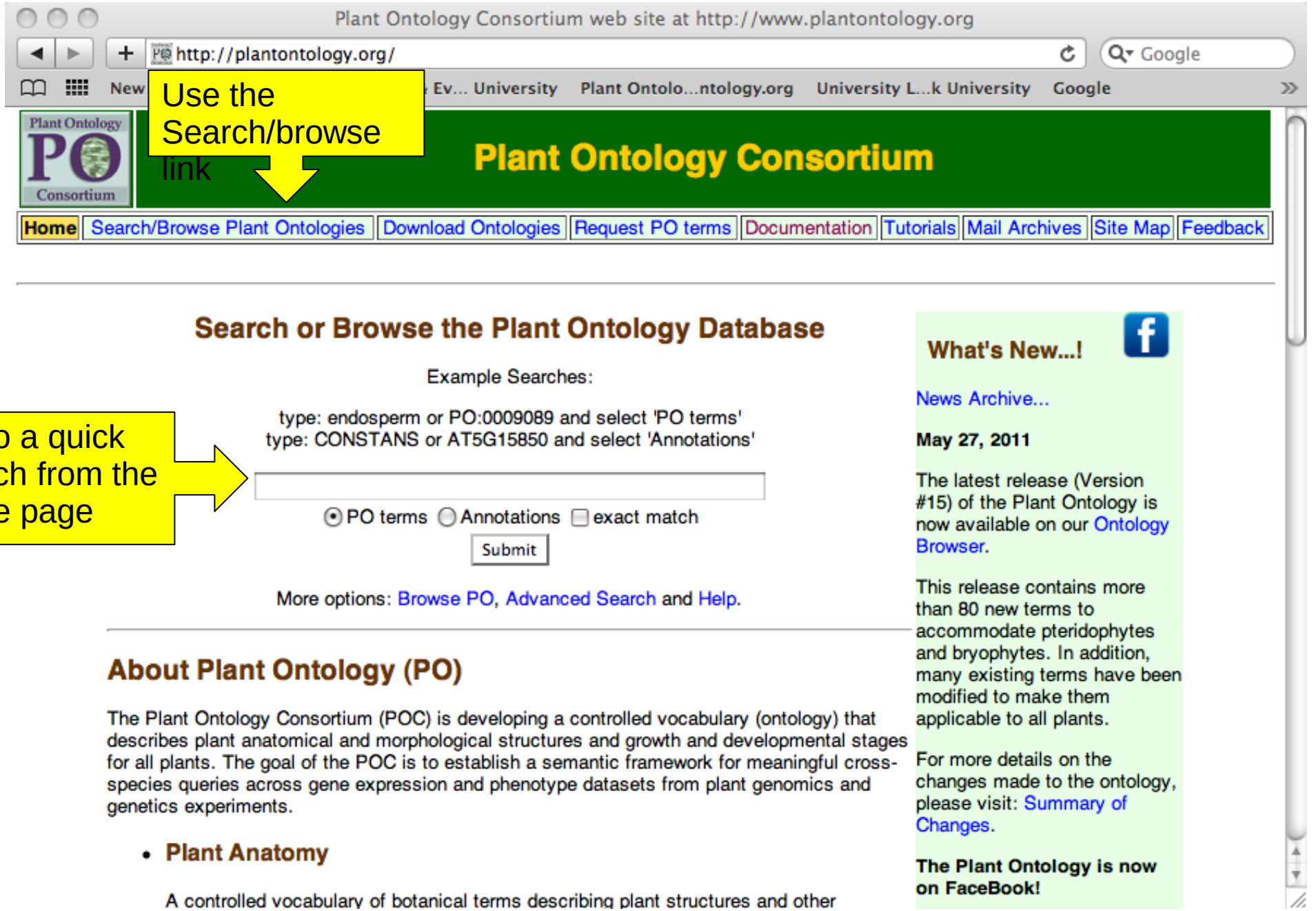
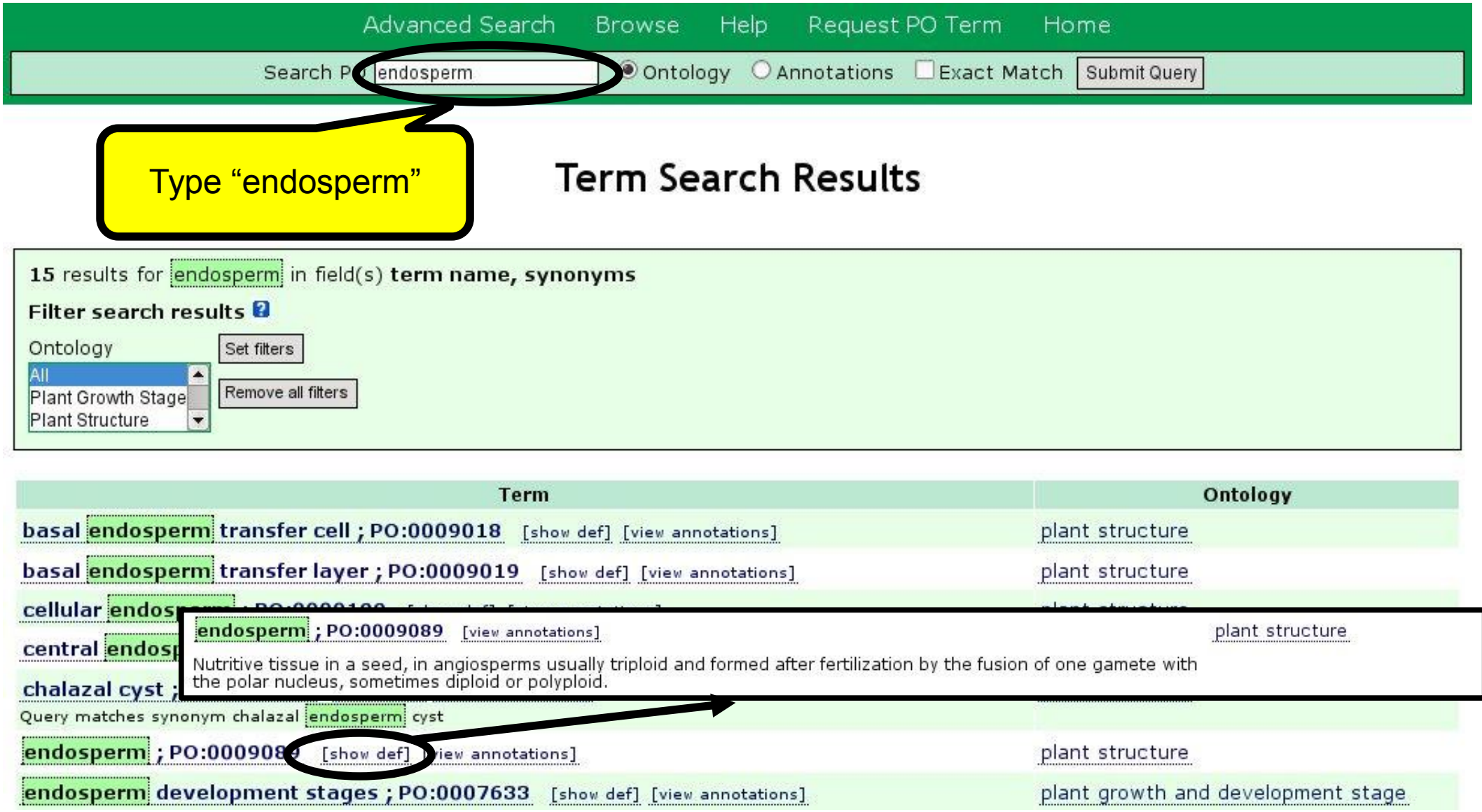
type: endosp
type: CONSTA
PO terms
Annotations
exact match
Submit
More options: Browse PO, Advanced Search and Help.
The toolbar is used to navigate within the website
What's New...!
About Plant Ontology (PO)
The Plant Ontology Consortium (POC) is developing a controlled vocabulary (ontology) that describes plant anatomical and morphological structures and growth and developmental stages for all plants. The goal of the POC is to establish a semantic framework for meaningful cross-species queries across gene expression and phenotype datasets from plant genomics and genetics experiments.
Plant Anatomy
A controlled vocabulary of botanical terms describing plant structures and other
Archive...
, 2011
est release (Version #15) of the Plant Ontology is now available on our Ontology Browser.
This release contains more than 80 new terms to accommodate pteridophytes and bryophytes. In addition, many existing terms have been modified to make them applicable to all plants.
For more details on the changes made to the ontology, please visit: Summary of Changes.
The Plant Ontology is now on FaceBook!

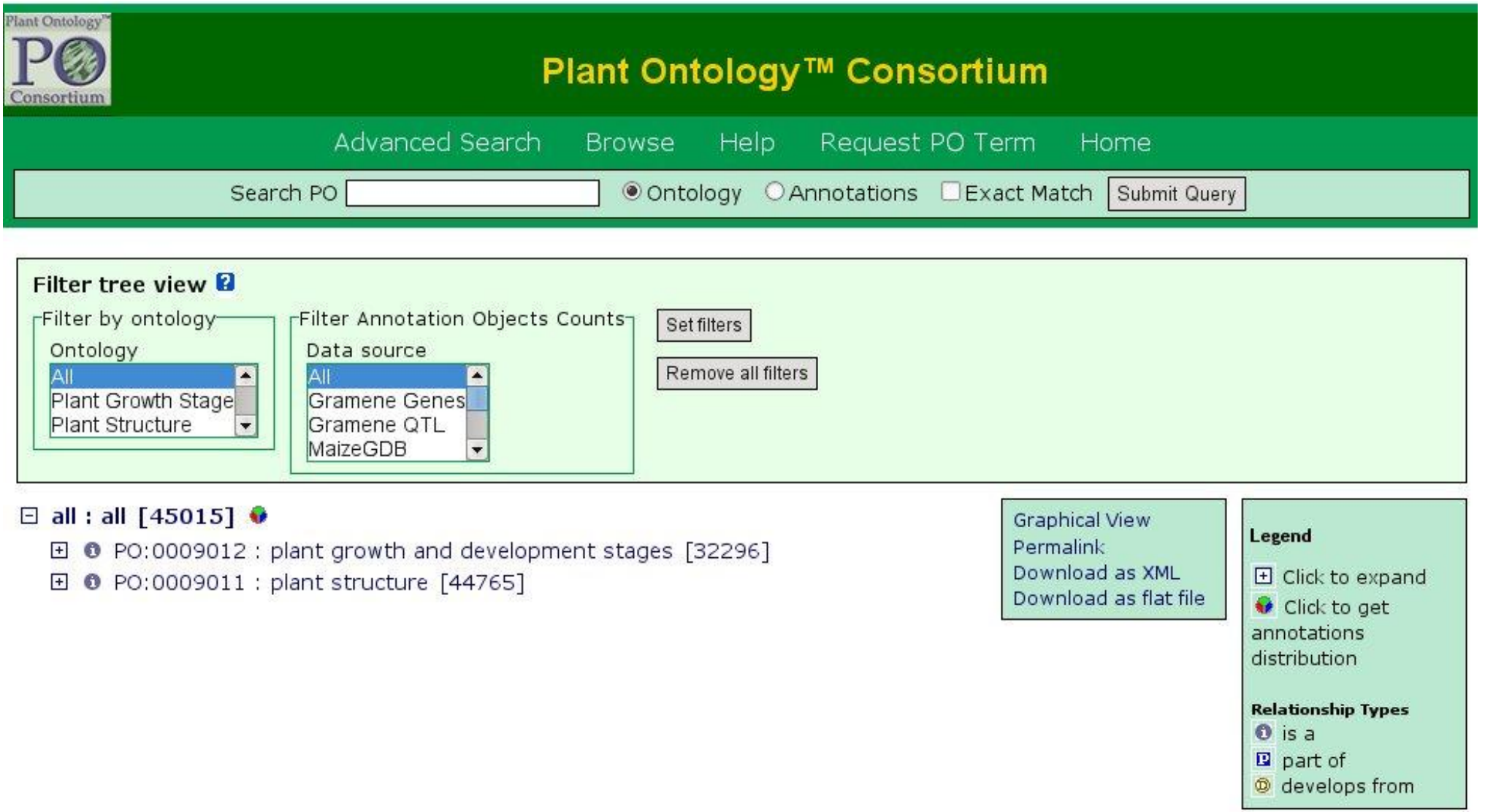
Browse or search the PO web site for ontology terms or annotations



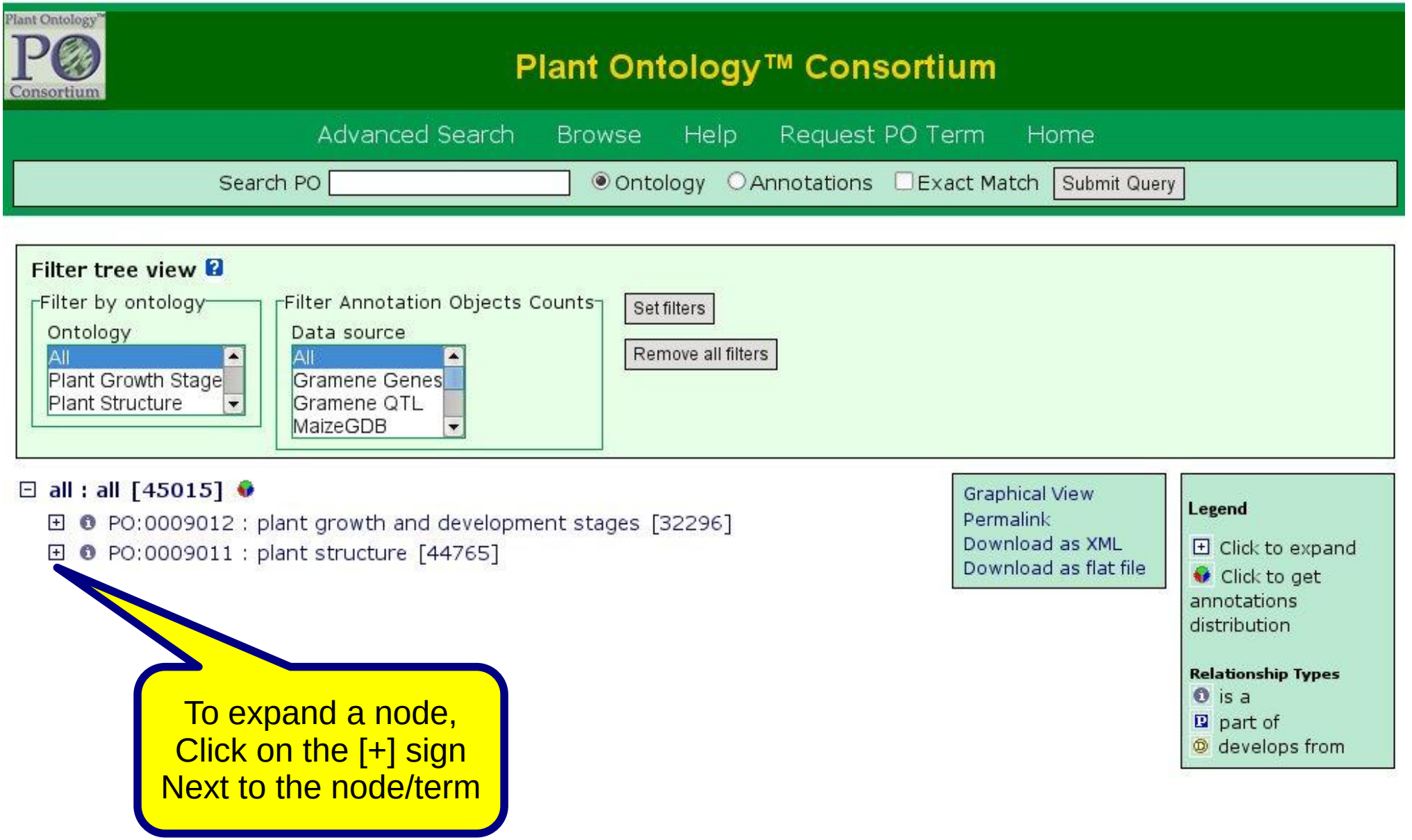
Term search


Advanced Search
Browse
Help
Request PO Term
Home
Search P
endosperm
Ontology
Annotations
Exact Match
Submit Query
Type “endosperm”
Term Search Results
15 results for endosperm in field(s) term name, synonyms
Filter search results
Ontology
Set filters
All
Plant Growth Stage
Plant Structure
Remove all filters
Term
Ontology
basal endosperm transfer cell ; PO:0009018 [show def] [view annotations]
plant structure
basal endosperm transfer layer ; PO:0009019 [show def] [view annotations]
plant structure
cellular endos
central endosp
chalazal cyst ;
endosperm ; PO:0009089 [view annotations]
plant structure
Nutritive tissue in a seed, in angiosperms usually triploid and formed after fertilization by the fusion of one gamete with the polar nucleus, sometimes diploid or polyploid.
Query matches synonym chalazal endosperm cyst
endosperm ; PO:0009089 [show def] [view annotations]
plant structure
endosperm development stages ; PO:0007633 [show def] [view annotations]
plant growth and development stage

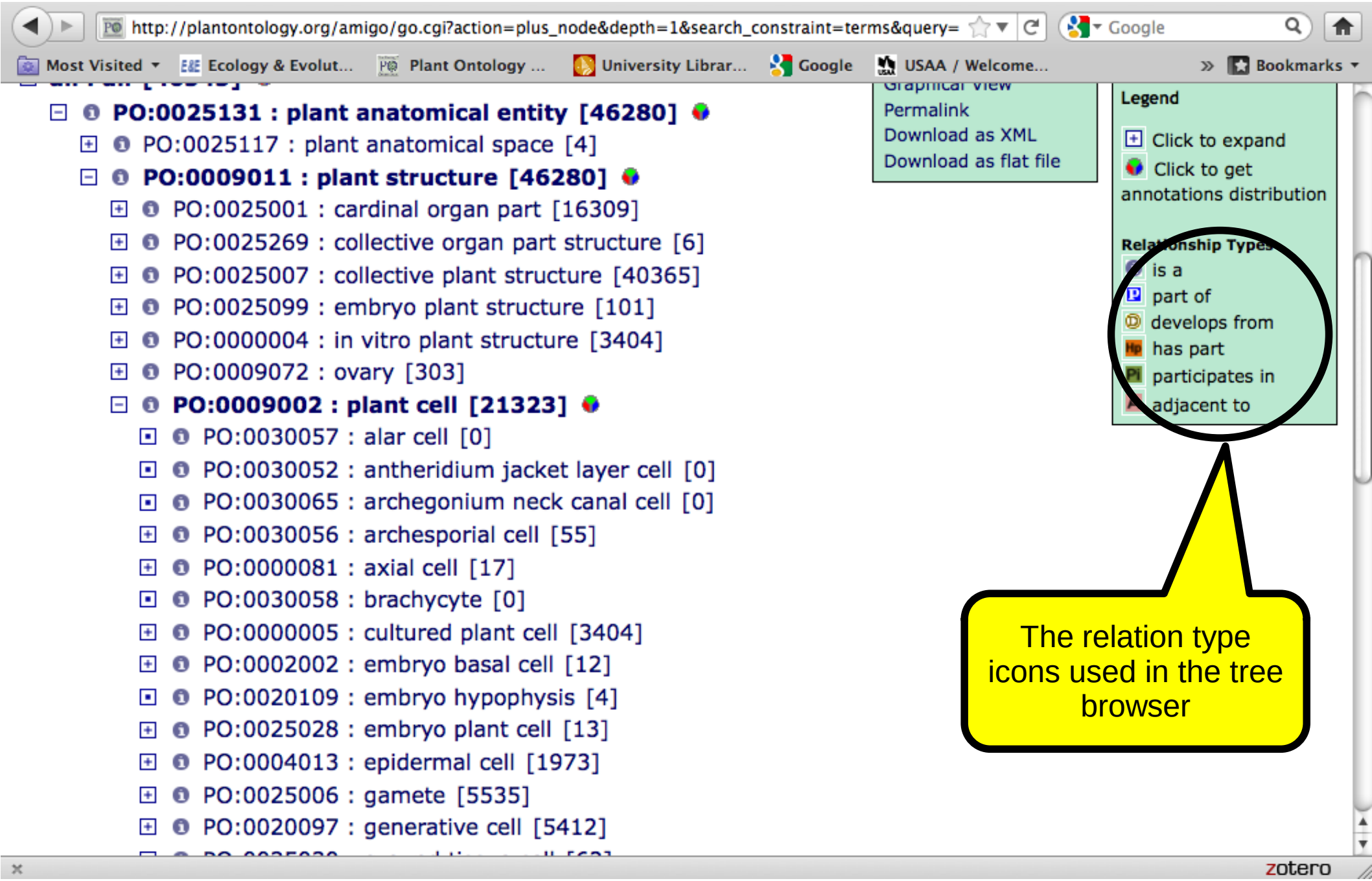
Browsing the ontologies



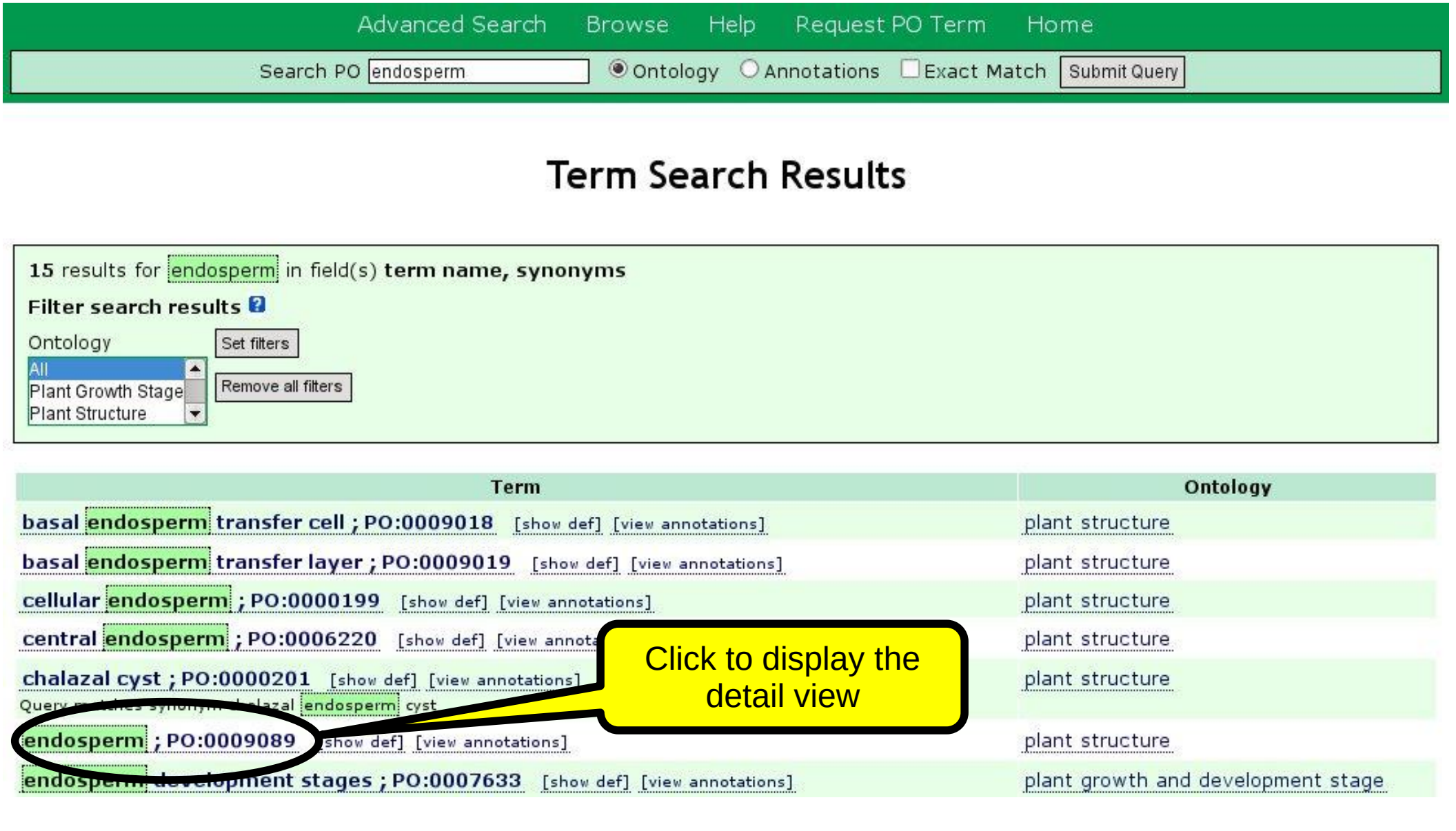
Expanding nodes



Relationship types



Term detail view



Term detail view

endosperm

Term information ⬇ Term lineage ⬇ External references ⬇ Term annotations ➡

Term Information

Accession PO:0009089

Ontology plant structure

Synonyms None

Definition Nutritive tissue in a seed, in angiosperms usually triploid and formed after fertilization by the fusion of one gamete with the polar nucleus, sometimes diploid or polyploid. [source: APWeb:Glossary, GR:pj]

Comment None

Back to top

Term Lineage

Filter tree view

Filter Annotation Objects Counts

Data source: All, Gramene Genes, Gramene QTL, MaizeGDB

Term View Options: Term ancestors / Term parents, siblings and children

Set filters | Remove all filters

all : all [45015]
- PO:0009011 : plant structure [44765]
  - PO:0009003 : sporophyte [39836]
    - PO:0006342 : infructescence [23763]
      - PO:0009001 : fruit [23762]
        - PO:0009010 : seed [21059]
          - **PO:0009089 : endosperm [1732]**
    - PO:0009010 : seed [21059]
      - **PO:0009089 : endosperm [1732]**
  - PO:0009007 : tissue [17491]
    - **PO:0009089 : endosperm [1732]**

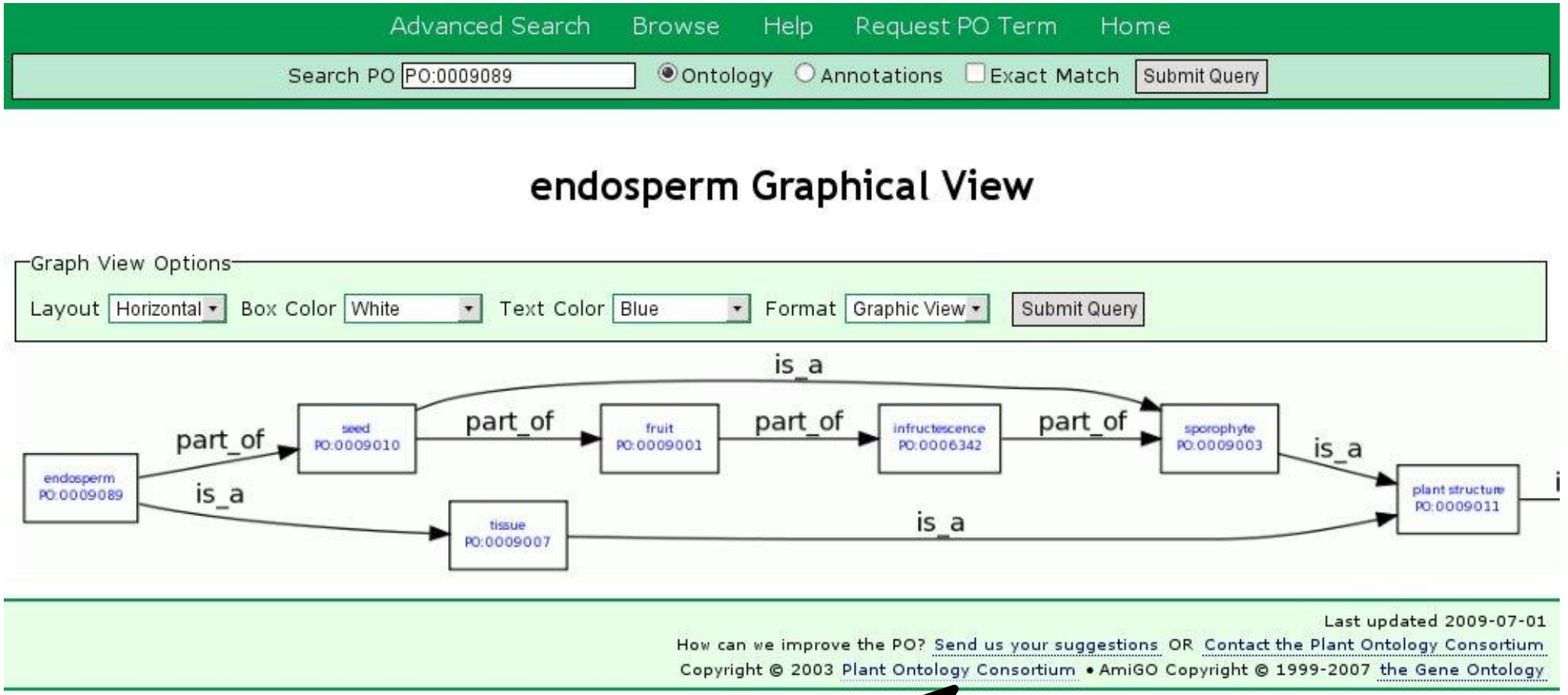
Graphical View
View in tree browser

Legend
Click to expand
Click to get annotations distribution
Relationship Types
is a
part of
develops from

To view the term lineage in a graphical format click on the Graphical View link

Plant Ontology™ PO Consortium

Graphical view



Layout can be changed to horizontal
or colors can be changed

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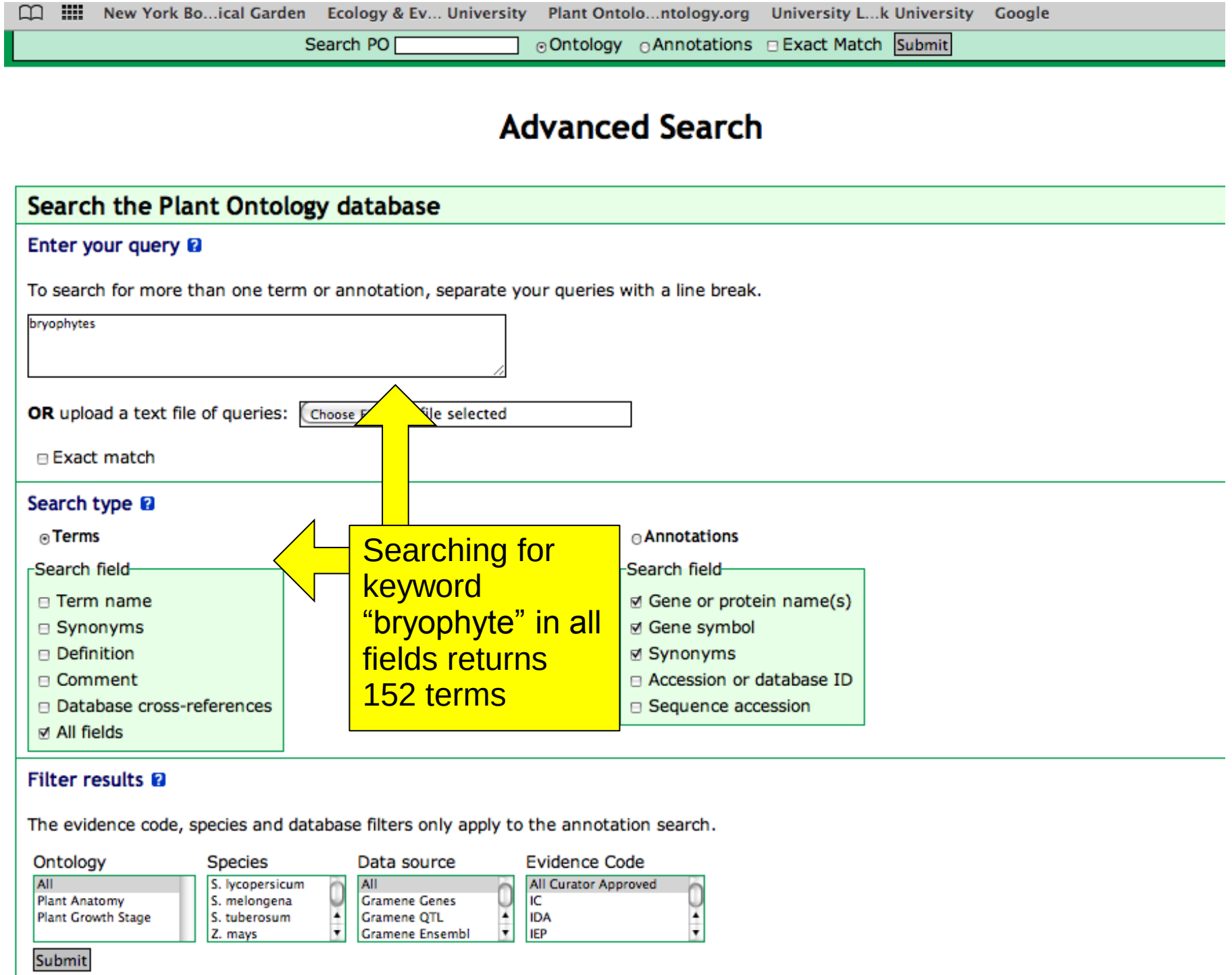
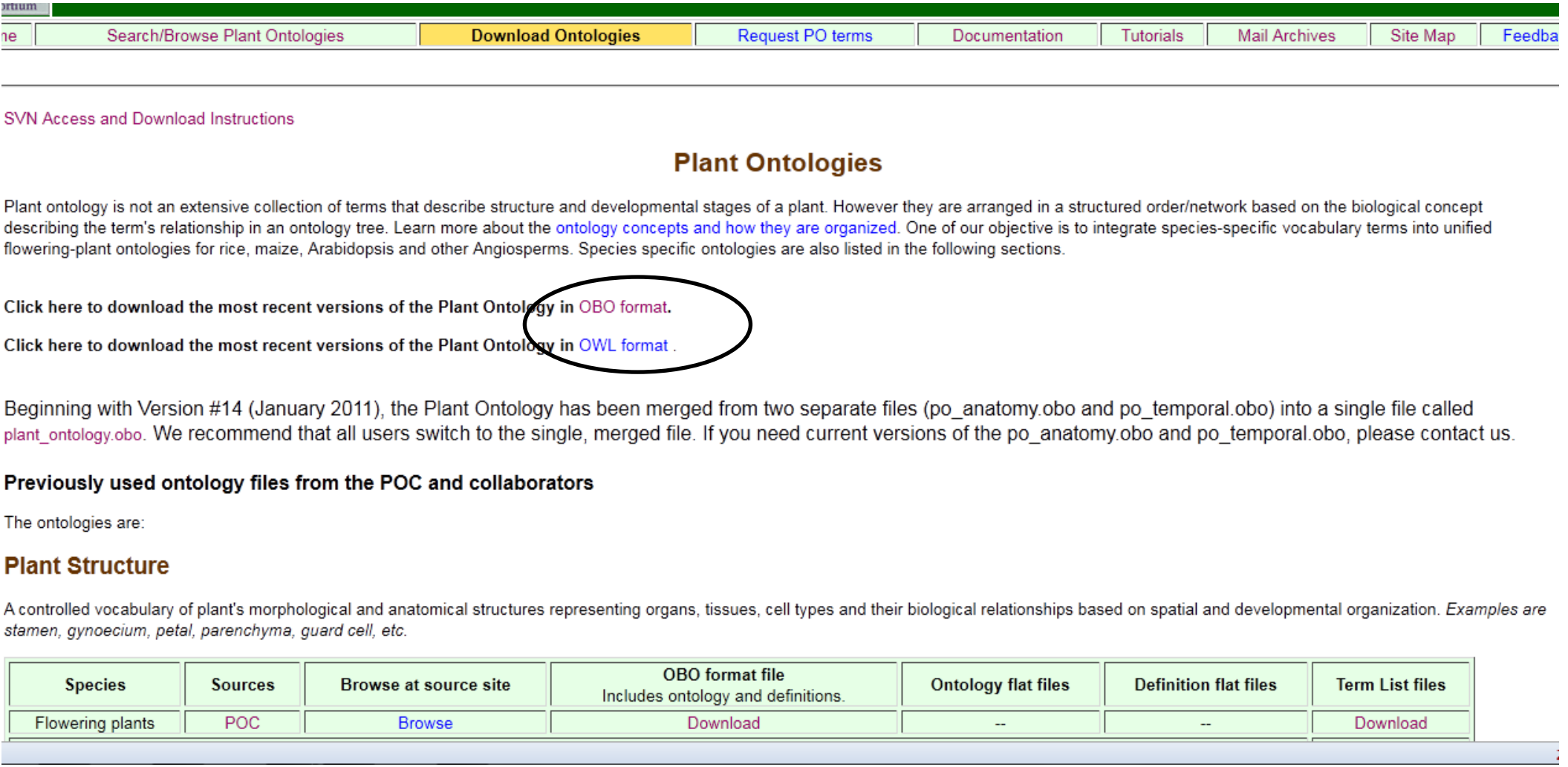
Use advanced search to find terms used for mosses



Downloading the Ontology File



ne | Search/Browse Plant Ontologies | **Download Ontologies** | Request PO terms | Documentation | Tutorials | Mail Archives | Site Map | Feedba

SVN Access and Download Instructions

Plant Ontologies

Plant ontology is not an extensive collection of terms that describe structure and developmental stages of a plant. However they are arranged in a structured order/network based on the biological concept describing the term's relationship in an ontology tree. Learn more about the ontology concepts and how they are organized. One of our objective is to integrate species-specific vocabulary terms into unified flowering-plant ontologies for rice, maize, Arabidopsis and other Angiosperms. Species specific ontologies are also listed in the following sections.

Click here to download the most recent versions of the Plant Ontology in OBO format**.**

Click here to download the most recent versions of the Plant Ontology in OWL format .

Beginning with Version #14 (January 2011), the Plant Ontology has been merged from two separate files (po_anatomy.obo and po_temporal.obo) into a single file called plant_ontology.obo. We recommend that all users switch to the single, merged file. If you need current versions of the po_anatomy.obo and po_temporal.obo, please contact us.

Previously used ontology files from the POC and collaborators

The ontologies are:

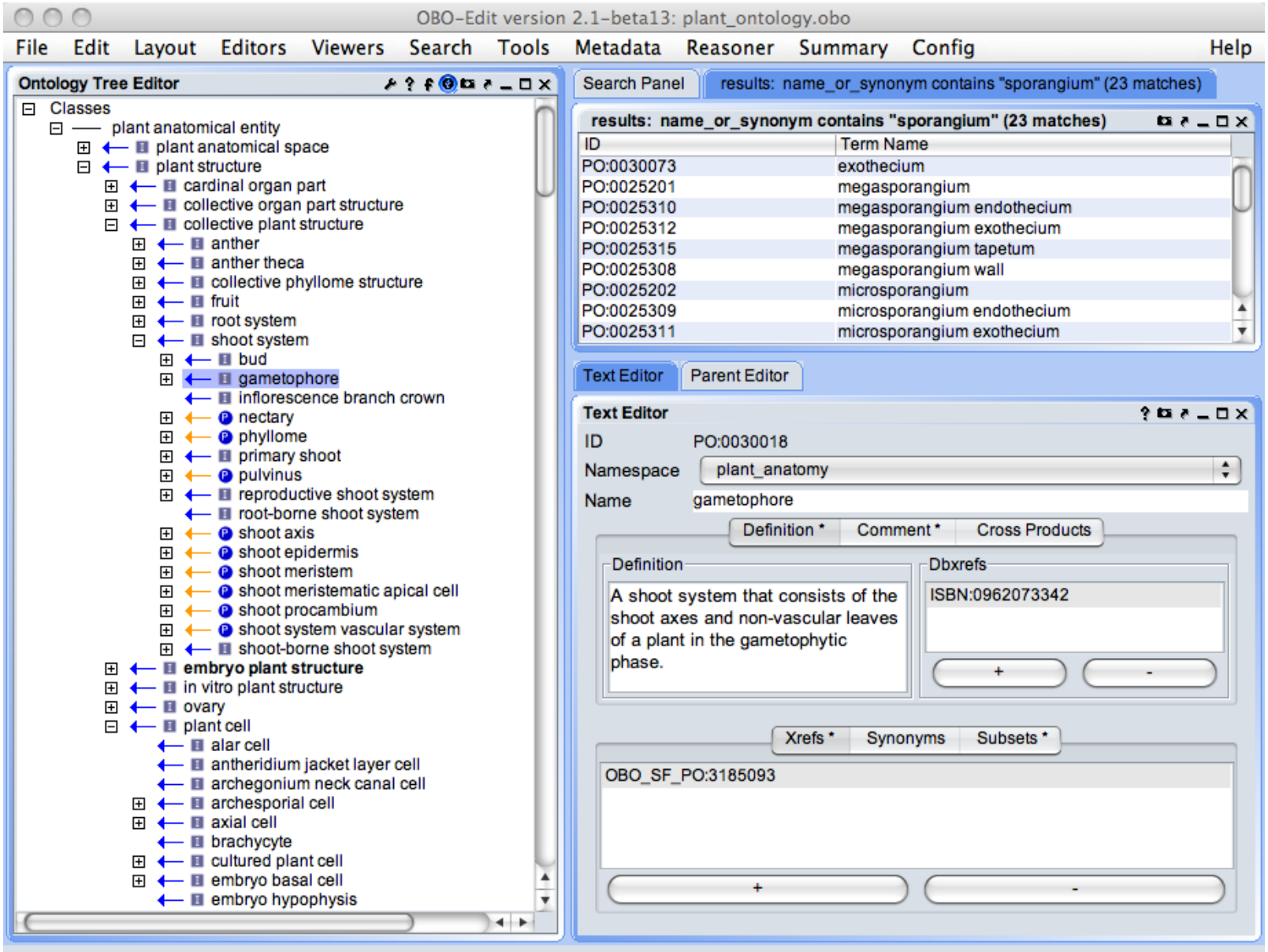
Plant Structure

A controlled vocabulary of plant's morphological and anatomical structures representing organs, tissues, cell types and their biological relationships based on spatial and developmental organization. *Examples are stamen, gynoecium, petal, parenchyma, guard cell, etc.*

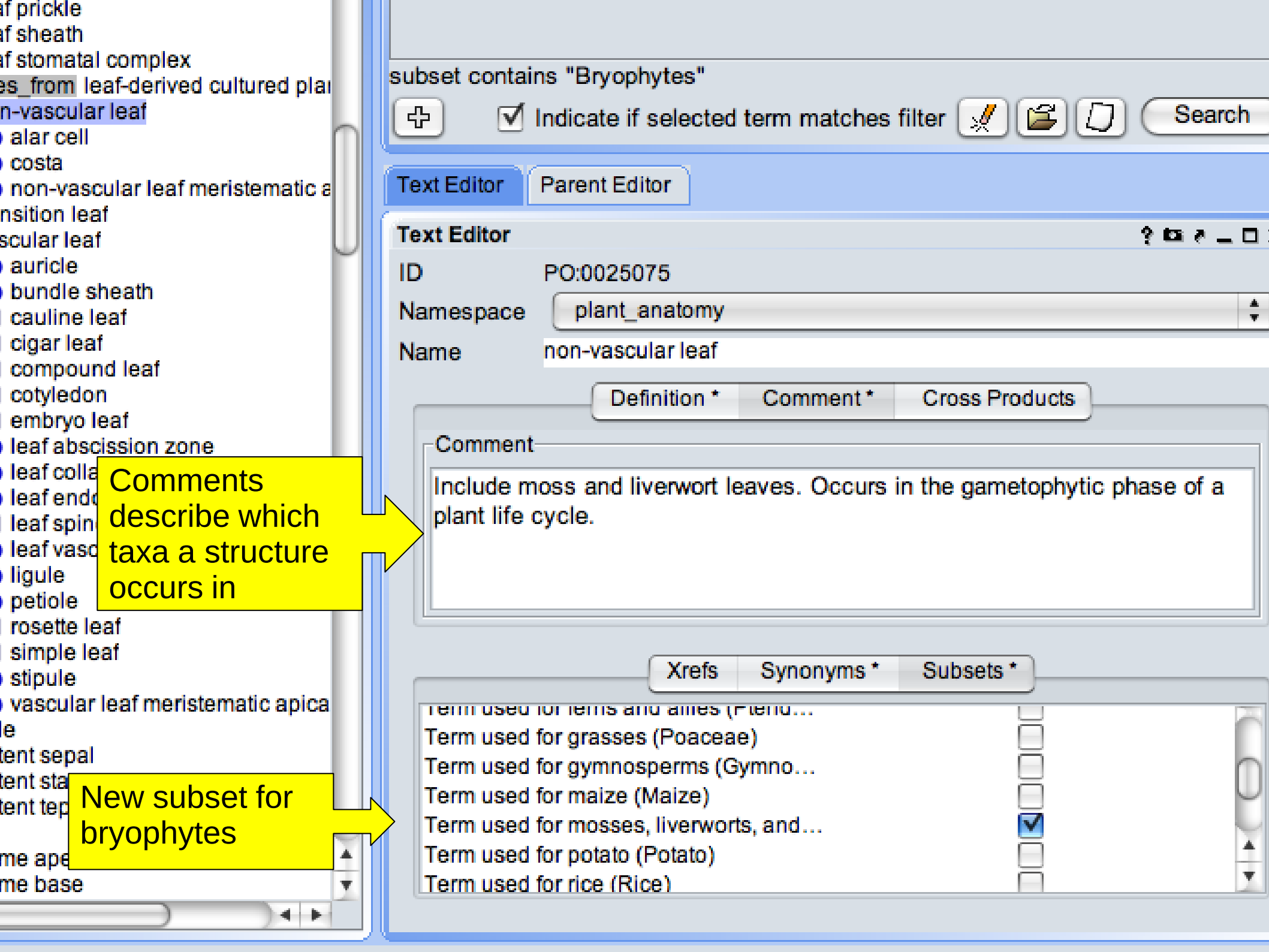
Species	Sources	Browse at source site	OBO format file Includes ontology and definitions.	Ontology flat files	Definition flat files	Term List files
Flowering plants	POC	Browse	Download	--	--	Download

http://palea.cgrb.oregonstate.edu/viewsvn/Poc/tags/live/plant_ontology.obo?view=co

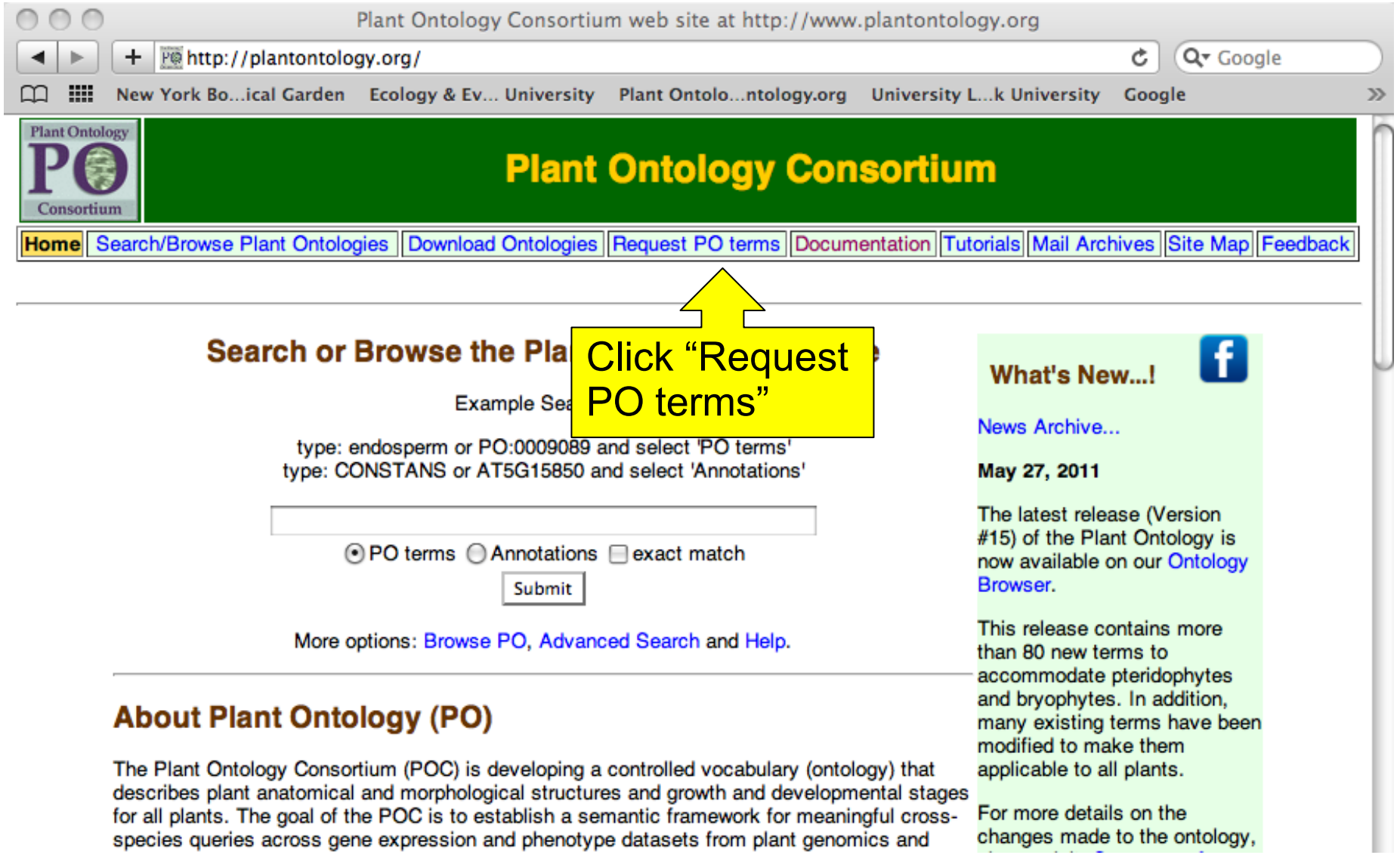
Ontology (.obo) files can be viewed using OBO-Edit or other software



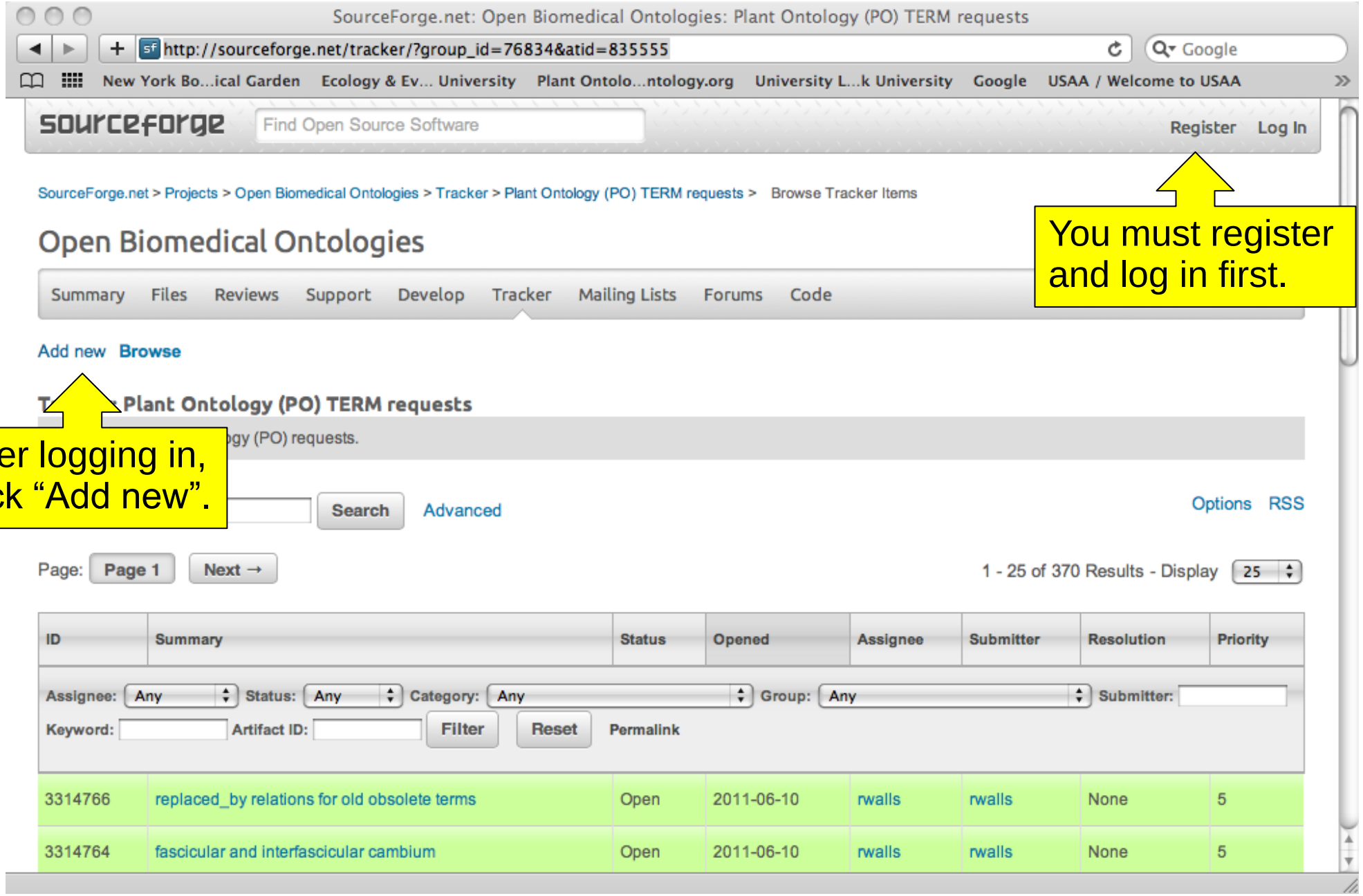
download at http://wiki.geneontology.org/index.php/OBO-Edit


f prickle
f sheath
f stomatal complex
es_from leaf-derived cultured plan
n-vascular leaf
alar cell
costa
non-vascular leaf meristematic a
nsition leaf
scular leaf
auricle
bundle sheath
cauline leaf
cigar leaf
compound leaf
cotyledon
embryo leaf
leaf abscission zone
leaf colla
leaf endo
leaf spin
leaf vasc
ligule
petiole
rosette leaf
simple leaf
stipule
vascular leaf meristematic apica
le
tent sepal
tent sta
tent tep
me ape
me base
Comments describe which taxa a structure occurs in
New subset for bryophytes
subset contains "Bryophytes"
Indicate if selected term matches filter
Search
Text Editor
Parent Editor
Text Editor
ID
PO:0025075
Namespace
plant_anatomy
Name
non-vascular leaf
Definition *
Comment *
Cross Products
Comment
Include moss and liverwort leaves. Occurs in the gametophytic phase of a plant life cycle.
Xrefs
Synonyms *
Subsets *
Term used for lems and allies (Pteid…
Term used for grasses (Poaceae)
Term used for gymnosperms (Gymno…
Term used for maize (Maize)
Term used for mosses, liverworts, and…
Term used for potato (Potato)
Term used for rice (Rice)

Requesting new term: link from PO home page

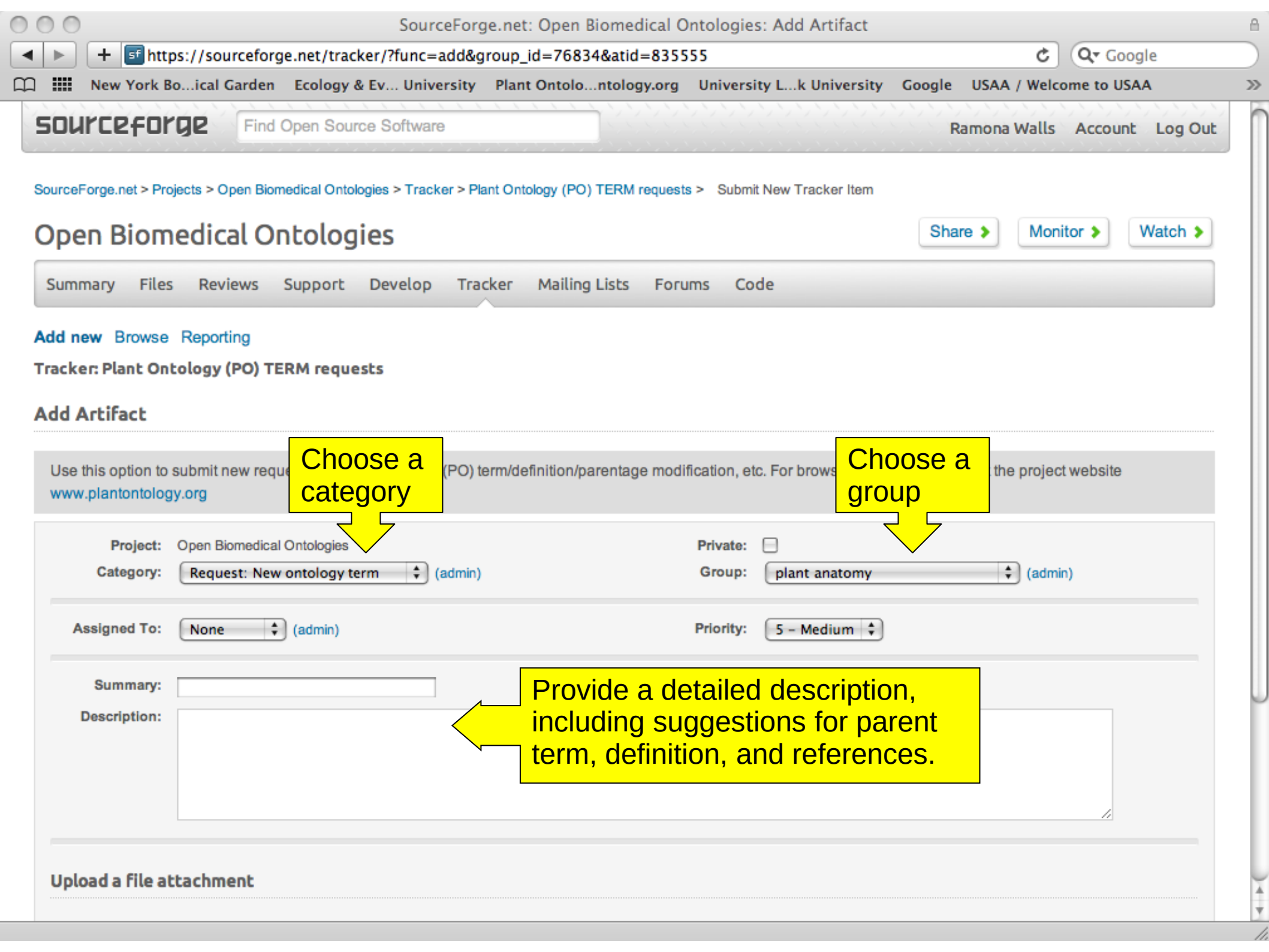


Takes you to SourceForge Tracker Page:
http://sourceforge.net/tracker/?group_id=76834&atid=835555



You must register and log in first.

After logging in, click “Add new”.


SourceForge.net: Open Biomedical Ontologies: Add Artifact
https://sourceforge.net/tracker/?func=add&group_id=76834&atid=835555
Google
New York Bo...ical Garden
Ecology & Ev... University
Plant Ontolo...ntology.org
University L...k University
Google
USAA / Welcome to USAA
sourceforge
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Ramona Walls
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SourceForge.net > Projects > Open Biomedical Ontologies > Tracker > Plant Ontology (PO) TERM requests > Submit New Tracker Item
Open Biomedical Ontologies
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Monitor
Watch
Summary
Files
Reviews
Support
Develop
Tracker
Mailing Lists
Forums
Code
Add new
Browse
Reporting
Tracker: Plant Ontology (PO) TERM requests
Add Artifact
Use this option to submit new requ
(PO) term/definition/parentage modification, etc. For brows
the project website
www.plantontology.org
Choose a category
Choose a group
Project:
Open Biomedical Ontologies
Private:
Category:
Request: New ontology term
(admin)
Group:
plant anatomy
(admin)
Assigned To:
None
(admin)
Priority:
5 - Medium
Summary:
Description:
Provide a detailed description, including suggestions for parent term, definition, and references.
Upload a file attachment

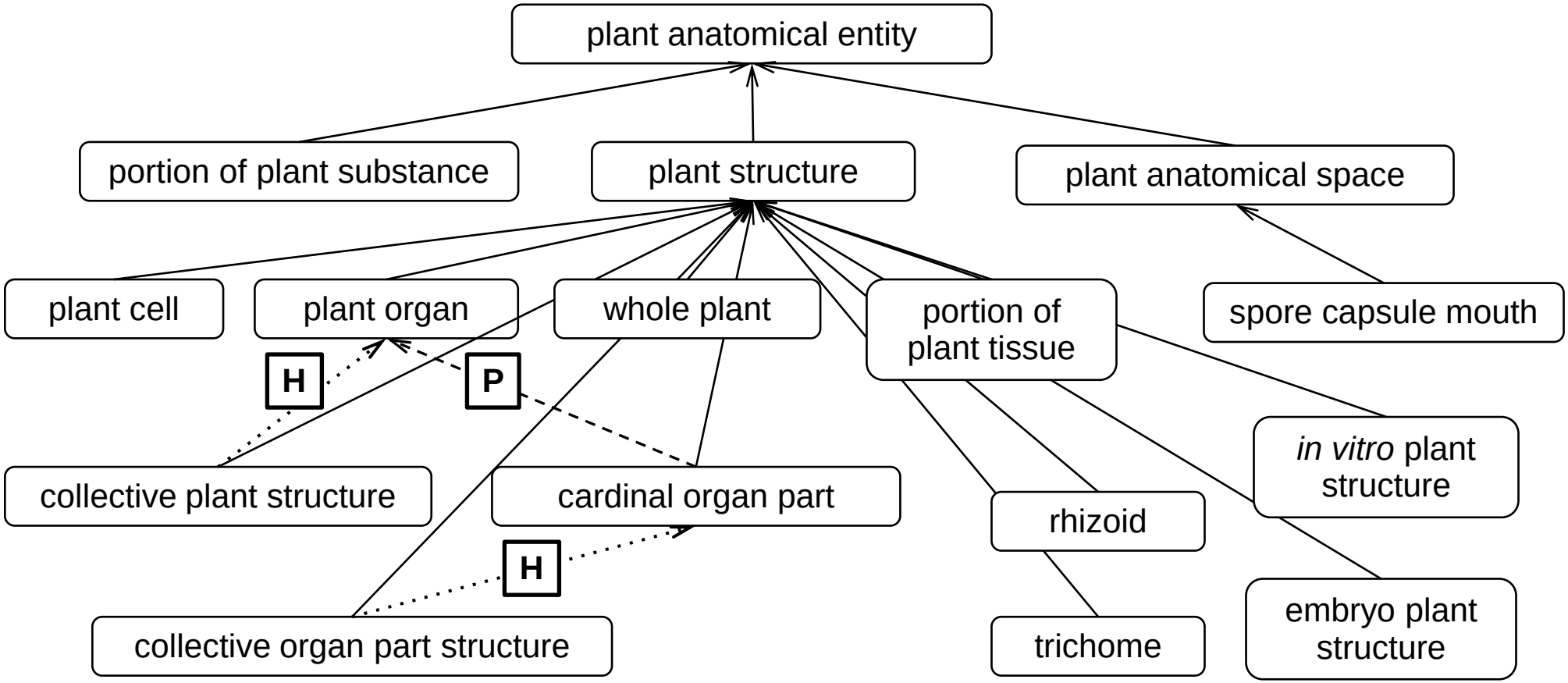
Review of changes that have been made to accommodate mosses

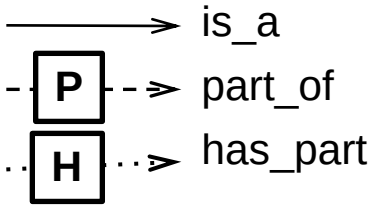
- More than 80 new terms were added to accommodate pteridophytes and bryophytes
- Review of new terms- Any questions?
- Plant life cycle phases: gametophyte phase and sporophyte phase were added to the PGDSO (during an earlier release).
- Also added protonema phase, for bryophytes and pteridophytes

Any questions about new terms or definitions?

adult leaf	PO:0006340
alar cell	PO:0030057
antheridial sperm cell	PO:0025120
antheridium	PO:0025125
antheridium jacket layer	PO:0030053
antheridium jacket layer cell	PO:0030052
archegonial egg cell	PO:0025122
archegonium	PO:0025126
archegonium neck canal cell	PO:0030065
archesporium	PO:0030074
archsporial cell	PO:0030056
brachycyte	PO:0030058
bract	PO:0009055
caulonema cell	PO:0030002
caulonema tissue	PO:0030005
chloronema cell	PO:0030001
chloronema tissue	PO:0030004
costa	PO:0030072
endothecium	PO:0030049
epidermal rhizoid	PO:0030071
exothecium	PO:0030073
gametophore	PO:0030018
gametophore axillary hair	PO:0030060
gametophore axillary hair basal cell	PO:0030064
gametophore axillary hair base	PO:0030063
gametophore axillary hair terminal cell	PO:0030062
gametophore axis	PO:0030020
gametophore axis apical cell	PO:0030023
gametophore bud	PO:0030026
gametophyte perianth	PO:0030031
gametophyte phase	PO:0028003
juvenile leaf	PO:0006339
leaf apex	PO:0020040
leaf base	PO:0020137
leaf epidermis	PO:0006016
leaf trichome	PO:0006504
meristematic apical cell	PO:0030007
non-vascular leaf	PO:0025075
non-vascular leaf apical cell	PO:0030013
paraphyllium	PO:0030069
perigonial bract	PO:0030028
peristome	PO:0030042
plant gametangium	PO:0025124
plant protoplast	PO:0000006
protonema	PO:0030003
protonema side branch initial	PO:0030067
rhizoid	PO:0030078
seta	PO:0030032
sporangium	PO:0025094/ PO:0025232
sporangium base	PO:0030040
sporangium theca	PO:0030041
spore capsule annulus	PO:0025093
spore capsule calyptra	PO:0030037
spore capsule columella	PO:0025231
spore capsule operculum	PO:0030044
sporocyte	PO:0006204
sporophyte foot	PO:0030029
stem base	PO:0008039
stomatal complex	PO:0002000
tmema	PO:0030061
tmema cell	PO:0030059
transfer cell	PO:0000078

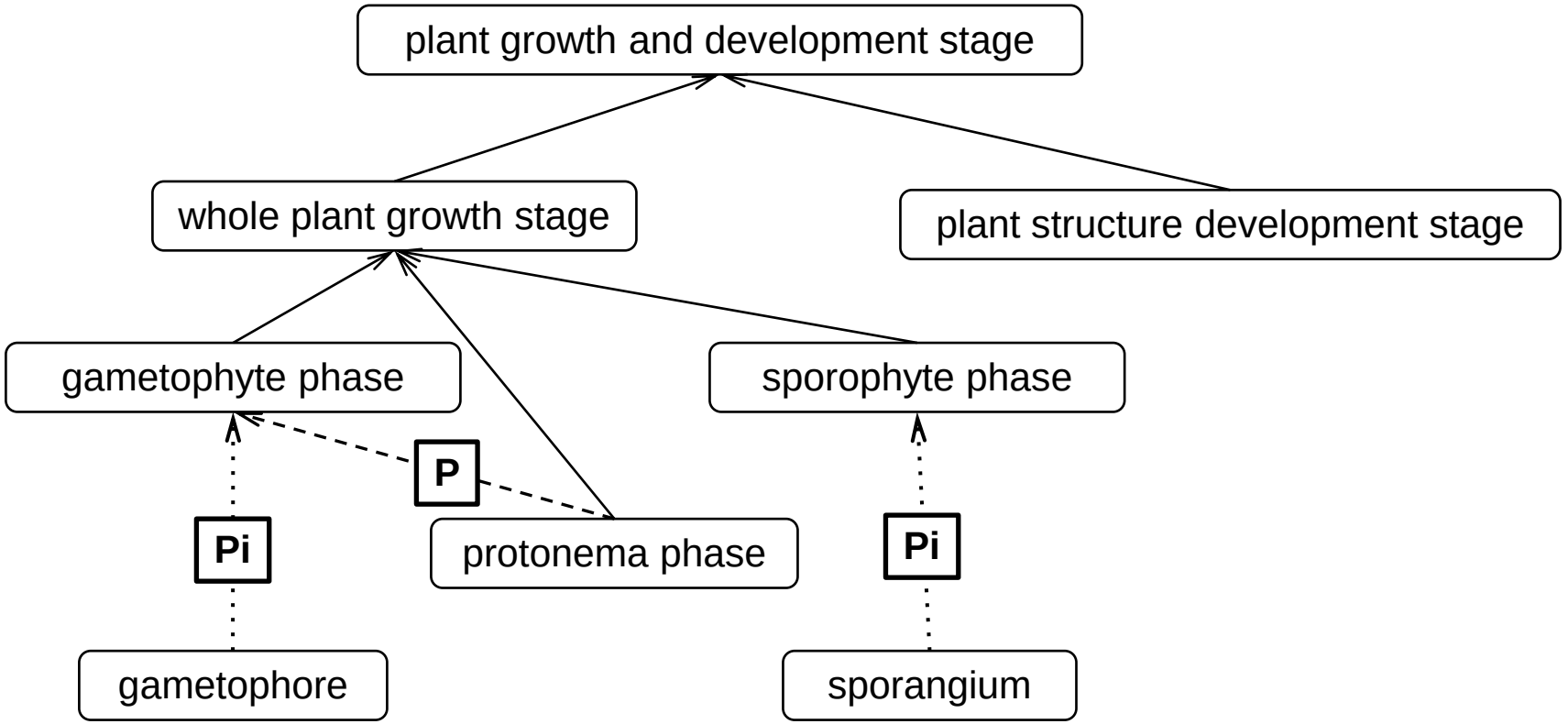
Top level re-organization of the PAO





New top-level terms include material and immaterial entities and provide parents for all plant structures

Plant life cycle phases: specified using the *Participates_in* relation



is_a

P part_of

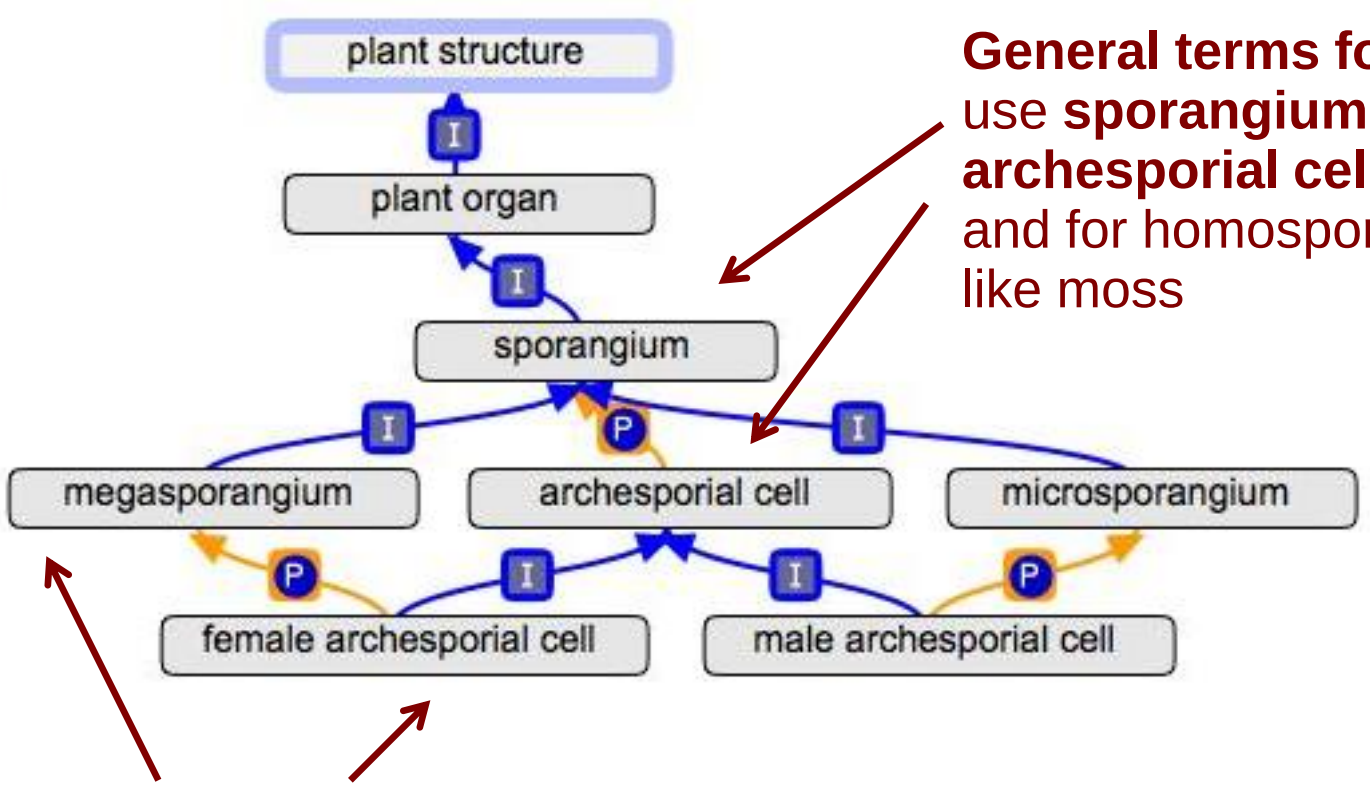
Pi participates_in

Examples:

gametophore participates_in gametophyte phase

sporangium participates_in sporophyte phase

Ontology structure: general categories for all plants, specific children for particular taxa, as needed

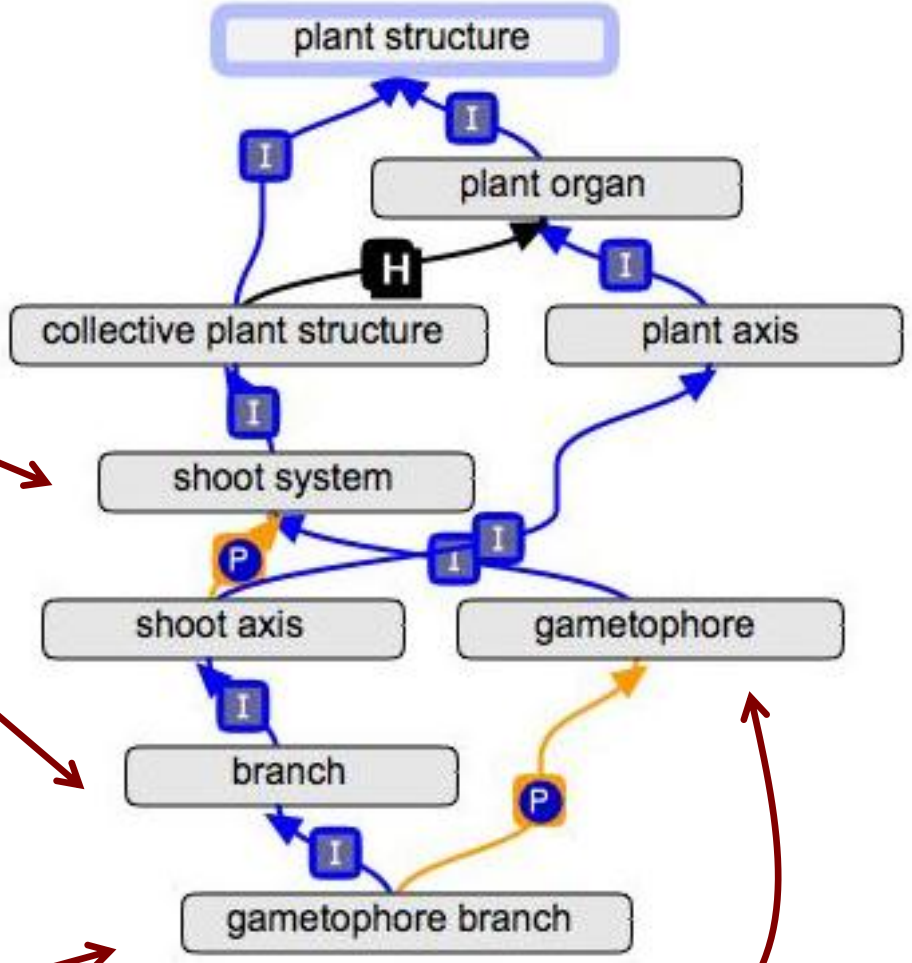


General terms for all plants:
use **sporangium** and **archesporial cell** for all plants, and for homosporous plants, like moss

Specialized child terms:
use **micro-** or **megasporangium** and **male** or **female archesporial cell** for heterosporous plants, like angiosperms

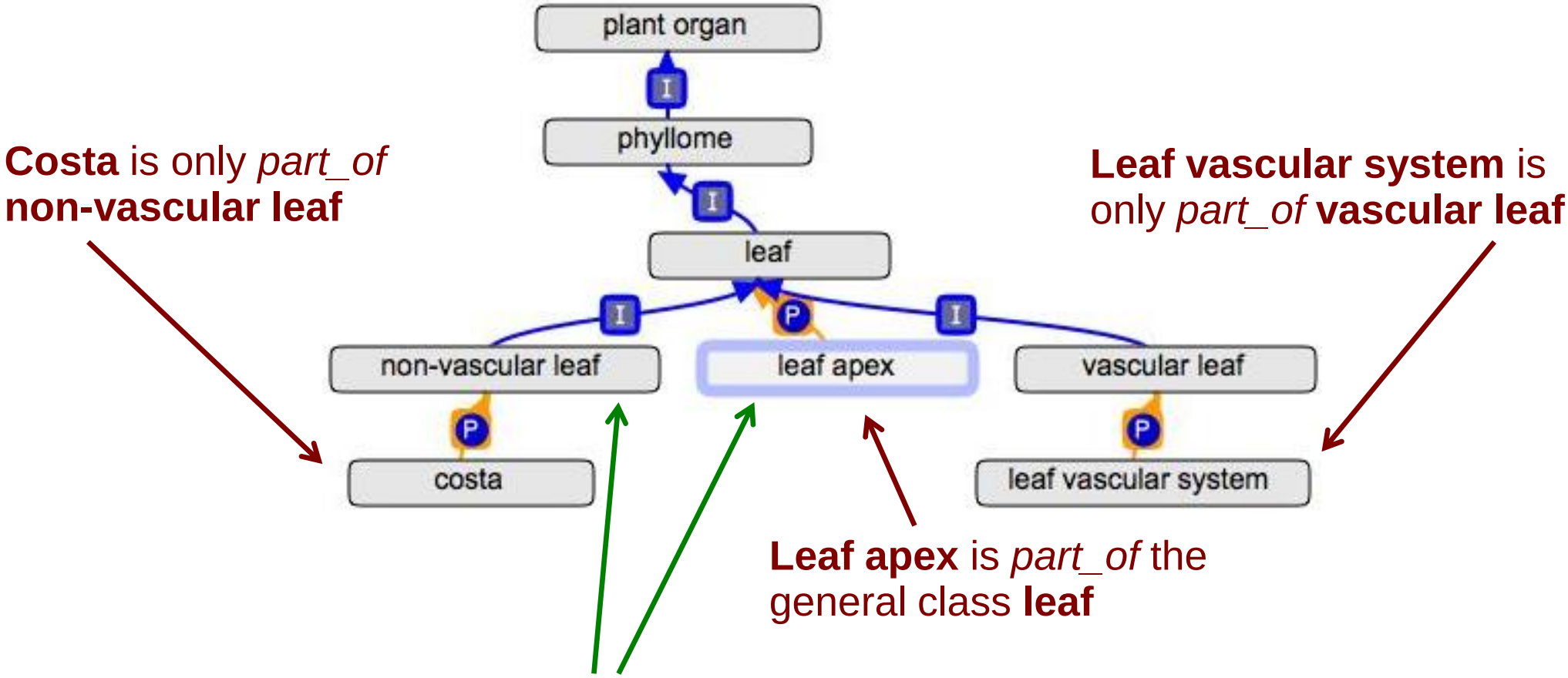
Ontology structure: general categories for all plants, specific children for particular taxa, as needed

General terms for all plants:
use **shoot system** and **branch** for all plants, and for vascular plants



Specialized child terms:
use **gametophore** and **gametophore branch** for bryophytes

How to describe structures if no pre-composed term exists in the PO



Costa is only *part_of* **non-vascular leaf**

Leaf vascular system is only *part_of* **vascular leaf**

Leaf apex is *part_of* the general class **leaf**

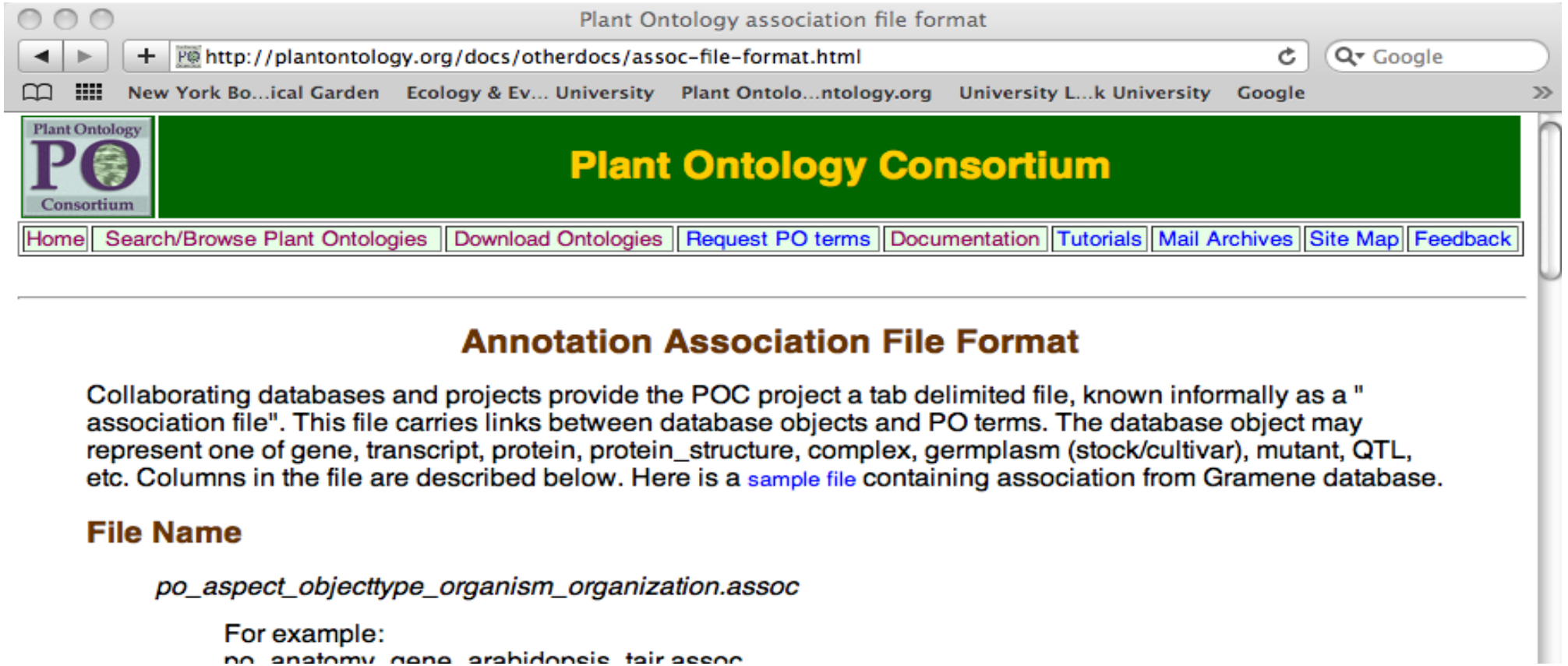
To describe gene expression in a leaf apex in *Physcomitrella*, put annotation on both **leaf apex** and **non-vascular leaf**

Annotations: links to genomics datasets

- May be created for:
  - whole genome sequencing projects
  - EST data sets
  - QTL data sets
  - protein data sets
  - germplasm data sets
  - phenotype data sets

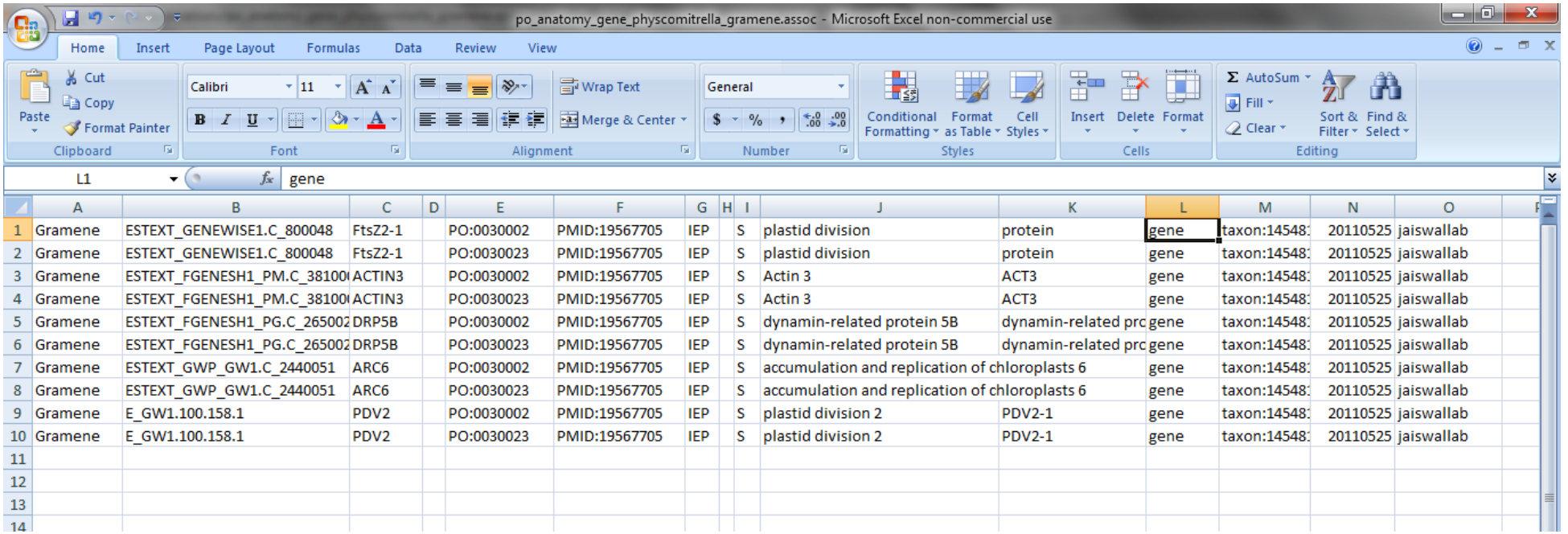
- Annotation files must be in the GAF1 or GAF2 format: 15 or 16 column spreadsheets, one line per association

Details on annotation file format:



http://plantontology.org/docs/otherdocs/assoc-file-format.html

Sample *Physcomitrella* annotations



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
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2	Gramene	ESTEXT_GENEWISE1.C_800048	FtsZ2-1		PO:0030023	PMID:19567705	IEP		S	plastid division	protein	gene	taxon:14548:	20110525	jaiswallab
3	Gramene	ESTEXT_FGENESH1_PM.C_38100	ACTIN3		PO:0030002	PMID:19567705	IEP		S	Actin 3	ACT3	gene	taxon:14548:	20110525	jaiswallab
4	Gramene	ESTEXT_FGENESH1_PM.C_38100	ACTIN3		PO:0030023	PMID:19567705	IEP		S	Actin 3	ACT3	gene	taxon:14548:	20110525	jaiswallab
5	Gramene	ESTEXT_FGENESH1_PG.C_265002	DRP5B		PO:0030002	PMID:19567705	IEP		S	dynamin-related protein 5B	dynamin-related prc	gene	taxon:14548:	20110525	jaiswallab
6	Gramene	ESTEXT_FGENESH1_PG.C_265002	DRP5B		PO:0030023	PMID:19567705	IEP		S	dynamin-related protein 5B	dynamin-related prc	gene	taxon:14548:	20110525	jaiswallab
7	Gramene	ESTEXT_GWP_GW1.C_2440051	ARC6		PO:0030002	PMID:19567705	IEP		S	accumulation and replication of chloroplasts 6		gene	taxon:14548:	20110525	jaiswallab
8	Gramene	ESTEXT_GWP_GW1.C_2440051	ARC6		PO:0030023	PMID:19567705	IEP		S	accumulation and replication of chloroplasts 6		gene	taxon:14548:	20110525	jaiswallab
9	Gramene	E_GW1.100.158.1	PDV2		PO:0030002	PMID:19567705	IEP		S	plastid division 2	PDV2-1	gene	taxon:14548:	20110525	jaiswallab
10	Gramene	E_GW1.100.158.1	PDV2		PO:0030023	PMID:19567705	IEP		S	plastid division 2	PDV2-1	gene	taxon:14548:	20110525	jaiswallab
11															
12															
13															
14															

- See http://plantontology.org/docs/otherdocs/assoc-file-format.html for more details

Annotation files are uploaded to our SVN repository:

/ [Poc] / trunk / associations

Index of /trunk/associations

viewvc

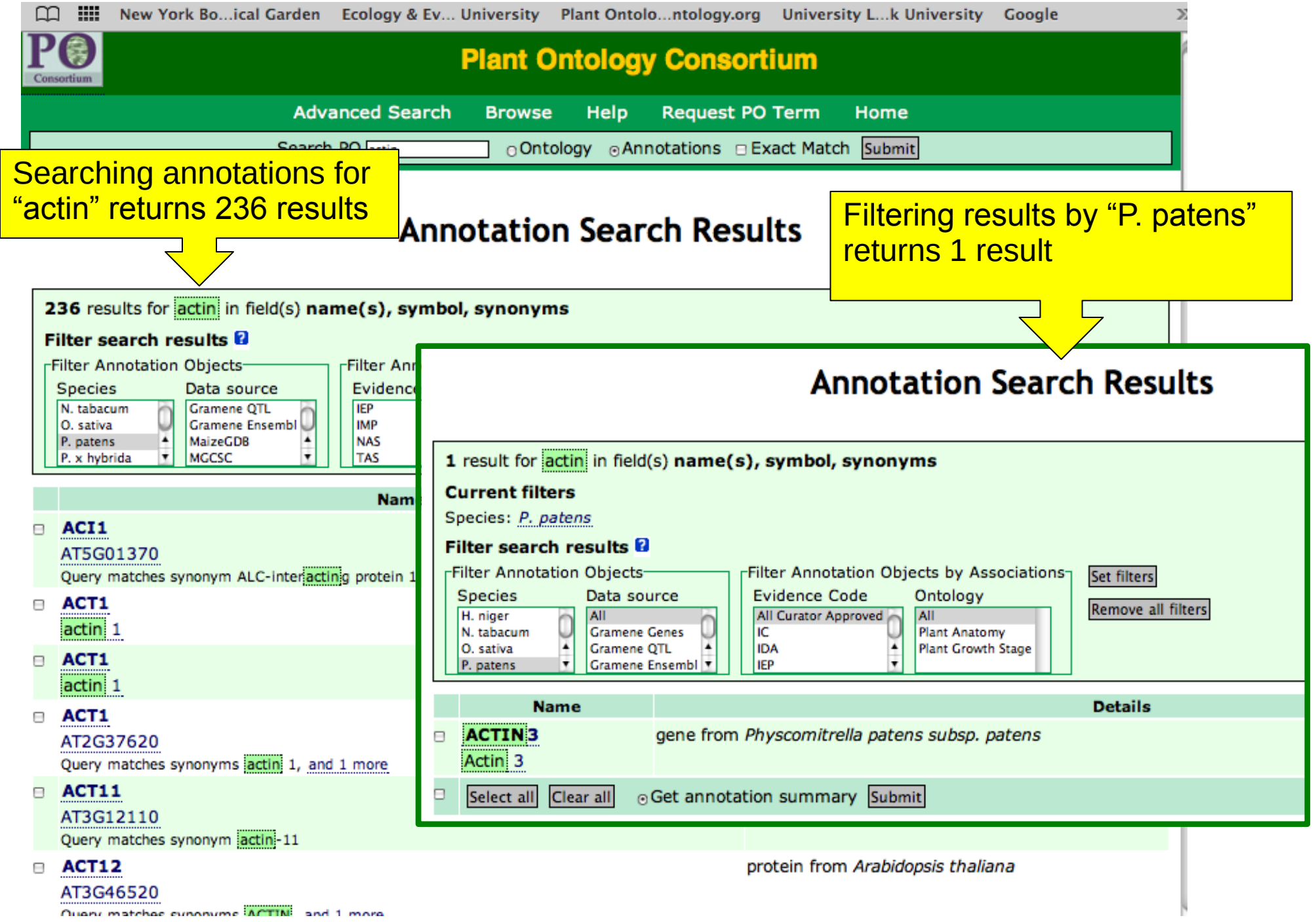
Files shown: 31
Directory revision: 1150 (of 1151)
Sticky Revision: Set

File	Rev.	Age ▲	Author	Last log entry
Parent Directory				
po_anatomy_gene_physcomitrella_gramene.assoc	1150	11 days	elserj	Added physco assoc file
po_growth_germplasm_S.lycopersicum_sgn.assoc	1146	13 days	elserj	Oops, was a bit overzealous with the tab removal
po_anatomy_germplasm_S.lycopersicum_sgn.assoc	1146	13 days	elserj	Oops, was a bit overzealous with the tab removal
po_temporal_gene_arabidopsis_tair.assoc	1138	2 weeks	cooperl	Copied 5 annotations from the po_anatomy_gene_arabidopsis_tair.assoc file on se…
po_anatomy_gene_arabidopsis_tair.assoc	1137	2 weeks	cooperl	Updated the TAIR anatomy and temporal files by reassigning annotations to new t…
po_anatomy_stock_zea_MaizeGDB_Stock.assoc	1136	2 weeks	cooperl	Updated the MaizeGDB, and TAIR temporal files by reassigning annotations to new …
po_anatomy_stock_zea_MaizeGDB.assoc	1134	2 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te…
po_anatomy_qtl_oryza_gramene.assoc	1134	2 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te…
po_anatomy_gene_Nicotiana_sgn.assoc	1134	2 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te…
po_anatomy_gene_zea_MaizeGDB.assoc	1134	2 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te…
po_anatomy_gene_S.lycopersicum_sgn.assoc	1134	2 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te…
po_anatomy_gene_oryza_gramene.assoc	1134	2 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te…
po_anatomy_gene_S.tuberosum_sgn.assoc	1009	4 months	cooperl	S. tuberosum - 1 annotation moved from pollen tube (PO:0006345)to new term polle…
po_growth_qtl_oryza_gramene.assoc	955	8 months	cooperl	101 annotations to SDLGVIG from'po_anatomy_qtl_oryza_gramene.assoc' copied to po…
po_growth_gene_Coffea_sgn.assoc	947	8 months	nm249	updated growth stage sgn associations
po_growth_gene_Nicotiana_sgn.assoc	947	8 months	nm249	updated growth stage sgn associations
po_growth_gene_S.lycopersicum_sgn.assoc	947	8 months	nm249	updated growth stage sgn associations
po_growth_gene_Petunia_sgn.assoc	947	8 months	nm249	updated growth stage sgn associations
po_growth_gene_Capsicum_sgn.assoc	947	8 months	nm249	updated growth stage sgn associations
po_growth_germplasm_S.melongena_sgn.assoc	947	8 months	nm249	updated growth stage sgn associations

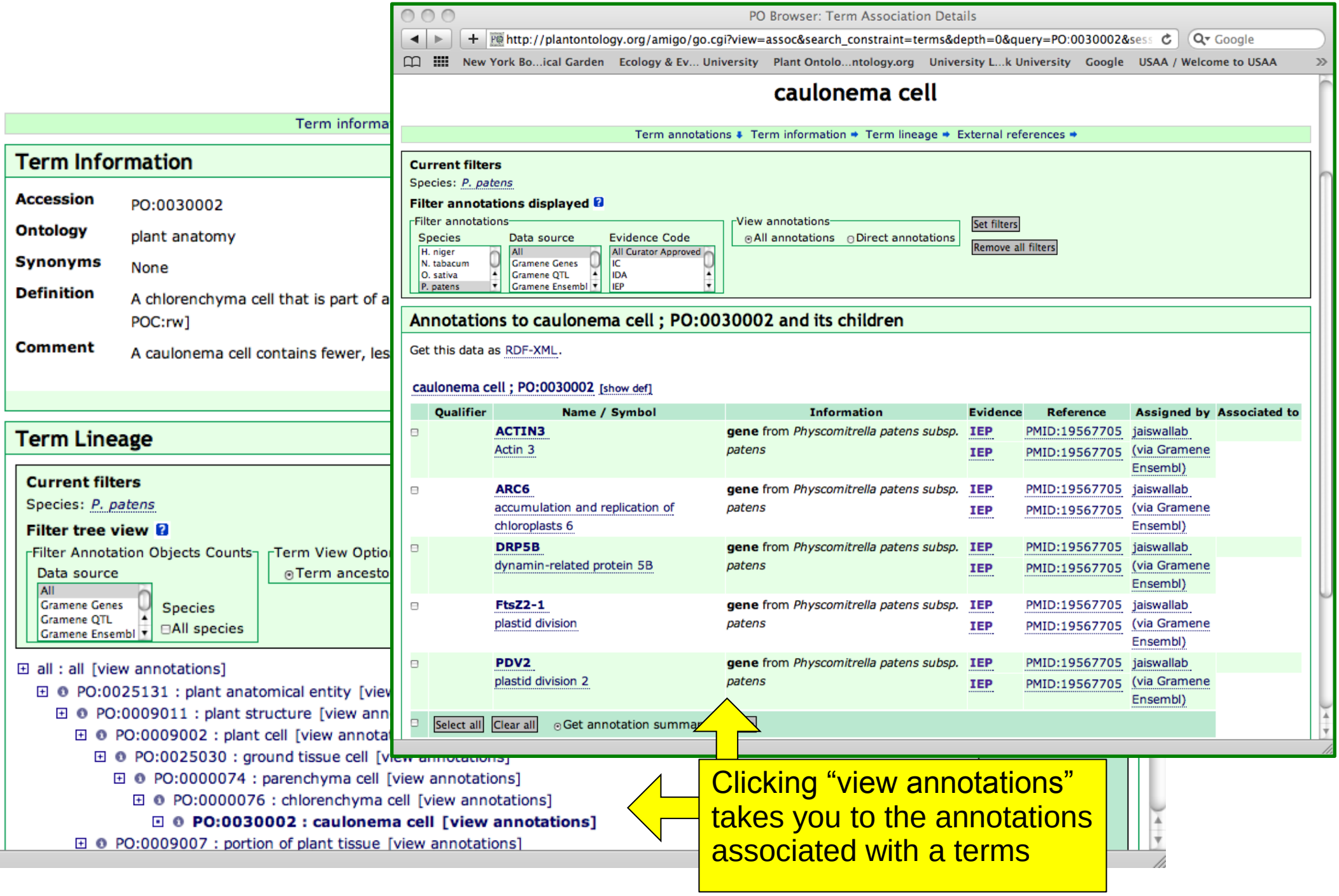
zotero

http://palea.cgrb.oregonstate.edu/viewsvn/Poc/trunk/associations/

Searching for annotations



View the annotations associated with any term:



Links out to source database

NCBI Resources How To

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Search Clear

Display Settings: Abstract Send to:

Plant Cell. 2009 Jun;21(6):1769-80. Epub 2009 Jun 30.

The PLASTID DIVISION1 and 2 components of the chloroplast division machinery determine the rate of chloroplast division in land plant cell differentiation.

Okazaki K, Kabeya Y, Suzuki K, Mori T, Ichikawa T, Matsui M, Nakanishi H, Miyagishima SY.

Initiative Research Program, Advanced Science Institute, RIKEN, Wako, Saitama 351-0198, Japan.

Abstract

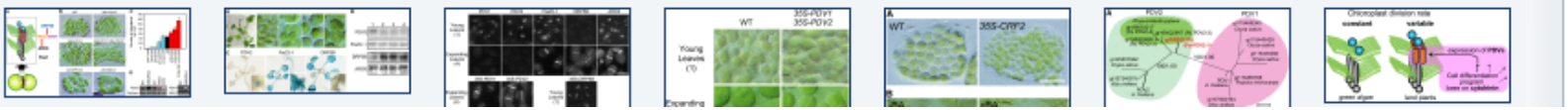
In most algae, the chloroplast division rate is held constant to maintain the proper number of chloroplasts per cell. By contrast, land plants evolved cell and chloroplast differentiation systems in which the size and number of chloroplasts change along with their respective cellular function by regulation of the division rate. Here, we show that PLASTID DIVISION (PDV) proteins, land plant-specific components of the division apparatus, determine the rate of chloroplast division. Overexpression of PDV proteins in the angiosperm Arabidopsis thaliana and the moss Physcomitrella patens increased the number but decreased the size of chloroplasts; reduction of PDV levels resulted in the opposite effect. The level of PDV proteins, but not other division components, decreased during leaf development, during which the chloroplast division rate also decreased. Exogenous cytokinins or overexpression of the cytokinin-responsive transcription factor CYTOKININ RESPONSE FACTOR2 increased the chloroplast division rate, where PDV proteins, but not other components of the division apparatus, were upregulated. These results suggest that the integration of PDV proteins into the division machinery enabled land plant cells to change chloroplast size and number in accord with the fate of cell differentiation.

Comment in

Plant Signal Behav. 2010 Feb;5(2):164-7.

PMID: 19567705 [PubMed - indexed for MEDLINE] PMCID: PMC2714929 **Free PMC Article**

Images from this publication. See all images (7) Free text



Plant Ontology PO Consortium

Annotation Search Results

1 result for actin in field(s) **name(s), symbol, synonyms**

Current filters

Species: *P. patens*

Filter search results

Filter Annotation Objects

Species: H. niger, N. tabacum, O. sativa, P. patens

Data source: All, Gramene Genes, Gramene QTL, Gramene Ensembl

Filter Annotation Objects by Associations

Evidence Code: All Curator Approved, IC, IDA, IEP

Ontology: All, Plant Anatomy, Plant Growth Stage

Set filters

Remove all filters

	Name	
☐	ACTIN 3 Actin 3	gene from *Physcomit*

Select all | Clear all | Get annotation summ

Clicking on gene name from Annotation Search Results or from the annotations associated with a term provides more details on that gene

ACTIN3

Information

Name(s)	Actin 3
Type	**gene**
Species	*Physcomitrella patens subsp. patens*
Synonyms	ACT3
Database	Gramene Ensembl, Gramene:ESTEXT_FGENESH1_PM.C_3810004
Associated	No associations to GO
Sequence	No peptide sequence available

Back to top

Term Annotations

Current filters

Species: *P. patens*

Filter annotations displayed

Filter Annotations

Evidence Code: All Curator Approved, IC, IDA, IEP

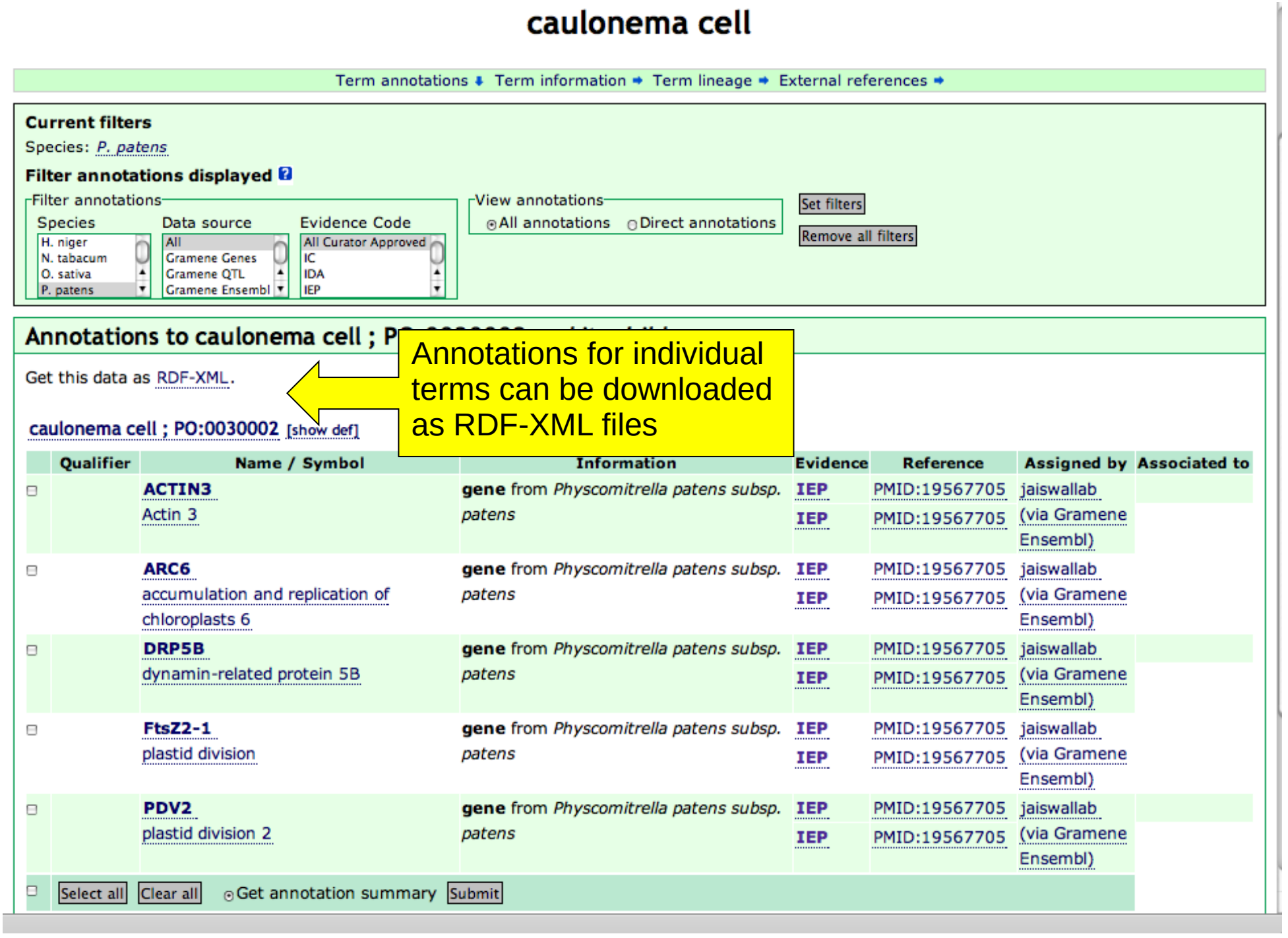
Ontology: All, Plant Anatomy, Plant Growth Stage

Set filters

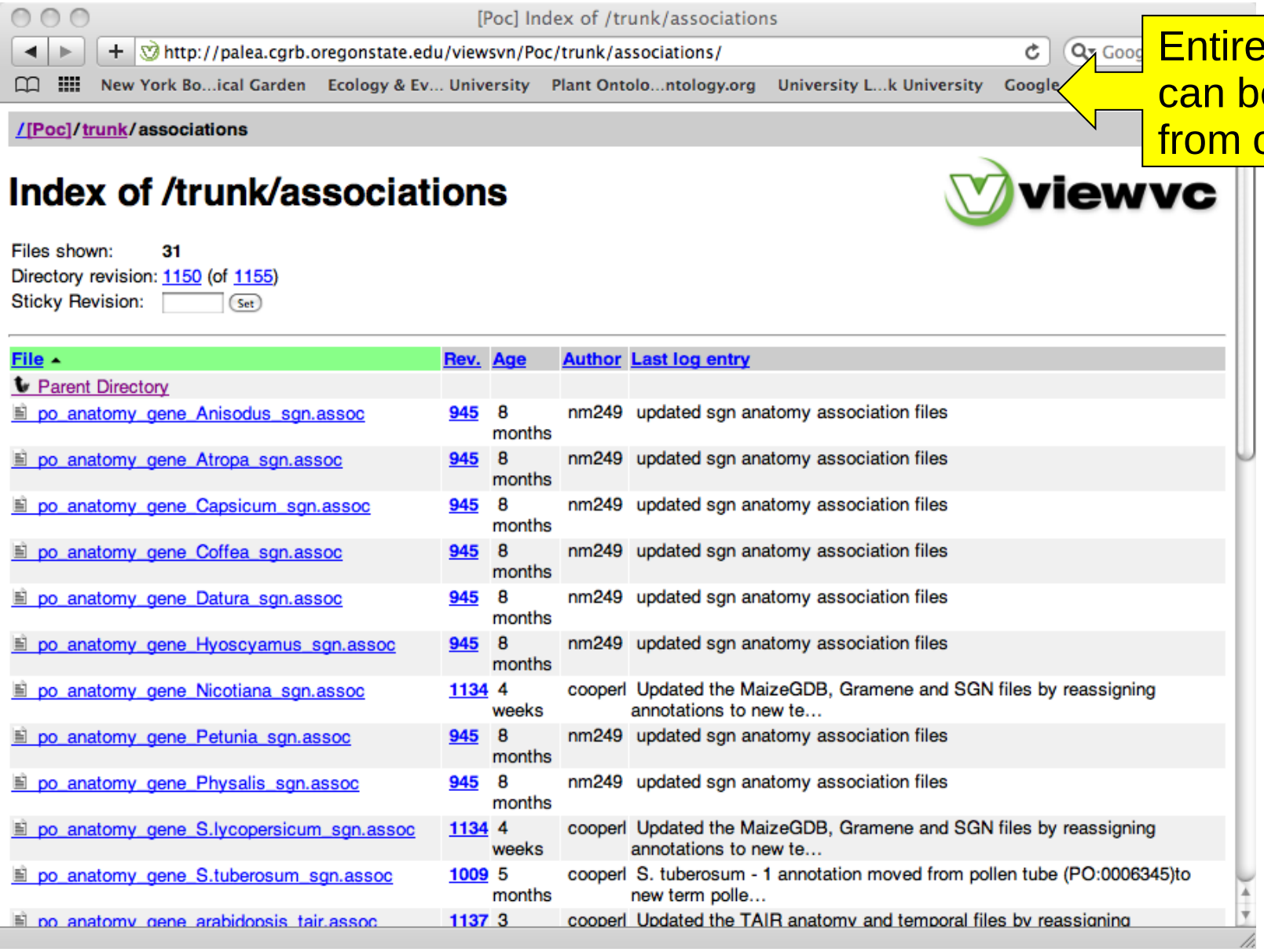
Remove all filters

Qualifier	Term	Ontology	Evidence	Reference	Assigned by
	caulonema cell [view annotations]	plant anatomy	IEP	PMID:19567705	jaiswallab
			IEP	PMID:19567705	(via Gramene Ensembl)
	gametophore axis meristematic apical cell [view annotations]	plant anatomy	IEP	PMID:19567705	jaiswallab
			IEP	PMID:19567705	(via Gramene Ensembl)

Downloading annotations



Downloading annotations

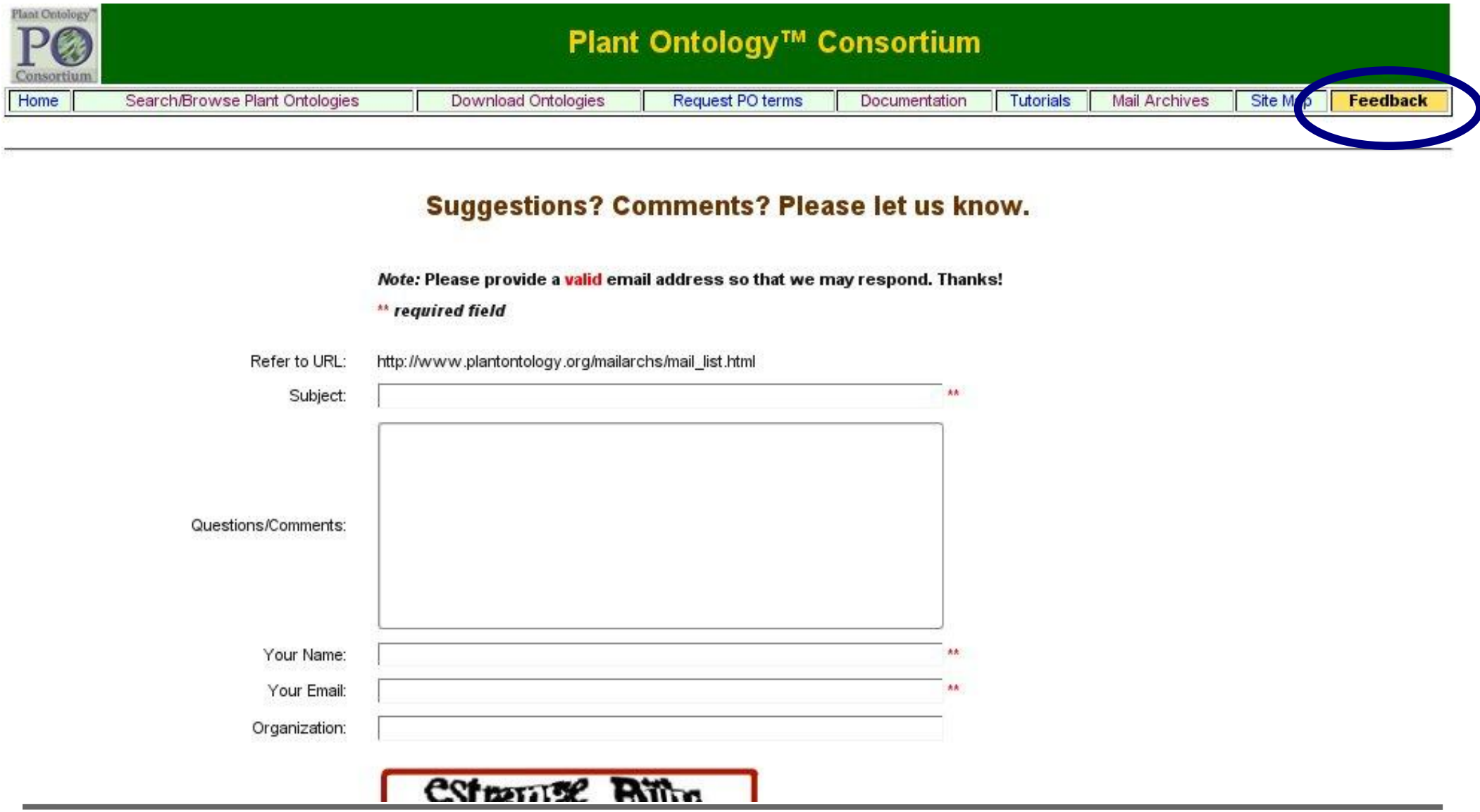


File	Rev.	Age	Author	Last log entry
Parent Directory				
po_anatomy_gene_Anisodus_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_Atropa_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_Capsicum_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_Coffea_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_Datura_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_Hyoscyamus_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_Nicotiana_sgn.assoc	1134	4 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te...
po_anatomy_gene_Petunia_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_Physalis_sgn.assoc	945	8 months	nm249	updated sgn anatomy association files
po_anatomy_gene_S.lycopersicum_sgn.assoc	1134	4 weeks	cooperl	Updated the MaizeGDB, Gramene and SGN files by reassigning annotations to new te...
po_anatomy_gene_S.tuberosum_sgn.assoc	1009	5 months	cooperl	S. tuberosum - 1 annotation moved from pollen tube (PO:0006345)to new term polle...
po_anatomy_gene_arabidopsis_tair.assoc	1137	3	cooperl	Updated the TAIR anatomy and temporal files by reassigning

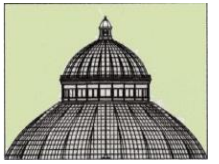
Entire annotation files can be downloaded from our SVN site.

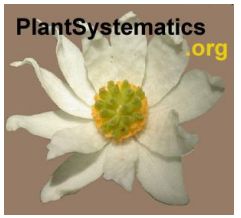
http://palea.cgrb.oregonstate.edu/viewsvn/Poc/trunk/associations/

Sending feedback



Acknowledgements:





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