Gramene

COMPARATIVE GENOMICS & PATHWAYS

Marcela Karey Tello-Ruiz, PhD

@GrameneDatabase

PB20 PLANT BIOLOGY

JULY 27 - 31 | WORLDWIDE SUMMIT

#PlantBio20

Gramene - *Exploring the Plant Gene Space through Comparative Genomics & Network Analysis*

Transnational collaboration

Doreen Ware
USDA ARS, CSHL – USA

Pankaj Jaiswal
OSU – USA

Crispin Taylor
ASPB – USA

Bruno Contreras-Moreira
Ensembl Plants
EMBL-EBI – UK

Irene Papatheodorou
Expression Atlas
EMBL-EBI – UK

Lincoln Stein
OICR - Canada

Gramene - *Comparative Plants DB* since 2001

- CSHL/EBI-Ensembl: 67 plant genomes (gene family trees, sequence alignments, synteny, homologs)
- EBI-Atlas: Gene expression (baseline, differential & single-cell)
- OSU-Reactome: Curated pathways & orthology-based projections to 97 species
- ASPB-DiVE: Automated ingestion of functional annotations from publications

Cold Spring Harbor Laboratory · EMBL-EBI · OICR Ontario Institute for Cancer Research · OSU Oregon State University · American Society of Plant Biologists · USDA · NSF

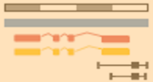
The Gramene Team

Gramene build 67

67 reference Genomes

EnsemblPlants

~2.5M gene annotations



>100K gene trees

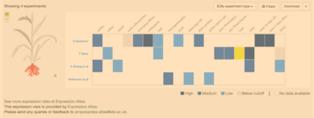
299 whole-genome alignments

ATCGAGCT
ATCCAGCT
ATCGAGAT

66 synteny maps

Expression

EMBL-EBI Expression Atlas

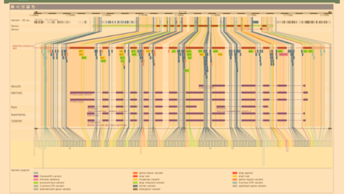


923 experiments in 24+ species

Integrated search and visualization

Variation

European Variation Archive

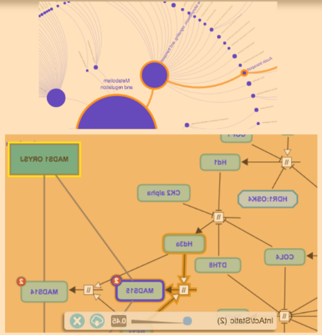


~223.7M SNPs in 12 genomes

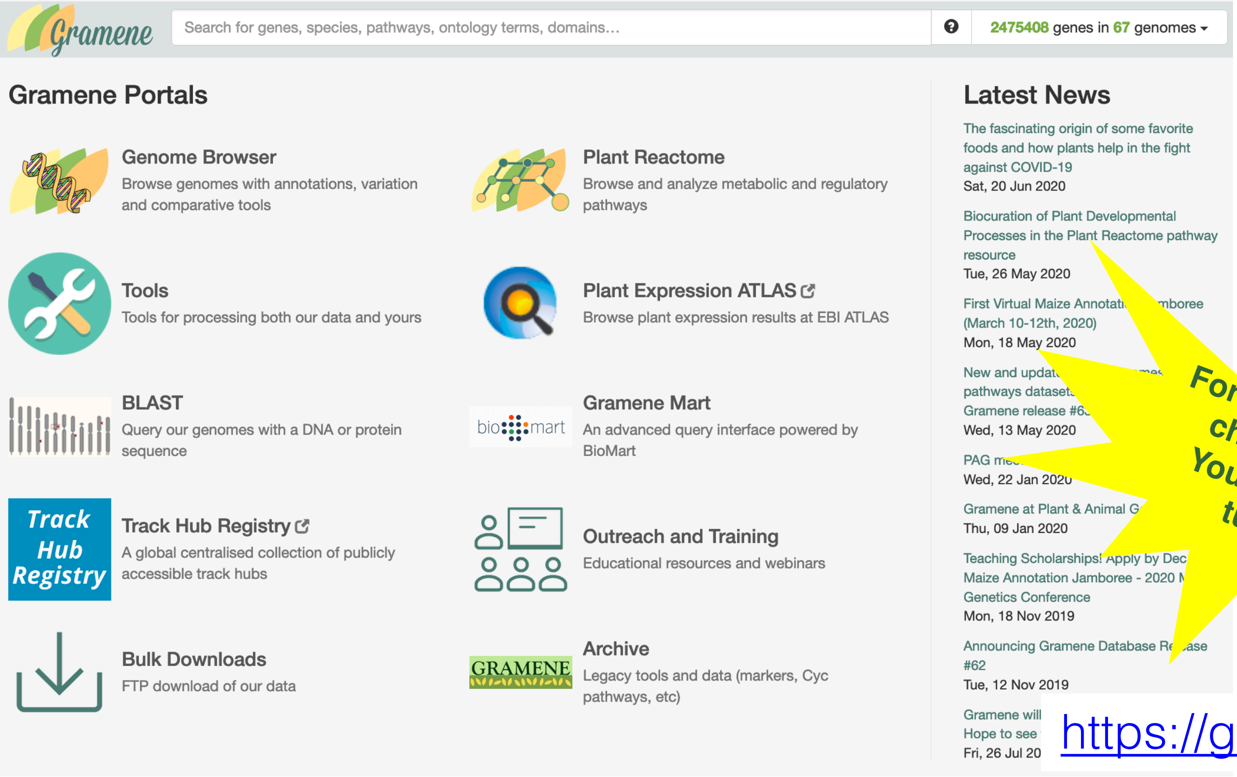
Pathways

305 curated rice projected to 97 species

Plant Reactome



Gramene.Org



For specific tasks, check out our YouTube video tutorials

https://goo.gl/In9RLD

Ensembl

Gene & Protein Expression

reactome

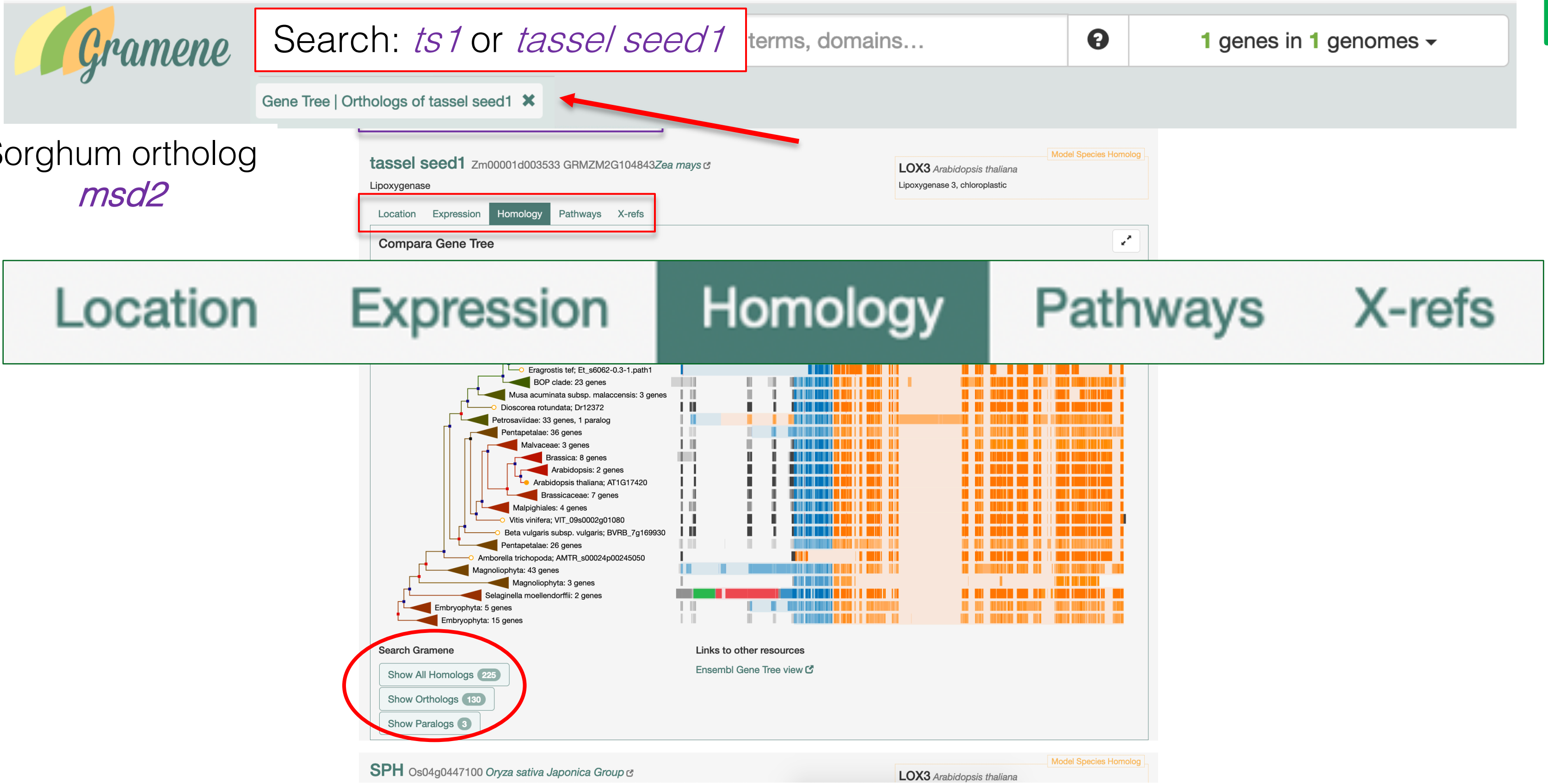
What can I do with Gramene ?

- Is my gene conserved in other species? Can I identify the function(s) of a novel gene through homology?
- When and where is my gene expressed?
- Is my gene in a metabolic or signaling pathway? Is the pathway conserved in other crops?
- Have genetic variants affecting my gene been identified? Can I access germplasm lines with naturally occurring (or introduced by mutagenesis) variants in my gene?

Find orthologs & paralogs

CSHL

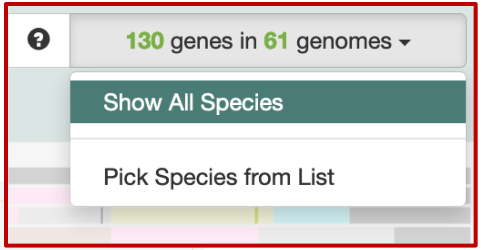
Sorghum ortholog *msd2*



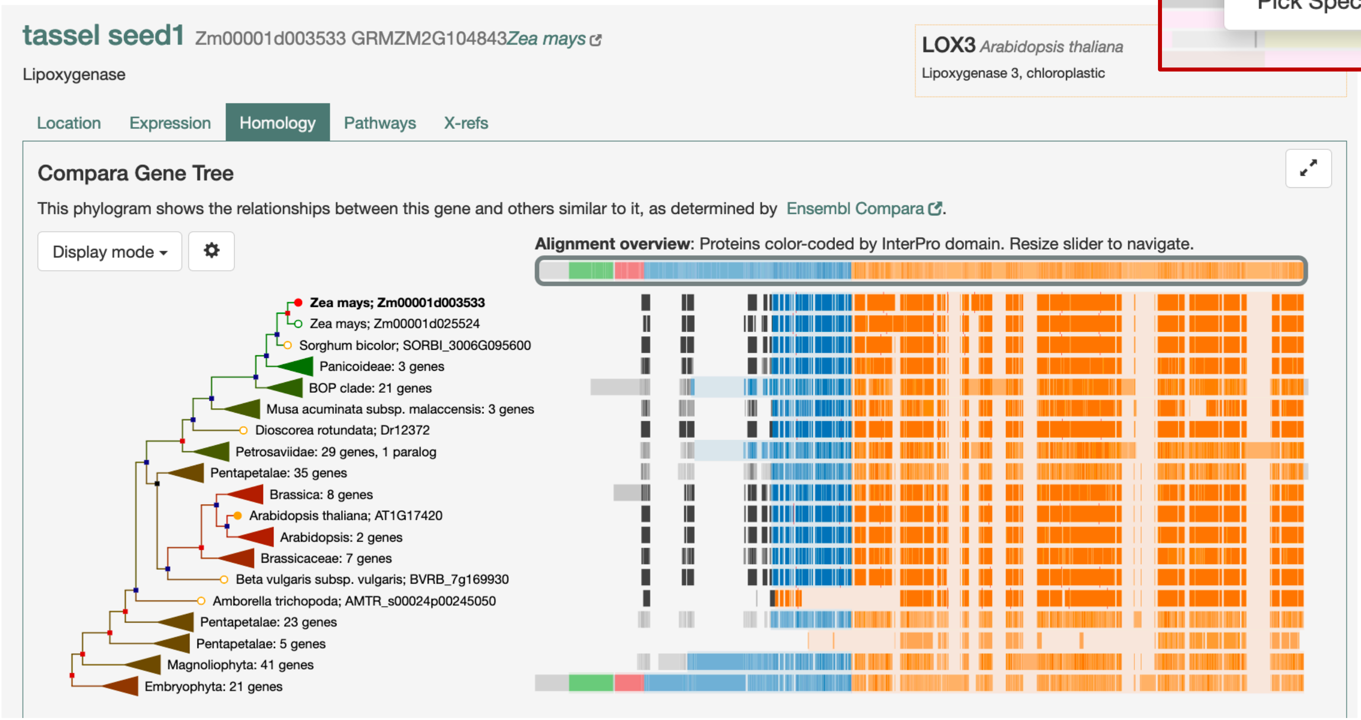
Gene Trees: Focus on species of interest

Phylogenetic power

=> Prune unwanted species

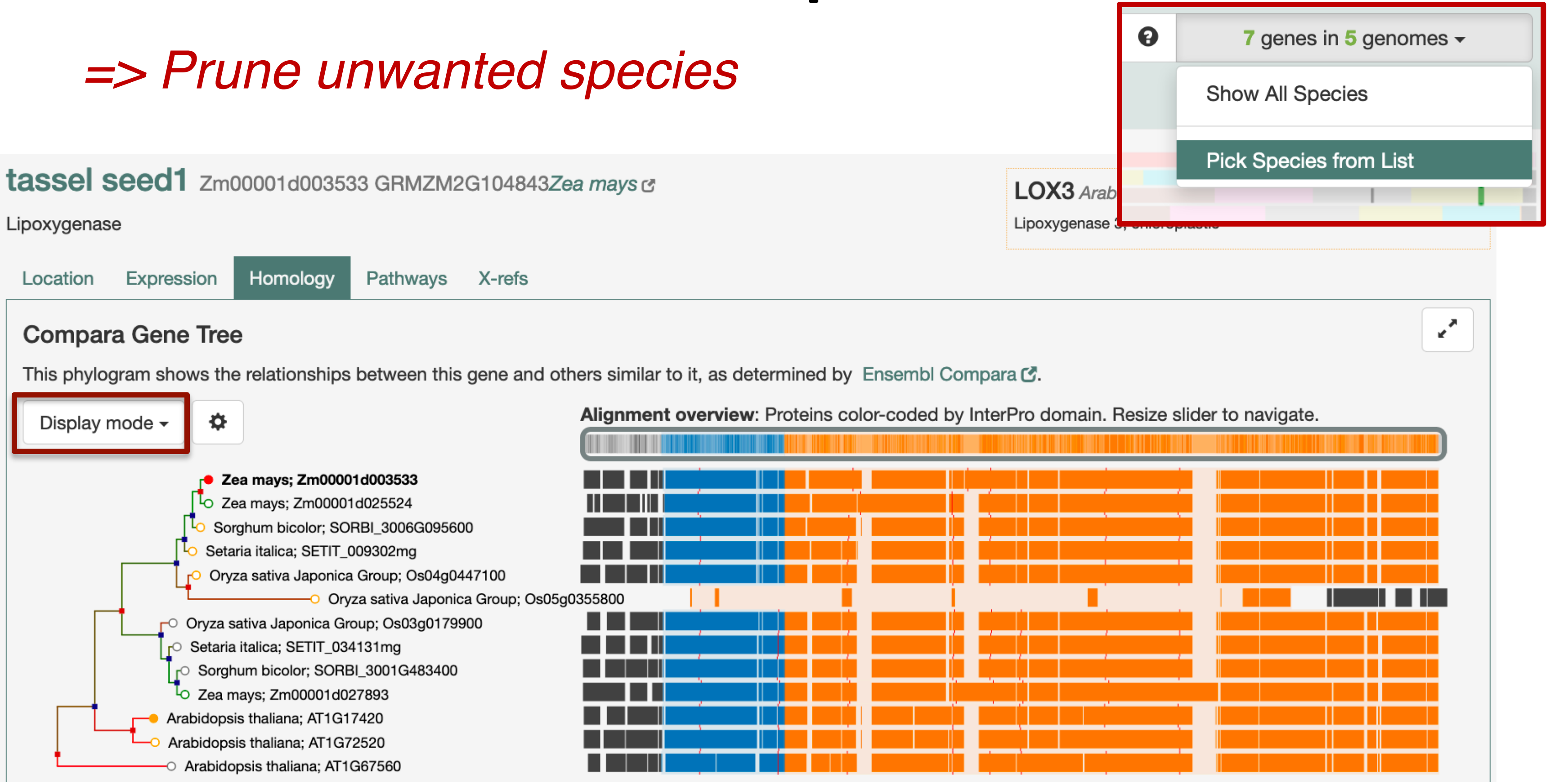


Gene Tree | Orthologs of tassel seed1



Gene Trees: Focus on species of interest

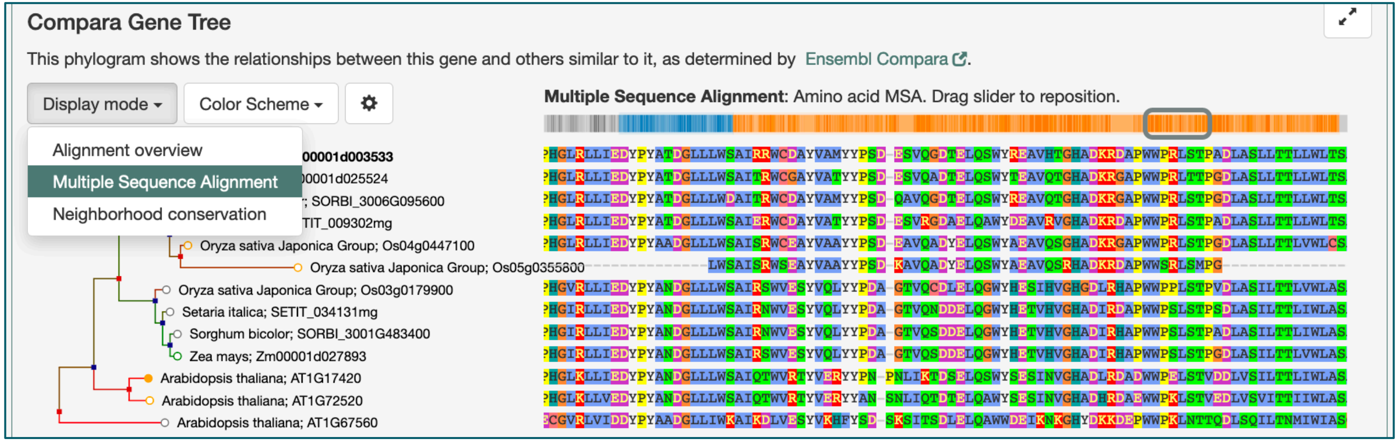
=> Prune unwanted species



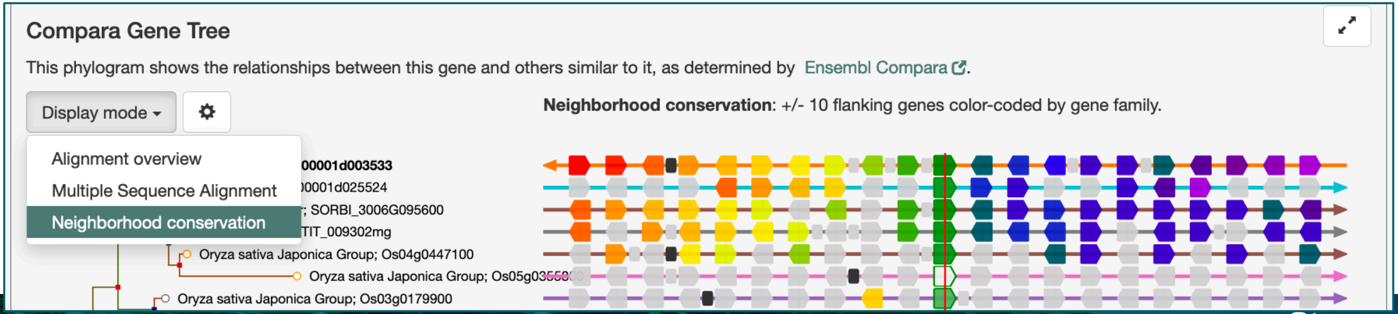
Explore a gene family tree

Gramene

=> Zoom In to view aligned amino acids

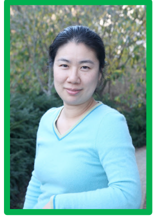


=> Zoom Out to view conserved gene neighborhoods

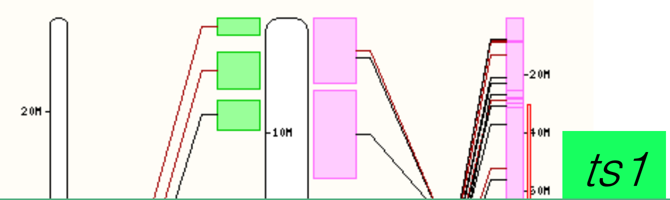


Explore synteny

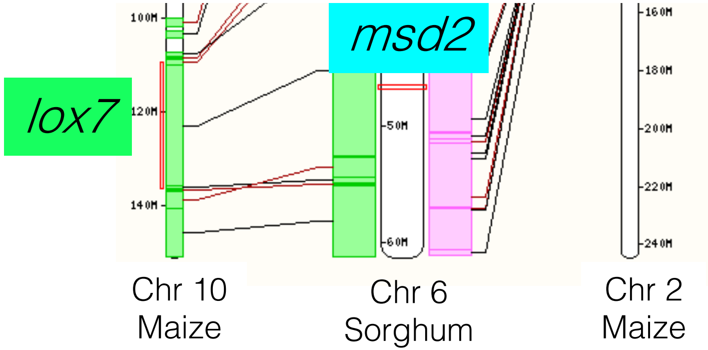
EMBL-EBI



CSHL



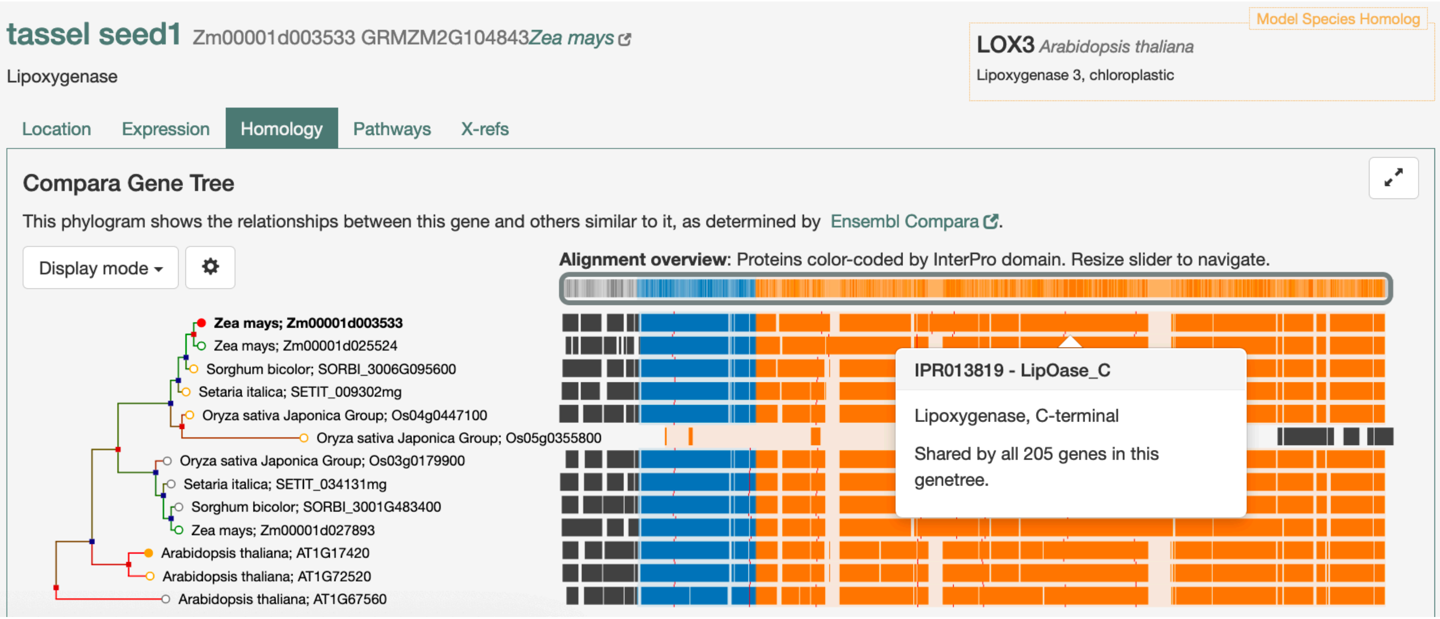
Show/hide columns					
Sorghum bicolor genes	Location		*Zea mays* homologues	Location	
SORBI_3006G095600 (SORBI_3006G095600)	6:46566240-46571064	→	tassel seed1 (Zm00001d003533)	2:47105187-47109372	Region Comparison
		→	lipoxygenase7 (Zm00001d025524)	10:121268606-121272616	Region Comparison



- Comparative Region View
- Download Gene Lists

Explore gene structure

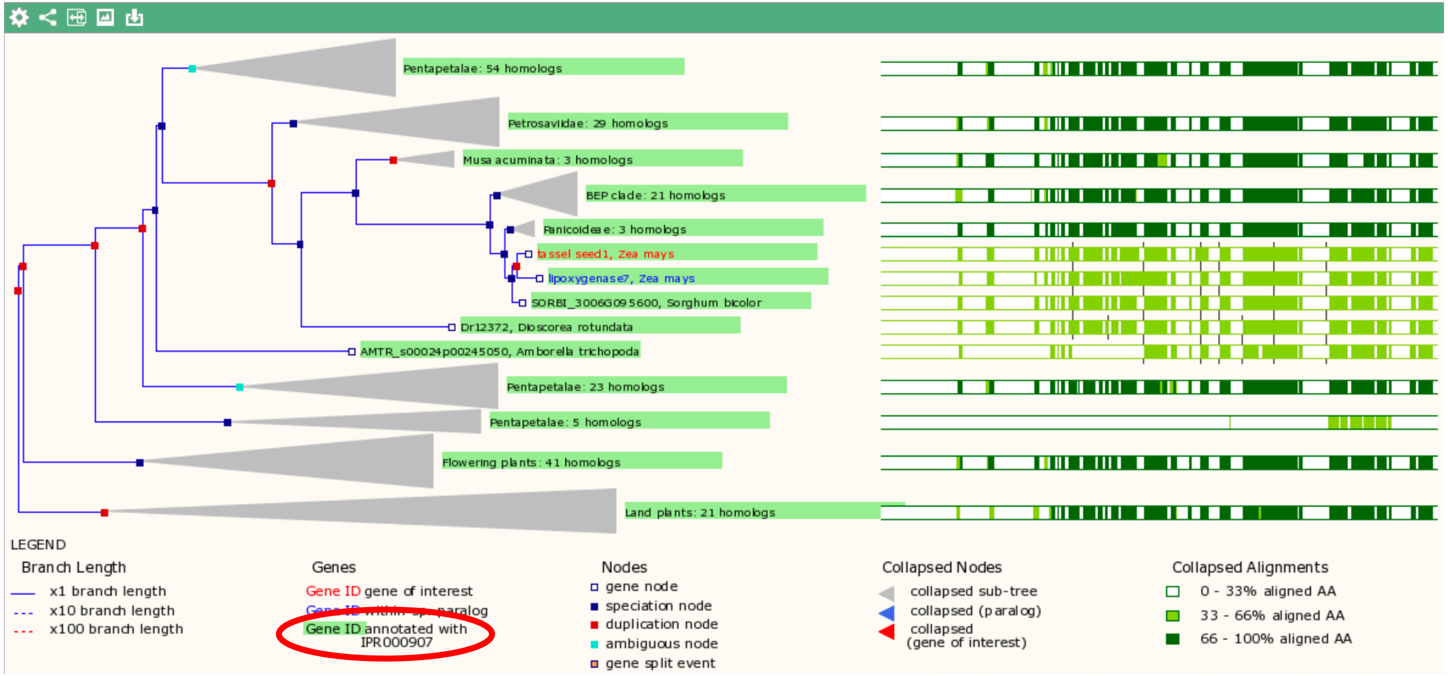
=> Identify protein domains



Explore functional gene structure

=> Highlight InterPro & GO annotations

Ensembl

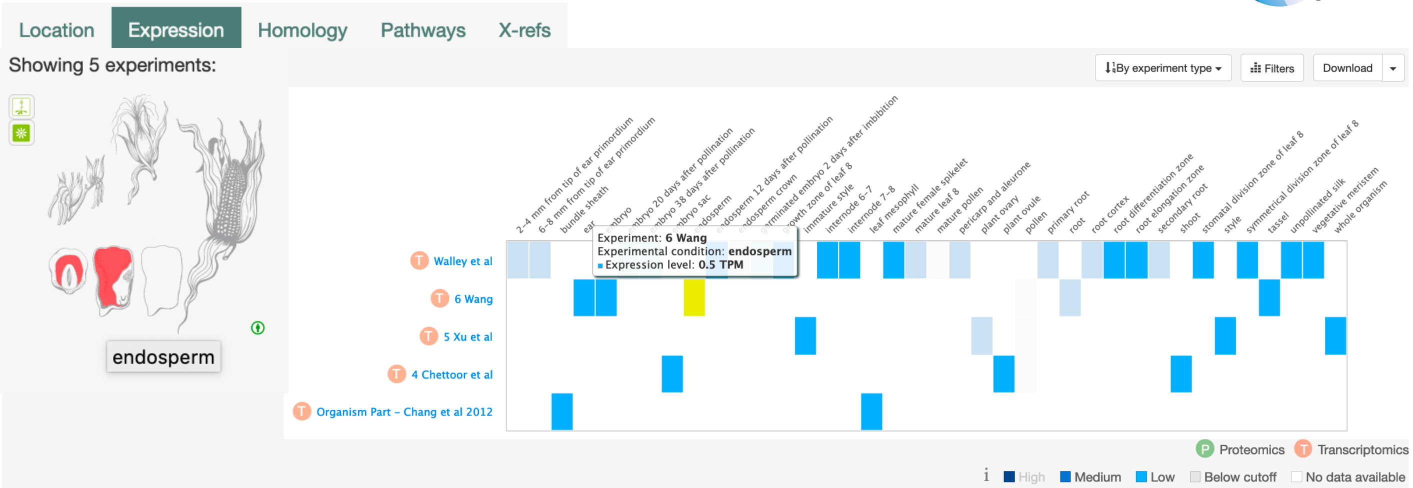


View patterns of gene expression

EBI-ATLAS

=> Visualize & download expression data from 900+ experiments in >24 plant species (EBI-Atlas)

Gene & Protein **Expression**



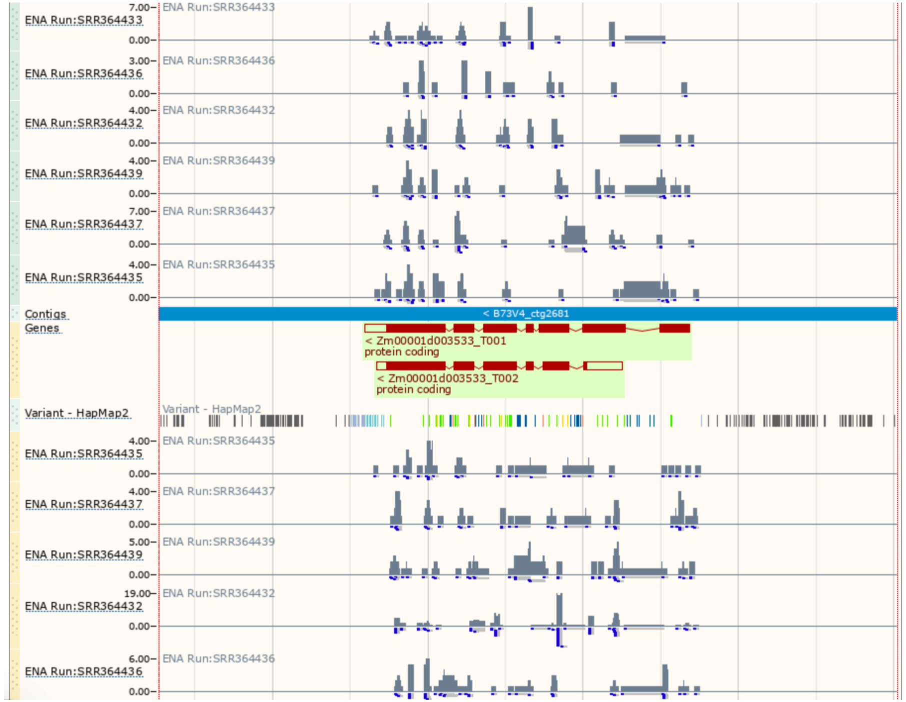
Ensembl

Gramene

Coming up… Single-Cell Experiments

Project Publicly available transcriptomics data

=> Find patterns of gene expression from public RNA-Seq studies in Track Hub

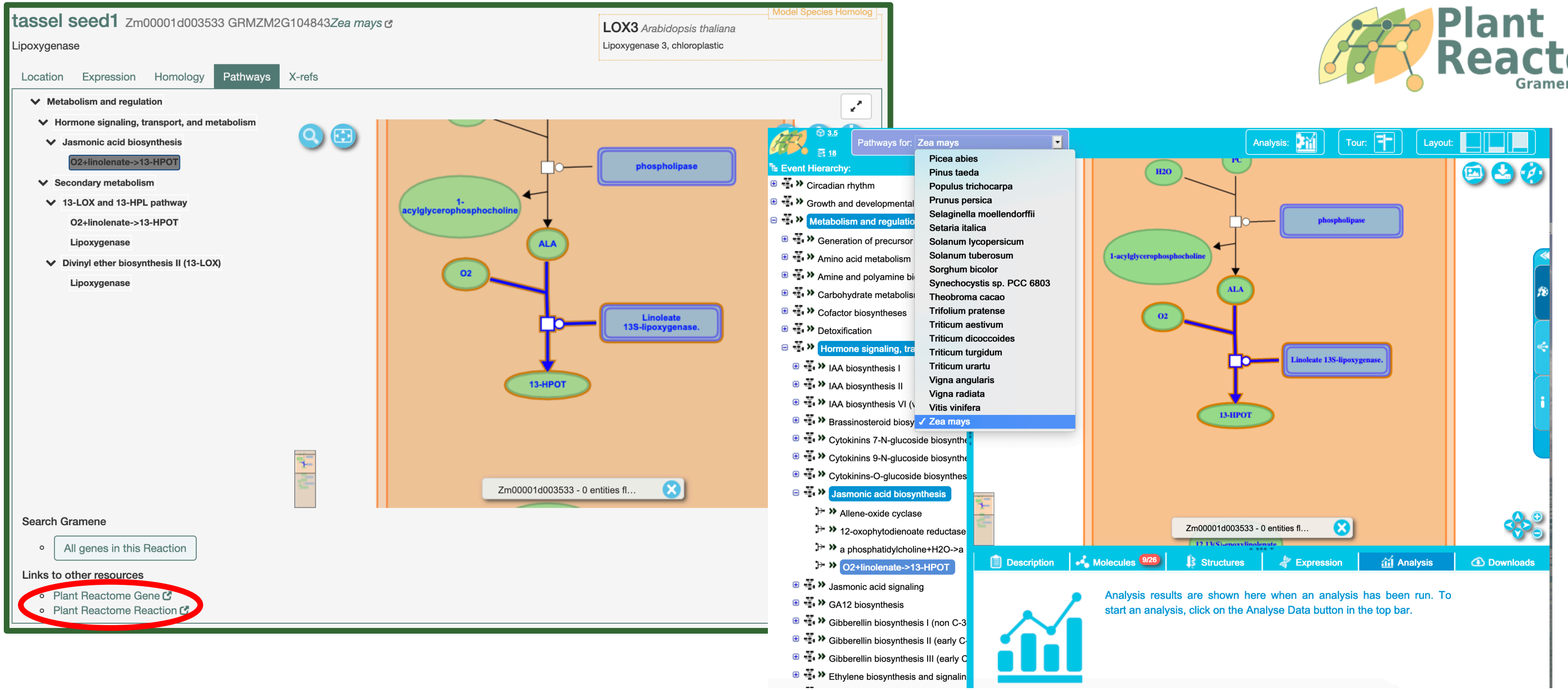


e!Ensembl

It's also possible to upload your own data!

RNA-Seq Experiment: SRP009313 – Parent-of-origin effects on gene expression & DNA methylation in the maize endosperm.

Identify pathways associated with my gene



Plant Reactome
Gramene Pathways

=> Explore Pathway & Overlay Omics Data

Videotutorials available! http://gramene.org/outreach

Explore genetic variation

⇒ *Identify germplasm with genetic variants*

e!Ensembl

Show/hide columns

Search...

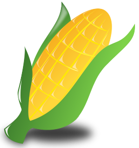
Variant ID	Chr: bp	Alleles	Source	Conseq. Type	AA	AA co-ord	SIFT	Transcript
tmp_6_47486610_G_A	6:46568309	G/A	Sorghum_EMS_mutants	missense variant	G/S	290	0.02	EES10882
tmp_6_47487006_C_T	6:46568705	C/T	Sorghum_EMS_mutants	missense variant	A/V	344	0.03	EES10882
tmp_6_47487513_G_A	6:46569212	G/A	Sorghum_EMS_mutants	splice acceptor variant	-	-	-	EES10882
tmp_6_47487541_C_T	6:46569240	C/T	Sorghum_EMS_mutants	missense variant	P/S	457	0.02	EES10882
tmp_6_47487823_G_A	6:46569522	G/A	Sorghum_EMS_mutants	missense variant	V/M	551	0	EES10882
tmp_6_47488026_C_T	6:46569725	C/T	Sorghum_EMS_mutants	missense variant	T/M	588	0	EES10882
tmp_6_47488163_G_A	6:46569862	G/A	Sorghum_EMS_mutants	missense variant	G/S	634	0.03	EES10882
tmp_6_47488256_G_A	6:46569955	G/A	Sorghum_EMS_mutants	missense variant	E/K	665	0.01	EES10882
tmp_6_47488613_C_T	6:46570312	C/T	Sorghum_EMS_mutants	missense variant	P/L	753	0.02	EES10882
tmp_6_47485843_G_A	6:46567542	G/A	Sorghum_EMS_mutants	missense variant	G/D	23	0.26	OQU81659
tmp_6_47486610_G_A	6:46568309	G/A	Sorghum_EMS_mutants	missense variant	G/S	279	0.01	OQU81659
tmp_6_47487006_C_T	6:46568705	C/T	Sorghum_EMS_mutants	missense variant	A/V	333	0.34	OQU81659

MSD2 phenotype – Gladman *et al* (2019)

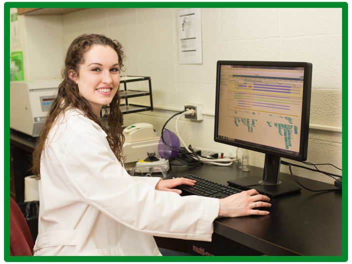
Data source – Jiao *et al* (2016): “A Sorghum Mutant Resource as an Efficient Platform for Gene Discovery in Grasses.”

EMS-mutant collections for sorghum & wheat

Community Curation: Course-based Undergraduate Research Experiences

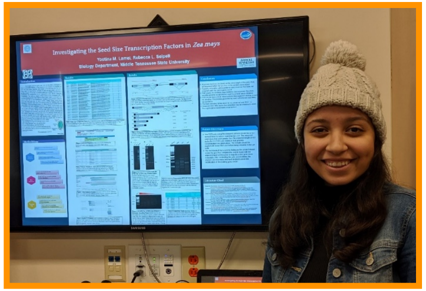


UCMO

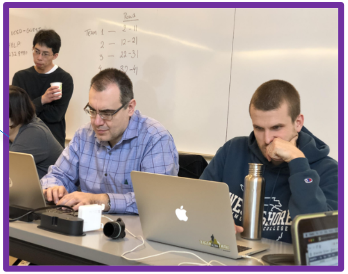


2019

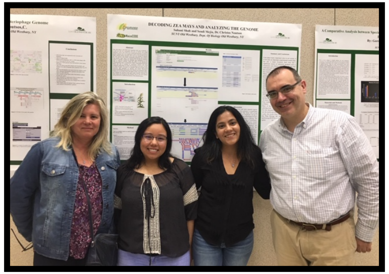
MTSU



Maize Annotation
PUI Faculty
San Diego
Jan 2019



SUNY OW



Coming soon…

Plant PanGenomes

Oryza Genome Evolution (oge.gramene.org)

Maize NAM Founders (maize-pangenome.gramene.org)

Wild & cultivated Grapevine (vitis.gramene.org)

USDA-ARS portal for Sorghum genomics/breeding resources (sorghumbase.org)

Thank you & Contact Us!

- Outreach resources: http://gramene.org/outreach
- Slides, exercises, brochures, posters: ftp://ftp.gramene.org/pub/gramene/outreach
- Mailing list & office-hours: feedback@gramene.org
- Collections & social networks in

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