

Marcela Karey Tello-Ruiz¹, Andrew Olson¹, Sharon Wei¹, Justin Preece², Parul Gupta², Sushma Naithani², Yinping Jiao¹, Bo Wang¹, Kapeel Chougule¹, Sunita Kumari¹, Vivek Kumar¹, Peter D'Eustachio³, Bruno Contreras⁴, Irene Papatheodorou⁴, Pankaj Jaiswal², Doreen Ware^{1,5}

¹Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, USA; ²Oregon State University, Corvallis, OR, USA; ³NYU School of Medicine, New York, NY, USA; ⁴EMBL-EBI, Hinxton, UK; ⁵USDA ARS NAE Robert W. Holley Center for Agriculture and Health, Ithaca, NY, USA

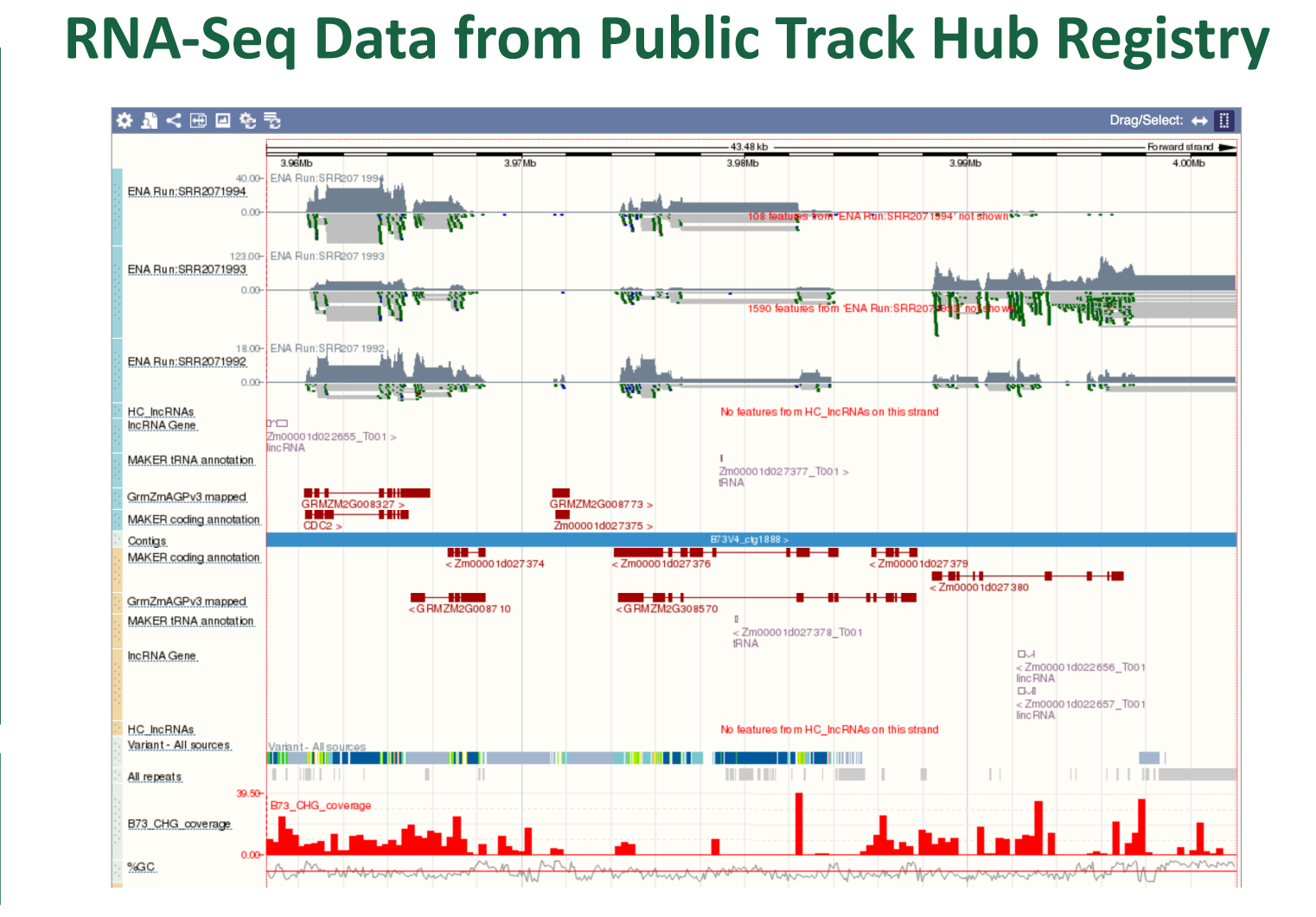
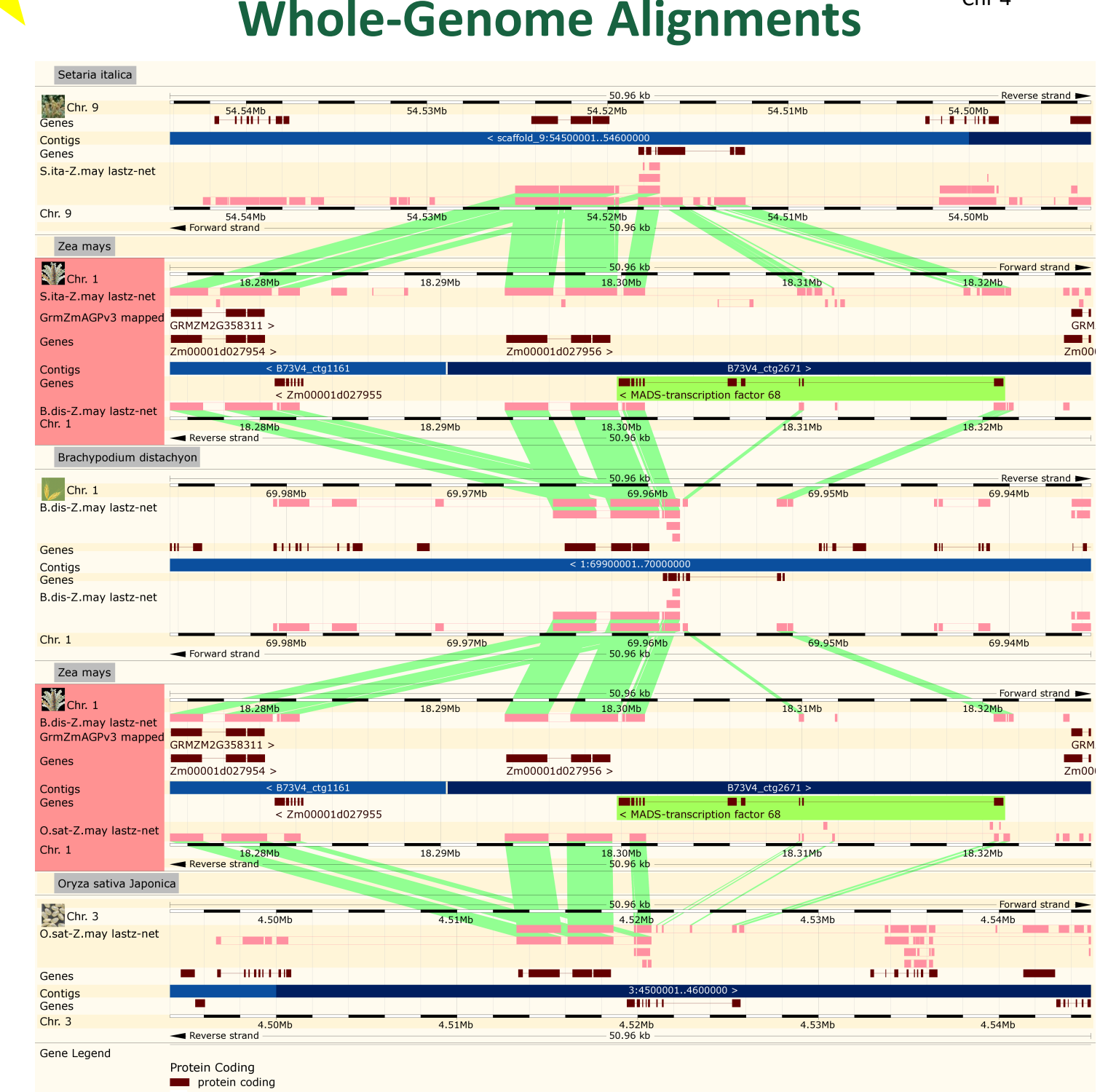
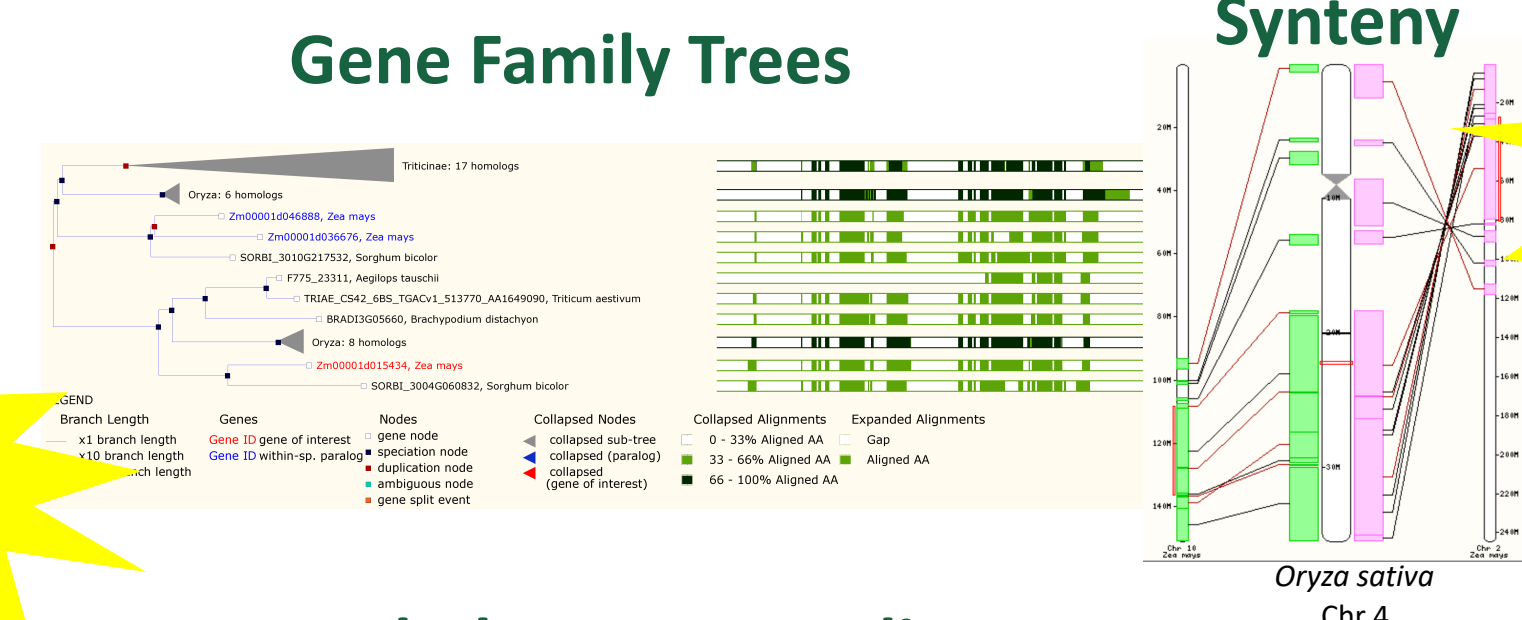
Gramene is developed in collaboration with Ensembl Plants, and leverages the Ensembl & Reactome platforms

A BOUNTY OF GENOMES

Year Highlights

- Two database releases: build 61 (April 2019), and build 62 (Nov 2019). Ensembl software updates V97-98
- 67 plant reference assemblies including:
 - Nine new genomes:
 - Coffea canephora* (robusta coffee)
 - Capsicum annuum* (hot pepper)
 - Cynara cardunculus* (global artichoke)
 - Eragrostis tef* (African tef)
 - Triticum turgidum* (durum wheat; AABB)
 - Marchantia polymorpha* (common liverwort)
 - Actinidia chinensis* (kiwifruit)
 - Panicum hallii* FIL2
 - Panicum hallii* HAL2
 - Three updated genomes and/or gene annotation:
 - Theobroma cacao* (criollo cocoa, cacao or chocolate tree)
 - Oryza sativa Japonica* (rice)
 - Solanum lycopersicum* (tomato)
- New & updated functional annotations (e.g., InterPro domains) and assembly-to-assembly mappings
- New & updated gene family trees, homologies, and split gene predictions using HMM-based method
- New & updated whole-genome alignments (WGAs) and synteny maps
- Updated wheat genetic variation

Next release #63 August 2020



What's New in the Upcoming Release #63

- 19 new genomes including apple, clementine, cherry, pineapple, watermelon, cantaloupe, pistachio, almond, olive tree, and cannabis.
- Over 35 million new genetic variants:
 - Bread wheat (Axiom 35K and 820K arrays from CerealsDB)
 - Durum wheat (35K, 90K, 820K and TaBW280K arrays)
 - Apple (10.6M SNPs)
 - Sunflower (11.8M SNPs)

Do you want to see other plant genomes or datasets added? Take our survey! <https://bit.ly/gramene>

PAN-GENOMICS: NAVIGATE MORE LINES

Coming up!



- Home of multiple genome assemblies for the same species
- Uniform annotation of genes and repeats
- Phylogenetic gene trees (orthologs, paralogs)
- Whole-genome alignments
- Gene-centered pairwise synteny maps
- Pangenome views (Syntelogs, PAV, CNVs)

25 NAM maize founders

Favourite genomes

- Zea mays b73 (Zm-B73-REFERENCE-NAM-5.0)
- Zea mays nc350 (Zm-NC350-REFERENCE-NAM-1.0)
- Zea mays k111 (Zm-K111-REFERENCE-NAM-1.0)
- Zea mays ky21 (Zm-Ky21-REFERENCE-NAM-1.0)
- Zea maysb73v4 (AGPv4)
- Zea mays W22 (Ver12)

All genomes

Select a species

Favourites

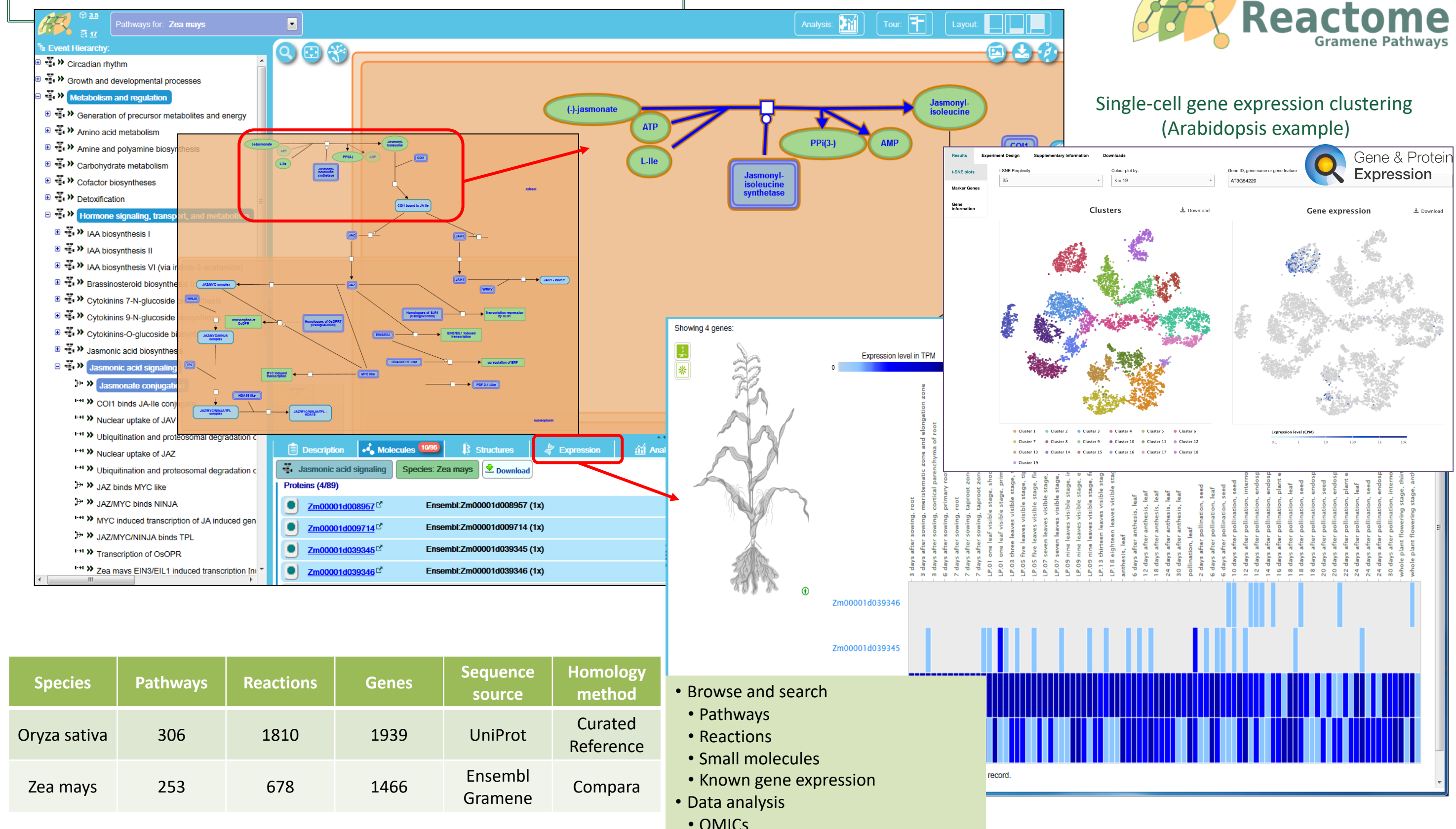
- Zea mays b73
- Zea mays nc350
- Zea mays k111
- Zea mays ky21

BUILD CONTEXT WITH PATHWAYS & EXPRESSION

- ### Year Highlights
- Plant Reactome:**
 - 10 newly curated & 3 "container" pathways to a total of 306 reference rice pathways
 - Orthology-based projections to 97 plant species (18 new) allowing pathway enrichment and inter-species comparison
 - Expression Atlas:**
 - Baseline and differential expression data sets from 819 experiments and 24 reference plant species
 - New visualization of single-cell expression data for >70K *Arabidopsis thaliana* assays

- Newly curated pathways:
- G1/S Phase
 - G1/S Transition
 - Assembly of pre-replication complex
 - Activation of pre-replication complex
 - G1/S-specific transcription
 - OsNAC5 transcription network involved in drought and high salinity tolerance
 - Root hair development
 - Phytic Acid biosynthesis (lipid independent)
 - Response to aluminum stress
 - Root-specific gene-network of NAC10_TF induced by drought, salinity, and ABA

<https://plantreactome.gramene.org>



Single-cell gene expression clustering (Arabidopsis example)

Species	Pathways	Reactions	Genes	Sequence source	Homology method
Oryza sativa	306	1810	1939	UniProt	Curated Reference
Zea mays	253	678	1466	Ensembl Gramene	Compara

- Browse and search
 - Pathways
 - Reactions
 - Small molecules
 - Known gene expression
 - Data analysis
 - OMICS
 - Species comparison

DIG DEEP WHEN YOU SEARCH & ANALYZE GENES

Gramene Gene Tree Triage Tool

Gramene Search Results: Location, Expression, Homology, Pathway & X-Refs Views

Multi-alignment view for viewing amino acid conservation

Year Highlights

- Gene, genomic location, gene expression, phylogeny, cross-references, and pathway data available via Gramene search
- Plant Reactome landing using Joomla
- Improved Gramene Gene Tree Triage Tool to flag canonical gene transcripts for potential annotation errors based on protein homology

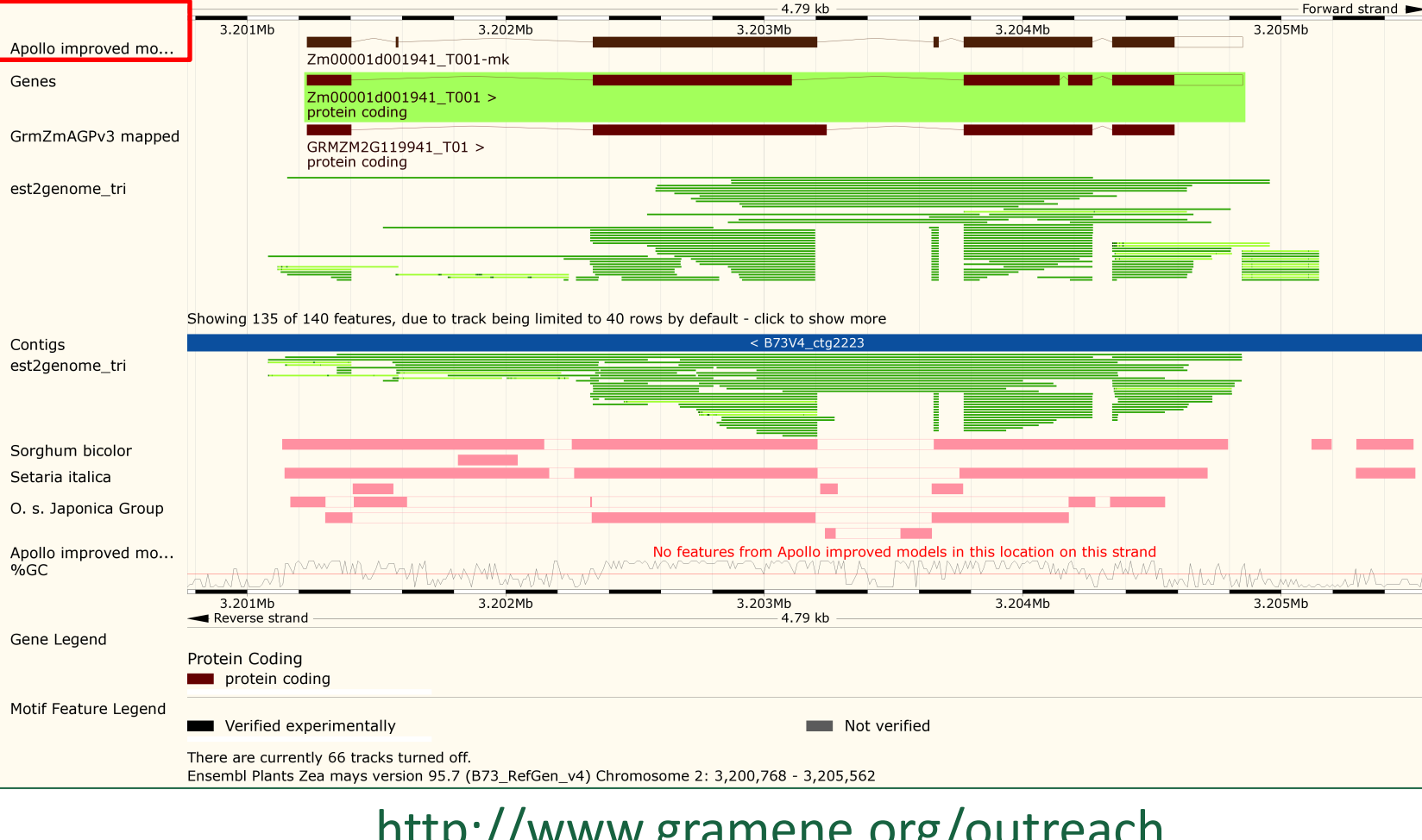
WORKING WITH THE PLANT COMMUNITY

Virtual Maize Annotation Jamboree March 2020



Improved Gene Models in the Gramene Genome Browser

http://gramene.org/curated_maize_v4_gene_models



<https://www.cshl.edu/teachers-make-genomes-more-useful-from-home/>

<http://www.gramene.org/outreach>

Community Annotation to develop CUREs

Looking for a virtual activity with undergrads?


Are you a plant researcher or educator who would like to see the structural annotation for your favorite maize or sorghum genes optimized using the latest available evidence?

We are looking for researchers to work with an individual PUI faculty and her/his students on improving genes of interest in a community curation effort.

Researchers are invited to take ownership of a set of genes of her/his interest and be the expert consultant for the PUI professor and his students. Join this effort and be among the first to gain access to unpublished gene annotations.

Interested? Contact us! feedback@gramene.org

Outreach and Training Educational resources and webinars



Meeting Maize with Gramene Webinar May 20, 2018 (12 views - 4 months ago)

Plant Reactome for Maize researchers: MOC2018 (13 views - 11 months ago)

Nov 2018 Gramene webinar: Updates in the Plant (12 views - 13 months ago)

May 2017 webinar: An Overview of Gramene (103 views - 3 years ago)

Genome Browser August 2017: Overview and new (103 views - 3 years ago)

Plant Reactome (103 views - 3 years ago)

Dec 2016 Gramene webinar: Translating genomics (84 views - 2 years ago)

Nov 2016 webinar: Visualization of gene (146 views - 2 years ago)

October 2016 Webinar: Genome Search (83 views - 2 years ago)

June 2016 Webinar: Genomic Resources and Pathways for (49 views - 2 years ago)

April 2016 Webinar: New Genome Search Interfaces (87 views - 2 years ago)

March 2016 Webinar: Variation Data in Gramene (86 views - 2 years ago)

Gramene Plant Reactome: responses for maize research (48 views - 2 years ago)

Gramene Webinars, Dec 2015: Plant Data Mining (48 views - 3 years ago)

Gramene Webinars: Updates on Plant Reactome (64 views - 3 years ago)

Gramene Webinar Nov 2015: Variant Effect Prediction (155 views - 3 years ago)

Gramene Webinar July 2015: 16 Qs: Plant Reactome (90 views - 3 years ago)

Preparing Access to Genomic Data by Dr. Paul (46 views - 3 years ago)

Deploying Gene Trees by Dr. J. Olson (28 views - 3 years ago)

Gramene Webinar June 2015: Update and explore your data (83 views - 3 years ago)

Drawing & Comparing Genomes using the Gramene (151 views - 3 years ago)

Main Data and Resources by Dr. Marcela Karey Tello-Ruiz (122 views - 3 years ago)

Site Data and Resources in Gramene Database (201 views - 3 years ago)

Download a quick start Gramene pamphlet and other e-learning materials: <ftp://ftp.gramene.org/pub/gramene/outreach>

