

Scholarships for PUI Faculty to Develop Student Projects in Genome Annotation



Apply to join us in November 2018 for a **Maize Genome "Annotation Jamboree"**

and the CSHL Biological Data Science Meeting

We invite PUI faculty to apply to a Maize genome annotation jamboree on November 10-11, 2018 at Cold Spring Harbor Laboratory (CSHL). Faculty will learn how they can involve students in authentic research by making meaningful contributions to genome annotation while improving reference Maize genomes at PanMaize. We will introduce tools developed by MaizeCODE and Gramene and provide help and support for faculty bringing these tools into the classroom. Resources are available to support travel, room and board, and registration for interested faculty to the adjacent CSHL Biological Data Science meeting (November 7-10). See our website for more about our current outreach project in annotation and to learn more about MaizeCODE and Gramene.

> Visit www.maizecode.org/outreach to register your interest or send questions: feedback@gramene.org

www.maizecode.org

www.gramene.org



Jamboree 2017



Conserved sequence missing in annotated gene



Annotation not supported by RNA-Seq evidence



NSF Award # 1744001

24 Maize NAM Founder lines



Yu et al. (2008) Genetics 178:539-551; https://doi.org/10.1534/genetics.107.074245

- Chromosome-level assembly
- Uniform annotation protocol
- Compara gene trees—ortholog identification
- All pair-wise synteny maps
- Pan-genome analysis
- Variation: copy-number presence/absence

Pangenome site: B73, W22, PH207 maize + outgroups Preview at maize-pangenome.gramene.org

| ra Gene Tree | | | | | | | | | | |
|--|-------------|--|-----------------------|---------------------------|--|--|--|-------------------------------------|------------|----------------------|
| oram shows the relationships between this gene and ot | hers simila | r to it, as d | etermined by I | Ensembl Compara 🖒 | | | | | | |
| | | - | | | | | | | | |
| mode - Color Scheme - 🌣 | Multiple | Sequence | Alignment: Ar | mino acid MSA. Drag slide | r to reposition. | | | | · · · · · | |
| | | | | | | | | | , | |
| Zea mays 873; [Zm00001d018971] | 5 8 | DED DE | OVELLEP 2 | NP2IER | VRINKESS RELATION TANKARD | U VARDA NECLICE DALMONT NOANVOIRVEAN REAL AND AND | STRUTENSSVPS | S NPIS & PT PROA | PVPPPPT R | S IV |
| Zea mays W22; [Zm00004b034038] | 2 | DED | -V-ILGP | Nr [.] ZZR | VILGUESS REAL STOR DALLARD | VALLA BELLE IAALMOYN AW BVLAN ILAN AND | E SD <mark>ER</mark> VIENSESV <mark>E</mark> S | S MPIS & PT PEODA | - PUPPPT - | 05-1V |
| Cea mays PH207; [Zm00006a026946] | | | | | DLEAP | VARIAN BELLERIAALMORYNDAWD NEULADA HLANDARD | E BLARVIENSSVP8 | REIS & PT PREDA | PABEBE S | 08 IV |
| Sorghum bicolor: 2 genes | | 01000 | Weitero | NPT IR | VIDEO DE LEASER PRODUCE | - VILLA BELL CALMON AV BOLAS BLAND NO | S SLOPID NTSL | IPIP LP BBB.V | - 1 | 0 IV |
| Setaria Italica; [Si029970m.g] | 100 | 000 00 | wettery | LT SEX | VOSIDE DE LO BACELO IN IDAMED 2 ME | VALUY REALL CATCHEST AT NOLARS IL AN AN | ALAVIOTESSOT | B DEP P VP ABACA | SG PI D | 1 II. |
| BUP clabe: 2 genes | | | | 200 200 | Contraction of the second s | | | PARTY PROPERTY AND INCOME. | NU NU N | 22. 10 |
| Southurn Monitor SOBBI 2011/01667001 | | 0000000 | TA DUTCHA | Strate 1 | LOUBLE DE REALES AND MEADERS AND | VARIAN MARTINE ADVISED AND DUT ADVITED ADVIS | E ROUTERMAN PRAVE | RETA HIPE & RETAINTS | AV PT 0 | 777 144 |
| -0. Zea mean Bill 977 (Zee 00000-019215) | | 100000 | TA TINGNO | SP/DO2 | DO REACON RESIDENCE PROVIDENCE | VART 2 MARTINE AND SOM DAVE DOLLAR VETTER DAVE | T BY TO TONNALY PAVE DE | SSIA SPEN & SPRINASTS | | TR 18 |
| C Zea mana W22: [Zm00004h011075] | | 000000 | ATNENS | SPYCO I | COTO DO TO ANEN L | VALLY BELLYLA VER AN BYLA V TLAN AND | STORATERSALYPAVED | SSLE MPTH & SPECIALTS | W 17 0 | TR 28 |
| Cea mays B73; IZm00001d013074 | | DDDMBC | DACTNENS | NP/COR | ORR BRANHLN ZUE | VADU VADU VERBELLER LADVINGEN ZAVEN VLOADVERLEA VERBE | E SVERINGHMALYPAVED | BELS HEEN & BEBDEABES | 12 12 0 | 00 18 |
| Zea mays 873; [Zm00001d034457] | | 000000 | ATTENS | NPV002 | LORRACIN REGARDER REAATELNELE | OVILIANA DE STERELE SEL AND NOT THE DANCE DANCE SERVICE AND A STREET | SVID/TONSTLEPAVED | SSLS HPPS & SPREASEA | AV PI 0 | 06 I.N |
| 2ee mays B73; [Zw00001d034455] | | 000120 | DARTICHE | SPYCOL | LOUR OSN REMARK SROTT ARLAND | VALLEVENSILLERLADING CHEANING PVLGADVELLERGING | B STANDIERSTLEPAYSDA | SSLE MPTH C SPECTARDA | AV PI Q | 00 I.N |
| Zea mays PH207; [Zm00008a005482] | | DDD 20 | DARTENS | NPNOR - | LORRECT RESARDER REALINED | O VADU <mark>RCENSKU JERCADANO</mark> RONENAVEN BAUGADARUSARA | B | SELS RPPN G SPEDEASDA | AV PI Q | 00 1. |
| | | DDDXEG | A TTGNG | SPYCE - | LORROSS RESARCE PRIMAILNELS | Q VEGEZVENSELLZZELA OVNOZVNENA VONZVLZA OVERLZAZIVANA | | SELS RPIN & SPECIASCA | AV PI 0 | 00 I.N |
| Zee mays B73; [Zm00001d034447] | | DDD SC | DARTICHO | SPACE R | LOUGOSS RESAMENT SURAHLNEDE | Q VEQUEVENEELLER LADVING "NEALVENEVLEADVERTARA AND AND | B | BELS MPER & BREDEABDA | AV PI Q | 00 28 |
| Zea mays PH207; [Zm00008a005480] | | DDD 88 | DABTTENS | NPACE 2 | LORRACIN REBARE OR PRAABLNELE | 0 VEDLEVERSELLER NOVINGERENNA DE EVLER DE LE COMPANY | E STURING STREPAUSER | SELS RPPN & SPEERARDA | AV PI O | 00 18 |
| To Setaria Italica; (SICISO62m.g) | | DODNEC | A TTONA | NPV001 | LORROSS RESARE RORDANLINELE | U VAUL OVERSELL CARANTER AND ANY DE VLOAD VEL CARANTER | SVID/TENSALSPPVSDA | SSLS MPYN & SPEESTSDA | AV PV D | 00 P |
| Arabidopsis thaliana; BZIP10 | | DED DE | ENETTERL | 20122 V 2 | RENRILSERERASE SHOULD BUTSDLE | O AND THE HERT TOT SHOW AND ANY ON THE ACT OF A CARLON | TWERVIENDIMLION STOR | NNNS MPIT G NN SHEBBB | II PA Y | Q P 18 |
| Arabidopsis thaliana; BZIP25 | 1.1 | 000.00 | <u>DXDXG</u> | 022012 | RARNIAN REBARS PRAR OF OWNERS | O VEGLER HETLINGLEDING TOARAVENETLER TO THE SAME | TANK TRANSPORT | G IPPS N 7 PRASS | SI PP N | - |
| Vitis vinifera; [VIT_07s0141g00170] | | 002 3 | A SALENS | OPA CON | CARGE STRATES DOLD HERE T | C VEGLEV RESELVED THOSY'S JAN SOUTH AND A VELLO VINC. | - AV. OTGUTSLEPAIPSI | PROF MPT VENTSSHERA | AAV 19 0 | 20-58- |
| rosids: 7 genes | | 1000 | 2 MATLINE | T NONE | NARRAL S REPARE ARREATED | C VEGLIE RESULTANT INSCRYPTION NUMBER | SHOTY COLLEGENERARS IN | SELE LPSPLOIDEPSTERAL | AAV PV D | |
| Setaria italica; (Si022331m.g) | | - | | 5-5-6-5 | STREET, STREET | C VERTICAL CONTRACTOR CONTRACTOR CONTRACTOR | AV CONTRACTOR | - PASS - 826 - 53 - 568 - 668 - 668 | | |
| O Zee mays Br3; (2/000010030995) | | | | To MAR | The Device States and a state of the state | | EVERY STOLEN PARTY | Badd ANY DO BODTANGAGE | | 10 - H <u>2</u> - |
| 200 mays Prev, (2000000000001) | | | | TRANS | CARDING THE REPORT OF THE PARTY OF THE | VERY RATING ADVISORY TRACTOR TO A TRACTOR TO A TRACTOR AND TRACTOR | AVAL PRIME PRAY | PRE AV. ES PREJASES | 5355 AT 3 | |
| Samhum bicelar (SOBB) 30083157100 | | | DI SIENT | Dirate A | SHURNLES UP BASE SUSRE AND NO. | VERTS NABLES A ONTO Y SOASE DE RUAVET IN SUSTRIA | - AVORLIGTTIMLSTAPDS | THE TTL BE GASTAABA | BY AT S | |
| BOP clade: 2 pages | | 10 | DI HENT | DPANAS | DARKING REBARD REAL AND THE | UTOLSA NASLIJSLA DATO TO TATLON SULAV DA SA SASLATA | AVOR TEASLEPSITED | ASS UPP IS CINCANSAN | AEAA PE | 38 88 |
| rosida: 6 panes | | PS DEEDE | AGAD OS | TNPADA | CORRECT ON DESCRIPTION OF SERVICE | VIEL VINATLY OF DADAID BRATTIN DALAS AVELAS | NVT SSPTTLANGLLOTOC | BORE EPPO | | LN TTN |
| BOP clade: 2 cenes | 0.0 | BLLBA | REAR PROPERTY | 1202812 | RURR TO SERVICE STREET | O VEOLENSELY CLASSOCCUTAVE DA DILLES DV DALLEVEVENDE | NVA AAMBOOLOOL | CLAPL | | 6 8 8 1 1 |
| Setaria Italica; (\$1007043m.g) | | SLY V | R GGC C R R G | 12012 C | ATRANTS RELATE BRAKE ALL SELE | U VERLENATIFERIA SANCETTAVE DE TLES DU BALQUEVAS | NVA CAN DOLLAR | CLAPY- | | CN-980 |
| [O Zee mays 873; [Zm00001d046937] | | SLY V | GV Y IG | 125 12 12 1 | Comparison and a second state of the second st | U VERDENATLY COLUMNOOC STAVE DE DI LE SVEAL DE MARKE | NVA NAVDOLODI | GLAPY | | VN-SUX |
| Zea mays PH207; [Zm00008a034882] | | SLYN | EGV2YERG | | RURRWERREEARS BRRECAULS DUE | O VERVICE AT LEVOLS DANCOR PLAN DARLE DVERU DVERU | 6 788 016 | | | 2 0 2 |
| C Zea mays W22; (Zm00004b000166) | 2 . | SLY V | GV2Y RG | NEC 202 | RIRRY'S RELAR BRANCHER | O VERVICENATION CONTANT NETRO DE LA CONTANT | NVA GAVDOGLODL | GLAPY | | V. 20 |
| Zea mays W22; [Zm00004b021670] | | Shrey | GV2Y SC | 12:12:2 | COURTER REST IN COURCE CERTER | VIII COMPARING STANCEST AND DED TO STATE SAND | E NVASSVVDELEDL | CLAPY | | VN - 8 002 |
| Cee mays 973; [Zm00001d050688] | TH-SLVLI | LL PLA | STAVA CLL | HPEARLEL INANHALESED | BERLINVIN RENVER RREK CLADE | A REAL FOR THE REAL OF STATE AND A REAL STATE OF | E NVARAVVARIADO | CAPY- | | VI BRE |
| C Zea mays PH207; (Zm00008a016342) | | | | | NVS8 21 EVER SHEER GOLD B | A TRANSPORT AND AND AN A TRANSPORT | NVA SIVUS LOL | GLAPY | | VI - 122 |
| Zea mays B73; [Zm00001d003529] | | | | | SVP2 | VILLAS MALLYDOR BUARDER BUARDER BUARDER VALUUS ALGUNAR | S NIACCEVERIA | CLAPY | | |
| Zea mays PH207; [Zm00008a007254 | | 200,00 | and the second second | | State of the second sec | A REAL PROPERTY AND A REAL | | States - | | |
| 2 Zaa mays PH207; (2m00006a020514) | i. | Contra Co | Contraction of the | 10 P-1 | STREET, RESTREET, REPERTATION | | T NYABAVVACTOR | OT APY | | |
| 7 200 mays 8/3; (2000010014/10) | i i | STATUTE OF | GUAY DO | 10121 | STREAT IN REAL TO REAL OF | VIEWS NATIFOLS AND PRAYER TILLS PART OF ANY | NVA BAVAGE 1877 | GLAPT | | |
| 0 Zea mays 873 (2m0001/006223) | | SLY W | GW2Y 100 | 1000 | DETURINES OF SAUCE DUDINGALLS OF | VAU. | NYA BYYSCELOT | GLAPY | | 10 000 |
| Somburn bicolor: ISOPRI 301062185001 | | BUTRY | GW2Y IG | NO. 10 10 | STORENT STREAM STREAM CONTRACTS | U VIELO NATLEO LE RANDO BRAVE IN RILLE IVERLOVO AL | E NVASIALECELED | OLAPT- | | CB - 800 |
| Scrohum bicolor: ISORBI 3004G059900I | | SLLET | 6670 05 | THEORY | MARNYS REAR ORDER OMILADLE | VOID OF NAMES OF TAXE OF TAXE OF TAXE OF TAXE OF TAXES | NVA GALDOGLOSI | di spy | | LN PRO |
| | | Data Di | 0070-05 | THEORY | MUNYER DE BASS BUSINGAHLAGLE | VORDER HABLY OLT DANCE THAN DA BILLES DUBAL VOID | NVA CALDOGLOBL | GLEPA | | LB 100 |
| Cea mays W22; [Zm00004b013002] | | BRLIER | F0070 05 | TNPODVE | MARNIN REAL BRANCARLADLE | U VOULANT ARTENDER AND PRAY DARLEY AND ARTENDER AND ARTENDER | NVA COAL SCOLOSI | GL SPX | | CN PRO |
| C Zea mays PH207; [Zm00008a040190] | | | | | HARNYES RELATE BREET | VERIES HARLINGER DANGE TRAVE DE RESERVERE DANS AND | NVA GALSCOLOSI | GLSPA | | LN PRO |
| Setaria Italice; [Si017778m.g] | | SLLEI | 1001010105 | TNEODAR | RENTER RESARDER ARLANCE | C VELLERARLY CLIPANCE TAY DIRITS DVDAL 2424 201 | NVA CALTON LOSL | GL SPY | | 6N 1980 |
| BOP clade: 3 genes | 2 4 | SSLL ST | 10070105 | TNPLEVE | RIARNY REALES REALES | O VOID CONARD COLORADO CONTRA DE COLORADO C | NVA GAL PEGLERL | GGC SPX | | 6) <mark>22</mark> 0 |
| | | | | | | | | | | _ |