**Tiling Path File (TPF) Specification v1.8**

**Date: Nov. 6, 2013**

**What it is:** A TPF specifies the order of a set of sequences along a larger molecule(s). Gap types and sizes can be specified, along with the desired orientation of the component sequences. The molecule can be as large as a chromosome and as small as a sequence contig made up of one smaller sequence. A TPF can have one or more sequences/clones.  
  
**What it is not:** A TPF does not specify the particular version of a sequence, nor does it specify the switch points between adjacent clones in a given scaffold/contig.

**Header Information:** Header information is provided in a key-value type of structure. Each header field will be prefixed with ##. These fields are available:

* ##Organism (Required)
* ##Assembly Name (Required)
* ##Chromosome (Required)
* ##Strain/Haplotype/Cultivar (Optional)
* ##Type (controlled vocabulary) (Required)
* ##Version (Calculated by Database, Required)
* ##Comment (Optional)

Additional header information will be calculated upon submission.

* ##Submitter
* ##Create date
* ##Update date

Here is an example header:

##ORGANISM: Mus musculus

##ASSEMBLY NAME: Reference

##CHROMOSOME: 1

##STRAIN/HAPLOTYPE/CULTIVAR: C57BL/6J

##TYPE: Complete Chromosome

##Version: 1

##Comment: some useful information here.

##SUBMITTER: Tina Graves, WUGSC

##CREATE DATE: Nov 3 2006 12:16PM

##UPDATE DATE: Nov 5 2006 12:12PM

The data defining the actual tiling path should be flanked by header and footer lines to minimize the chance of file truncation. The header and footer lines shall have the following format:

All header “## TAG: value” pairs must occur before this line:

##=== Beginning of TPF Data ===

Required after the TPF data rows:

##=== End of TPF Data ===

**Column definitions for sequence lines:**

**Column 1:** accession number. This must be a valid accession assigned by the International DNA Sequence Database (GenBank/EMBL/DDBJ). No version number should be used. It is assumed that the current version of the accession is what is intended. **OPTIONAL**, use “?“ if unknown.

**Column 2:** clone name. If the sequence is defined by a clone, then the clone name should be specified here. Ideally, standard Clone DB nomenclature will be used. **OPTIONAL**.

* If a sequence is derived from more than one clone, the clone name can be given as “MULTIPLE”.
* Use “?“ if clone name unknown or component is not a clone.

**Column 3:** local contig identifier. The name given to the scaffold/contig generated by assembling the listed sequences. **REQUIRED.**

* **NOTE: A local contig identifier may only be used once per assembly.**

**Column 4:** contained status or component orientation. This column is only used to specify clones that are known to be contained within another clone on the TPF, or to indicate the desired orientation of a component within the contig.

* For contained components, the only values allowed are "CONTAINED" and "CONTAINED\_TURNOUT". **Use: REQUIRED for contained components, otherwise OPTIONAL.**
* When indicating orientation, the only allowed values are "PLUS" and "MINUS". **Use: OPTIONAL.**
  + **Note:** If no orientation is specified for a singleton component, a default orientation of “PLUS” is assumed
  + **Note:** Orientation cannot be specified for components marked as contained

**Column 5**: accession number. This must be a valid accession assigned by the INSDC. No version number should be used. It is assumed that the current version of the accession is what is intended. The accession provided in this column must be in column 1 on another line of the same TPF and must also belong to the same local contig (column 3) as the contained clone. See below for requirements. **REQUIRED if COLUMN 4 is CONTAINED or CONTAINED\_TURNOUT, otherwise not valid.**

**Column 6:** clone name. The clone name used in this column should correspond to the accession listed in column 5, if the sequence is derived from a clone. Ideally, standard Clone DB nomenclature will be used. See below for requirements. **REQUIRED IF COLUMN 4 is CONTAINED or CONTAINED\_TURNOUT, otherwise not valid.**

* NOTE1: Columns 5 and 6- these are similar to columns 1 and 2 in that at least one, but not both, requires a value. However, if both are known, please supply both values.
* NOTE2: If column 4 is not populated with CONTAINED or CONTAINED\_TURNOUT in a sequence line, do not populate columns 5 or 6. If column 4 is populated with CONTAINED or CONTAINED\_TURNOUT, then provide values or “?” for columns 5 and 6.

**Column definitions for non-sequence lines:**

**Column 1:** GAP. This is the term used and it should always be capitalized. Used to note the gap lines. **REQUIRED**

**Column 2:** gap type. Specifies the type of gap. **REQUIRED**

Values are:

* TYPE-1: [Deprecated]- was a place-holder for a picked clone.
* TYPE-2: clone gap
* TYPE-3: contig gap- unable to close using available technology
* Biological Gap: If there is a biological gap such as a centromere, etc. then use the name rather than type-4. This is a controlled vocabulary:
  + CENTROMERE
  + TELOMERE
  + HETEROCHROMATIN
  + SHORT-ARM
* PAR: (Y-chromosome only) The pseudoautosomal regions of the Y chromosome are represented by PAR gaps. Accessions for chr. X-derived PAR sequences are omitted from the chr. Y TPF, but are present in the chr. Y AGP. Switch points for PAR boundary clones will be curated manually.
  + Note: The comments section of the header should be used to provide the bp positions at which the PAR region begins and ends in the relevant accessions. Header comments are entered via the web-based form at the time of submission. This information will be inserted into the ##COMMENT line of the header. It will also be stored in the database and can be retrieved for future use.
* Biological Feature: If there are TPF components providing representation of a biological feature (e.g. centromere, heterochromatin), use the following terms to flank the first and last such components on the TPF. **NOTE: No gap will be inserted at these lines; they are used for TPF mark-up only.**
  + CENTROMERE\_DATA\_START
  + CENTROMERE\_DATA\_END
  + HETEROCHROMATIN\_DATA\_START
  + HETEROCHROMATIN\_DATA\_END

**Column 3:**

* For TYPE-2, TYPE-3 or Biological gap: Gap size. Estimated size of gap. In the absence of submitted gap sizes, a pre-defined species-specific gap size will be used for clone and contig gaps. **OPTIONAL**, unless the gap type is ‘Biological’ then required.
* For PAR gap: accession number of the first sequence to contain the PAR region, as defined on the X chromosome (this accession may contain both non-PAR and PAR sequence)

**Column 4:**

* For TYPE-2, TYPE-3 or Biological gap: Method used to determine gap size. If a gap size has been estimated experimentally, the method should be noted here. Currently acceptable values:
  + - FISH
    - OPTICAL MAP
    - RADIATION HYBRID
    - PCR
    - FINGERPRINT
    - PAIRED ENDS
    - ALIGN GENUS
    - ALIGN XGENUS
    - ALIGN TRNSCPT
  + Multiple methods may be entered for a single gap. Methods should be separated by a semi-colon (Example: FISH;OPTICAL MAP;ALIGN GENUS).
  + **REQUIRED if column 3 is populated and gap type is not biological, otherwise not valid.**
* For PAR gap: accession number of the last sequence to contain the PAR region, as defined on the X chromosome (this accession may contain both non-PAR and PAR sequence)

All columns are tab delimited and lines are terminated by a newline. Lines beginning with a single “#” can occur anywhere within the file, are comments and can be ignored by parsers. Lines beginning with “##” can be ignored by simple parsers but contain structured information about the TPF.

Each file should have only one header, so all of the objects described in a file should have common header information.

**Validation:**

**For sequence based lines:**

* If column 1 is populated with a valid accession, column 2 may be unpopulated (using “?“ as a placeholder). Ideally, this will only occur in the case where a sequence is not based on a defined clone and has no other easily identified name.
* If an accession is supplied, it must be valid according to the IDNSC.
* A given accession cannot be used more than once per assembly, but may be used in >1 assembly. (The assembly name is listed in row 3 of the TPF header).
* If column 1 is not populated (using “?“ as a placeholder), then column 2 should be populated.
* If there is not enough information to populate column 1 or 2, then a gap line should be used.
* If column 4 = CONTAINED or CONTAINED\_TURNOUT, then columns 5 and 6 must be populated.
* If column 4 = PLUS or MINUS, then columns 5 and 6 must not be populated.
* If column 4 is not populated, then columns 5 and 6 must not be populated.
* If column 4 = CONTAINED or CONTAINED\_TURNOUT, the accession provided in column 5 must be present in the same local contig (column 3) as the accession in column 1.

**For gap lines:**

* Gap type-1 lines are no longer allowed.
* Gap type-2 lines will default to a species-specific preset size if no sizing data is provided.
* Gap type-2 lines may not be adjacent to one another.
* Gap type-3 lines will default to a species-specific preset size if no sizing is provided.
* Gap type-3 lines may not be adjacent to one another.
* Gap type-2 and type-3 lines may not be adjacent to one another.
* TYPE-3 gaps may not be contained within a contig
* Biological gaps must provide a size estimate in column 3; they do not need to have a method in column 4.
* Biological gaps may not be contained within a contig
* There can be consecutive biological gap lines of different types.
* If a gap size is provided in column 3, the method used to determine this size must be provided in column 4, unless column 2 is a biological gap.
* PAR gaps are only permitted on the Y chromosome TPF.
* If the gap type is PAR, the beginning and ending accessions for this region must be listed in columns 3 and 4, respectively.
* If the gap type is PAR, columns 3 and 4 must both contain valid accessions that are found in column 1 on the chromosome X TPF.

**CONTAINED COMPONENTS**

**Types of Contained Components**

A component is considered “contained” when its entire sequence can be aligned to another component on the TPF (excluding any internal alignment gaps). A contained component MUST be marked on a TPF if it is to be included in the corresponding AGP. There are two designators that can be used to mark contained components on the TPF: CONTAINED and CONTAINED\_TURNOUT. The designators differ in the switch point selection rules applied to the contained component during AGP production.

**A. CONTAINED**

TPF components marked with the “CONTAINED” designator will follow the default switching rules during AGP production. Examples for usage are shown.

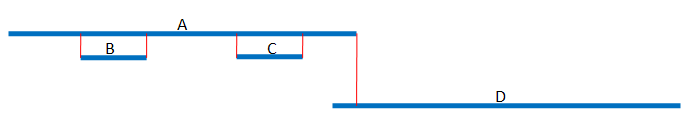
**Example A1: Single contained clone**

contained_1TPF shows:

A

B CONTAINED A

**Example A2: Multiple non-overlapping contained clones**

****TPF shows:

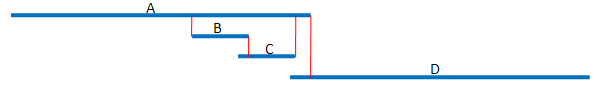
A

B CONTAINED A

C CONTAINED A

D

**Example A3: Multiple overlapping contained clones**

TPF shows:

A

B CONTAINED A

C CONTAINED A

D

Note that the TPF mark-ups for examples A2 and A3 are identical. The software that produces the AGPs will determine the relationship between clones B and C and produce the appropriate switch points.

**IMPORTANT:** **If the last clone in a chain of contained clones will switch back to the container, all clones in the chain should be marked CONTAINED.**

**B. CONTAINED\_TURNOUT**

TPF components marked with the “CONTAINED\_TURNOUT” designator will follow alternate switching rules during AGP production. Examples for usage are shown.

**Example B1: Single contained clone**

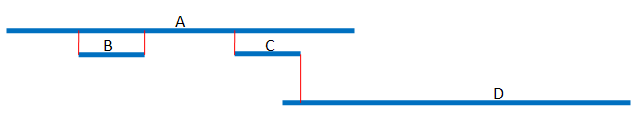
contained_to_1

TPF shows:

A

B CONTAINED\_TURNOUT A

**Example B2: Multiple non-overlapping contained clones**

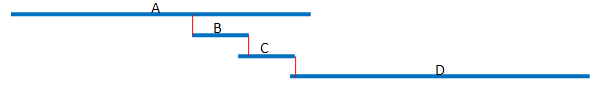
TPF shows:

A

B CONTAINED A

C CONTAINED\_TURNOUT A

D

**Example B3: Multiple overlapping contained clones**

TPF shows:

A

B CONTAINED\_TURNOUT A

C CONTAINED\_TURNOUT A

D

**IMPORTANT:** In Example B3, note the use of CONTAINED\_TURNOUT for both components, and contrast to Example A3. **If the last clone in a chain of contained clones will not switch back to the container, the entire chain should be marked as CONTAINED\_TURNOUT.**

**Additional Info for TPF Representation of Contained Components**

* A component can only be contained by another component present in the same TPF contig
  + If column 4 = CONTAINED or CONTAINED\_TURNOUT, the accession provided in column 5 must be present in the same local contig (column 3) as the accession in column 1.
* In situations of hierarchical containments, the TPF should always display the nearest contained relationship for any contained sequences.
  + Example:
    - A ---------------------------------
    - B -------------------
    - C --------
  + TPF should report:
    - B contained in A
    - C contained in B
* In situations of hierarchical containments the order of the contained sequences on the TPF does not need to reflect the desired sequence order on the AGP.
* In situations where multiple sequences are contained within the same sequences (but are not hierarchical), the order of the contained sequences on the TPF does not need to reflect the desired sequence order on the AGP.

**Specifying Orientation for TPF Components**

Component orientation may be optionally specified in TPF column 4 (PLUS or MINUS).

* If the TPF component with specified orientation is a singleton, the specified orientation will be used in the AGP.
* If no orientation is specified for singleton TPF components, they will be placed in “plus” orientation in the AGP by default.

Although there is no need to specify orientation for non-singleton TPF components (their orientation is defined automatically via the alignments with neighboring components), this is allowed. This can be useful for cases where a TPF component is flanked by phase 1 or “?” components and will thus appear as a singleton in the AGP.

* If the TPF component with specified orientation appears as a singleton in the AGP, the specified orientation will be used in the AGP.
* If the TPF component with specified orientation does not appear as a singleton in the AGP, the orientation derived from its alignments will still be used for the purposes of contig building. However, if the component orientation in the AGP conflicts with the orientation specified on the TPF, a warning/error message will be reported.

Orientations cannot be specified on the TPF for contained components. Their orientation will always be derived from the alignment with the container clone.

**Specific TPF examples:**

1. A TPF may contain one or more partial contigs. For example:

##ORGANISM: Mus musculus

##CHROMOSOME: 1

##ASSEMBLY NAME: NOD/MrkTac

##STRAIN/HAPLOTYPE/CULTIVAR: NOD/MrkTac

##TYPE: Contig

##VERSION: 1

##COMMENT: EXAMPLE TPF ONLY

##SUBMITTER: Schneider, NCBI

##CREATE DATE: Nov 3 2006 12:16PM

##UPDATE DATE: Nov 3 2006 12:16PM

##=== Beginning of TPF Data ===

AL645951 DN-29B18 NCBI\_Mmchr1\_ctg163678

AL596283 DN-257N2 NCBI\_Mmchr1\_ctg163678

CR936839 DN-120A16 NCBI\_Mmchr1\_ctg37199

CR936842 DN-189K17 NCBI\_Mmchr1\_ctg37199

#

AL671997 DN-396O20 NCBI\_Mmchr1\_ctg163206

AL672024 DN-378G17 NCBI\_Mmchr1\_ctg163206

##=== End of TPF Data ===

The absence of gap lines implies there is no known order for these contigs. Note that contigs may be separated by“#”. This is not required and is only done to facilitate reading of the TPF by individuals.

2. A TPF may specify an entire chromosome. For example:

##ORGANISM: Mus musculus

##CHROMOSOME: 2

##ASSEMBLY NAME: Reference

##STRAIN/HAPLOTYPE/CULTIVAR: C57BL/6J

##TYPE: Complete Chromosome

##VERSION: 2

##COMMENT: EXAMPLE TPF ONLY

##SUBMITTER: Schneider, NCBI

##CREATE DATE: Oct 29 2007 04:39PM

##UPDATE DATE: Oct 29 2007 04:39PM

##=== Beginning of TPF Data ===

GAP CENTROMERE 3000000

? WI1-1974M19 Mmchr2\_ctg1

? WI1-923N3 Mmchr2\_ctg1

CU207330 WI1-2764C4 Mmchr2\_ctg1

AL928883 RP23-60E18 Mmchr2\_ctg1

AL732620 RP23-167G19 Mmchr2\_ctg1

AL929080 RP24-129J15 Mmchr2\_ctg1

AL732328 RP23-106P4 Mmchr2\_ctg1

AL844530 RP23-248L2 Mmchr2\_ctg1

CU181741 WI1-2132D7 Mmchr2\_ctg1 CONTAINED AL845441 RP23-327I5

AL845441 RP23-327I5 Mmchr2\_ctg1

AL935139 RP23-74F20 Mmchr2\_ctg1

AL954325 RP23-416H10 Mmchr2\_ctg1

AL928978 RP23-95M7 Mmchr2\_ctg1 CONTAINED\_TURNOUT AL954325 RP23-416H10

AL928947 RP23-69N1 Mmchr2\_ctg1 CONTAINED\_TURNOUT AL954325 RP23-416H10

AL807832 RP23-198D21 Mmchr2\_ctg1

AL928550 RP23-272I15 Mmchr2\_ctg1

AL807778 RP23-198G1 Mmchr2\_ctg1

BX682541 RP23-349P20 Mmchr2\_ctg1

AL928662 RP23-379M5 Mmchr2\_ctg1

AL732403 RP23-119L20 Mmchr2\_ctg1

BX323054 RP23-329P15 Mmchr2\_ctg1

AL928940 RP23-94J17 Mmchr2\_ctg1

AL929142 RP23-340A13 Mmchr2\_ctg1

AL928958 RP23-344N23 Mmchr2\_ctg1

AL928924 RP23-307E15 Mmchr2\_ctg1

CR388026 RP23-39L16 Mmchr2\_ctg1

AL928735 RP23-413M3 Mmchr2\_ctg1

BX842658 RP23-86F17 Mmchr2\_ctg1

AL845275 RP23-112F5 Mmchr2\_ctg1

AL845515 RP23-256D19 Mmchr2\_ctg1

AL845492 RP23-222P7 Mmchr2\_ctg1

AL929240 RP23-245A10 Mmchr2\_ctg1

AL772190 RP23-124P7 Mmchr2\_ctg1

CR936244 RP24-562B12 Mmchr2\_ctg1

CU207293 WI1-632G16 Mmchr2\_ctg1

AL845485 RP23-237D23 Mmchr2\_ctg1

BX649227 RP23-114C18 Mmchr2\_ctg1

AL840637 RP23-113H3 Mmchr2\_ctg1

AL845488 RP23-215P8 Mmchr2\_ctg1

AL928600 RP23-348O19 Mmchr2\_ctg1

AL929143 RP23-339G18 Mmchr2\_ctg1

AL773590 RP23-181A13 Mmchr2\_ctg1

BX005023 RP24-316N23 Mmchr2\_ctg1

AL928713 RP23-399M5 Mmchr2\_ctg1

AL929149 RP23-93B24 Mmchr2\_ctg1

BX293551 RP23-107O21 Mmchr2\_ctg1

AL929043 RP23-58H6 Mmchr2\_ctg1 CONTAINED BX293551 RP23-107O21

AL929187 RP23-8G6 Mmchr2\_ctg1 CONTAINED AL929043 RP23-58H6

BX294115 RP24-465I11 Mmchr2\_ctg1

AL929440 RP23-292F11 Mmchr2\_ctg1

AL928665 RP23-294O23 Mmchr2\_ctg1

AL928832 RP23-261N18 Mmchr2\_ctg1

AL929194 RP23-385L14 Mmchr2\_ctg1

AL772377 RP23-141B15 Mmchr2\_ctg1

AL845529 RP23-276D17 Mmchr2\_ctg1

AL928704 RP23-393G10 Mmchr2\_ctg1

AL772367 RP23-119N4 Mmchr2\_ctg1

AL953853 RP23-6M16 Mmchr2\_ctg1

AL772216 RP23-153M22 Mmchr2\_ctg1

AL844485 RP23-436D21 Mmchr2\_ctg1

AL845264 RP23-116F18 Mmchr2\_ctg1

AL772352 RP23-147F6 Mmchr2\_ctg1

AL928715 RP23-373D16 Mmchr2\_ctg1

AL929020 RP23-291L24 Mmchr2\_ctg1

BX679665 RP23-247J17 Mmchr2\_ctg1

AL929179 RP23-428M4 Mmchr2\_ctg1

AL831794 RP23-114B13 Mmchr2\_ctg1

AL845548 RP23-307N14 Mmchr2\_ctg1

AL928795 RP23-38B1 Mmchr2\_ctg1

AL928909 RP23-320I18 Mmchr2\_ctg1

AL845313 RP23-202C2 Mmchr2\_ctg1

AL845533 RP23-232K16 Mmchr2\_ctg1

AL772342 RP23-105D19 Mmchr2\_ctg1

AL928641 RP23-272N6 Mmchr2\_ctg1

AL928560 RP23-353N23 Mmchr2\_ctg1

BX649225 RP23-104N16 Mmchr2\_ctg1

AL929209 RP23-415C3 Mmchr2\_ctg1

AL935271 RP23-336A16 Mmchr2\_ctg1

AL928807 RP23-97D20 Mmchr2\_ctg1

AL773538 RP23-14I24 Mmchr2\_ctg1

AL772303 RP23-185P20 Mmchr2\_ctg1

BX322642 RP24-363O9 Mmchr2\_ctg1

AL928918 RP23-403G13 Mmchr2\_ctg1

AL844560 RP23-334M9 Mmchr2\_ctg1

AL845434 RP23-211O3 Mmchr2\_ctg1

AL845290 RP23-201A19 Mmchr2\_ctg1

AL844558 RP23-378I2 Mmchr2\_ctg1

BX649230 RP23-157J23 Mmchr2\_ctg1

AL935312 RP23-56A7 Mmchr2\_ctg1

AL929165 RP23-446D4 Mmchr2\_ctg1

AL928632 RP23-303M15 Mmchr2\_ctg1

AL929268 RP23-379F6 Mmchr2\_ctg1

AL929158 RP23-92O15 Mmchr2\_ctg1

AL844166 RP23-107K21 Mmchr2\_ctg1

AL845417 RP23-20I9 Mmchr2\_ctg1

AL928841 RP23-95M4 Mmchr2\_ctg1

AL844839 RP23-191F2 Mmchr2\_ctg1

AL845543 RP23-257O6 Mmchr2\_ctg1

AL935116 RP23-59I2 Mmchr2\_ctg1

AL772224 RP23-131N18 Mmchr2\_ctg1

AL845271 RP23-119O19 Mmchr2\_ctg1

AL928888 RP23-390M20 Mmchr2\_ctg1

AL844888 RP23-193F18 Mmchr2\_ctg1

AL845520 RP23-283C20 Mmchr2\_ctg1

AL928882 RP23-281I20 Mmchr2\_ctg1

BX510346 RP23-188D15 Mmchr2\_ctg1

AL929011 RP23-55O12 Mmchr2\_ctg1

AL928545 RP23-218A13 Mmchr2\_ctg1

AL935297 RP23-419K8 Mmchr2\_ctg1

AL772218 RP23-129K21 Mmchr2\_ctg1

AL845498 RP23-222D20 Mmchr2\_ctg1

AL954131 RP23-32H12 Mmchr2\_ctg1

AL928589 RP23-350C1 Mmchr2\_ctg1

AL928557 RP23-349H7 Mmchr2\_ctg1

AL928620 RP23-319M16 Mmchr2\_ctg1

AL845265 RP23-158O8 Mmchr2\_ctg1

AL928904 RP23-463M17 Mmchr2\_ctg1

AL928680 RP23-396N6 Mmchr2\_ctg1

AL928653 RP23-410F9 Mmchr2\_ctg1

AL844855 RP23-113K9 Mmchr2\_ctg1

AL929034 RP23-90F9 Mmchr2\_ctg1

AL928806 RP23-34E4 Mmchr2\_ctg1

BX649213 RP24-189E15 Mmchr2\_ctg1

AL928877 RP23-52D18 Mmchr2\_ctg1

AL928860 RP23-5I15 Mmchr2\_ctg1

BX571892 RP23-207B21 Mmchr2\_ctg1

AL928572 RP23-333P17 Mmchr2\_ctg1

AL845528 RP23-25P15 Mmchr2\_ctg1

BX276179 RP23-204B24 Mmchr2\_ctg1

AL844538 RP23-289K19 Mmchr2\_ctg1

BX649224 RP24-555L22 Mmchr2\_ctg1

AL929100 RP23-436G18 Mmchr2\_ctg1

BX649226 RP23-105O21 Mmchr2\_ctg1

AL773540 RP23-177L19 Mmchr2\_ctg1

AL929117 RP23-442K5 Mmchr2\_ctg1

AL928939 RP23-294B13 Mmchr2\_ctg1

AL929311 RP23-291N2 Mmchr2\_ctg1

BX294442 RP23-310O19 Mmchr2\_ctg1

AL772387 RP23-133B16 Mmchr2\_ctg1

AL805928 RP23-136C12 Mmchr2\_ctg1

AL929257 RP23-75A23 Mmchr2\_ctg1

AL929064 RP23-442A7 Mmchr2\_ctg1

AL929036 RP24-548P4 Mmchr2\_ctg1

GAP TYPE-3 20000 ALIGN XGENUS

AL928693 RP23-407K8 Mmchr2\_ctg2

BX649461 RP23-114M13 Mmchr2\_ctg2

CT030013 RP23-282P19 Mmchr2\_ctg2

AL845257 RP23-280K4 Mmchr2\_ctg2

AL928706 RP23-54E16 Mmchr2\_ctg2

CR847856 RP23-447G16 Mmchr2\_ctg2

AL773534 RP23-183O12 Mmchr2\_ctg2

AL928690 RP23-443L19 Mmchr2\_ctg2

AL844844 RP23-103D7 Mmchr2\_ctg2

AL844838 RP23-263E15 Mmchr2\_ctg2

BX005038 RP24-550O4 Mmchr2\_ctg2

AL732430 RP23-176J12 Mmchr2\_ctg2

AL732528 RP23-218B17 Mmchr2\_ctg2

AL732546 RP23-264D16 Mmchr2\_ctg2

BX294112 RP24-316M2 Mmchr2\_ctg2

AL732525 RP23-358I10 Mmchr2\_ctg2

AL935039 RP24-144B2 Mmchr2\_ctg2

AL732585 RP23-226M2 Mmchr2\_ctg2

AL732309 RP23-132N23 Mmchr2\_ctg2

AL732557 RP23-47P18 Mmchr2\_ctg2

AL732590 RP23-464C2 Mmchr2\_ctg2

BX649340 RP23-225D24 Mmchr2\_ctg2

AL731682 RP23-123F7 Mmchr2\_ctg2

AL845455 RP23-325E4 Mmchr2\_ctg2

AL773595 RP23-297I16 Mmchr2\_ctg2

AL732541 RP23-306D20 Mmchr2\_ctg2

BX649422 RP23-70A22 Mmchr2\_ctg2

AL732311 RP23-125H15 Mmchr2\_ctg2

AL773563 RP23-414L19 Mmchr2\_ctg2

AL845266 RP23-449M10 Mmchr2\_ctg2

AL954801 RP23-171K6 Mmchr2\_ctg2

BX649202 RP24-157P15 Mmchr2\_ctg2

AL731552 RP23-113K24 Mmchr2\_ctg2

AL772282 RP23-328F3 Mmchr2\_ctg2

AL772166 RP23-413I12 Mmchr2\_ctg2

AL928953 RP24-83K6 Mmchr2\_ctg2

AL732513 RP23-344B24 Mmchr2\_ctg2

AL731778 RP23-475B13 Mmchr2\_ctg2

AL732616 RP23-466D3 Mmchr2\_ctg2

AL772249 RP23-430H1 Mmchr2\_ctg2

AL928994 RP24-118E9 Mmchr2\_ctg2

AL731851 RP23-362N19 Mmchr2\_ctg2

AL732526 RP23-338O4 Mmchr2\_ctg2

AL845267 RP23-426D2 Mmchr2\_ctg2

AL772379 RP23-170D24 Mmchr2\_ctg2

AL772213 RP23-104G16 Mmchr2\_ctg2

AL929437 RP23-74P16 Mmchr2\_ctg2

AL845323 RP23-304D11 Mmchr2\_ctg2

BX294378 RP23-457B12 Mmchr2\_ctg2

AL928926 RP23-443G7 Mmchr2\_ctg2

BX005298 RP23-261D24 Mmchr2\_ctg2

AL845258 RP23-315H12 Mmchr2\_ctg2

AL954388 RP23-395P6 Mmchr2\_ctg2

AL954299 RP23-399D3 Mmchr2\_ctg2

AL928593 RP23-100E9 Mmchr2\_ctg2

BX649430 RP24-553E7 Mmchr2\_ctg2

AL844532 RP23-221O14 Mmchr2\_ctg2

AL844546 RP23-243I3 Mmchr2\_ctg2

AL732572 RP23-32C16 Mmchr2\_ctg2

AL928861 RP24-153B19 Mmchr2\_ctg2

AL732564 RP23-442G9 Mmchr2\_ctg2

AL929275 RP23-65P13 Mmchr2\_ctg2

BX511243 RP23-62N18 Mmchr2\_ctg2

AL928893 RP23-55I14 Mmchr2\_ctg2

AL808027 RP23-161B9 Mmchr2\_ctg2

AL928669 RP23-375I1 Mmchr2\_ctg2

AL928710 RP23-255P20 Mmchr2\_ctg2

AL772271 RP23-17P12 Mmchr2\_ctg2

AL845471 RP23-320N1 Mmchr2\_ctg2

AL929154 RP23-94M9 Mmchr2\_ctg2

AL731852 RP23-365F1 Mmchr2\_ctg2

AL929197 RP23-47C18 Mmchr2\_ctg2

AL845277 RP23-35J6 Mmchr2\_ctg2

AL928955 RP23-426L14 Mmchr2\_ctg2

AL929212 RP23-65G6 Mmchr2\_ctg2

BX649361 RP24-326B24 Mmchr2\_ctg2

AL845360 RP23-421L7 Mmchr2\_ctg2

AL929510 RP23-241O13 Mmchr2\_ctg2

AL954347 RP23-438I5 Mmchr2\_ctg2

AL845165 RP23-281N9 Mmchr2\_ctg2

AL808102 RP23-192O6 Mmchr2\_ctg2

AL845262 RP23-14N22 Mmchr2\_ctg2

AL929106 RP23-446N16 Mmchr2\_ctg2

AL929068 RP23-9N11 Mmchr2\_ctg2

AL845534 RP23-223C17 Mmchr2\_ctg2

AL773523 RP23-186B18 Mmchr2\_ctg2

AL929199 RP23-458A10 Mmchr2\_ctg2

AL929076 RP23-64F21 Mmchr2\_ctg2

AL929241 RP23-4L24 Mmchr2\_ctg2

AL732413 RP23-366N13 Mmchr2\_ctg2

AL845477 RP23-206J10 Mmchr2\_ctg2

AL773525 RP23-169L4 Mmchr2\_ctg2

BX293557 RP23-324A16 Mmchr2\_ctg2

AL929054 RP23-454A14 Mmchr2\_ctg2

AL845349 RP23-311F6 Mmchr2\_ctg2

AL935058 RP23-409M4 Mmchr2\_ctg2

AL732452 RP23-177C20 Mmchr2\_ctg2

AC123829 RP24-117E16 Mmchr2\_ctg2

AL845356 RP23-29O14 Mmchr2\_ctg2

BX294439 RP23-294J22 Mmchr2\_ctg2

AL929572 RP23-464H12 Mmchr2\_ctg2

AL953890 RP23-321B3 Mmchr2\_ctg2

BX545905 RP23-339J7 Mmchr2\_ctg2

AL805959 RP23-391H10 Mmchr2\_ctg2

AL928810 RP23-71I16 Mmchr2\_ctg2

AL929238 RP23-480I16 Mmchr2\_ctg2

AL929186 RP23-399K8 Mmchr2\_ctg2

BX813320 RP24-399L16 Mmchr2\_ctg2

AL928896 RP23-42H18 Mmchr2\_ctg2

AL844842 RP23-354G20 Mmchr2\_ctg2

AL935155 RP23-334M3 Mmchr2\_ctg2

AL844588 RP23-244N6 Mmchr2\_ctg2

AL845350 RP23-322M5 Mmchr2\_ctg2

AL928639 RP23-446O17 Mmchr2\_ctg2

BX284649 RP23-42M7 Mmchr2\_ctg2

AL845159 RP23-263O22 Mmchr2\_ctg2

BX293566 RP23-441G5 Mmchr2\_ctg2

AL928615 RP23-156E1 Mmchr2\_ctg2

AL773531 RP23-179F21 Mmchr2\_ctg2

AL732603 RP23-154H8 Mmchr2\_ctg2

AL929159 RP23-424F12 Mmchr2\_ctg2

AL929156 RP23-475H18 Mmchr2\_ctg2

AL935162 RP24-463M4 Mmchr2\_ctg2

AL840626 RP23-151M8 Mmchr2\_ctg2

BX649304 RP23-273K8 Mmchr2\_ctg2

BX000439 RP23-430L20 Mmchr2\_ctg2

AL844225 RP23-119M24 Mmchr2\_ctg2

AL805948 RP23-18C13 Mmchr2\_ctg2

AL844553 RP23-255J15 Mmchr2\_ctg2

AL844515 RP23-133G5 Mmchr2\_ctg2

AL844533 RP23-299K8 Mmchr2\_ctg2

AL928732 RP23-403C18 Mmchr2\_ctg2

AL845293 RP23-328P7 Mmchr2\_ctg2

AL935161 RP23-433M8 Mmchr2\_ctg2

AL928962 RP23-455A4 Mmchr2\_ctg2

GAP TYPE-2

AL806522 RP23-167H2 Mmchr2\_ctg2

AL928981 RP23-54O14 Mmchr2\_ctg2

AL929412 RP23-59M8 Mmchr2\_ctg2

BX294105 RP24-88D23 Mmchr2\_ctg2

AL928809 RP23-435J5 Mmchr2\_ctg2

AL772239 RP23-179O4 Mmchr2\_ctg2

AL844898 RP23-346M17 Mmchr2\_ctg2

AL731854 RP23-120A20 Mmchr2\_ctg2

AL845336 RP23-391P24 Mmchr2\_ctg2

AL845160 RP23-303O15 Mmchr2\_ctg2

AL928611 RP23-263O5 Mmchr2\_ctg2

AL732320 RP23-140D16 Mmchr2\_ctg2

AL935152 RP24-387M5 Mmchr2\_ctg2

AL844535 RP23-211K16 Mmchr2\_ctg2

AL844891 RP23-350N21 Mmchr2\_ctg2

BX294003 RP24-472P11 Mmchr2\_ctg2

AL935057 RP23-90D6 Mmchr2\_ctg2

BX293544 RP23-109C9 Mmchr2\_ctg2

AL929120 RP23-457H10 Mmchr2\_ctg2

AL935127 RP23-431O5 Mmchr2\_ctg2

AL773566 RP23-181C9 Mmchr2\_ctg2

AL845487 RP23-288M4 Mmchr2\_ctg2

AL732296 RP23-131P6 Mmchr2\_ctg2

BX000354 RP23-107G20 Mmchr2\_ctg2

AL928741 RP23-264P3 Mmchr2\_ctg2

AL844557 RP23-203N14 Mmchr2\_ctg2

AL845270 RP23-186C16 Mmchr2\_ctg2

BX537253 RP24-173B15 Mmchr2\_ctg2

AL928855 RP23-452C10 Mmchr2\_ctg2

AL928879 RP23-228D12 Mmchr2\_ctg2

BX649214 RP24-267P18 Mmchr2\_ctg2

AL935147 RP23-33O19 Mmchr2\_ctg2

GAP HETEROCHROMATIN 1000000 FISH;OPTICAL MAP

AL929323 RP23-337P15 Mmchr2\_ctg2

AL929191 RP23-330G15 Mmchr2\_ctg2

AL928547 RP23-226B16 Mmchr2\_ctg2

AL844531 RP23-211J18 Mmchr2\_ctg2

AL772185 RP23-103G12 Mmchr2\_ctg2

AL928562 RP23-288O19 Mmchr2\_ctg2

AL732329 RP23-118K22 Mmchr2\_ctg2

BX649206 RP24-425C2 Mmchr2\_ctg2

BX004985 RP23-320O16 Mmchr2\_ctg2

AL929167 RP23-5F14 Mmchr2\_ctg2

AL929375 RP23-49G18 Mmchr2\_ctg2

AL772366 RP23-171C7 Mmchr2\_ctg2

AL845361 RP23-315F13 Mmchr2\_ctg2

AL732317 RP23-139F8 Mmchr2\_ctg2

BX284644 RP24-335I23 Mmchr2\_ctg2

AL845521 RP23-359C5 Mmchr2\_ctg2

AL845298 RP23-280N11 Mmchr2\_ctg2

BX546465 RP23-167N13 Mmchr2\_ctg2

AL845163 RP23-282J1 Mmchr2\_ctg2

AL845332 RP23-326D18 Mmchr2\_ctg2

AL929069 RP23-466O21 Mmchr2\_ctg2

BX813318 RP23-123N16 Mmchr2\_ctg2

AL806528 RP23-190C17 Mmchr2\_ctg2

AL845157 RP23-343I2 Mmchr2\_ctg2

BX649293 RP23-360N18 Mmchr2\_ctg2

AL844592 RP23-244J24 Mmchr2\_ctg2

AL731871 RP23-111J19 Mmchr2\_ctg2

AL844550 RP23-277K21 Mmchr2\_ctg2

AL929178 RP23-77M17 Mmchr2\_ctg2

AL844893 RP23-355H24 Mmchr2\_ctg2

AL935175 RP23-397E13 Mmchr2\_ctg2

BX682229 RP24-531M17 Mmchr2\_ctg2

BX005304 RP23-328P5 Mmchr2\_ctg2

AL805965 RP23-193K10 Mmchr2\_ctg2

AL929026 RP23-332K7 Mmchr2\_ctg2

AL929138 RP23-395O2 Mmchr2\_ctg2

AL844571 RP23-224C23 Mmchr2\_ctg2

AL845355 RP23-330F15 Mmchr2\_ctg2

AL845467 RP23-435G20 Mmchr2\_ctg2

AL928960 RP23-413K16 Mmchr2\_ctg2

CT978680 WI1-125H10 Mmchr2\_ctg2 CONTAINED AL928960 RP23-413K16

AL844859 RP23-263O20 Mmchr2\_ctg2

AL844510 RP23-54C21 Mmchr2\_ctg2

AL845170 RP23-282A22 Mmchr2\_ctg2

AL844552 RP23-265N10 Mmchr2\_ctg2

AL928737 RP23-382O14 Mmchr2\_ctg2

BX649223 RP24-547J10 Mmchr2\_ctg2

AL928943 RP23-435J15 Mmchr2\_ctg2

AL844209 RP23-105M20 Mmchr2\_ctg2

AL928911 RP23-271N3 Mmchr2\_ctg2

AL844850 RP23-255B16 Mmchr2\_ctg2

BX005138 RP24-104L2 Mmchr2\_ctg2

AL929421 RP23-284N23 Mmchr2\_ctg2

AL845426 RP23-289M11 Mmchr2\_ctg2

AL929113 RP23-424D23 Mmchr2\_ctg2

AL844865 RP23-350L23 Mmchr2\_ctg2

BX321901 RP23-303P18 Mmchr2\_ctg2

AL844895 RP23-359N12 Mmchr2\_ctg2

AL929546 RP23-402K10 Mmchr2\_ctg2

BX294370 RP24-98I1 Mmchr2\_ctg2

AL845483 RP23-256M16 Mmchr2\_ctg2

AL929253 RP23-350F14 Mmchr2\_ctg2

BX293987 RP24-426C3 Mmchr2\_ctg2

AL928993 RP23-74A1 Mmchr2\_ctg2

AL732448 RP23-116F12 Mmchr2\_ctg2

BX294173 RP24-257B15 Mmchr2\_ctg2

AL929084 RP23-66M24 Mmchr2\_ctg2

AL807400 RP23-196A4 Mmchr2\_ctg2

BX649212 RP23-404D17 Mmchr2\_ctg2

AL845352 RP23-29A7 Mmchr2\_ctg2

AL928683 RP23-78O17 Mmchr2\_ctg2

AL844889 RP23-35D6 Mmchr2\_ctg2

AL731855 RP23-107N13 Mmchr2\_ctg2

BX813305 RP23-137E6 Mmchr2\_ctg2

AL844871 RP23-271B15 Mmchr2\_ctg2

AL845166 RP23-236H15 Mmchr2\_ctg2

BX679669 RP23-73K23 Mmchr2\_ctg2

BX324200 RP23-382H2 Mmchr2\_ctg2

AL845442 RP23-392D9 Mmchr2\_ctg2

AL805953 RP23-189N21 Mmchr2\_ctg2

AL929144 RP23-441D24 Mmchr2\_ctg2

AL928564 RP23-255J22 Mmchr2\_ctg2

AL772179 RP23-100B18 Mmchr2\_ctg2

AL807788 RP23-279F23 Mmchr2\_ctg2

AL732468 RP23-149P17 Mmchr2\_ctg2

AL844163 RP23-467L21 Mmchr2\_ctg2

AL929070 RP23-199L4 Mmchr2\_ctg2

CR626863 RP23-348H1 Mmchr2\_ctg2

CU210857 WI1-1635E3 Mmchr2\_ctg2

GAP TYPE-3 140000 ALIGN GENUS;OPTICAL MAP

BX649232 RP23-271J11 Mmchr2\_ctg5

AL845536 RP23-311G5 Mmchr2\_ctg5

AL845283 RP23-151F21 Mmchr2\_ctg5

AL772215 RP23-114N20 Mmchr2\_ctg5

AL929160 RP23-98B9 Mmchr2\_ctg5

AL929242 RP23-78D16 Mmchr2\_ctg5

BX649357 RP23-364J19 Mmchr2\_ctg5

AL929211 RP23-323P11 Mmchr2\_ctg5

AL935326 RP23-10L17 Mmchr2\_ctg5

BX679662 RP23-364B23 Mmchr2\_ctg5

AL928546 RP23-412C22 Mmchr2\_ctg5

AL928833 RP23-68H20 Mmchr2\_ctg5

AL929012 RP23-477G20 Mmchr2\_ctg5

AL928581 RP23-318H20 Mmchr2\_ctg5

AL929219 RP23-53I18 Mmchr2\_ctg5

BX322625 RP24-158I12 Mmchr2\_ctg5

AL929372 RP23-461G6 Mmchr2\_ctg5

AL928859 RP23-479N10 Mmchr2\_ctg5

AL845291 RP23-1O11 Mmchr2\_ctg5

AL845278 RP23-37H22 Mmchr2\_ctg5

AL772323 RP23-370F9 Mmchr2\_ctg5

AL928613 RP23-33E20 Mmchr2\_ctg5

AL928804 RP23-87G8 Mmchr2\_ctg5

AL928576 RP23-343C17 Mmchr2\_ctg5

AL929246 RP23-34J8 Mmchr2\_ctg5

AL928689 RP23-35P3 Mmchr2\_ctg5

AL772313 RP23-128J10 Mmchr2\_ctg5

BX649208 RP24-190F19 Mmchr2\_ctg5

AL928663 RP23-315A20 Mmchr2\_ctg5

AL772407 RP23-112N9 Mmchr2\_ctg5

BX293558 RP23-182P17 Mmchr2\_ctg5

AL928826 RP23-456N9 Mmchr2\_ctg5

AL929262 RP23-452K24 Mmchr2\_ctg5

BX293999 RP24-213L10 Mmchr2\_ctg5

AL928553 RP23-312N5 Mmchr2\_ctg5

AL772173 RP23-163P22 Mmchr2\_ctg5

AL845531 RP23-232I4 Mmchr2\_ctg5

AL845504 RP23-297M18 Mmchr2\_ctg5

AL928595 RP23-34C18 Mmchr2\_ctg5

AL929033 RP23-427N17 Mmchr2\_ctg5

AL928703 RP23-308K19 Mmchr2\_ctg5

AL929129 RP23-238P9 Mmchr2\_ctg5

AL935171 RP23-286N21 Mmchr2\_ctg5

BX321909 RP23-443D3 Mmchr2\_ctg5

AL929132 RP23-346G8 Mmchr2\_ctg5

AL928621 RP23-401G6 Mmchr2\_ctg5

AL772235 RP23-155K12 Mmchr2\_ctg5

BX284648 RP23-300F1 Mmchr2\_ctg5

AL935061 RP23-186P20 Mmchr2\_ctg5

AL929230 RP23-306G16 Mmchr2\_ctg5

AL928586 RP23-353H5 Mmchr2\_ctg5

AL844526 RP23-201O18 Mmchr2\_ctg5

AL928726 RP23-397A11 Mmchr2\_ctg5

AL928623 RP23-276I21 Mmchr2\_ctg5

AL928720 RP23-83A3 Mmchr2\_ctg5

AL772149 RP23-108H7 Mmchr2\_ctg5

AL929127 RP23-263B13 Mmchr2\_ctg5

AL845473 RP23-212E8 Mmchr2\_ctg5

AL773549 RP23-183A1 Mmchr2\_ctg5

AL929411 RP23-353O20 Mmchr2\_ctg5

AL929125 RP23-262O4 Mmchr2\_ctg5

AL928598 RP23-326I20 Mmchr2\_ctg5

AL845519 RP23-295F2 Mmchr2\_ctg5

BX936296 RP23-27J1 Mmchr2\_ctg5

AL845486 RP23-236H7 Mmchr2\_ctg5

AL844841 RP23-143P18 Mmchr2\_ctg5

BX293546 RP23-459M13 Mmchr2\_ctg5

AL928873 RP23-104C18 Mmchr2\_ctg5

AL929137 RP23-412L18 Mmchr2\_ctg5

AL929221 RP23-431D4 Mmchr2\_ctg5

AL929170 RP23-451M16 Mmchr2\_ctg5

BX649336 RP24-111M20 Mmchr2\_ctg5

AL845489 RP23-300E5 Mmchr2\_ctg5

AL929083 RP23-436E15 Mmchr2\_ctg5

AL845261 RP23-174C9 Mmchr2\_ctg5

BX322634 RP23-193M12 Mmchr2\_ctg5

AL929249 RP23-273G23 Mmchr2\_ctg5

BX649205 RP23-194A22 Mmchr2\_ctg5

AL845263 RP23-337L20 Mmchr2\_ctg5

AL929164 RP23-226L18 Mmchr2\_ctg5

AC097273 RP23-118N13 Mmchr2\_ctg5

AL928868 RP23-428O15 Mmchr2\_ctg5

BX000490 RP24-96D14 Mmchr2\_ctg5

CR405704 RP23-395B7 Mmchr2\_ctg5

AL929228 RP23-359E23 Mmchr2\_ctg5

BX544878 RP23-203A24 Mmchr2\_ctg5

BX284624 RP23-299A2 Mmchr2\_ctg5

AL928931 RP23-419H3 Mmchr2\_ctg5

AL928973 RP23-259J7 Mmchr2\_ctg5

AL928963 RP23-5K9 Mmchr2\_ctg5

AL928617 RP23-326E21 Mmchr2\_ctg5

AL929498 RP23-438L23 Mmchr2\_ctg5

AL928699 RP23-386I18 Mmchr2\_ctg5

AL845274 RP23-146F24 Mmchr2\_ctg5

AL929126 RP23-424N5 Mmchr2\_ctg5

AL844840 RP23-337P9 Mmchr2\_ctg5

AL928608 RP23-275P21 Mmchr2\_ctg5

BX284615 RP23-20B20 Mmchr2\_ctg5

AL954713 RP23-463K8 Mmchr2\_ctg5

AL928813 RP23-325P5 Mmchr2\_ctg5

AL928889 RP23-271L22 Mmchr2\_ctg5

AL845523 RP23-290B1 Mmchr2\_ctg5

AL844581 RP23-146O7 Mmchr2\_ctg5

AL928803 RP23-319N14 Mmchr2\_ctg5

AL928658 RP23-238A18 Mmchr2\_ctg5

AL929025 RP23-288B11 Mmchr2\_ctg5

AL929455 RP23-463J10 Mmchr2\_ctg5

AL928644 RP23-313J15 Mmchr2\_ctg5

AL928733 RP23-190O13 Mmchr2\_ctg5

AL935170 RP23-480P16 Mmchr2\_ctg5

AL929196 RP23-7D13 Mmchr2\_ctg5

AL845539 RP23-263O6 Mmchr2\_ctg5

AL773530 RP23-180A8 Mmchr2\_ctg5

AL928571 RP23-261A9 Mmchr2\_ctg5

AL772214 RP23-370C18 Mmchr2\_ctg5

AL772404 RP23-374O4 Mmchr2\_ctg5

AL773533 RP23-159H12 Mmchr2\_ctg5

AL772341 RP23-179N22 Mmchr2\_ctg5

AL929589 RP23-259H15 Mmchr2\_ctg5

AL929133 RP23-427I10 Mmchr2\_ctg5

AL845373 RP23-211L7 Mmchr2\_ctg5

AL928905 RP23-70E24 Mmchr2\_ctg5

AL928867 RP23-468L22 Mmchr2\_ctg5

AL928789 RP23-435F21 Mmchr2\_ctg5

AL928721 RP23-402N20 Mmchr2\_ctg5

AL928681 RP23-82M15 Mmchr2\_ctg5

AL772242 RP23-15E4 Mmchr2\_ctg5

AL928583 RP23-287C12 Mmchr2\_ctg5

AL928537 RP23-236E7 Mmchr2\_ctg5

AL845547 RP23-296A4 Mmchr2\_ctg5

AL929402 RP23-248M13 Mmchr2\_ctg5

AL928915 RP23-276J8 Mmchr2\_ctg5

AL928791 RP23-65N20 Mmchr2\_ctg5

CU137723 WI1-1639C23 Mmchr2\_ctg5

AL928971 RP23-430K13 Mmchr2\_ctg5

AL928659 RP23-271B13 Mmchr2\_ctg5

AL929145 RP23-362L7 Mmchr2\_ctg5

AL844495 RP23-252L9 Mmchr2\_ctg5

BX276109 RP23-209P8 Mmchr2\_ctg5

AL928604 RP23-220K22 Mmchr2\_ctg5

AL772181 RP23-118H3 Mmchr2\_ctg5

BX842662 RP24-156K24 Mmchr2\_ctg5

CR388391 RP23-293H4 Mmchr2\_ctg5

AL844590 RP23-335P15 Mmchr2\_ctg5

AL928696 RP23-387G11 Mmchr2\_ctg5

AL928770 RP23-20E18 Mmchr2\_ctg5

AL844577 RP23-129P1 Mmchr2\_ctg5

AL928607 RP23-326J18 Mmchr2\_ctg5

AL928811 RP23-74P23 Mmchr2\_ctg5

AL928587 RP23-282M14 Mmchr2\_ctg5

AL928578 RP23-33L19 Mmchr2\_ctg5

AL928869 RP23-393F9 Mmchr2\_ctg5

BX284612 RP23-332H17 Mmchr2\_ctg5

BX005181 RP24-364O14 Mmchr2\_ctg5

BX293555 RP23-202M10 Mmchr2\_ctg5

AL928575 RP23-37A11 Mmchr2\_ctg5

BX677672 RP23-382M3 Mmchr2\_ctg5

AL772188 RP23-143O19 Mmchr2\_ctg5

BX323821 RP24-88B2 Mmchr2\_ctg5

AL773582 RP23-174J23 Mmchr2\_ctg5

AL845525 RP23-298B10 Mmchr2\_ctg5

AL772389 RP23-106D7 Mmchr2\_ctg5

AL845296 RP23-121B24 Mmchr2\_ctg5

AL928991 RP23-455F5 Mmchr2\_ctg5

AL928626 RP23-365O18 Mmchr2\_ctg5

AL928633 RP23-345M3 Mmchr2\_ctg5

AL845542 RP23-288I12 Mmchr2\_ctg5

AL845500 RP23-221K3 Mmchr2\_ctg5

AL928822 RP23-419O21 Mmchr2\_ctg5

AL845497 RP23-232K9 Mmchr2\_ctg5

AL929051 RP23-418P21 Mmchr2\_ctg5

AL929035 RP23-234F15 Mmchr2\_ctg5

BX294652 RP23-254N16 Mmchr2\_ctg5

AL772301 RP23-111F12 Mmchr2\_ctg5

AL772256 RP23-141N19 Mmchr2\_ctg5

AL929088 RP23-360J2 Mmchr2\_ctg5

AL772159 RP23-107H15 Mmchr2\_ctg5

AL845305 RP23-202K13 Mmchr2\_ctg5

AL928616 RP23-268P6 Mmchr2\_ctg5

AL929079 RP23-387F9 Mmchr2\_ctg5

AL928914 RP23-399J8 Mmchr2\_ctg5

AL935159 RP23-232L15 Mmchr2\_ctg5

BX546441 RP23-366I14 Mmchr2\_ctg5

AL928793 RP23-89M14 Mmchr2\_ctg5

BX294665 RP24-227K21 Mmchr2\_ctg5

AL929147 RP23-429P18 Mmchr2\_ctg5

AL773585 RP23-16D18 Mmchr2\_ctg5

AL929285 RP23-60G16 Mmchr2\_ctg5

AL928687 RP23-384L16 Mmchr2\_ctg5

AL928839 RP23-298M2 Mmchr2\_ctg5

AL845499 RP23-232A21 Mmchr2\_ctg5

AL935138 RP23-222H15 Mmchr2\_ctg5

AL772265 RP23-2D7 Mmchr2\_ctg5

BX294651 RP23-50K8 Mmchr2\_ctg5

BX005136 RP23-449C14 Mmchr2\_ctg5

BX284685 RP23-114J1 Mmchr2\_ctg5

AL929417 RP23-25M5 Mmchr2\_ctg5

AL928801 RP23-116P4 Mmchr2\_ctg5

AL928966 RP24-388A9 Mmchr2\_ctg5

AL928797 RP23-178B19 Mmchr2\_ctg5

AL929312 RP23-463G15 Mmchr2\_ctg5

AL929227 RP23-16E8 Mmchr2\_ctg5

AL929424 RP23-24F19 Mmchr2\_ctg5

BX649203 RP23-24C12 Mmchr2\_ctg5

AL935055 RP23-131J21 Mmchr2\_ctg5

AL928829 RP23-390B17 Mmchr2\_ctg5

AL929214 RP23-195I21 Mmchr2\_ctg5

AL928912 RP23-209L8 Mmchr2\_ctg5

AL929265 RP23-316D8 Mmchr2\_ctg5

AL928847 RP24-386K1 Mmchr2\_ctg5

AL928871 RP23-350F2 Mmchr2\_ctg5

AL928850 RP23-260B13 Mmchr2\_ctg5

AL928818 RP23-309M6 Mmchr2\_ctg5

AL929235 RP23-82L23 Mmchr2\_ctg5

AL929555 RP24-427F7 Mmchr2\_ctg5

BX293542 RP24-68B14 Mmchr2\_ctg5

AL928796 RP23-150I5 Mmchr2\_ctg5

AL929065 RP23-270H4 Mmchr2\_ctg5

AL953900 RP24-166A20 Mmchr2\_ctg5

AL928890 RP24-314D20 Mmchr2\_ctg5

AL928949 RP23-226K16 Mmchr2\_ctg5

BX546464 RP24-113P16 Mmchr2\_ctg5

AL954341 RP23-213D14 Mmchr2\_ctg5

AL954378 RP24-327K3 Mmchr2\_ctg5

AL935132 RP23-8G23 Mmchr2\_ctg5

AL714026 RP23-322I11 Mmchr2\_ctg5

AL672241 RP23-147D3 Mmchr2\_ctg5

AL691439 RP23-263H8 Mmchr2\_ctg5

AL691450 RP23-20F9 Mmchr2\_ctg5

AL732478 RP23-42N14 Mmchr2\_ctg5

BX294440 RP23-337H8 Mmchr2\_ctg5

AL691489 RP23-176N9 Mmchr2\_ctg5

AL714023 RP23-12H6 Mmchr2\_ctg5

AL731772 RP23-273F8 Mmchr2\_ctg5

AL732484 RP23-37B7 Mmchr2\_ctg5

AL691462 RP23-267F7 Mmchr2\_ctg5

AL731709 RP23-316M14 Mmchr2\_ctg5

AL731799 RP23-337A15 Mmchr2\_ctg5

AL683814 RP23-165L23 Mmchr2\_ctg5

AL732588 RP24-159M19 Mmchr2\_ctg5

AL840633 RP23-290E9 Mmchr2\_ctg5

BX842664 RP23-293P3 Mmchr2\_ctg5

AL844903 RP23-197C2 Mmchr2\_ctg5

AL713913 RP23-125F10 Mmchr2\_ctg5

AL683882 RP23-205P2 Mmchr2\_ctg5

AL691472 RP23-217C12 Mmchr2\_ctg5

AL732483 RP23-70K10 Mmchr2\_ctg5

AL935151 RP23-193M4 Mmchr2\_ctg5

AL732493 RP23-358F6 Mmchr2\_ctg5

AL732472 RP23-41P22 Mmchr2\_ctg5

AL772372 RP23-375N21 Mmchr2\_ctg5

BX284932 RP24-110I12 Mmchr2\_ctg5

AL683878 RP23-201G13 Mmchr2\_ctg5

AL672251 RP23-16O15 Mmchr2\_ctg5

AL732453 RP23-33D23 Mmchr2\_ctg5

AL731558 RP23-235D11 Mmchr2\_ctg5

AL731734 RP23-26C7 Mmchr2\_ctg5

AL731713 RP23-32L9 Mmchr2\_ctg5

AL732554 RP24-73M23 Mmchr2\_ctg5

AL731767 RP23-338L13 Mmchr2\_ctg5

AL928895 RP23-338J3 Mmchr2\_ctg5

AL935118 RP23-464I16 Mmchr2\_ctg5

AL772398 RP23-173J23 Mmchr2\_ctg5

AL929244 RP23-456L5 Mmchr2\_ctg5

AL845524 RP23-248D22 Mmchr2\_ctg5

BX649486 RP24-109B15 Mmchr2\_ctg5

AL691435 RP23-246E11 Mmchr2\_ctg5

AL732507 RP23-67E13 Mmchr2\_ctg5

AL683896 RP23-184N2 Mmchr2\_ctg5

AL672307 RP23-141N2 Mmchr2\_ctg5

BX649359 RP24-103D10 Mmchr2\_ctg5

AL954380 RP23-156O9 Mmchr2\_ctg5

AL845319 RP23-429I7 Mmchr2\_ctg5

AL672273 RP23-15A12 Mmchr2\_ctg5

AL954654 RP23-27A8 Mmchr2\_ctg5

AL935327 RP23-259I23 Mmchr2\_ctg5

AL844145 RP23-403F4 Mmchr2\_ctg5

BX813336 RP23-207B5 Mmchr2\_ctg5

BX842668 RP23-161M5 Mmchr2\_ctg5

BX813308 RP23-34G12 Mmchr2\_ctg5

AL592405 RP23-358N17 Mmchr2\_ctg5

BX649561 RP23-392O16 Mmchr2\_ctg5

BX936411 RP24-62G2 Mmchr2\_ctg5

AL845538 RP23-280L19 Mmchr2\_ctg5

AL683876 RP23-100E6 Mmchr2\_ctg5

AL837506 RP23-353G2 Mmchr2\_ctg5

AL683839 RP23-183N16 Mmchr2\_ctg5

AL683881 RP23-10M6 Mmchr2\_ctg5

AL844493 RP23-396G18 Mmchr2\_ctg5

BX537155 RP24-118I4 Mmchr2\_ctg5

AL953849 RP23-384G9 Mmchr2\_ctg5

AL845449 RP23-211M20 Mmchr2\_ctg5

BX936295 RP23-256P1 Mmchr2\_ctg5

AL731724 RP23-1F19 Mmchr2\_ctg5

AL929259 RP23-141E12 Mmchr2\_ctg5

AL691443 RP23-186A9 Mmchr2\_ctg5

AL929095 RP24-576M16 Mmchr2\_ctg5

BX649526 RP23-227O6 Mmchr2\_ctg5

AL683810 RP23-10L18 Mmchr2\_ctg5

AL928853 RP23-179L7 Mmchr2\_ctg5

AL732428 RP23-347P2 Mmchr2\_ctg5

AL683805 RP23-183M16 Mmchr2\_ctg5

AL731660 RP23-43E15 Mmchr2\_ctg5

AL935176 RP23-38O10 Mmchr2\_ctg5

AL672239 RP23-144D15 Mmchr2\_ctg5

AL691498 RP23-16B21 Mmchr2\_ctg5

AL929569 RP23-325I3 Mmchr2\_ctg5

AL929571 RP23-313G3 Mmchr2\_ctg5

AL929534 RP23-275L13 Mmchr2\_ctg5

BX322585 RP23-286C17 Mmchr2\_ctg5

AL845300 RP23-397A17 Mmchr2\_ctg5

BX571894 RP23-203N8 Mmchr2\_ctg5

AL691444 RP23-224E21 Mmchr2\_ctg5

AL845337 RP23-373A4 Mmchr2\_ctg5

AL845276 RP23-350K13 Mmchr2\_ctg5

AL844605 RP24-115D19 Mmchr2\_ctg5

AL844155 RP23-163L4 Mmchr2\_ctg5

AL954375 RP23-16F14 Mmchr2\_ctg5

BX908734 RP23-266F3 Mmchr2\_ctg5

BX901906 RP23-328F9 Mmchr2\_ctg5

AL954374 RP23-445A5 Mmchr2\_ctg5

AL773505 RP23-209M19 Mmchr2\_ctg5

BX537331 RP23-338B23 Mmchr2\_ctg5

AL928544 RP23-358C5 Mmchr2\_ctg5

BX640578 RP23-261L3 Mmchr2\_ctg5

BX813317 RP24-297H17 Mmchr2\_ctg5

AL954370 RP23-180P4 Mmchr2\_ctg5

AL844591 RP23-414J11 Mmchr2\_ctg5

AL606905 RP23-394K13 Mmchr2\_ctg5

AL844603 RP24-334I20 Mmchr2\_ctg5

BX908741 RP23-189F6 Mmchr2\_ctg5

AL606494 RP23-198B6 Mmchr2\_ctg5

AL512584 RP23-232D1 Mmchr2\_ctg5

AL672153 RP23-8C14 Mmchr2\_ctg5

AL512583 RP23-444H3 Mmchr2\_ctg5

AL512582 RP23-290H11 Mmchr2\_ctg5

AL512589 RP23-431C3 Mmchr2\_ctg5

AL590380 RP23-146D23 Mmchr2\_ctg5

AL928773 RP24-225B15 Mmchr2\_ctg5

BX649381 RP23-245K23 Mmchr2\_ctg5

AL670860 RP23-50K11 Mmchr2\_ctg5

BX649317 RP23-415G15 Mmchr2\_ctg5

AL773508 RP23-253D15 Mmchr2\_ctg5

AL773514 RP23-300H23 Mmchr2\_ctg5

AL773516 RP23-102F9 Mmchr2\_ctg5

CU181744 WI1-2806N16 Mmchr2\_ctg5

CU137676 WI1-441D14 Mmchr2\_ctg5

AL512587 RP23-467P7 Mmchr2\_ctg5

BX890640 RP23-12N7 Mmchr2\_ctg5

BX649348 RP23-359M23 Mmchr2\_ctg5

BX294441 RP23-421H1 Mmchr2\_ctg5

BX293548 RP23-417K1 Mmchr2\_ctg5

BX682231 RP24-369N16 Mmchr2\_ctg5

AL928788 RP24-294K11 Mmchr2\_ctg5

AL844596 RP23-35J22 Mmchr2\_ctg5

BX842238 RP24-159M2 Mmchr2\_ctg5

AL773512 RP23-454N6 Mmchr2\_ctg5

BX678774 RP23-193A4 Mmchr2\_ctg5

AL805942 RP24-71G5 Mmchr2\_ctg5

AL845281 RP23-476B1 Mmchr2\_ctg5

BX842663 RP23-176P20 Mmchr2\_ctg5

AL844885 RP23-226E14 Mmchr2\_ctg5

AL805926 RP24-135N15 Mmchr2\_ctg5

AL928925 RP23-405K7 Mmchr2\_ctg5

BX813328 RP23-469G4 Mmchr2\_ctg5

BX813309 RP23-450P5 Mmchr2\_ctg5

AL691430 RP23-206C1 Mmchr2\_ctg5

AL691469 RP23-248F18 Mmchr2\_ctg5

AL732485 RP23-70G24 Mmchr2\_ctg5

AL732477 RP23-393E8 Mmchr2\_ctg5

AL845423 RP23-207C2 Mmchr2\_ctg5

BX294391 RP23-184O20 Mmchr2\_ctg5

AL928922 RP23-431J22 Mmchr2\_ctg5

AL845518 RP23-300M9 Mmchr2\_ctg5

AL691416 RP23-110I8 Mmchr2\_ctg5

AL732495 RP23-76E19 Mmchr2\_ctg5

BX005257 RP24-331J23 Mmchr2\_ctg5

AL731779 RP23-48D8 Mmchr2\_ctg5

AL731700 RP23-239G1 Mmchr2\_ctg5

AL732542 RP23-92H5 Mmchr2\_ctg5

AL732559 RP23-9A5 Mmchr2\_ctg5

BX649344 RP23-340E7 Mmchr2\_ctg5

BX649474 RP24-383G18 Mmchr2\_ctg5

AL731699 RP23-336F11 Mmchr2\_ctg5

AL732496 RP23-35G10 Mmchr2\_ctg5

BX649573 RP23-364E11 Mmchr2\_ctg5

AL935124 RP23-88C15 Mmchr2\_ctg5

BX293988 RP24-405C9 Mmchr2\_ctg5

AL929556 RP23-353B17 Mmchr2\_ctg5

AL713853 RP23-63C10 Mmchr2\_ctg5

AL683897 RP23-208E23 Mmchr2\_ctg5

AL731840 RP23-52C15 Mmchr2\_ctg5

AL691423 RP23-21D3 Mmchr2\_ctg5

AL672250 RP23-148F9 Mmchr2\_ctg5

AL732316 RP23-367I7 Mmchr2\_ctg5

AL929348 RP24-357K4 Mmchr2\_ctg5

BX649564 RP23-405A18 Mmchr2\_ctg5

AL929450 RP23-288M21 Mmchr2\_ctg5

AL691466 RP23-231L5 Mmchr2\_ctg5

AL691437 RP23-248J10 Mmchr2\_ctg5

AL672253 RP23-13G19 Mmchr2\_ctg5

AL772405 RP23-178K16 Mmchr2\_ctg5

BX294663 RP23-328O18 Mmchr2\_ctg5

AL844569 RP23-230H3 Mmchr2\_ctg5

AL928987 RP23-55M21 Mmchr2\_ctg5

AL845453 RP23-296G5 Mmchr2\_ctg5

AL732404 RP23-177D21 Mmchr2\_ctg5

AL928543 RP23-345P1 Mmchr2\_ctg5

AL844593 RP23-227F18 Mmchr2\_ctg5

AL732441 RP23-142N2 Mmchr2\_ctg5

AL844556 RP23-21N12 Mmchr2\_ctg5

AL928942 RP23-97B2 Mmchr2\_ctg5

AL844901 RP23-158F12 Mmchr2\_ctg5

AL844544 RP23-230B1 Mmchr2\_ctg5

AL929037 RP23-297K24 Mmchr2\_ctg5

AL772135 RP23-162G11 Mmchr2\_ctg5

AL844561 RP23-214D2 Mmchr2\_ctg5

AL929218 RP23-447G18 Mmchr2\_ctg5

AL845260 RP23-232J15 Mmchr2\_ctg5

AL954700 RP24-322F9 Mmchr2\_ctg5

AL845440 RP23-294B7 Mmchr2\_ctg5

AL845318 RP23-326F22 Mmchr2\_ctg5

AL807741 RP23-224B9 Mmchr2\_ctg5

AL928959 RP23-73I19 Mmchr2\_ctg5

AL844579 RP23-219M22 Mmchr2\_ctg5

AL929110 RP23-275P20 Mmchr2\_ctg5

AL935133 RP23-70C14 Mmchr2\_ctg5

AL929063 RP23-291N19 Mmchr2\_ctg5

AL845490 RP23-259M16 Mmchr2\_ctg5

AL928957 RP23-75E19 Mmchr2\_ctg5

AL845495 RP23-234E8 Mmchr2\_ctg5

AL929163 RP23-450P9 Mmchr2\_ctg5

AL929381 RP23-266K3 Mmchr2\_ctg5

AL845470 RP23-204G5 Mmchr2\_ctg5

AL772255 RP23-172B16 Mmchr2\_ctg5

AL845164 RP23-286G12 Mmchr2\_ctg5

AL772264 RP23-15I21 Mmchr2\_ctg5

BX649572 RP24-389G5 Mmchr2\_ctg5

AL929318 RP23-46P4 Mmchr2\_ctg5

AL844862 RP23-355P22 Mmchr2\_ctg5

AL844536 RP23-22A15 Mmchr2\_ctg5

AL844896 RP23-356L21 Mmchr2\_ctg5

AL954662 RP23-348L16 Mmchr2\_ctg5

AL833774 RP23-383I16 Mmchr2\_ctg5

BX000525 RP24-396J14 Mmchr2\_ctg5

AL844608 RP23-27L22 Mmchr2\_ctg5

AL935121 RP23-432M14 Mmchr2\_ctg5

AL772299 RP23-158L6 Mmchr2\_ctg5

AL935168 RP23-337M17 Mmchr2\_ctg5

AL844548 RP23-263D22 Mmchr2\_ctg5

AL845479 RP23-232N20 Mmchr2\_ctg5

AL929059 RP23-437L13 Mmchr2\_ctg5

AL845466 RP23-433P19 Mmchr2\_ctg5

AL928678 RP23-273B19 Mmchr2\_ctg5

AL928856 RP23-413G24 Mmchr2\_ctg5

AL845286 RP23-328F20 Mmchr2\_ctg5

AL845457 RP23-34E24 Mmchr2\_ctg5

AL844573 RP23-277B16 Mmchr2\_ctg5

AL844566 RP23-173H17 Mmchr2\_ctg5

AL954714 RP23-357I14 Mmchr2\_ctg5

AL772253 RP23-101F14 Mmchr2\_ctg5

AL928950 RP23-70E1 Mmchr2\_ctg5

BX322545 RP23-74N4 Mmchr2\_ctg5

AL929449 RP23-279D23 Mmchr2\_ctg5

AL732625 RP23-169H17 Mmchr2\_ctg5

AL929015 RP23-412F11 Mmchr2\_ctg5

BX649464 RP23-51N4 Mmchr2\_ctg5

AL773536 RP23-186J20 Mmchr2\_ctg5

AL845285 RP23-167M2 Mmchr2\_ctg5

AL773586 RP23-18P19 Mmchr2\_ctg5

BX322659 RP23-349I12 Mmchr2\_ctg5

AL929570 RP23-74G9 Mmchr2\_ctg5

AL928992 RP23-208O9 Mmchr2\_ctg5

AL833808 RP23-442N3 Mmchr2\_ctg5

AL929517 RP23-455E2 Mmchr2\_ctg5

AL935323 RP23-302M17 Mmchr2\_ctg5

AL844854 RP23-368I1 Mmchr2\_ctg5

AL928902 RP24-221D3 Mmchr2\_ctg5

AL929451 RP23-300D11 Mmchr2\_ctg5

AL844547 RP23-216B20 Mmchr2\_ctg5

AL928930 RP23-386P7 Mmchr2\_ctg5

BX321866 RP23-264M2 Mmchr2\_ctg5

AL929166 RP23-323D9 Mmchr2\_ctg5

AL844580 RP23-367K9 Mmchr2\_ctg5

BX293543 RP23-102A7 Mmchr2\_ctg5

AL845292 RP23-386I21 Mmchr2\_ctg5

AL929175 RP23-456N11 Mmchr2\_ctg5

AL929245 RP23-460B5 Mmchr2\_ctg5

AL831764 RP23-203A3 Mmchr2\_ctg5

AL844555 RP23-251E2 Mmchr2\_ctg5

AL732330 RP23-130L11 Mmchr2\_ctg5

AL928836 RP23-239M4 Mmchr2\_ctg5

AL928590 RP23-26A12 Mmchr2\_ctg5

AL845368 RP23-206D14 Mmchr2\_ctg5

AL731836 RP23-119A13 Mmchr2\_ctg5

AL731831 RP23-105O13 Mmchr2\_ctg5

AL844204 RP23-189N15 Mmchr2\_ctg5

AL844481 RP23-44H23 Mmchr2\_ctg5

AL845358 RP23-375N8 Mmchr2\_ctg5

AL805950 RP23-134I15 Mmchr2\_ctg5

AL845156 RP23-340F21 Mmchr2\_ctg5

AL844486 RP23-249P4 Mmchr2\_ctg5

AL844586 RP23-259N17 Mmchr2\_ctg5

AL928910 RP23-464B2 Mmchr2\_ctg5

AL808104 RP23-30M20 Mmchr2\_ctg5

AL833780 RP23-24M22 Mmchr2\_ctg5

BX000699 RP24-388N11 Mmchr2\_ctg5

AL772347 RP23-160G19 Mmchr2\_ctg5

AL808143 RP23-384K11 Mmchr2\_ctg5

AL808126 RP23-37B4 Mmchr2\_ctg5

AL808137 RP23-358G23 Mmchr2\_ctg5

AL935309 RP24-113M11 Mmchr2\_ctg5

AL808127 RP23-263L18 Mmchr2\_ctg5

AL833804 RP23-20A6 Mmchr2\_ctg5

BX936285 RP23-162H12 Mmchr2\_ctg5

BX890605 RP23-29K12 Mmchr2\_ctg5

AL731707 RP23-100C5 Mmchr2\_ctg5

AL772162 RP23-175J8 Mmchr2\_ctg5

AL772361 RP23-136C22 Mmchr2\_ctg5

AL833771 RP23-228H14 Mmchr2\_ctg5

AL831736 RP23-32L15 Mmchr2\_ctg5

AL935321 RP24-378G18 Mmchr2\_ctg5

AL808128 RP23-387C21 Mmchr2\_ctg5

AL831781 RP23-307O24 Mmchr2\_ctg5

AL831731 RP23-442K11 Mmchr2\_ctg5

AL833793 RP23-366F22 Mmchr2\_ctg5

AL833794 RP23-401J24 Mmchr2\_ctg5

AL929513 RP23-370C15 Mmchr2\_ctg5

AL831706 RP23-74B12 Mmchr2\_ctg5

AL807793 RP23-33N15 Mmchr2\_ctg5

AL807386 RP23-190K7 Mmchr2\_ctg5

AL935270 RP23-391A14 Mmchr2\_ctg5

AL929562 RP23-77H16 Mmchr2\_ctg5

AL831763 RP23-308A23 Mmchr2\_ctg5

AL833799 RP23-26L11 Mmchr2\_ctg5

AL935331 RP24-264J19 Mmchr2\_ctg5

AL833807 RP23-305G2 Mmchr2\_ctg5

AL831753 RP23-384M14 Mmchr2\_ctg5

AL928739 RP23-409L24 Mmchr2\_ctg5

AL929046 RP23-308N4 Mmchr2\_ctg5

AL929018 RP23-253K17 Mmchr2\_ctg5

AL731708 RP23-103D3 Mmchr2\_ctg5

AL845474 RP23-380N15 Mmchr2\_ctg5

AL845309 RP23-376O20 Mmchr2\_ctg5

AL845418 RP23-207F4 Mmchr2\_ctg5

AL954351 RP23-109H4 Mmchr2\_ctg5

AL840635 RP23-418D21 Mmchr2\_ctg5

AL928956 RP23-74G16 Mmchr2\_ctg5

BX323085 RP23-323C10 Mmchr2\_ctg5

AL928635 RP23-410E7 Mmchr2\_ctg5

AL935278 RP23-84E1 Mmchr2\_ctg5

BX649260 RP24-364H2 Mmchr2\_ctg5

AL929052 RP23-464H11 Mmchr2\_ctg5

AL935301 RP23-132B12 Mmchr2\_ctg5

AL928798 RP23-7A19 Mmchr2\_ctg5

AL845354 RP23-318L10 Mmchr2\_ctg5

BX294446 RP23-459F16 Mmchr2\_ctg5

AL928792 RP23-88O15 Mmchr2\_ctg5

BX537252 RP23-268L10 Mmchr2\_ctg5

AL844565 RP23-427L11 Mmchr2\_ctg5

AL732447 RP23-142F14 Mmchr2\_ctg5

AL731706 RP23-199B10 Mmchr2\_ctg5

AL713981 RP23-173O12 Mmchr2\_ctg5

BX005130 RP23-475L14 Mmchr2\_ctg5

BX510956 RP24-284A5 Mmchr2\_ctg5

AL929060 RP23-17F8 Mmchr2\_ctg5

AL954738 RP23-327A15 Mmchr2\_ctg5

AL954315 RP23-105O1 Mmchr2\_ctg5

AL844167 RP23-66F6 Mmchr2\_ctg5

AL954653 RP23-253C11 Mmchr2\_ctg5

AL845299 RP23-370J19 Mmchr2\_ctg5

BX649382 RP23-143J12 Mmchr2\_ctg5

AL935129 RP23-181O3 Mmchr2\_ctg5

AL772205 RP23-162C3 Mmchr2\_ctg5

AL731814 RP23-109J20 Mmchr2\_ctg5

BX000441 RP23-163A24 Mmchr2\_ctg5

BX000344 RP24-88L6 Mmchr2\_ctg5

AL844537 RP23-448A16 Mmchr2\_ctg5

AL928794 RP23-51H24 Mmchr2\_ctg5

AL929066 RP23-68E1 Mmchr2\_ctg5

BX284641 RP23-70B20 Mmchr2\_ctg5

AL928899 RP23-347C2 Mmchr2\_ctg5

AL928831 RP23-296P2 Mmchr2\_ctg5

AL844881 RP23-244B19 Mmchr2\_ctg5

AL929001 RP23-324H1 Mmchr2\_ctg5

BX294004 RP24-95M10 Mmchr2\_ctg5

AL844528 RP23-139H14 Mmchr2\_ctg5

AL731795 RP23-123M13 Mmchr2\_ctg5

AL929027 RP23-217F24 Mmchr2\_ctg5

AL928700 RP23-388J20 Mmchr2\_ctg5

AL844562 RP23-230F7 Mmchr2\_ctg5

AL837516 RP23-234L8 Mmchr2\_ctg5

AL929380 RP23-467E8 Mmchr2\_ctg5

BX296531 RP24-82I9 Mmchr2\_ctg5

AL953906 RP23-109E21 Mmchr2\_ctg5

AL844582 RP23-234C7 Mmchr2\_ctg5

BX294658 RP23-13M8 Mmchr2\_ctg5

AL929443 RP23-467A7 Mmchr2\_ctg5

BX296543 RP23-344F5 Mmchr2\_ctg5

AL845462 RP23-236D15 Mmchr2\_ctg5

AL845530 RP23-281B6 Mmchr2\_ctg5

AL928823 RP23-472P9 Mmchr2\_ctg5

AL731790 RP23-104P2 Mmchr2\_ctg5

AL929136 RP23-442B16 Mmchr2\_ctg5

AL731712 RP23-100M24 Mmchr2\_ctg5

CR753894 RP23-222I6 Mmchr2\_ctg5

BX510362 RP23-371L4 Mmchr2\_ctg5

BX510304 RP23-128I6 Mmchr2\_ctg5

BX004973 RP24-260G16 Mmchr2\_ctg5

AL831780 RP23-394B8 Mmchr2\_ctg5

AL807800 RP23-438D2 Mmchr2\_ctg5

AL807801 RP23-235A15 Mmchr2\_ctg5

AL929550 RP23-77A2 Mmchr2\_ctg5

AL928891 RP23-17O9 Mmchr2\_ctg5

AL824710 RP23-35E16 Mmchr2\_ctg5

AL808123 RP23-73K21 Mmchr2\_ctg5

AL808119 RP23-70J9 Mmchr2\_ctg5

AL844516 RP23-367O15 Mmchr2\_ctg5

BX005092 RP24-472B14 Mmchr2\_ctg5

AL808106 RP23-281P6 Mmchr2\_ctg5

AL833797 RP23-89B11 Mmchr2\_ctg5

AL772192 RP23-161B16 Mmchr2\_ctg5

AL831783 RP23-201L10 Mmchr2\_ctg5

AL808117 RP23-240N3 Mmchr2\_ctg5

AL824715 RP23-98P15 Mmchr2\_ctg5

AL935135 RP23-16C1 Mmchr2\_ctg5

AL672100 RP23-125A1 Mmchr2\_ctg5

AL732467 RP23-147L14 Mmchr2\_ctg5

AL935056 RP23-185F7 Mmchr2\_ctg5

AL845273 RP23-334D15 Mmchr2\_ctg5

AL845430 RP23-402L5 Mmchr2\_ctg5

AL929407 RP23-99C16 Mmchr2\_ctg5

AL929215 RP23-8L8 Mmchr2\_ctg5

AL928876 RP23-236O6 Mmchr2\_ctg5

AL929317 RP23-239F11 Mmchr2\_ctg5

AL805918 RP23-191L7 Mmchr2\_ctg5

BX649513 RP23-139J7 Mmchr2\_ctg5

AL935130 RP23-452B16 Mmchr2\_ctg5

AL806514 RP23-18D24 Mmchr2\_ctg5

AL844890 RP23-380E2 Mmchr2\_ctg5

AL845297 RP23-207P16 Mmchr2\_ctg5

BX323456 RP24-366O18 Mmchr2\_ctg5

BX005046 RP23-462J6 Mmchr2\_ctg5

AL844873 RP23-26H8 Mmchr2\_ctg5

AL935149 RP23-70N3 Mmchr2\_ctg5

AL929395 RP23-263P13 Mmchr2\_ctg5

AL928638 RP23-377E1 Mmchr2\_ctg5

AL844519 RP23-250M11 Mmchr2\_ctg5

AL844545 RP23-383C3 Mmchr2\_ctg5

AL772408 RP23-339B20 Mmchr2\_ctg5

AL929232 RP23-294G12 Mmchr2\_ctg5

AL935314 RP23-367B2 Mmchr2\_ctg5

AL845478 RP23-186J18 Mmchr2\_ctg5

AL954684 RP24-352O9 Mmchr2\_ctg5

BX649512 RP24-87G15 Mmchr2\_ctg5

CR388226 RP24-131D9 Mmchr2\_ctg5

AL845436 RP23-299N13 Mmchr2\_ctg5

AL831742 RP23-11F9 Mmchr2\_ctg5

AL929042 RP23-91K11 Mmchr2\_ctg5

AL935313 RP23-356H10 Mmchr2\_ctg5

AL844568 RP23-369H9 Mmchr2\_ctg5

AL845174 RP23-156P22 Mmchr2\_ctg5

AL954712 RP23-241M12 Mmchr2\_ctg5

AL808125 RP23-193L22 Mmchr2\_ctg5

AL845175 RP23-283M2 Mmchr2\_ctg5

AL845308 RP23-31I2 Mmchr2\_ctg5

BX679657 RP23-267P2 Mmchr2\_ctg5

AL928719 RP23-419G21 Mmchr2\_ctg5

AL928988 RP23-402M7 Mmchr2\_ctg5

AL845480 RP23-361N10 Mmchr2\_ctg5

AL845161 RP23-214I20 Mmchr2\_ctg5

AL953902 RP23-5F22 Mmchr2\_ctg5

AL831735 RP23-452D3 Mmchr2\_ctg5

AL928568 RP23-396N8 Mmchr2\_ctg5

AL844517 RP23-453K8 Mmchr2\_ctg5

AL845162 RP23-35I8 Mmchr2\_ctg5

AL731857 RP23-106A3 Mmchr2\_ctg5

AL833801 RP23-414F8 Mmchr2\_ctg5

AL928862 RP23-88J10 Mmchr2\_ctg5

BX682228 RP24-191G20 Mmchr2\_ctg5

AL807380 RP23-192G18 Mmchr2\_ctg5

AL844144 RP23-204D17 Mmchr2\_ctg5

AL929021 RP23-89H14 Mmchr2\_ctg5

AL833803 RP23-244H7 Mmchr2\_ctg5

BX470156 RP23-2L1 Mmchr2\_ctg5

AL732466 RP23-149G14 Mmchr2\_ctg5

AL845461 RP23-331F18 Mmchr2\_ctg5

AL732601 RP23-154J12 Mmchr2\_ctg5

AL928894 RP23-192L3 Mmchr2\_ctg5

AL772292 RP23-109C16 Mmchr2\_ctg5

AL929557 RP23-29D15 Mmchr2\_ctg5

AL929024 RP23-480H10 Mmchr2\_ctg5

AL805955 RP23-192A6 Mmchr2\_ctg5

AL845429 RP23-290O4 Mmchr2\_ctg5

AL929588 RP23-87L24 Mmchr2\_ctg5

AL845325 RP23-32O9 Mmchr2\_ctg5

AL844852 RP23-260N23 Mmchr2\_ctg5

AL929233 RP23-388H13 Mmchr2\_ctg5

BX004872 RP23-464N1 Mmchr2\_ctg5

AL845445 RP23-380B10 Mmchr2\_ctg5

AL833786 RP23-220D12 Mmchr2\_ctg5

BX649640 RP23-107C23 Mmchr2\_ctg5

AL929404 RP23-71H9 Mmchr2\_ctg5

AL928935 RP24-114E18 Mmchr2\_ctg5

AL929153 RP23-55C8 Mmchr2\_ctg5

BX004793 RP23-188D9 Mmchr2\_ctg5

BX571766 RP23-366O12 Mmchr2\_ctg5

AL935150 RP24-482A24 Mmchr2\_ctg5

AL669932 RP23-430P1 Mmchr2\_ctg5

AL669828 RP23-163J20 Mmchr2\_ctg5

BX510908 RP23-264F3 Mmchr2\_ctg5

AL672259 RP23-169M4 Mmchr2\_ctg5

AL669961 RP23-43M17 Mmchr2\_ctg5

AL663092 RP23-91I20 Mmchr2\_ctg5

AL845511 RP23-308M21 Mmchr2\_ctg5

AL669824 RP23-396G1 Mmchr2\_ctg5

AL663063 RP23-407H16 Mmchr2\_ctg5

AL844513 RP23-132A3 Mmchr2\_ctg5

AL663091 RP23-392P11 Mmchr2\_ctg5

AL663077 RP23-22K4 Mmchr2\_ctg5

AL669910 RP23-119H5 Mmchr2\_ctg5

AL669913 RP23-479C2 Mmchr2\_ctg5

AL669917 RP23-188I17 Mmchr2\_ctg5

AL663062 RP23-401I8 Mmchr2\_ctg5

AL732310 RP24-223B6 Mmchr2\_ctg5

AL591882 RP23-53L16 Mmchr2\_ctg5

AL591967 RP23-143E11 Mmchr2\_ctg5

AL591970 RP23-190L21 Mmchr2\_ctg5

AL672162 RP23-100C4 Mmchr2\_ctg5

AL592042 RP23-380K13 Mmchr2\_ctg5

AL591936 RP23-28B10 Mmchr2\_ctg5

AL591665 RP23-333A18 Mmchr2\_ctg5

AL591905 RP23-152H17 Mmchr2\_ctg5

AL591673 RP23-471I9 Mmchr2\_ctg5

AL590414 RP23-305K11 Mmchr2\_ctg5

AL590389 RP23-393F23 Mmchr2\_ctg5

AL590430 RP23-384K10 Mmchr2\_ctg5

AL591763 RP23-480D17 Mmchr2\_ctg5

AL596263 RP23-392O2 Mmchr2\_ctg5

AL591606 RP23-272O14 Mmchr2\_ctg5

AL606841 RP23-466K24 Mmchr2\_ctg5

AL591586 RP23-126L18 Mmchr2\_ctg5

AL591675 RP23-420L2 Mmchr2\_ctg5

AL591598 ? Mmchr2\_ctg5

AL731671 ? Mmchr2\_ctg5

AL590415 RP23-97B17 Mmchr2\_ctg5

AL645766 RP23-41B10 Mmchr2\_ctg5

AL645827 RP23-443O6 Mmchr2\_ctg5

AL645794 RP23-129E1 Mmchr2\_ctg5

AL645736 RP23-474J7 Mmchr2\_ctg5

AL732362 RP23-53I23 Mmchr2\_ctg5

AL590418 RP23-206I14 Mmchr2\_ctg5

AL606473 RP23-327A19 Mmchr2\_ctg5

AL591584 RP23-335N12 Mmchr2\_ctg5

AL589874 RP23-109E10 Mmchr2\_ctg5

AL589876 RP23-117O11 Mmchr2\_ctg5

AL591607 RP23-215C14 Mmchr2\_ctg5

AL591488 RP23-36P22 Mmchr2\_ctg5

AL591490 RP23-144O20 Mmchr2\_ctg5

AL731698 RP23-161B3 Mmchr2\_ctg5

AL591542 RP23-321M14 Mmchr2\_ctg5

AL591512 RP23-346D16 Mmchr2\_ctg5

AL590429 RP23-462O16 Mmchr2\_ctg5

AL591478 RP23-140D14 Mmchr2\_ctg5

AL591127 RP23-370H21 Mmchr2\_ctg5

BX323066 RP23-163C23 Mmchr2\_ctg5

AL591495 RP23-61O3 Mmchr2\_ctg5

AL591411 RP23-428M13 Mmchr2\_ctg5

AL591430 RP23-41B20 Mmchr2\_ctg5

AL591064 RP23-395E18 Mmchr2\_ctg5

AL591805 RP23-90N15 Mmchr2\_ctg5

AL591712 RP23-138C10 Mmchr2\_ctg5

AL928840 RP24-233J2 Mmchr2\_ctg5

AL589902 RP23-108D12 Mmchr2\_ctg5

AL589873 RP23-120P1 Mmchr2\_ctg5

AL669836 RP23-79H8 Mmchr2\_ctg5

AL844574 RP23-155G13 Mmchr2\_ctg5

AL591884 RP23-183N8 Mmchr2\_ctg5

AL732357 RP23-383K1 Mmchr2\_ctg5

AL591703 RP23-448P12 Mmchr2\_ctg5

AL591911 RP23-216D20 Mmchr2\_ctg5

AL591711 RP23-19L12 Mmchr2\_ctg5

AL591854 RP23-105M23 Mmchr2\_ctg5

AL591762 RP23-465I6 Mmchr2\_ctg5

AL589870 RP23-118A2 Mmchr2\_ctg5

CR626861 RP23-31D7 Mmchr2\_ctg5

AL935060 RP24-151H6 Mmchr2\_ctg5

AL928998 RP23-58A8 Mmchr2\_ctg5

AL831766 RP23-209N3 Mmchr2\_ctg5

BX005039 RP23-391M18 Mmchr2\_ctg5

AL840639 RP23-156E17 Mmchr2\_ctg5

AL844575 RP23-156F1 Mmchr2\_ctg5

AL929248 RP23-354I18 Mmchr2\_ctg5

AL844882 RP23-360H15 Mmchr2\_ctg5

AL772258 RP23-337P24 Mmchr2\_ctg5

AL844511 RP23-244B6 Mmchr2\_ctg5

BX248383 RP23-63C4 Mmchr2\_ctg5

AL844884 RP23-266B14 Mmchr2\_ctg5

AL731826 RP23-123O12 Mmchr2\_ctg5

AL844845 RP23-155C1 Mmchr2\_ctg5

AL929563 RP23-68O14 Mmchr2\_ctg5

AL731822 RP23-105H6 Mmchr2\_ctg5

AL844576 RP23-233M15 Mmchr2\_ctg5

AL928812 RP23-321B23 Mmchr2\_ctg5

AL935134 RP23-321D1 Mmchr2\_ctg5

AL954701 RP23-43J11 Mmchr2\_ctg5

BX000530 RP24-500B8 Mmchr2\_ctg5

AL731703 RP23-100O16 Mmchr2\_ctg5

BX510350 RP23-123H13 Mmchr2\_ctg5

BX813333 RP23-255A6 Mmchr2\_ctg5

AL844551 RP23-117M21 Mmchr2\_ctg5

AL928805 RP23-291H20 Mmchr2\_ctg5

BX323803 RP23-319L12 Mmchr2\_ctg5

AL845432 RP23-332H19 Mmchr2\_ctg5

AL929157 RP23-94K14 Mmchr2\_ctg5

AL928974 RP23-56C2 Mmchr2\_ctg5

AL929097 RP23-76M8 Mmchr2\_ctg5

AL844846 RP23-358I19 Mmchr2\_ctg5

AL844162 RP23-160O12 Mmchr2\_ctg5

AL833787 RP23-228E2 Mmchr2\_ctg5

CU207329 WI1-264L4 Mmchr2\_ctg5

CU210915 WI1-2203P6 Mmchr2\_ctg5

GAP TYPE-3

CU210858 WI1-1997I11 Mmchr2\_ctg11

? WI1-1848B19 Mmchr2\_ctg11

CU302419 WI1-676J2 Mmchr2\_ctg11

AL845460 RP23-453H2 Mmchr2\_ctg11

AL929140 RP23-188A4 Mmchr2\_ctg11

AL928599 RP23-368M21 Mmchr2\_ctg11

AL837509 RP23-44L6 Mmchr2\_ctg11

AL837520 RP23-412O4 Mmchr2\_ctg11

AL845482 RP23-479E23 Mmchr2\_ctg11

AL807384 RP23-18F9 Mmchr2\_ctg11

AL845503 RP23-292G16 Mmchr2\_ctg11

AL844849 RP23-383L13 Mmchr2\_ctg11

GAP TYPE-2 100000 FINGERPRINT

CR931957 RP23-21C14 Mmchr2\_ctg11

AL669896 RP23-477F4 Mmchr2\_ctg11

AL593857 RP23-439H2 Mmchr2\_ctg11

BX950212 RP24-342N13 Mmchr2\_ctg11

AL844534 RP23-59M10 Mmchr2\_ctg11

AL670951 RP23-6N18 Mmchr2\_ctg11

AL844524 RP23-45P4 Mmchr2\_ctg11

AL844489 RP23-101P8 Mmchr2\_ctg11

AL928913 RP23-38C16 Mmchr2\_ctg11

AL845494 RP23-330D3 Mmchr2\_ctg11

BX000464 RP23-166A1 Mmchr2\_ctg11

CR318639 RP23-317N11 Mmchr2\_ctg11

CT573378 RP24-114J8 Mmchr2\_ctg11

CT010482 RP23-282O12 Mmchr2\_ctg11

GAP TYPE-3

BX890623 RP23-83O23 Mmchr2\_ctg12

CT571270 RP23-294G7 Mmchr2\_ctg12

AL845476 RP23-355G16 Mmchr2\_ctg12

GAP TYPE-3

BX682537 RP23-376N23 Mmchr2\_ctg13

CR848808 RP23-442I10 Mmchr2\_ctg13

CR354442 RP24-562O19 Mmchr2\_ctg13

BX324204 RP23-86F8 Mmchr2\_ctg13

BX511235 RP23-232H13 Mmchr2\_ctg13

BX679659 RP23-125B17 Mmchr2\_ctg13

AL845456 RP23-90C6 Mmchr2\_ctg13

AL845491 RP23-360A2 Mmchr2\_ctg13

BX649320 RP23-230J14 Mmchr2\_ctg13

AL845468 RP23-67E6 Mmchr2\_ctg13

BX294394 RP24-63F2 Mmchr2\_ctg13

GAP TYPE-3

BX649322 RP23-389L22 Mmchr2\_ctg14

AL935320 RP23-275N21 Mmchr2\_ctg14

BX284639 RP24-87L14 Mmchr2\_ctg14

AL731783 RP23-124E18 Mmchr2\_ctg14

AL772217 RP23-160K5 Mmchr2\_ctg14

AL935120 RP23-204I8 Mmchr2\_ctg14

AL773557 RP23-391F9 Mmchr2\_ctg14

AL929332 RP23-476I19 Mmchr2\_ctg14

AL928923 RP23-472B12 Mmchr2\_ctg14

AL805958 RP23-179F9 Mmchr2\_ctg14

AL928985 RP23-477P11 Mmchr2\_ctg14

AL845172 RP23-285J17 Mmchr2\_ctg14

BX000474 RP24-80C21 Mmchr2\_ctg14

BX537257 RP23-89C2 Mmchr2\_ctg14

AL669921 RP23-67P9 Mmchr2\_ctg14

AL663028 RP23-23J11 Mmchr2\_ctg14

AL663067 RP23-23G3 Mmchr2\_ctg14

AL672130 RP24-74N4 Mmchr2\_ctg14

AL663027 RP23-16P3 Mmchr2\_ctg14

AL672157 RP24-499M12 Mmchr2\_ctg14

AL669926 RP23-74K21 Mmchr2\_ctg14

AL732560 RP24-209P15 Mmchr2\_ctg14

AL954707 RP23-359C15 Mmchr2\_ctg14

BX649560 RP23-397H18 Mmchr2\_ctg14

AL450341 RP23-401L17 Mmchr2\_ctg14

AL845506 RP23-401M24 Mmchr2\_ctg14

BX322535 RP23-83A14 Mmchr2\_ctg14

AL928965 RP23-60M5 Mmchr2\_ctg14

AL929094 RP23-33L3 Mmchr2\_ctg14

AL844529 RP23-138J20 Mmchr2\_ctg14

AL845173 RP23-322G1 Mmchr2\_ctg14

AL928734 RP23-409P4 Mmchr2\_ctg14

CU207327 WI1-2443D1 Mmchr2\_ctg14

? CH25-44K11 Mmchr2\_ctg14

GAP TELOMERE 200000

##=== End of TPF Data ===