GB/T XXXXX—201X

中华人民共和国国家标准

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B 04

植物品种鉴定 MNP标记法

**Protocol for identification of plant varieties——MNP marker method**

（征求意见稿）



**国家市场监督管理总局**

**中国国家标准化管理委员会**

发布

发布

201X-XX-XX 发布

201X-XX-XX实施

1. 前言

本标准按照GB/T 1.1—2009给出的规则起草。

本标准由中国标准化研究院提出并归口。

本标准起草单位：

本标准主要起草人：

植物品种鉴定　MNP标记法

1 范围

本标准规定了植物品种鉴定多核苷酸多态性（MNP）标记法的原理、试剂或材料、仪器设备、测定步骤、结果分析。

本标准适用于水稻、玉米、大豆、棉花、花生、谷子、西瓜、甜瓜、黄瓜、艾草、番茄、辣椒、白菜、龙眼、荔枝、猕猴桃的原始品种鉴定、实质性派生品种鉴定和品种真实性鉴定。其他植物品种鉴定可参考此标准。

2 规范性引用文件

下列文件对于本文件的应用是必不可少的。凡是注日期的引用文件，仅所注日期的版本适用于本文件。凡是不注日期的引用文件，其最新版本（包括所有的修改版）适用于本文件。

GB/T 3543.2 农作物种子检验规程扦样

GB/T 6882 分析实验室用水规格和试验方法

NY/T 2594 植物品种鉴定 DNA分子标记法

3 术语与定义

下列术语和定义适用于本文件。

3.1

多核苷酸多态性 multiple nucleotide polymorphism，MNP

在基因组水平上由多个核苷酸引起的序列多态性。

3.2

实质性派生品种 essential derived variety，EDV

由原始品种派生或者由原始品种的实质性派生品种再次派生，且保留了原始品种的基因型或基因型组合产生的基本特性，但与原始品种存在明显差别的品种。

3.3

变异度 degree of variance

异型株（非典型植物）占总观测植株的百分率。

3.4

平均覆盖倍数 average coverage

比对到标记位点上的测序片段数目与标记位点数目的比值。

3.5

检出的标记位点 detected markers

至少有一个等位基因型有20条及以上测序片段支持的标记位点。

4 原理

利用多重PCR和二代高通量测序扩增并检测样品基因组上的MNP标记位点，分析测序数据，获得标记位点的分型结果和鉴定结论。

5 试剂或材料

除非另有规定，仅使用分析纯试剂。

5.1 水：GB/T6682一级。

5.2 多重PCR扩增与文库构建试剂盒。

5.3 高通量测序试剂盒。

5.4 MNP标记引物：见附录A。

6 仪器设备

6.1 样品粉碎仪或研磨机。

6.2 恒温孵育器或水浴锅。

6.3 涡旋振荡器。

6.4 PCR扩增仪。

6.5 离心机。

6.6 电泳仪。

6.7 凝胶成像仪。

6.8 超微量分光光度计，最小样品进样量为1 μL。

6.9 实时定量PCR仪。

6.10 微量移液器，2 μL、10μL、20μL、100μL、200μL和1000μL。

6.11 高通量测序仪。

7 测定步骤

7.1 操作要求

样品准备、DNA提取、多重PCR扩增与文库构建、高通量测序在规定的区域按单一方向进行操作且保持实验室通风良好。不同区域的仪器设备应专用。

7.2 取样

7.2.1 样品应为从变异度不高于5%的植物品种群体中抽取的个体样本混合物。

7.2.2 从植物品种群体中抽取的个体的数量宜满足NY/T 2594要求。

7.2.3 样品中个体的类型宜为幼嫩且新鲜的叶、根、茎、胚等器官或组织，也可为种子。

7.2.4 应注意从植物品种群体抽样的代表性。农作物种子扦样应符合GB/T 3543.2要求。

7.3 DNA提取

提取与纯化的DNA溶液在260 nm与230 nm处的吸光度值的比值大于2.0；在260 nm与280 nm处的吸光度值的比值介于1.7与1.9之间；DNA电泳主带明显，无明显降解和RNA残留。

7.4 多重PCR扩增与文库构建

按多重PCR扩增与文库构建试剂盒的说明书进行DNA质控、多重PCR扩增、文库构建与纯化。其中，多重PCR的扩增循环数不高于20个。

7.5 高通量测序

按高通量测序试剂盒和高通量测序仪的操作说明进行高通量测序。

高通量测序的平均覆盖倍数设置为700倍以上，测序长度大于标记引物在参考基因组上的扩增长度。

7.6 测序数据质量控制

利用品种鉴定软件将样品的测序数据比对到参考基因组的标记位点上，统计第一次检测的标记位点的平均覆盖倍数*C*1。

当*C*1＜500时，判定样品的测序数据量不足，从7.5或之前的步骤开始重新实验至第一次检测的标记位点的平均覆盖倍数*C*1≥500。

当*C*1≥500时，进一步计算检出的标记位点的比例，其中，和*T*分别为样品的检出的标记位点的数目和检测的标记位点的数目。

当*R*1≥95%时，判定测序数据合格。

当*R*1＜95%时，判定文库构建可能失败，从7.3或之前的步骤开始重新实验至第二次检测的标记位点的平均覆盖倍数*C*2≥500。

当*C*2≥500时，进一步计算第一次和第二次共同的检出的标记位点的比例，其中，为第一次和第二次共同检出的标记位点的数目，和为第一次和第二次分别检出的标记位点的数目。

当*R*2≥95%时，判定测序数据合格。

8结果分析

8.1 结果计算

遗传相似度按式（1）计算

……………………………………………………………（1）

式中：

——待测品种与对照品种的遗传相似度（%）；

——待测品种与对照品种中均检出的但基因型无差异的标记位点的数目；

——待测品种与对照品种中均检出的标记位点的数目。

8.2 结果判定

8.2.1原始品种的鉴定

当对照品种为在待测品种植物新品种权申请日前的已知品种时，判定待测品种是否为原始品种。

当待测品种与所有对照品种间的遗传相似度均小于*a*时，判定待测品种为原始品种。

其中，*a*为待测品种所在植物的实质性派生品种的判定阈值。

8.2.2 实质性派生品种的鉴定

当对照品种为原始品种时，判定待测品种是否为对照品种的实质性派生品种。

当时，判定待测品种不是对照品种的实质性派生品种；

当*GS*≥*a*时，判定待测品种是对照品种的实质性派生品种。

其中，*a*为待测品种所在植物的实质性派生品种的判定阈值。

8.2.3品种真实性鉴定

8.2.3.1水稻、玉米、大豆、棉花、花生、谷子、西瓜、甜瓜、黄瓜、番茄、辣椒、白菜、猕猴桃

当时，判定待测品种与对照品种为“不同品种”；

当时，判定待测品种与对照品种为“近似品种”；

当时，判定待测品种与对照品种为“极近似品种或相同品种”。

8.2.3.2 艾草、龙眼、荔枝

当时，判定待测品种与对照品种为“不同品种”；

当，判定待测品种与对照品种为“近似品种”；

当时，判定待测品种与对照品种为“极近似品种或相同品种”。

8.2.3.3 对“近似品种”或“极近似品种或相同品种”的样品，可按相关国家标准或行业标准进一步进行田间种植鉴定。

附录A

（规范性附录）

MNP标记引物

A.1 水稻MNP标记引物。

表A.1水稻MNP标记引物

|  |  |  |  |
| --- | --- | --- | --- |
| 位点编号 | 染色体 | 正向引物 | 反向引物 |
| 1 | chr1 | CATCGGAGTTTGTGAAAATAGAGAATAACC | GAGTATCAATTTTGAGCATGTAGCTAGACT |
| 2 | chr1 | AATATGTTCTCTCTGTTTCACAATCTTGGA | GGGATCATGAGGTCGATCATGTTG |
| 3 | chr1 | AAAAACTCCAATCTTGTCAAAGCGA | TGTTCTCCTGGTCTTTACTAACCTG |
| 4 | chr1 | TTCATGCTAACCACGTGCACTA | TTTTCCCGGTTTTATTTTTCTATAGGGACA |
| 5 | chr1 | GGCTTTCTCCCATGCTTATACCT | CCAGTGTGAGAGGCGAAAATACC |
| 6 | chr1 | TATAAGTTGAGGTGTTGTTGAGTGCA | ACTAAACGGAATCTTTTTAATAGCTCACCA |
| 7 | chr1 | TTCTTATGGCATCACGATTTAGAGGTAAC | ACAACTGAATGAGACTTATGCTACCAAG |
| 8 | chr1 | ACTCCAGTAAAAGCATCAAAACCTG | TGACCATGACAGAGGTGAATAAGAG |
| 9 | chr1 | ATGAGGTTAATAATCTGGACATGGCAA | GGAGGTAGTAGTAAGCAATCCCATTG |
| 10 | chr1 | GTACGTTTATGTGCCATTTGTTTGG | AAAATTTCAGGCCTCTTCCCTTTTT |
| 11 | chr1 | GCGCTTGAGACAGTGGAGATTC | GTGGTTTCGTTGATCACCAAAGTG |
| 12 | chr1 | AATTGCCATTGCTCTTCGCTT | GCTAGGTTTTCGACGGTGAGGTTA |
| 13 | chr1 | GCCTTCAAGGGAGGGAAAGCTAC | GTACTGATTTTCATAGAGCACACTTTTGTG |
| 14 | chr1 | CATGCAAGGATAAAGTGAGGCAGTA | AGATACAGTGCATGCATCAGCTT |
| 15 | chr1 | TACTACTGTTGAGGCATCCTATCATTATGA | GCTAAGGAGTTGGAATCAATGGCT |
| 16 | chr1 | GAGGGAGAGGGAGAAGAGAAAAAG | ATAGCGAGATTGGAGAGGGAAC |
| 17 | chr1 | TCATGATCACTTGGCAACAATAGCT | GAACATGAATGTGCATGCGAAGA |
| 18 | chr1 | TGTTGGCCTACATCATGATGCTATA | CATGTCGAACTTGAACCCCAATG |
| 19 | chr1 | CAGTGTGCTATAACGTATGCACAGTA | GGGATAGCCTACAAGCAGTACCT |
| 20 | chr1 | CGCCTCCTCCTACACCTACTGTT | CGTCGTCGTAGAGGAGATCGAA |
| 21 | chr1 | GATGTATGGTCAAACGTATCTCAGAAAA | CAAACTGTGTGCAGTCGCAATAG |
| 22 | chr1 | CCGTGGAACTGGGACAACAATT | GCCAGACACGTCAGAGATTCAAC |
| 23 | chr1 | CGACCGACAAATTAATCTATCCACGA | TCACTGTCTTGTGGTTGCAGTTT |
| 24 | chr1 | CGATCGATGAGCACTTGCAAAGT | TGGAGTTGGAGAGACGTATATATGAGAAGTA |
| 25 | chr1 | TCAGGTATGCACCCATTACGAAG | GCAAGCATATCACATTTGGAACAAT |
| 26 | chr1 | TCAGACACGCTGCATCAATGTA | CGCTTCTCTTAGGATCAATTAGATAGAGGT |
| 27 | chr1 | TTTCAAGGTATCATGGTACTACGATGTAGT | GGCTAAAGGTCAACTGTGATGTGTAG |
| 28 | chr1 | GGGACTTTGGGAGTTTTGGGAT | CATCCTGGTTCTCTCGACCAA |
| 29 | chr1 | GCTTGCTGAGCTGTTGTTTCAT | GCGTTCCAGGAGCACTAAGATG |
| 30 | chr1 | AATCCATTAGCTGGGCTCTAGGTT | TCTCGTAGTTTGTACAGGCGGAAT |
| 31 | chr1 | TCGAGGAAGGAGGGAGGAGTT | TGCAATATATAGTTGCACTCACTCCTCA |
| 32 | chr1 | CCCACAAACCCTAGGAATTTTGTTT | CCCAAACTCCACCTCCTCTGAGT |
| 33 | chr1 | ACAGGAAATATGTGTTCAATGATTGC | TTAGCAAAATAGTAAGGACACTACTGGTCA |
| 34 | chr1 | CGTAAGCCCGTAACAACCGTAA | GACTTTTGATCTCTTCAGGCATTCA |
| 35 | chr1 | CACTACTGCGGTTCTAAAGGATATTCG | GAACGAATTAGGTATATTATTGTGGCCTT |
| 36 | chr1 | ACACGGGGATGATAAGGTTTAATCT | CCACATCCTCTCAAACAATCACAAA |
| 37 | chr1 | CAGTGGGAAGCCACATAAACCA | GGGACATGTTCTACCTCATGATCATG |
| 38 | chr1 | AACTCAACCCTTTGATGCAATCTG | TGATTAAAATAGGAATTCAAATTGGTGCA |
| 39 | chr1 | TGGATTAGCTTGATTTGAACAAATGC | CGACGGCTGATCTTGAGGATTT |
| 40 | chr1 | AACGAAAATGTGCATCTGTTTAGTTTCTT | GCTAAAATGAGGAATGAGGCCAAGA |
| 41 | chr1 | CCATTCATATTGGTTCTACATGGTACATG | TTAAGTTACCTGACGGTCATTTCATTAAG |
| 42 | chr1 | AACCCGTCAACATTTAACTTCATCC | ACTAAGTTCTAACTGGTAAGCACGA |
| 43 | chr1 | CTAGTGTTATCAAAGATATACTGCTGC | AGACTCGGCTACAGTAGGAATATTG |
| 44 | chr1 | GGTTTAAAAGATTTGTCGCGCAATT | ACTCCAAACTGTACTGTATAAGCCT |
| 45 | chr1 | CATAATCACGCCGTGAGAGAGA | AATTTGGTTGTACTGCGTTCTGCTA |
| 46 | chr1 | TGAGGATGAACCCAATACTGAAAAA | TGAAGAATTTTAATTGGCTTTTGGTC |
| 47 | chr1 | GGATTCAAGTCATGGCAGATTGA | CAAAACTCAAGACTGAGCAATTCG |
| 48 | chr1 | GGGACTAAACTGGACTTAGGCGAA | ATAGCCTATTCGGTTTGATCAATTGT |
| 49 | chr1 | TCTCCACTGTAAGGTGTTCAATGTA | TGTTTTTCCTGTACGTTCTGACAAG |
| 50 | chr1 | CCGTTCCTAGGCAGATCTTTTATCT | TTCTGGTGTTTGGTGTGTGTTTTTA |
| 51 | chr1 | TGCTTCTTCATTTGTTCAATCTTGT | CAAACATAAGACAGATGAGCGCTAG |
| 52 | chr1 | ATACCTGGGATTAAGTGATCAAGCC | CTAATCCCCTCACCCTGATTATCAC |
| 53 | chr1 | TGTCAATGTCAGGTCGGGTACATA | TATTACTGCTGCCTTCTAATCTCCATAGA |
| 54 | chr1 | TGGAGCAAATAATCAATTTCAAAGTTCAGC | TGTTAGGCTGTAGTAATTCACATGATGTG |
| 55 | chr1 | TCATGCTCATGCATGTGCACT | ATCCTCAATGACCACTAGTCAAGACTC |
| 56 | chr1 | TGGACCACGATATGTGTAAATCATG | TCACCATGTTGGCCAAAACTG |
| 57 | chr1 | AGGTGTACAATGGGACGAGATTAAAG | GATTTTATTTAGGACCACCAACTGCTATT |
| 58 | chr1 | TTATTCCTGGTCTCATGTGTTCTTGA | CACTGAGTAGAAGGCAACTACAAGAGGTAG |
| 59 | chr1 | TTCGGTTTATAACATACTAAGTCGTGCAT | CGTGTAGTCCCTCTCTGAAACG |
| 60 | chr1 | GTATACGCTACGTAGAACAAAACCG | TCGATTCAAAGTACCCTGCCAAAA |
| 61 | chr1 | CCAAACAAATCCTATGCCTAAACTCGT | GTTCGTCATTGCCTTAATTTCTTTCCT |
| 62 | chr1 | GCAGATTTACAATACAGATGGGGTG | CCTCTAACTATTGAAAGTGGTCCCT |
| 63 | chr1 | AGATTGATCTGGACAAAATGGCTAATTAGT | GCTATTTACGCCAAGTTTAGTTCCAAAA |
| 64 | chr1 | TTTTTGAAGATACACGAGCCATAGAA | TTAGCAGTGACTAAACATTTTTCCACA |
| 65 | chr1 | ACTAAACAAGCCCACAGTCGTAATG | CAATGAGTACGATGGTGTAATTAGATTCA |
| 66 | chr1 | TGAAAAGTGCACACTTCCACATG | AGGCTCCACTTCATGTTGTTTAAATC |
| 67 | chr1 | AGCTTCGTGCTCCAGCTCAT | TGCAAAACGAAGAAAATTCTCTCAC |
| 68 | chr1 | GCATCCATACATCAAGAAACCGAAT | AAAAAGACCAGTCAAATGATGCCAA |
| 69 | chr1 | TGTTAAAATGAAGGGACAATGGACG | TCCCAAAATACGTAAAATAAGCGAAA |
| 70 | chr1 | CCCACACAACTACGACTGTGTT | ACAGTTTATGCGTCCTTGCACATA |
| 71 | chr1 | CCACGAGCTCCATATCCAGTTG | CAGCCTCTCCATCCACTCTCTCTAC |
| 72 | chr1 | GCAAGCAATCAAACACCTGCAT | CGTTTGGAGGTGCCATTTCCT |
| 73 | chr1 | TATATATTGGGCTTTGCTCGGTGAT | GGCCTATCTGTTGATCCTACGATAG |
| 74 | chr1 | CAAGTATTTCTGGTATGTATCTGGACAAGA | CAACAACCATGCATGCAATGGAT |
| 75 | chr1 | ACGCCATCCATCCGATCAT | AATCCTTCTTTATCTCCTCCTCGTGTA |
| 76 | chr1 | GTCTTAAATTAGGCAGCCGTACGAT | CTGGTGTTTAGTGTGGCTTCAAG |
| 77 | chr1 | GGATCCCTTAACTTACAATACCGGTT | GTCGCTCGTTTGCACTTGAG |
| 78 | chr1 | CTTAATTTCATCCTTGGGCTTATACTCAGA | GCACATACACATCACTGTACACGT |
| 79 | chr1 | GACAAGGTGGCCTATAAATAAGCAGA | CCTCTCACAAACCATGGTATGCAT |
| 80 | chr1 | GGCTCCTATTTGCCGCTGATTA | TCTAGCTCGGCGAATTAAGAATACAAG |
| 81 | chr1 | GCATAAGGGAAGCCTTCATCTTTAC | AAATCAGCATAGAAAACTGGCCAAA |
| 82 | chr1 | GTCAGGTGCACCATCCTCAC | TGGAAGAACCTGCGAACGTC |
| 83 | chr1 | AGAAATTCAGGAAGATGGCATTTGG | CTACGGTAGTTGCAATGTCCTAAAA |
| 84 | chr1 | GCAGATTTGCTGCTGCTACAGTT | GGATGGAGAGAGCATGATGAAAAA |
| 85 | chr1 | CGTCTTTTCGTTGTCGTATTGAGG | GCTAGGCACAATAATTCCCTCGAT |
| 86 | chr1 | GATTATTCGGTCACTTGTTAAGGGAGT | GTTTTTCTTCTACTGCCACATAAGCATC |
| 87 | chr1 | TCTACTCAGGACTTTTACCATTTGTT | ATACCATCGGACGTCCTATTTGTAG |
| 88 | chr1 | GAATGGGTAAATTGGAATCATGCCA | GACATTACGACGAGTAATGAACAGGTAAA |
| 89 | chr1 | ATGATACGAGTAAATATTATTAGGCCGTGTTTT | GACAACAGAAATTGCCGGTGT |
| 90 | chr1 | GAGGGAGTAGTATGGTTGTTTTGTGTTAG | CTCTTGCTAGGAGTACGTGTGATGTC |
| 91 | chr1 | CCATATGGCCATCTATAGTCACTTTG | TCCCATCAAGAAAGGGTACAATCAT |
| 92 | chr1 | GCAAGTTGTCCAGGGCAAAATATATA | TGGAAGTGAAGGAAAAACAGGAGATA |
| 93 | chr1 | TTCCAGTTTCTCCCTTTTTAAACTCA | TGAAGTGTGTTGTTTCTGTGTGAAACTA |
| 94 | chr1 | ATATGCCGCTTGCTTGACTCT | GCATGATGCTCAGCATCCCTT |
| 95 | chr1 | TCTAGAAAACTCAATACGGAGTATTGCC | AAAGGTGTTCTAAATTTTGTTTAAAGAGCTACA |
| 96 | chr1 | TTCATTAACACGCGCATTACACTTA | TCGTTCGTAACTTAGCTAGGCAATA |
| 97 | chr1 | TGCAACGTAGTCCCACATACCAA | GCACTTGGAGAACGGTAGTGGTATT |
| 98 | chr1 | CCAATTTATACACACACTACGTCTTGGA | AAATTCTAGATGCACTCACAGCATTACT |
| 99 | chr1 | GGTCACGCCTTCTCCACTTG | CGAAGACTCACCACCATGAGT |
| 100 | chr1 | CGTATTGTTTAGTAGTTTAGAAAATGTGCCG | CAGTATTATATTCGCGTTCCTGGGATT |
| 101 | chr1 | GGATTTGACATTGCCTTGTACTAACACTTA | GCATATCATTTTCAGAGCTTACACAAAGT |
| 102 | chr1 | TGTTTCCATTAATTAGTAGCCCTCCA | TCATTTAGATTTTCGTTAGCAGCCC |
| 103 | chr1 | GTCTTATAACCTGAAACGGAGGGAA | GAATTATGACGACTCTCTCCAAGGA |
| 104 | chr1 | CGCCACTACCTCGCTTGT | GACTATTCATCTTTCTGAAAAATGTTTTCACAA |
| 105 | chr1 | CTCCCTCTTTCTGCCTTCCTATG | TTGCGGTGCAATTAAATAAGTGC |
| 106 | chr1 | CGACGCTCGGGTTTAAAAATATGTA | TCCACATCCAGAAGTTAATCGTCTT |
| 107 | chr1 | GCTCGGCAACGACTACGT | ACTTATGTTGCGTGCGAAGACA |
| 108 | chr1 | TCATCTAGTCTGAATCCAGTTCCACT | AACTTCTTGTTACTGAGGCTTCTAGATCTA |
| 109 | chr1 | CACATGGATTCACCTCTGTTATGATTT | GATCGGTGTAGCCCAGAAAATG |
| 110 | chr1 | CCAACTCCAACTCCACCCTTT | CGGAGTTGGCGGTGACAAAGT |
| 111 | chr1 | ACCGAGGGTTTTCTGTTAAGCAC | TTGACGCATCTTCTTCCCTTCT |
| 112 | chr1 | CACTCCAAACAGTAGTGAGTAGTGT | GGGCCTGTTTATCCTAATTTTGTTTTCTT |
| 113 | chr1 | GATGGCTAGTGTTTGGTGCAAAG | GCGGACAACTTGTGTAACCCTT |
| 114 | chr1 | GAGGTGCATATGACCCAAATTTGG | TTGTACTCAAGAACTGTCTTCATCTTCG |
| 115 | chr1 | TTTTTGGGTTAATTTTAGCATCACCAGA | TACCGTGTTAAAATATTGGCAAGGTCTAAA |
| 116 | chr2 | TTAGGCATGGGATGCAAGGAT | CTGAATCAAATTGATGTCGCTGAA |
| 117 | chr2 | CAAAGAGGGTAAGCTGAGGCTT | CCTAAGAGCGGTACAATAAAAGGCTATAAA |
| 118 | chr2 | AGAAGCAATCACCCATAGCTACTTT | CCTTTAGGAACACATGAATTGACCC |
| 119 | chr2 | CATTGCATGAAATTTAATGTTTACTGCCA | TCTGGCACAGCTAACAGAATCAAG |
| 120 | chr2 | TCCTTCTAGATGAAGGACCTGAAGATT | GCACGGGTATGGAATCTATACATGG |
| 121 | chr2 | TTTTAGCAGAACCGAGCTGTCAA | TTCCAATGTTGACATCCTCTTGCT |
| 122 | chr2 | GGATGTACTTTCAAATTAGGTCGAGTGT | GGTCGCCCTCATGGTAGAACTG |
| 123 | chr2 | TGTACATGCGGGACGATGAAG | CACAATCCAATTTTGCTAGCTAAGATG |
| 124 | chr2 | TTTTTACATGTGGAGCTGCGGATA | CATCACACCAACCTCAAGTCCT |
| 125 | chr2 | GAGATGTCTCATCATGGAACTCGAT | CATCAAGGTTTCCAAGACCCTTAAC |
| 126 | chr2 | ACATGGCACATCCTCACATCAA | CAAATTCACTACCAGTACAGAATGTCAATC |
| 127 | chr2 | GGGAGTGAAATGCCCTGAAAA | CAAAGATTGTTAATGTTGAGTACCTGTGAT |
| 128 | chr2 | CAACACATAAGCTGTGTGCACTT | CCCTACATTCATCCATGTATTAAAACATCC |
| 129 | chr2 | TCACCACTATCATTTAACCGGACTT | AAATCCCTAATTAAAACCGCGGTAC |
| 130 | chr2 | AAGTTCGTTCGCTTTTGAAATTGAAGA | GTCTGACTTTCATCTCAAGTTAACATTCG |
| 131 | chr2 | TGGCACAATTATATTTCCATTGCATT | GACCACCTCATTACACTAATCCCATT |
| 132 | chr2 | GACCTTGCATATTTACGAAGTGATCA | GGCTACTTTCCTTGCTTTGGTCA |
| 133 | chr2 | CCACCCTTTTATCGTTGAAGTTTCA | TCCCTTATATTCACGGATAGAGGGA |
| 134 | chr2 | CCCAAGGCTAAAGCTCGTTGTA | GCACTCGACGAGGATAAGGTAG |
| 135 | chr2 | AAGAGGGCATCATTCTTGTACTCTT | AATCTTTCTAATTTAATGCGGCCGT |
| 136 | chr2 | CATGTCAGCAACACCAGACTTCA | CACTTACTGGTGCATGTGTCGTTG |
| 137 | chr2 | TTTCCATGTTAAGGGATCAAATGACCA | CCATCCTACTCATTCGAACACCA |
| 138 | chr2 | TTCTATAGCTAAAAAGTTCTTAAAATCTGGA | ACCAGTTCATCCAGTTTATCCGTTA |
| 139 | chr2 | GTGTAAATGACTCACAGATGGTTTGG | CAACACGTGACACACACACATACATT |
| 140 | chr2 | GACCTTCTGTTTCTACCAGAAAAACAC | GCTCTCTTCCTTCTGTTCAATGGATG |
| 141 | chr2 | AAGAGGGATCGATCTACCCAGCTA | TGGTGATCAGGTAGTTGTTGTTGC |
| 142 | chr2 | TGGAGGAAGTATCTCATGGGTATTG | CCACATCATCAAACAAATATTAACCCTTC |
| 143 | chr2 | TAAATCAAGCTTTGCAGCAGCTAAAG | CCAATCTCACTTGCACGAGGTT |
| 144 | chr2 | GGATTTTGCCGGAAAACTCTTCTAAAAA | CAATGGAATCCCTAATCTATATGCACATCT |
| 145 | chr2 | TGATAATATGCATATGGCATACTGTGGA | CCACTATCGCCAATACACTTCTCAAC |
| 146 | chr2 | CCCTATTCCGGTCGATCGAT | CATCATCGTGAAAGGTGTAGTAGCTCT |
| 147 | chr2 | TGATCAATCAACTTGCTGTATACCACA | GGGAAAAATCCAAATAAGAACCAAA |
| 148 | chr2 | TGGAATTAAGAGGAAAGAGAGGAATCAC | TTCCACGCGGATTGCTTTT |
| 149 | chr2 | GACTTGGTGGCCACAACATCTA | GACTTCTGCTTCCTTTTGGATTCG |
| 150 | chr2 | TGCATCCGCTGATTGTATCTCC | CAAGTAATCGCTCGACAGCTTCATC |
| 151 | chr2 | ACCACACACAATCTGATCTTTTGAG | ATAATTCACTGTGGTGTGTTTTCCC |
| 152 | chr2 | CAAATATATCTCTGGCGCTTGGAA | CCTGCTGTTCTTTCTTCAGTTCGT |
| 153 | chr2 | CGGTACCAAGCTTTAGAGGGAA | TGACTGACTTATTGCATACTGAAGTTGAG |
| 154 | chr2 | GCTCATCTGATCCGTATACTCCGA | GAAAGACCGAAAGAAGAGGAGGAT |
| 155 | chr2 | GGGATCTCAATTGCTTTTGCAGA | GCTGCCTTTTGACAGCAAGATC |
| 156 | chr2 | TCAAAATGGTAGAGAAGACTAGCTAATGCT | ACCCTCGTAAATGTCGTGAGACA |
| 157 | chr2 | CCCACGTTGATTGAGTAGATGGA | CGTAACATGCTATTTCTTTGGAATAGAGGT |
| 158 | chr2 | AATAACGACATAGACTTCTGAGTGACATTTC | TGGTCACAAATACTAGTTGCTTTATGCATAC |
| 159 | chr2 | CCCGCCTCAAGATGCATGG | CAAATTCAAGTATAGCCTAGTCCCGA |
| 160 | chr2 | AAAAACTTGCACGCTCAATATCGT | TCATAGTTGTGCTTAGTGGACCTACAACT |
| 161 | chr2 | CCTTCCTCGTCCTCTTCCTCTTC | GGGTGGACGAATCTGGAATGTC |
| 162 | chr2 | GGAGCATAGAAGCACTTCTCACAAA | AAGACACATTTTGGTATCAATCCAAATTCC |
| 163 | chr2 | TCCCCAAAATATAGCAACTTCTGGA | TATCAAGGTGCACAAAGTTGCTAAG |
| 164 | chr2 | CCTTGTAGATGTACTTTCCGAGGAA | CTTCGTCATCTTCATCCGCAC |
| 165 | chr2 | CCACATTTGCTCGGTTTTCGTAAG | CGAAATCTTGTTTTGACAGTGGACAAG |
| 166 | chr2 | GCTACCAGCATTCAGCCATTCA | GATCCAAACAAGGCCATTGACAG |
| 167 | chr2 | AATAGACCAGCTAGAAATCACAACTATGC | GTCTTGCATGAAAATAGTTGCAACTC |
| 168 | chr2 | ACAGTATATGTGCTCTAGAAACATCGAAAC | AACAGAAAGCAACTTCAGTTAAAAGACAC |
| 169 | chr2 | TCATCTCTCTCTCTCCAACTGATGTCT | TGACAGACGAGGTTGGCAACT |
| 170 | chr2 | GATCGGTAGACGCTGGTGAG | ATATACCCTAATCGATGGCTCATGG |
| 171 | chr2 | ATGTATAATGTCCTGTGATTATATGTGGCA | GGTCGCAAAATGCGAAGAACAA |
| 172 | chr2 | TTGCTAGGGTCGTTTTCGAGAAC | TTTATTAGAAGTGTATTCACGGTCCTAACAA |
| 173 | chr2 | CGTGGAGATAAAATACAATGGCCC | CACCAATAGTCGGATTCCTGCTATA |
| 174 | chr2 | GGTAAAGAACATACCCATATCCACGT | TGCACCAAGAGATGGCAATG |
| 175 | chr2 | GCAGAAGTTCTTCGAGCATAACG | GAGGATGAACATTTCTCTCGCAA |
| 176 | chr2 | GCTCGATTGAAAAAGAAACTCTGGA | GATGCAAACCAGGACTATATAGGGT |
| 177 | chr2 | CGATTGTTTTCGGTATGTCAGTTGTG | TGATGCCAGTGAACATTTGGGT |
| 178 | chr2 | GAGTGTGGTCAAACCTTGAATTGA | AAAAAAACAGGTACTAGTAGTATGTCATGTCCT |
| 179 | chr2 | TGCTGCAAGGTTTGTTTGATTCTG | TCCGCTACAATTACAGGATCCAATG |
| 180 | chr2 | GATATCCACTGCATTGTAAGGGAGA | GTCAGCTCTTTTAATACCTAAATGGGTTT |
| 181 | chr2 | GTAAGTGACTTATCTACACATACGTGCA | TATTCCACCCAAGGAGTGCTAATTG |
| 182 | chr2 | GGGTCTCACACTTGGAAGAAAATTT | CTCACAGGACACGACATTCAGG |
| 183 | chr2 | CAAGAATTTCAGTCGACATTGGCA | ATGAGTACCCAAAACCTCCTAGACT |
| 184 | chr2 | TGCCGAATTATGACCAAATTTCCAA | AACGGGATCCTAGGCAGTGTATC |
| 185 | chr2 | CAACTACTTGTTGGTCATTGTTTGTCA | AGAAGGCATCCAGGAAACTTATCAT |
| 186 | chr2 | TTCTGATTATGACAAAGGTGGCTATG | GGAGCTGGTTTGAAGTGGATTAATTAT |
| 187 | chr2 | GGCATATTTCTAATGACATGGATCAAA | GAACAACCTAAACTCTACCACCAGT |
| 188 | chr2 | CCGGCTAATCATTCTGAAACTTGTT | AATTTGAGTCGTTTAAATGGGTCGG |
| 189 | chr2 | GAGGAGGGAGGAGGGTAGATC | CCCGGAGGCGGTTTTATACC |
| 190 | chr2 | CATTCAAACCGTACAATTGAAGAGG | TGACCTGTGTTTGTCGAAAATGTT |
| 191 | chr2 | CGACGGCATTGCACACGAA | TGGCGTAGCAAAAACAATGTCAC |
| 192 | chr2 | GTCCAGTACTAACCACTCAGATTTCAGA | GGCCGGTTCATACACGAGG |
| 193 | chr2 | GCTTACACAAAATATGAACTCTGTGGTGA | TTGGCTAATATTGCACGATTTTAGTG |
| 194 | chr2 | GGAGGTAGTACCTTCTTTTCCGTT | CTCACATGGAGTAGCCACATTTCT |
| 195 | chr2 | CATGACCATATTTAAGGGCCTTTTG | CTCTTGCACTAGAGATGAGGCTTAGAG |
| 196 | chr2 | TCTGTATAGCCTCAGACTGCCTTGA | AGCGGACAATTTATTTATTACTGTCCA |
| 197 | chr2 | CGGCATCACGGACATCTACAACT | CGAAAGTTGACACCGTAGGAGAA |
| 198 | chr2 | TGTTTGGACTTATATGACACCCGAAA | TGATGGCTTGAAGAATATAAAGCACTAGT |
| 199 | chr2 | GCTTTGACGATGCAAAAACGA | GGCCCTAATTATACGTTATACGTTAATTGG |
| 200 | chr2 | CGAAGAACTTATTTGGACAAATATGACCA | GGAACATTTGGAAAACCATGAGAAA |
| 201 | chr2 | GTGCTGTGTGATTCATTATGATTCTCC | CTTGCGCACGTACTACTCATTAGA |
| 202 | chr2 | CTGCTCATAAACGAGTTCACGTCTT | CCCTAATCCTTGATTCCATCTTCCA |
| 203 | chr2 | CTCTCTGCTGCAAAGAGCTTCT | CAGCTAGCCACGATACCTGATAC |
| 204 | chr2 | CTTCCTATATCCCTCCTCCTCTCC | ACCACAAGATAATAAATCGACCGAG |
| 205 | chr2 | GAAGAAGCGCGGCTCATTG | TCTTCTTCCTTATCTCATCTGCGAG |
| 206 | chr2 | CACTGTCATCTGCTTATCCAGCTGT | ACATAGGATCTGAGCAGAAAAAGAAGG |
| 207 | chr2 | TGTGATGATCAGTCCTAGAGGTGA | ATTTAGGAGGAAACTGCATCTATTCATGTT |
| 208 | chr2 | TTTTTCCCTAGTAGGTGTAGATATCTAGTAGCTC | CATAGATATCCCATTGTATGTCAACAAGA |
| 209 | chr2 | ATAGTCTGCTATTGTACCTGCTCTTAGAAAG | CAGTTTGCCCAATTTTCAAATTCTTA |
| 210 | chr2 | CCCACAAGATTCAGTACTGTGCAGA | ACTGTTCTCACCTGGCTGATATCC |
| 211 | chr2 | TGGTTAATGGATATAGAAGGTAGCTATGGT | CAAGAAACTAATTGTCATCACCTCGTAA |
| 212 | chr2 | CCGGTGGGCCTTTTGTCTTTAT | CATTATACTAAAACAGAGTGCCTCAACAGT |
| 213 | chr2 | TCAAGAGGAAAATAAGCATGAGGCAA | TCAGGTCAGTAGCTATAGTATTCAAATCGT |
| 214 | chr3 | GGATCTATGATTTGTTACTGCGCAA | AAATTCGATCCTATGCTAGCTCCAT |
| 215 | chr3 | AAACAACAGAAAGAACCAAGTCTGTCA | GCTATAGAACCATCCTTTACTCCTCTTTTGT |
| 216 | chr3 | TCAGACATTTCTTCTCATGGTCCATTG | GTGAGTTGTGACAGGATAGTACTACTAGT |
| 217 | chr3 | ACGGTTCCAACATTATTTGGTAATACA | TCTAATACTCCCGTCATCCCAAAATA |
| 218 | chr3 | GGGTTTGCAGCAACAGTGGATA | GGAATGCCATCGTGTCGTCAT |
| 219 | chr3 | GTACGGATCTGCAGCTGTTGTTT | AAAACGAGGTGTGTTTAGTTCCAAAG |
| 220 | chr3 | CGTATACTCAATTGCGTTGAGCTATG | CGGATGGTAGGGATTAGCAAATCC |
| 221 | chr3 | GTGTGTTTAGTTCATGCTAAAATTGGTTGA | GAGAGAGATATATAGATCGATCGATCGCTT |
| 222 | chr3 | CACTTTCAGTTTACCTCTTTTCAAGTTACC | TCTCAACTATCTCTACTCAGGGTTTACG |
| 223 | chr3 | AGTTGCTTAAAAAGATAACGGTCAAAGTTC | CTGAAAAGTTGACAGGCTAAACACATG |
| 224 | chr3 | AGAGAGCCAGCGTCTCTCATAA | GAAGTCGGCCTCGAATCTATCC |
| 225 | chr3 | TGCATTCGTGCGAGAAAAATCC | TGCATGCAGACGAGCAGATAAT |
| 226 | chr3 | AGTCTTCCGCGACTCAGATCATA | GGTTGCTGGTGAAGTGCTGATTA |
| 227 | chr3 | ATGAGCCAATCCTTTGATTACCC | GCGAAACTTCCTCCATACTCCATA |
| 228 | chr3 | GCTAATGAGAGGGCTGTGTTCT | CCCACAAGTAAATCGTTAATTTGATGTGAA |
| 229 | chr3 | TGAGTAGATCTAATGGGCGAGTGTT | GGATTGTTATATGGCATTCGAATGA |
| 230 | chr3 | ACTTAACTTAGTGGGTGTTGATCGA | TAACAACATGTGGAGTGTTTTCTGC |
| 231 | chr3 | TGGGATAGAGGAATCACCGAACT | TGTGCATACGCACATTGTTGTC |
| 232 | chr3 | GTGAATCTAAACACCAACTAGCAAA | TTATATAGCCACCTGTAGCATGACC |
| 233 | chr3 | ATCTTAATACAATCCGATGGCCACAA | CCTCATTTGATGGGACATTAGTCGAC |
| 234 | chr3 | GGAACTCTAAAAGGGATGACGGG | GGTGTGACTTCCTTGTAGGATCG |
| 235 | chr3 | CGGAAGAAAACGCCAGTAAAAATA | TTGTGCGAACTTTGCATCACTC |
| 236 | chr3 | GCATGCAATGTAGGATATAATGACCA | CGAGCTTTTAAATATCTCGTTGCAA |
| 237 | chr3 | GACAGTTGGGACCATGTATTAATAGTGTAC | TTGTTTTTAAAAGAACCGGCACATAT |
| 238 | chr3 | GGTGAGGTGAGATCGAGGAAGA | GGAGTTGAAGGCATTTTTAAAGTCCTAA |
| 239 | chr3 | GTAATGGTAAAAACATCTATAGCTGACCTTAGT | GGACTGGCTAGCATCTGACC |
| 240 | chr3 | CTTGTATCCCGTACGCATCGTA | ATCAACGGTTCTAGAAAGCCTATGATAAAA |
| 241 | chr3 | GTATTCTTGGAGAGCAGCACCATT | ACACTCGTCATATATTGCAGAATTCTACA |
| 242 | chr3 | CCATCCCTTGCTGGTATATGGTG | CGTAGTATCCTATTCGGGAGAGAACTG |
| 243 | chr3 | TGCTAGATTCGATGAAACTACTCTGGT | TGGTCAATATCGTTGCCACGTT |
| 244 | chr3 | CATTGACGCCATCCCATCAT | GAAGGGTCAATTTGTCAAAATTATGG |
| 245 | chr3 | GACTTCATCATCAGTGAGACCATCA | TCATCAACCCAAATTGTGCAAAT |
| 246 | chr3 | GGATTAGGTAACCCAAGACAGGGTAGT | TGTTCACATGGCAAACAGCATC |
| 247 | chr3 | GGAGCGTGACTCGAGCAA | GCGAGCTAATTAGCACAAATTTTACACTAC |
| 248 | chr3 | CGAAGGAGTGGTTCGAATCTGA | CACTAGAATTGTGTCTGACAACTAACAACC |
| 249 | chr3 | CGAAAAATATTTACCAATGAGTAGTGCAGT | CACTAGTACTGTGTTCTTCGCCTACGTT |
| 250 | chr3 | GCAAGCCTGCAACCTGTAAACAG | TTTCCAACTCTACATGCTCTTCCATA |
| 251 | chr3 | AAAGTCTTACGTTGTAAAACGGATGAA | TCAAATTTGACGGTAGAGCTAACACA |
| 252 | chr3 | AAATTTAACACCACCACCCACATAG | CACAACCACCCTTCCTTCTCC |
| 253 | chr3 | AGTAGTAATAAGTCATCGGAGCGAGTA | CTGGCAGGTAGGGCAAGGAAAAA |
| 254 | chr3 | GCTTCAATCCCTGGAGATGGAA | AGGTTCAGTGATTCACCATGCAT |
| 255 | chr3 | AGAAATAGTTGCTATTGGGCATTGG | CGCTAGTTGTTTAGTCGTCAGAATC |
| 256 | chr3 | TTTTGTAGGTCGTCCGTTAAAGATC | GTTTGTTCCCTGGAGATAGGCATAG |
| 257 | chr3 | AGAAAAGACATATTGCAACATCGCA | TTTCTCTCTTATCTCCCCATGTGTG |
| 258 | chr3 | AAAAACAAAACGCAGCAAGATTCC | TAAACCGGCAAAACAAGATTGAGAG |
| 259 | chr3 | GAAGAAGCATTCCTACATCAGCCAT | GTGGTTGTCGTGCAAGACAAAG |
| 260 | chr3 | CACAATTTTGGAACGGATGCAGT | AAAATTTTCGGAAATTCCGAGGAAATTTCT |
| 261 | chr3 | TACGTGATACGTCTATGCGTAGGA | TCGAGGAGATCTCTCTAGTACTCCTATC |
| 262 | chr3 | GGATCATGTGAACTCTGGGAGGTATC | CAAGTCAAGTTTCAGAATTGTGTATGTAGCT |
| 263 | chr3 | ACGCTCTGGTCAGATTCTGGTTAGT | CCACTATAGGTAGCACTTGTTGCTTCAG |
| 264 | chr3 | GGGTGCCCAAAAATTTGGTTAAGA | AAGTGGTATCTCATGATACCTTCTTAAGGA |
| 265 | chr3 | TGGGTTTAAGTTGTACAAAACCATACGA | AGTAGATCAAAGAAAAATTAGTTAATGGTGTGA |
| 266 | chr3 | AAACAGTTGCAACGTCACCAAAC | TGTTTTTGCCTTGCGTGCTAAG |
| 267 | chr3 | AAAATGTAACGGAGGGAGTAATAAAGGATC | CACTTCTCCCTTATCTACGTACTCCA |
| 268 | chr3 | AGCTATCCCATTTCTTTCAAAATGC | CAAAGCGGCAAAAATATACCGA |
| 269 | chr3 | GCCCATTTAGACCAAACAGAGAAAA | TAAGACAGTAATCGTACAGCTCTCG |
| 270 | chr3 | GGTAGCGACGGGCTTTAGATTT | ACTAGGAGATACACAAGGTTTGAGAAAGAT |
| 271 | chr3 | TGCCGAATCCTGAACCTAACC | GGACACTATGGTACATCTGTGTCAAAAA |
| 272 | chr3 | GACGCAAAACGGGATCAGAATC | CCGTAGTTAAGCTGAAACAGGCTA |
| 273 | chr3 | CTATTTTGGTGAGCAGCGACAA | CTACCATGTTTTGTTTGGGAATTTTT |
| 274 | chr3 | CGCTTCAAATTACTTATCGTTCTAGCAA | CCAGTGAATGCAATTTTGGTTCAAAATTTC |
| 275 | chr3 | CGTAGGGCTGAAATAATGAGAGTCT | TGAACCGCTCCTTATTAAGAGTGAA |
| 276 | chr3 | ACGGAGTAGTTTTACTCCTAATAGCACA | TTGTCATGTTACCCGGACTGATTTT |
| 277 | chr3 | ACGCTTAAAGGGAAATGATCAATGAGT | TTGGGTATCTAATCGCATACAAAGGAATT |
| 278 | chr3 | CCCAAATTTTAGAACTACGGCTTCA | ATCCTGCACTCGTGTGTGG |
| 279 | chr3 | TTGCCATGCTAGATCTAGGAATTGA | CATTGCTACCGTTGTTCCAAATAGT |
| 280 | chr3 | TGATGTGTATCATACCACGGTCAG | GGGTTTATATGTCGTCAGGACCTAG |
| 281 | chr3 | AAAATTGCACACAAACTAAACACGG | GGAGGTATAGTGTTGCTCATGAGTT |
| 282 | chr3 | CGGATCGGCAGTCGTGTCTAT | GGCCGTGATCTCCTCACACTCT |
| 283 | chr3 | TGAAAGATATATTTTGGAGACAGCGTCAT | GTGATTCAACATATAATGGCTGATAATCCC |
| 284 | chr3 | CTTAGAAATGCTCTACACACGTGGAT | CCACAAGCTTAAAGGCTTTGGTTTG |
| 285 | chr3 | CTATTTACTAAGAGAAGATGCCTCTACAATCTGT | AATGCTTTTCCCTTTACAATGAAGTACC |
| 286 | chr3 | AATTAATCAGCTCATTAACTGGTGTGTTAG | AGTGTATCATGCATCATTTGCTTCTTTG |
| 287 | chr3 | AAATTTTATGTCCTAAGTGCAGAAGAGTG | CCTTGTTGCAAAATTGTTCTCCA |
| 288 | chr3 | CTGATTGAAGCTTTGGTTCTTAACTATTCC | GGGAGTAAAAATGACCCAAATAACCC |
| 289 | chr3 | TTTTGGACCAAATTACCCATGTGTT | GGCCTCGCTACCAATACCTG |
| 290 | chr3 | CTGCTTTTCCTTCAAATGTACCCTT | CATACATGCATATGGGTCCTAAGGT |
| 291 | chr3 | TCATAGCTAGGTGTCCTATTTGATTGGT | CTTGATTTTGCAGAGGAATTTGAAAT |
| 292 | chr3 | CCTCGCCATCTTCTTCCTTGAA | CTCTTTGTAGTCTTCCCAGCTCAATTT |
| 293 | chr3 | GGGTCAACCAGAGTTGTTGGTCA | CTTTGGTACGTATTCGTTCCGTATTT |
| 294 | chr3 | TAACGTATGTTCACAACTAAATTTGTCCTTTTC | CCCTCGTTATTTGTATACCACTCAAATAGTTAT |
| 295 | chr3 | GCGGTTTTGGAAACCCTGACTA | GGTGCAATAATTGAGGCTTCAACT |
| 296 | chr3 | GAATGAAGACGTGTGGTGTCTAGGA | CACAAGTGCATTACCCATAGAAATTTATT |
| 297 | chr3 | TTGTCGCATAAGTCAACAAAGGAAA | TAATTTTTGTTGGACATGATTCGCA |
| 298 | chr3 | GGGTTCTCCATCGTCGGATTTG | CGAGTTGCGAGCTTCATTTGTTC |
| 299 | chr3 | TTTACATCTCTAGTCTCTTATGTTGGACACA | CCAACTTGTCATTATAGTCTTGAGTGCAT |
| 300 | chr3 | TTGTCACGTAACGCCAACTTTTG | GCTAGGCTTGATTTCAATCCAACAAATATG |
| 301 | chr3 | TTTTTTACGGAGGGTGTACTCTTTAAGA | CGGTATTATCACCAACTCATTACCTACC |
| 302 | chr3 | CACTGCACTGGAGTAAGCCAAAC | CCAGATAAATTTCTTCTCCCACAAAGAC |
| 303 | chr3 | TTGTATGACATAGCGCATTCCTCTA | AACCCCAGATCGGTCATATGAATAG |
| 304 | chr3 | CGTGGCCAAATTTCCAATTGTTTAA | TACCCCATATCATTGAGGGCTAAAG |
| 305 | chr3 | GACCTTAAACCTTAACTCCACTGTCTTCA | TCTGAAATATCGATGCTTTTCACCA |
| 306 | chr3 | TGATTTTCCGTACACAACTTTGACCA | GAACAAAATGGCTGGCCTTACT |
| 307 | chr3 | AGGACCGGCTCAACATGGA | CATGGAGTCCACATGTAAGGGAGA |
| 308 | chr3 | CACGTCAGCCAAAACCATTTCT | CTCTCTCGACGGATTTTTGCA |
| 309 | chr3 | ACAAACTTATACATCCACATCTGCT | TATCGAGCTGGACATTTCCTTTTTG |
| 310 | chr3 | CTGACTGCTCAAGCCCAAAATC | AGTCCCAACAAGTCTCGATCTATATTC |
| 311 | chr4 | CCTGAGCTTGCATACTCCCAAT | GCTCTGTCACTGTGTGTGACGAT |
| 312 | chr4 | CGAAACACGAGGCGTGAGAGTAT | GTGTTCGATGGCCTCATTGAA |
| 313 | chr4 | CACACACCCGGTCTCCAATT | CACGTCCACGTACGTTGTTGAG |
| 314 | chr4 | CCCTCTGTTGCCAAAAAGATCAG | TCACCTTTCTGTAGAGATGCCCAT |
| 315 | chr4 | GGATATCCCAACCATAGTATTTGTAGAGC | CTACACTAGTAGTCGATTGCGTGTT |
| 316 | chr4 | ACCCAACTCTTCAAGCAGAGAATAA | CATTTCAGGCTTCAGAGATGCTATG |
| 317 | chr4 | GGTTTTTGGATAGTGGTTGGGAGTT | CCTGTCGTCCCTGTCTCTTGTA |
| 318 | chr4 | GCACCTGATATGTAAAGTTATTTTCTTGAGAC | GCATTGTCTAGAGACATTAGATTGTACCACA |
| 319 | chr4 | GATGGAGTCAGAGATATCGACGTAC | TTATCTCCCTGTCATGTCATGATCT |
| 320 | chr4 | GAGTATTGTCTTGTGTTCGCCAGTT | ACAAGCATGCAACTTCAGTAATAGC |
| 321 | chr4 | GTGGTTAAGGTCTCTGGCGAAA | CCACTTCGGCAGCAGATAACATT |
| 322 | chr4 | TTTCGCTTTTACTTAGGCCTTGTTT | AGCCTAAGGTTTCGAACATTCTAGA |
| 323 | chr4 | AATTTCAAGTCTTGGAATGTTTTGTGCT | GGGTTAACTTCTTTTGGAGTCCCTAAG |
| 324 | chr4 | ACATAAGCAAAGCTTGGCATCACT | CATCTATAGTCATTGTTGCTTGCCTGTT |
| 325 | chr4 | AGAAGGTGCTTCAAGTGCATGAC | CCAAGATTACCAGTCAAATATCATCCTG |
| 326 | chr4 | CTAAACAAGGGCTTTATTAGTTGAAATTAAAA | TGTCTACGTTTATCAACTCTGAGCTTCAT |
| 327 | chr4 | TCCCTAAACAGAGGTCGGGAAT | GAGGAATAGCCAAATAGGTGGAATACC |
| 328 | chr4 | TGTAGCAACTTCTATTGTGTTTTTCAGG | CGAAGTGTTTTTGAGAGGCTAAGTTT |
| 329 | chr4 | GGAAATACATATCCGTGTTTGAGTCAGA | TGAGAGAGAGAGAGATAACAATTGGTGTAA |
| 330 | chr4 | TGAAATTCCAACCATATTCCAACCT | GCCAATATAAAGGTTCTGTTCAGGA |
| 331 | chr4 | CCTTTAATCACAAAGGAAATATCCGCGTA | ACACCATGTGGAAACTCCACAAA |
| 332 | chr4 | CCAACTGAAGGTTTGTTGTTAACTCC | TGAAAAGATAGTTCATCACATTGTTCAGGT |
| 333 | chr4 | GAAGCGGTACAGGTTGGTTTTC | AGAAAATTATGGCTACACTCCCTGT |
| 334 | chr4 | TTCGTTTTCTATGCACACAACTTGTG | GTTCTTTGGAGTGGAAACCGTTTG |
| 335 | chr4 | AGGTATTCCTTTTTGCATCTGTAATTCTGT | GCAAAGTGTGCAGGAGATGGTAA |
| 336 | chr4 | CGGTATTGTATCATCTTTCCCATTGGA | CTCATCTCCTGTTCTTGCCCAT |
| 337 | chr4 | GCAGTACATGCCGAGCTTACCAT | TCTGATTCCTGGCGATAGGAATAC |
| 338 | chr4 | CCCACTATTGTTGGAGCCAACA | CACAGACCCTTTGTTATAGAGACAACATAT |
| 339 | chr4 | CCTTACTTGGAGGCCAAGATGA | TTGCTGACTTTATCAACGAGGGATAC |
| 340 | chr4 | CAGTCAATCTAGTTAACTGAGGTTGGT | CTCTCTCTCGATCACTTGTGGAAAAG |
| 341 | chr4 | TCACTGTATCGTCATACAAATCATAGTCCT | GTGGCTTTTAGCTTTAGCATTTTAAGTACA |
| 342 | chr4 | CAAGACCAGCGTGTTCCTTTTT | TGTCCTTACAATCATATCACTTTTGGGT |
| 343 | chr4 | CGTACAGGTACCACCACCAC | ACGGTTTAGGTTCAATCCATATCCT |
| 344 | chr4 | GTGGCCCACCTAACCTGTTTTTA | TGGAGAGAGAAAGGAGTCACAAATAAGTTAA |
| 345 | chr4 | TGTTGCCAACTTGCCATTGTTC | GCCAAACATTTGATATGACTATGATGTCAA |
| 346 | chr4 | CGCCAGCCGCTGCTATATTT | GCCGCTCAGTTTGACTTTACAGA |
| 347 | chr4 | CCCTTGTGTAAAATGGTTTCAGTCA | TTGAAAATGCAATTAGGTTTTTGGGACA |
| 348 | chr4 | GGAATCCATTCATCAATCATGCAG | CTCCACAATGATAGTCTGATCTCTGATG |
| 349 | chr4 | GGCCTTAGAGGAAGAGATATCGCT | GATGGTCCCATCCCATCCATA |
| 350 | chr4 | TGAAAACCAAGGGCTAGGGCTAA | GATCTGGATGAATTTTTGAACAAGGTT |
| 351 | chr4 | CAATTCTGTTCAGACCATCAGCCTA | GTTACTAAATGGGATGTTGTACCTACTGTT |
| 352 | chr4 | CGAAACCGATGCAGTCTCATCAA | CACCAAACCAATCTGTTTAGGTGTT |
| 353 | chr4 | GAGAAGATCTACATGGACGCCC | TTCTATTTCCTTCGACTCTTCACCG |
| 354 | chr4 | CACGCTCGCATCATTTTAAAAAG | CAAGGTAGCTTTTCTCTCAGTCCGTT |
| 355 | chr4 | GGGAGAGAGAGAGGTGAAGAGATT | GCAGAATCGGACGGTAGTACAGTAT |
| 356 | chr4 | GCGAAACGGTATATTTAGAGCAGGT | TACAAATTATTTTCCGTTTGTAAGAGCAAGTTT |
| 357 | chr4 | GGAATTTATAAAATCTCCCTGAAGCATG | AACTTTCATAGAGAAGGCTGGTTTATGTT |
| 358 | chr4 | CAAAGGAGTAGAGCTTCATGTTGG | TTACCCGTCAAGATGCCGAC |
| 359 | chr4 | CATCGTTGTCAAAACCAAGACGA | GATCTTCTCGGGATTTGCCTCTATC |
| 360 | chr4 | GATCTTCTCGATCTCCAACTCGC | ACCGAAATAATATCGTATTGGAGGGT |
| 361 | chr4 | AGTACTAGAACTTTTATGCCTTGCAACT | GATGCTTCATTTCGTACGAGAAAAAGG |
| 362 | chr4 | CATGCGTCACCATCACCGTT | AATATATATAGTGTTTTTCAATATTGGCACCTAGTATAT |
| 363 | chr4 | TATGGAAGTTGAAGTCCTGTAACGAAAATT | GAATATTTCAGGCTCTGGCATATCCAA |
| 364 | chr4 | GCGCTGTCCAAGAGCTTCTC | TTTATGAAGCAATCGATTGCCA |
| 365 | chr4 | GCAGATGCATGCATCTTTACTCC | CCAAATTTTGGCCTATATGGAAATG |
| 366 | chr4 | CATGTAACGGTCCGATTTTCGTTC | CGGCAGTTGGATCGGGAAC |
| 367 | chr4 | CATATGAACTATTATAGCCATCGTTTCGC | GGTATGTGTGTATGCATGCATGC |
| 368 | chr4 | TGGCAGAGGAAGACTGGCAA | GCATGCACCAGCCAATCAG |
| 369 | chr4 | TTATTTAACATTCGAGTTGGGCCAC | TAACACAATCTTTCTTTACGGCCAC |
| 370 | chr4 | TGCATTTCTTTTTCGTATTGCGCTT | CCTCCTTTGTAAAGAATCTCATTGGTTTG |
| 371 | chr4 | TCCCATAACACATCAGTTAAGGAGG | TTAGGTGTAGGGTCTGGGATGATTA |
| 372 | chr4 | GTAGATGTTGGTGCTCATATAACGC | AATTGGAAGGGTTGGGGTAATACAA |
| 373 | chr4 | GGCAACCAAATTGTAGCTAACATTCT | ACACCAAGTCTTGCTGAATTGTATTAACTA |
| 374 | chr4 | GAGAGACCTTCCTCCAAACATATCT | ACATCGCTAATGTTATAGAAGAACGA |
| 375 | chr4 | GCCCATGTTTGGAGATCAATCTC | TTTGCCCTGTACTCAAAACATAAAAGTTG |
| 376 | chr4 | AAATTGAGGGGGATTTAGAGGTACC | GTAGCAGCAGGGAACATACAGAT |
| 377 | chr4 | GTTTTTAGCCAGAAAGAATTGAATGTGC | TCTTCAAGTAACACAAGGAGAAAACGT |
| 378 | chr4 | GAAGAAGCTTTGCTAGGCCAAA | AGTTAGACTGCTTGGTTTTTGCAAC |
| 379 | chr4 | GCTCGCTGTAAGTGAAAATCTTTGG | TTCAGCAGCGGCTCAAGCAAAT |
| 380 | chr4 | TGGCGCATCACCAGATGATAT | CAAAATGCTTATCCAGTGTCAATTTCTG |
| 381 | chr4 | CCGGATACACACGAGACGACTACT | GCCAAGATAACTGTGCACGACAT |
| 382 | chr4 | TATTCAAGAATGGCACCACTGAGAT | ATTTGTTATTTCTTGCCCTCTCTGC |
| 383 | chr4 | TTTCTTAGCGTTGGTGCAAAGATAAAC | GACAAGAGGAGGCTAAAATGATATTGAACT |
| 384 | chr4 | GCCAGTAACTTTTGTGACATCCATGTA | AATGTTAAGGCGTGACACCTGAA |
| 385 | chr4 | GTTGATGGATTATGTGACTCCGTTC | GCATGCTAATAATTCACCTCGTGAT |
| 386 | chr4 | TATTCTGAATGGCTGCAGACTATGG | TCTTTAGTCTCGATTTGTAACCCGG |
| 387 | chr4 | CTGCCTCCTTTCCCCTTTCC | CTACTCTTCCAAAATGCCGTTCTAC |
| 388 | chr4 | GATATTCCCGTGGGTTGCTTTG | ATAAACCAAGATAAGGACAACACAACAGCT |
| 389 | chr4 | CACCTCTACCATGAATCATCCTCTGT | GATATGTCACCACAAGTAACAAGTAATGAGC |
| 390 | chr4 | GCCAGTGCCATCAAGTTTTTAATCA | CGATTCACCCAAAGAAGTACCAAAA |
| 391 | chr4 | CGGCGAATGAGGATGGTGAT | GCAACCGCAACGTACAACCTCT |
| 392 | chr4 | CCGGTTACCCGATGATGAACAT | GGAGAAGCACTGGCTCTTGATG |
| 393 | chr4 | AATGGTACTACTCATATGAGGCTAGGTT | GCTTCATGATTTGACAATATAATGCTACAT |
| 394 | chr4 | ATGCGAGATCTTGTTATAAAGATTTATTCT | AAAAATCGGACTTCTGATCCAACAC |
| 395 | chr4 | CCTTTCGATGGGTTCTTGTTTTCG | CTGACTTAGTCAGAATATCAAACGTAACCA |
| 396 | chr4 | CCCTGCAGAAGTGATATTTACCTGT | CTATTCCAATGGCCGATTTCAACTAAAA |
| 397 | chr4 | CCCTTTCTCGTTGCTTCCAGTT | GCTCTAACATCAACCCTGTCAACTG |
| 398 | chr5 | CCTCTGGCCTCCTACATCATACA | CGGACAAATGGTGTTGTACAAATACAATT |
| 399 | chr5 | GCCCAGAAAGAGAAACGTGTGT | CCACATCCTACATTGACTGTTAAACCA |
| 400 | chr5 | CTACGCATAGGTAATTGATCTGGGA | GGGCCACAAGTAGGAGTATATGATT |
| 401 | chr5 | TGAGCATCTGATTTTCGCAGAA | CGCATATGGTCAAATAGCATTGC |
| 402 | chr5 | AGCCTTTCCTAACCAAATCACAATG | GATAGCGGCGTCATTAATCTCAAAA |
| 403 | chr5 | TCCAAGTTTAGCAAACCTTCTGACA | CATTCAGTACGACCATGCTAATTATGATT |
| 404 | chr5 | TTTGATGGCAGTCCTCAACCATATA | GAATAGTGGGAGAAAGCGAGAGAG |
| 405 | chr5 | CAAACTCGAGGAATTCAAGACTTGG | CTAATTGTGAAAGAGCAGGACATGG |
| 406 | chr5 | TGACCACGATATATGGCTAGCCA | TACGTGTCGCCGTCTGAC |
| 407 | chr5 | GCGACTTGACCACTCAACATCT | TCAATAGAATAACAAGAACAGTGCTGAACT |
| 408 | chr5 | AATTGACAGCTGGGCCTTATTACA | CATTTGTGTTGATTTGACATTGTATAGCT |
| 409 | chr5 | TATGTGCTACCAGAGTATATCACAGCA | GAAACATGCCCAAAGAGCACATC |
| 410 | chr5 | GCATCTGCATCTGCAAATGGTG | GCACTGTGCGAAAATCATTGGAG |
| 411 | chr5 | GGGTCTTCTTTACCTTCCCAGTT | GTAATGTTCCGGTCATTCTCTTGTC |
| 412 | chr5 | CAGATGATATATTCCCTTTGACAATGG | TGAATGATCCAATGGCTCTAATTAGCT |
| 413 | chr5 | AGAAAACTTCGGTAATAGCCACCTTT | CCAATGCTCACTGAGACTGACTATTTG |
| 414 | chr5 | TTCAGAAACATTCCCTGACGCTAT | TGCTGATGATAAAGGAGAAGATTTCAA |
| 415 | chr5 | CGCTCTGTTTCCGGAACAATT | GGCAAATATGCCGAATTATTGG |
| 416 | chr5 | ACATTAACATCACGCGGATAACCA | GGCATGATGGGAAATTGGGAAGA |
| 417 | chr5 | CTGCTCAACAAAGAACTGCTCAA | CCTAGGCCTCAGAGCCTCTTAG |
| 418 | chr5 | CATTTGCAATGATGCAAACTAAAACA | CTCGACAATATCAAAGGTACCGAGAT |
| 419 | chr5 | ATCTGAAATATTTTGGACGATCGGC | TATACTCATACAGACGCACACTCAC |
| 420 | chr5 | GCTAAAATGAATGAGTTATGCTTGTTTAAAGAT | AGTAAATGTCTCAATGACATGCGG |
| 421 | chr5 | GCAGCACGATCAGCATACTCAG | TTCACAGGTCCTCACCAAATCC |
| 422 | chr5 | GAAACCTGTGGAACAAAGCAACA | GCTGGTTGAACCTGTGAGAATCC |
| 423 | chr5 | TCTAGCAAATGCTTCTCAAAATTTTAAGGC | CGTATGGTGGAACAGGGTACTCTA |
| 424 | chr5 | CCATGTCCTCCAACCAAACAA | AACTATGTGCAAATGTTGTAAATGCAA |
| 425 | chr5 | AGCTAGAGCTGTGCCAAACAGACT | GTCTCGGTTGGTGTTGGTTAGACT |
| 426 | chr5 | AGCGAAATGTACACCCAAACCA | GGGCACAGGTATATAACCCTCTTGA |
| 427 | chr5 | CCTTTGGGTCACTCGGTTGTAC | GTACGGTTTCTAGCATCATTACTGGTT |
| 428 | chr5 | AGTCGACGGAGAGGTGCGA | AAATTATTCCGCCAAAAATCCG |
| 429 | chr5 | CCACTTATCTTATTTTGCAACACATCAAGT | CATGCCATAGAATAACAAACTACATGGGTA |
| 430 | chr5 | GGATTGCAAACCAGCCCAAA | AGGCACTTAAGATTTGTCCCAAAATA |
| 431 | chr5 | TCTAGGTCACCGTCAATTGCAAG | CAGGAGGGAAAGGCTCTACATG |
| 432 | chr5 | CATTTTGGATGGTTTTGTTGGATTCCT | AGAATTCCAATACTCACAATCACAAGCA |
| 433 | chr5 | CACCGCCCAGATCTTGTCTC | CTTTAGATCCAGACAAGGTGGGAC |
| 434 | chr5 | ATATGGGTTCCTTGTAATAGTGGGG | TTGAACGCATGTTTCAATTTTCAGG |
| 435 | chr5 | TGAAAACCCGCTTAATTTTGTCA | GGGCTCTAACTGGTGTGAATTACTACTAGTAC |
| 436 | chr5 | TGAACACGGAAATACAAAACTGCAC | AACAAAAGCACCTAGCTTTATCCTATCC |
| 437 | chr5 | GCGTGCATGTTTGTTCGTACTA | GCCGTTAAGCCGTCACATGTAT |
| 438 | chr5 | TGTGGCACATATGCACACCATA | GGTTCAAAAATAAACCCTACCCTATTGGA |
| 439 | chr5 | TGGTTGTTGTTGTAGCAAAGAGGA | TCCTAGATAAGCAGCGAAGGAAATT |
| 440 | chr5 | TTTTTGACGGAGGGAGTAGTAATCAA | GACGGAGGGAGTACTAGTAATTGC |
| 441 | chr5 | TATGTATCAAGGTGATCCAACCAAAAAGT | CCTAGCTGGGATCGAAGCAATG |
| 442 | chr5 | TCCACCCAAGAGATTAGAATCCATC | TCCAAAAATTATATACTCCCGCCCA |
| 443 | chr5 | CTTAAGAGAAGCCATCCCCATCAC | TTCACGCAACCCAAATACCAAATTA |
| 444 | chr5 | TGCAACCTCATTTCTACTTCTTTCATG | CGAAGAGTGATGTCTATAGTTTTGGAGTTA |
| 445 | chr5 | GGTGGTGTAGTGGGCTAGATCT | CTTGTGTAGCTATGATTCTTCACATCACT |
| 446 | chr5 | GGGTTTGAATTGTTATATTGTGCGC | AATATATGGGCCTGACTCGTTACAA |
| 447 | chr5 | CCATTCCTTTCATTATTTAGCAACCA | CAGTGTGGCTTATTACTTATTAGCTACCAA |
| 448 | chr5 | CTCTGCGATAGATTGTGGACGT | GGTAGCTGGAGCAAGAGAAGG |
| 449 | chr5 | GGTTGAGGACATTGCACAAATCTTA | TATTGCCCAAGTCACATTCAAACTC |
| 450 | chr5 | ACACATTGGACTAGGGACAAAGTAA | AATTGAGCCTTCGGTAAAACTTGAG |
| 451 | chr5 | AATTAAGTCTGTCTCTGTGGCGA | CGATTCTATTGAGCCTAATTAACCCATGATTAT |
| 452 | chr5 | GGGCTGTCTGCAATCTAAAGAGG | GGGCCTATTAGTTTATTAGAGAGCCACAT |
| 453 | chr5 | GGCCGAATGAACTATAGATGCCT | ACCAAGATTTATAAGACCGTGTGGTTATC |
| 454 | chr5 | ATGAGAGAACTACATACGCAGGATGA | TTGTGACTGACGAGGATGATATGG |
| 455 | chr5 | CTAATAGACATCGAAAAACGTGCCA | GCCTTTGAGCTAAGGTTGAAGTAAA |
| 456 | chr5 | GGATCAATGGCAATGGTAAATCGAT | TGCGCATTCACCACTATAAATTCAA |
| 457 | chr5 | TGCTATATGCTTAACACCAACAACC | GAAGAAACGTGCATTATTACATCGC |
| 458 | chr5 | ATTGAATTGCCCATACATGTGGATC | TTTTAGTGAGATTAGGGATGTGCCA |
| 459 | chr5 | ACTAACCTCACGCTGCATATGC | GTAGAGCAAACAATGGAAGCACATAG |
| 460 | chr5 | AATGAGCTACAATGACCTACTCATCGT | TGTGAGTGTCTGCGTTGTATTGTGTAG |
| 461 | chr5 | GGTTGCCGATTATTTTTCCTAGTTT | AGGAAATATGTCGCTTTTCAAGTGA |
| 462 | chr5 | GTAGAAACTACAGTGCCTTTGGTTG | AGAGGAGAAACCCATCAAGTAGAAC |
| 463 | chr5 | GACGGCGAGAGAGAGATACAATG | GAGCCCAACCTTGAAATCTTAACAA |
| 464 | chr5 | GCTTTCTCCTGATTTATCTGCCAAA | TTAATTCCCTTTTCTCTCCGTTTGC |
| 465 | chr5 | ATTCATAATGTCGGCATGAACAAATACG | TTACGTGTTTAGCCAAGCCAATAAGTA |
| 466 | chr5 | AATCTTTCTTGTCACTATTTGCATAGG | CACAACCTTCGCTCATATTTCCTTT |
| 467 | chr5 | ACAAAAGCAGCAATGAAGACATGTA | CCACCAATTAGTACACCACAAAACT |
| 468 | chr5 | AACAGAGGATTACCATTTTACCAGCA | TCCATGTGCTTCTGAAACTTGATTTTG |
| 469 | chr5 | TAGAGAATGGCGTCAACTTTTGGAT | TGATTAACACAATGCAACCTCAACA |
| 470 | chr5 | CCTATAGGAGGAAAGTATAGGTGCTGA | ATACCTATCGAAAGATTAGGACCTAACGT |
| 471 | chr5 | GGGTAATCACAGAAATGGACTGATATTTTT | AAAAACACAAGTCACCAAAATATGCTGTAT |
| 472 | chr5 | GACGGAGGGTGTAGTTTTCGATC | GCTAGGTAGCCAGATCAGTTTCGTTC |
| 473 | chr5 | AATCTTTCAGCAGGTTCAGTGTATGTC | CTGAATGAGACCTCTCGGCATT |
| 474 | chr5 | CAAAACGGTGGTGGTAAATACGG | GTGGTATTTGGATCTTCGAAACATGT |
| 475 | chr5 | GAAATGGACGTACGGGAATATGC | TTGACGTTTTGTAGGCTAAAGGAAC |
| 476 | chr5 | TCATTAGTATCTGATAAGTGGGAAACA | ATGTCTGATGTGTAGGAATTCCTCA |
| 477 | chr5 | CCCCTCTATTTTTGTAGGTGAACTAAGAGT | GGTGATGGATCCACACCCTTAC |
| 478 | chr5 | CACATCCTCCTGCAAAATGACTC | CCATCCACTTTTGCAACCATTTCC |
| 479 | chr5 | CCCGTATCGATCGACGTCATAG | CTTGCATTGTCTGCTCTTTGTCTAGT |
| 480 | chr5 | AGATTCATTGATTGATTGATAAGAGTACATGGG | GTGCTCGAAGACTATCTGTCCG |
| 481 | chr5 | AAAGTGTACTAGGGGTAAGGTGAAC | TCACTTGATATGCATGCATTTCACA |
| 482 | chr5 | TCCTGTATGTAATGCTAGTATTTGTTAGCG | CTCACAATGAATTTTGCCTTAACTAAACCT |
| 483 | chr5 | TTCAAGAAGGTCATGGCATCATAGA | GAGTTTTGAGTTGGCAGAAGTTGTA |
| 484 | chr5 | GGGACTTCAATATATTTCTTGTGCATTGT | CCCATAGCTACTAGACTTAATTTCCACC |
| 485 | chr5 | CACTAGATACACCTAGCTACATGTATGGT | CATGGCCAGTCCATGATTTTTGG |
| 486 | chr6 | CCACGAGGTATACCGATGTTTCA | CAAACCCAACATATTAATTTATCCTGCACA |
| 487 | chr6 | GCATAGACATGCCGATTGGGTT | CATGATGATGGAAGGACATACATCTGTTT |
| 488 | chr6 | GTTGTTCACAACTGACCCACTTACA | CCTTGTCATCGGTGACAATGTAGC |
| 489 | chr6 | CATCCTACAAATCCTAGATCTGTCAC | GTTTATAATTCGCTGCAGATCCGG |
| 490 | chr6 | ACTGGACTTGTCTGGTAGTGATACA | TGATGAATGCATCCTCAGATAACATCG |
| 491 | chr6 | CCTGTGGAGTTATCGAGAAAGCT | ATCTCCAATGAAATGTATTTACATTGTCTCCT |
| 492 | chr6 | GTGATCATGATTCATCCCGGATGTA | ACAGCAGAAGAGCTTGTGGATAG |
| 493 | chr6 | CATACAGATTACACTTGGATCTCAGGA | GCACTGATCCAACCATATATCCAAGG |
| 494 | chr6 | ATGTCAAATTTCAGAAACAATGACCTCTTG | CTTCTTGGTCATTTCTGGTGGTAGTTTATA |
| 495 | chr6 | GATTTGGAGCAAACGAAAAGAGGA | CCATTTAGCAGCGTCTTAAACCTTC |
| 496 | chr6 | GAAGTGCTAAGTATATACTTCTTCCGTCA | TTTAGATATTAAGCCCTGTTGTGCCTT |
| 497 | chr6 | TGGCTACTTTAGTTTCCTATCTGTCGA | CTAGCGGTTTGCACATAATGACC |
| 498 | chr6 | ACTTCTATCATCAACCAGAGGTACATAGAA | CACTGCAGAGTAACAGCACACT |
| 499 | chr6 | GCTGTTGTTTCTCTTGCCTTCA | GTTTGGACTGAAAAACAACAACCGT |
| 500 | chr6 | TTCTGAGAAGGGTATAACTCAGAAAGTACAC | TCGATCTCTGGGATCGCAA |
| 501 | chr6 | AAATTCTAGATACGCCACTAGGAGATCA | ACCTGCCATGGAAGCTCGT |
| 502 | chr6 | ATAAGTCCCCAACGCTAATTACACT | AATAAACCCTTTTCACGATACCAGC |
| 503 | chr6 | ACTACTACTCAACAACCAATGAACCAAA | GAGAGTAGTACTACGGCAGTGTTTAGTTCC |
| 504 | chr6 | TCCTCTCCAAAGATTCCGACAAC | GCTCCCTTCCTTCTCTGCAAAC |
| 505 | chr6 | TGGAAGCTTGGAGATTTTAGTACGC | CGAGGAGTACACATCTTATTGGAGAAG |
| 506 | chr6 | TTGCCTCTTTCTCGTTAGTAAATGGT | TTATTTTAGAAGCCATAGCCACCAATA |
| 507 | chr6 | TATTATGCAGACACGGAAGGACACCAT | AATTCCCAGTTTTGAGCTCTGCTAT |
| 508 | chr6 | GCAGGAGGGAAGAAGTTAGTGC | AGTGATGGATTGATAGCTTTCTATATGCTG |
| 509 | chr6 | CCAACAGCAAAAGGTAAACCACATC | CAGTTCAGATTAATTATGGGTCTGGGTTT |
| 510 | chr6 | AATTAACATCAGTGGTGTATGTTTGCTC | GCAACGAATACTGATATGATATGGCTAC |
| 511 | chr6 | CGCTGAATCTTCTTCCAGGCTT | TGAAATACAGGGTAGGGCAGATTATT |
| 512 | chr6 | CTCCTCCCTCTACCGCCATA | TATACCTCAGTAACCGCACGACTAT |
| 513 | chr6 | CCCATCTTGCACATCCTCTTGA | GGCTAGAGGGATCTGCTCTGAA |
| 514 | chr6 | TTGGGATTCACACGAGTGGAT | TTTTAAACCACGGTATACCTTATGTGC |
| 515 | chr6 | AGAATTTCACAGTGCAAACCAAGAA | AGGATTCATGGCATAGAAACTTGTG |
| 516 | chr6 | TGTCCACCAGCTACGTAGCTAAGTATC | TGAAGCACGTCATGGAGAAAAATATAT |
| 517 | chr6 | GAGGTCATCGAAGCTGTACGTC | TTATCTTGATGTGATTTCGGTCGTG |
| 518 | chr6 | AGTTGTCTGCACATTTCTTCCCA | TGATTGTAACAACCAGATTAGATGGAGTA |
| 519 | chr6 | CCTCCGTCTCCGAGTGATATCA | CGAATTGGTGGAGAGAGGTGAGA |
| 520 | chr6 | GTCATCGAAGGCAAGACTGGTT | GGTTCATGCAGTTCCTGACCAT |
| 521 | chr6 | CTGGCTCTCACCATCTTCTCAG | GCTTCAGCGGGTATCCGAATAAC |
| 522 | chr6 | GCGTCAGAACTTCAACACCAAG | CCTTAGCCTTGCTCAGCTATTTAATTG |
| 523 | chr6 | GGCTGCACCGATTAGTCACTTT | AACATGAATTCTAGTTTGCAAAATGCCA |
| 524 | chr6 | CTGCTCCTCATCTTTCACCCAT | GCAATCTGCAGGACATCAAGGT |
| 525 | chr6 | GAAACATCACGAGTATAATTGCTGAAACA | TTTGCAATAAATAACGGAAAATGTTAGCGA |
| 526 | chr6 | TCGTCAGCGCTAGAGGGTTTT | TGTGAGGGACCTTCCCTAATGC |
| 527 | chr6 | TGCCACCTCTCCCTCTTGTATACA | TGGGCAACTGTACTCAATTTATTTCAC |
| 528 | chr6 | CAAATCTAAGTCATACCAAATAGCAAGCA | AAAAAGCTCTTTCCAGGCGATT |
| 529 | chr6 | TCGGCTTACATCTGGTCAGCTAGT | TCAACAAGGAGAACACATAACAAGAAA |
| 530 | chr6 | AGCAGTGATTTGGTTTGTCTTACTG | GCAATAACCGTCTAATCGCACTAAA |
| 531 | chr6 | CGATCGACTTCAGGCCTTGTTT | ATGCTGGCTACAGATTTATAGCTCG |
| 532 | chr6 | GAGGATACAATTCAGGAAGCACAAG | TTGGTCTTGGTGTCAAAAGTAAAAGA |
| 533 | chr6 | TGGTATCCACTTGATTCAAAGTTTTGA | AGCGAAGATTAATTGTTACCTTAGTGG |
| 534 | chr6 | TGTGCATGACCTTTGCTCAGAA | AGTAACTGGATTGATCGATGCAGATTT |
| 535 | chr6 | CTGAGGTTTGCAGAGTAGATGCT | CTTGTAGTGCTTGGGAAAGATGC |
| 536 | chr6 | GGCAGCTCTGATAACAACGGT | TAACCTTGGCCGTGAACCAAA |
| 537 | chr6 | GGGCTACTTCCTCTCTAAATGCG | AAAGTGATTGAGACGAGGGAGTTTT |
| 538 | chr6 | GACAGAGAGAGTACATTATTTGTGTTATTTGC | ATCTATTTTTAGTCCCGAGTATTTGAACAGG |
| 539 | chr6 | GATGGAGGTAGTAGCAAATGCAAAG | CCCGTTAGACCTAATGGAAGTAATCG |
| 540 | chr6 | CCAGCAAGAATGCTAGAGTGCT | TCCCTTTCCAACATCTCTCCATTG |
| 541 | chr6 | ATCAATGCAGCTCCTAATAAGACCT | AGATCCTAACACAATGAGGGGAAAA |
| 542 | chr6 | CATCTTTGCTATCGAACCAAACATTTG | CACTGGTTGCTAATGTTTACAATGCTA |
| 543 | chr6 | CATCCGAACGTAAAGGAGGGAT | AGTTTAAAATTGCAAATGACACGGCTTA |
| 544 | chr6 | CCATCCATTTCACACTCCTCACT | GCTTCCCTTCAAAATTGATTGAAATCCATT |
| 545 | chr6 | CGGCAAAACAAATGCAACTG | GAAAACCTATGCTATGTGAGCTCAGATT |
| 546 | chr6 | CGTAACTTGTAGCAAATTGCTCCA | TGCATTTTCCACGCTGGATTT |
| 547 | chr6 | ACATGTCTTAAGCATATCGATTCCA | GCTTCAGTTAGACGAAACAATCCAA |
| 548 | chr6 | CTCAATGGGAGGAGCGTAGAAA | TGATGTTATATTTAGACGAGCTTCTCGAA |
| 549 | chr6 | CGTCTTTCGGCCTTTCTCACTT | GGGAGGGCAAAAATTACATTTAGC |
| 550 | chr6 | GCAGAAGTACCCAACATGCTTG | GGAGGTAACTTGGAAGTTGTCTATCATTTT |
| 551 | chr6 | CAAAAGCTTCTCTCCTCTCTCTTTTCTCT | CGTTACTGTGAGTGAGTCAACCGTTT |
| 552 | chr6 | GTTGCCACTACTGGAGAAGTGATTT | CACCAATCCGGACTAAAGATCCTTC |
| 553 | chr6 | TACCCCTCATTAATACTCCAAGCAG | AACAGAACACACCTACAGATTCAGA |
| 554 | chr6 | GCAGTATATGGATGAGAGACGAATGAAC | GTTTGACTTGGCATAAAACAAAAATGGC |
| 555 | chr6 | CCGATGAAGCGGAAGAACTG | AAACCGACATTTCAGACAAATGGTA |
| 556 | chr6 | CGACGTGCAATTAGGAAGCTTCAT | TCTATGCATAGGAGTGACTGAATCAGAG |
| 557 | chr6 | TCTGCATTATTGGTTTTTGGACTTT | CCGCACAATAATCCAACCAGAATG |
| 558 | chr6 | CATTAAGATAATAAACCAAGCTTGGCACAT | GGCATCACTCATATTCCATGAAAAATATCA |
| 559 | chr6 | AGGGCAGAACATTTCCATTTCAAAT | TTCAATTCATCCTCCTTTTGAACCA |
| 560 | chr6 | TGTGTAACTTTTATAGTGTGCCTGCAAT | CCGACAGTTGGGTAAAATAGACTTATTTT |
| 561 | chr6 | GTTGCACTGATGATCCCAGCTA | GGATTTCCCAGTTTCCAACTGAA |
| 562 | chr6 | ACGCCAAAACTTTACACTAGGCA | ACGGGCAGGAAGATTTGGAATT |
| 563 | chr6 | CCTCGGCTCATCCTCTATCTGT | AACAATCGCACACCTCACTATGTTA |
| 564 | chr6 | GGTGCAGAGGCACCATTTAATC | CTTCTTTCTTTCTTTCTTGCTTGCTCA |
| 565 | chr6 | TGAGAAAGAGGAAAGGGAGAGGATA | ACAATTGCTTCTTTGACCATGTTCT |
| 566 | chr6 | ATTCGGATTTGTTTTTCGGAAACAGTT | TGACGGTGCAATACAGAGGAAAAA |
| 567 | chr6 | GCATTCTAGCACAATAACTTGGCA | TTCTACATCCAGTTTAGTTGACCTTCAG |
| 568 | chr6 | TCAAGTTAAATGAGAAGCGGGAAA | TGTGAGCATTGAGAATAGTTGAAGTTTG |
| 569 | chr6 | GGATGCTCCAGAGCTGAAGGTAC | CAACATCCCGGTTTCCTTGAAC |
| 570 | chr6 | ATCTGCCACATGACCATCACTT | TCCCTCTGTCCTAAAATATAGAAGCCTAG |
| 571 | chr6 | TGTCAAGTTACGTAACACATCAACTG | TAAGGGTGGATTCTTTATGGCATCT |
| 572 | chr6 | GGGACTCGTTTATGGATCTCATGT | GTGAGTAGGTTGGCCTGTTGATT |
| 573 | chr6 | CGTGTCAATGGAAAACAAGGCA | GCTAGCCTGTGAAAAATAATTATTTTCGCA |
| 574 | chr6 | AAGAGCCAAGATCACCACATAACC | TCAAAATTCCCAAACTCATTTTCAG |
| 575 | chr6 | AGGACTAAAGATGTTTTTGGGACT | CGACATCTCGAACCTACACACG |
| 576 | chr6 | TGTATGTGTACTGTATAGCTAGCTGATCGA | CATTATGTTGGATGACAGCGTCAAT |
| 577 | chr6 | GGTAAGATGAATCATATTAGTGATGGCCAT | TGGCGATTACAAAACTTCAAAAGCTAAC |
| 578 | chr6 | TTTCATTGTGTCCCTTCTCCAGA | CATCCTATATGTCAAAAACCACGGTAAA |
| 579 | chr6 | TTTTACTCTGCTATGTATGGCTCCA | CCATCAAATCGACTTTACTCGTGAG |
| 580 | chr6 | CACAGCCACAACGAGAATGTT | GCATTTGCTCTCGGTCTGGA |
| 581 | chr6 | CGGTTTGCGACGATATGGATA | CATTGATAAACCAAAAGAAAACCGA |
| 582 | chr6 | ATTGTTGTGCAAGTTCTGTCGTAAT | GTCCTTCTGTTCCTAGTTCCTACTG |
| 583 | chr6 | GGTGAGAGCGATCGAAATGAGG | CTTTGCAATGTGCATGCAGTTTG |
| 584 | chr6 | CATTTCCAGCAGAAGGGCAAGTA | TGATGGTTTGGTTAATCTTAGCCATT |
| 585 | chr6 | TGACACTGGAGTTGATTACAAAGACAA | ATCATCATGGATTCCTTCGAAGAAAGTTAT |
| 586 | chr6 | CCTGGGAAGGAAGATGCAAGTG | GAAATCCTACAGCACCACACAGAAA |
| 587 | chr6 | CAAGTCACCTTTCTCCATTGCA | CATTCTCCTTGGTGTTAACTTAGTCAGTAA |
| 588 | chr7 | AAAAAGTCACTGTGTGCAAACATT | TGCTTCGTCGAGGTAAAATCCTTTT |
| 589 | chr7 | CAACTTCTTCTGTGTTTCTAAAAGCGAA | ATGTGGATCGAATTTAAACTTGCATGTTT |
| 590 | chr7 | GTGAGGCATTCATGCGTCTATG | TGTCCACGAGTGGTGTGTTCTTTAG |
| 591 | chr7 | GCACCCACTGACCCACATAATG | GCCTGTAGATCGTGTTGCTACTATTAC |
| 592 | chr7 | GAGTAGATCTTGTAAGGGAGACGC | AAGTCTTCGTTTCAAGTTGGATACC |
| 593 | chr7 | AGGAGATGTGAAAATGTGAATAGTGAACA | GTCGGTGCTGCTATCTTAGTTTCT |
| 594 | chr7 | CATGCCATGAATATCAACAAGACCA | AAGAGAAAATGACTGCTCCTTCTCT |
| 595 | chr7 | CGGTGATGGACCATCATCCAAC | GGTTTATCAGCCGTTGCTCAAA |
| 596 | chr7 | GATTGAAATCGATGCAGTCAACTCG | CTCCAGAGCAAAGCTACCAGCT |
| 597 | chr7 | GGACCCGAACTAGCATGTCTCTCT | TGGTGGCTTCAGGAATTTTAGTTG |
| 598 | chr7 | TGGAAGTGAAGAGGCTTCTGGAT | GATGAGCCTGTACTAACGTCAGAAAAATAG |
| 599 | chr7 | TGTCTAAGACCGACTTGCATGCT | GCCATTAAGCAATTACCACCATTG |
| 600 | chr7 | TGCCAACCTTTTCGCCATTT | CGCTTTCCGATTATTTGTTGTTTCC |
| 601 | chr7 | TTTTGTGGAATGTCGTAAACATGAGC | GCTAGCTGCCAGCGAAAAGTTAT |
| 602 | chr7 | TAAATACACAACATGCATGGAGAGC | GTTTGGTTTCGCCCTAAAGTTTCTA |
| 603 | chr7 | TTGCCAACACCTTCCTCACTAG | GTCTAAAAGAGGTTCAGTGCTGTCAA |
| 604 | chr7 | GCTCAAACAACACCAGAGCTAAGTTT | GCCAAAGCGGCAGTCATGG |
| 605 | chr7 | GCCGTAGTATACACCTCCACCTT | CCTCCTCCTCCAAGATTCCCAA |
| 606 | chr7 | CATGTTCCCGACTGCAAAGTTC | GCTCACAGTTACAATGATCTGCAAT |
| 607 | chr7 | CACGTCAGATCCTCCACATGT | TGACTTCTCTCACCTAGCAAAGCTA |
| 608 | chr7 | TTAGAGTTCAGTCTCACATTGGTGGT | AGGCACCACAAGCACTAGAACTATATTT |
| 609 | chr7 | CAGCTCAGAGCTATAAACTGTAGTACAGTACG | TGCCATTGTATTCCTCTAGTATTCCTATGT |
| 610 | chr7 | TTAAGTTCCCTCGATGGTTTTACCT | ACCTCCTTTCCGTTTTCATGC |
| 611 | chr7 | CATCTAGCTCATACTTGCTTAGCTGT | GACATGCGGATAGTATGCGGAT |
| 612 | chr7 | CCCAATCACTGTGTCTCAGATCAT | GGTTATTGGTGCACAAGGCATAATAAAC |
| 613 | chr7 | CATCCTCGGTTTTCTTCGGTAAG | GAGATTCTTCCATACAACAATAGGCATC |
| 614 | chr7 | TCTCCTTCCTCTCCCATCTCATC | AAAAAGAAAAACACACGAATCGCTC |
| 615 | chr7 | TCACTTACCCAGAATCCAGCAGA | GGCAAACTTATTAGATTCATCAGGTTG |
| 616 | chr7 | CACTGGGATTGTGGACTATAAAGTTACCT | TTTAGTAGGAGGGACCTGCCAAA |
| 617 | chr7 | GGTTGGTCATAAGACTGTCACGGTA | GGGTATATTCACTGGAATTGATAGCATG |
| 618 | chr7 | GGTGACAAACGTGATTTATTGCAAT | CATATCCGTATCCGTGTCATCAGTA |
| 619 | chr7 | ATTCTCTGTTTGGCATGAGAGATAAAGT | CTCGTCGAGTATTTCCATAAAAATCACTG |
| 620 | chr7 | TGATTAGCTTATAGTTGCTTTTGTTCAGC | CACAGTCGTGGGAATATACGAACATT |
| 621 | chr7 | CCTCCCGACCAAGAAGAACCTAA | TGCTCAATAGGAACATGGTCCAT |
| 622 | chr7 | CCAGCAGCCCAAGAACTTGT | CCCACGTTTTGCTGACTCTTTC |
| 623 | chr7 | CATGAAGGAACCTGGGCATAGAT | AGACGAGAAAGTTGTAGTTTAGAATGGG |
| 624 | chr7 | GGACAGCTGCTGCTATGAGAAAGA | CGTTGGATCGAGGATTTGTCGT |
| 625 | chr7 | ATGCCTGCATTAGGTGGGATAAAA | AATTCGTAATGTGGCAAGATGACAGTA |
| 626 | chr7 | AGAACATTTGCTAACCTCAACGTTT | TTTTAGGAGTTGGAGCTCTACCAAA |
| 627 | chr7 | AAAAGGAGATGTGCCTATAAGTATGTCCT | AGCTACTGGCCAATTTTGTTTCAC |
| 628 | chr7 | CACATTTAGTGCGGACGGAGA | AAAATAGACTTTTCAAGAGGATTTGATTTGGG |
| 629 | chr7 | TTGTTGCCTCATTACAGAAGTACGAA | CGTTGAAGTATTTGATCCTGCTTATG |
| 630 | chr7 | TTATTCCATCCTCCTAGTACTATGTCTGTAGA | GAAAGTTGAGGAAAGAGCTCAGTCTTAA |
| 631 | chr7 | CAAGGAGAAGGTGTTCGTCCAG | CCATATGACGACTGTACTTCTCAGA |
| 632 | chr7 | CAGCCACAAGACTTAGTAGATGCAGA | CAGTGACCGACGAGGTGCTCTA |
| 633 | chr7 | GCATTGCGACGAGCTCTGTA | CCTTGACATTCAGCCATGAATAGC |
| 634 | chr7 | TGGTAATCAATCACTAGTTAAACGAAACCA | AAAAATATTCGGGATACAATTGTTTTGGCA |
| 635 | chr7 | TCACTTCACATAGCACATTGCACATA | GTGGCTTCATTGATGAAGCTACCT |
| 636 | chr7 | CCTAAAACCCACGTGTCAGCTCTA | CCAAACCCAAAAATAATTTAAATCACA |
| 637 | chr7 | CGAAGATGAAGGTTCCAAAGACCT | TTGTAGGCGAAATACTTACGTAGATATGC |
| 638 | chr7 | AGATTCAATTTGATTAAGCAGAGATGCAAC | TGAGGTTTTGAGCATCACAGAGATAAG |
| 639 | chr7 | GTCACTGTTAATGCATTAGTACATCAGGA | GCTATAGAAACTTTTCATCAGCTCAGAACT |
| 640 | chr7 | AGATCTTCATAAACGTCCAGGGATCT | AATCAATTAATCGTGCTTAATCCTGTCTTG |
| 641 | chr7 | TGTCATTGCTTTTTGTGCACCTA | CGTCCCATTTAATGATACAGGTACATTG |
| 642 | chr7 | GGGAGTCGAACCCAAATATCAGG | CGCACCTCTGCTTCACTTCATTA |
| 643 | chr7 | GGCGAAAATAAATCTTTTGGCTGT | CCTTCAACTGAATTGATTGGCAAATAG |
| 644 | chr7 | CACTAAAAATGGAGGTAGTATCTCTGACCT | CGTACTAGCTTGGTTTTTACGGAATAAA |
| 645 | chr7 | TAGCTTCGACAGGGAACGCTTATC | CATCTGGCGAAGAATTTGGAGTAC |
| 646 | chr7 | GGGCCTGGGTCCATTAATTTTATAAGG | AGTGTGCCCTTACACAATTTCAGA |
| 647 | chr7 | TATTTGTGATTCACATGACCACGTG | GGAAAGGGAACTAAGTAAGAGCTGA |
| 648 | chr7 | GGTTTTGTTTTGCAACCATCCA | GCTAACGGTGGCAAATTGTTTG |
| 649 | chr7 | CAAAATTCTACCGTGACAAACCCA | ACCAGAGTTTCACTTTTGCAATGTT |
| 650 | chr7 | GGGAAAAGTTAGCAAGAGCTCTAACCT | GACAGCATTCAGATGGAGTGGAA |
| 651 | chr7 | CGGCATAGGCGTTGGTGT | GATGATCTTTTGAGTTCGCCCTAAG |
| 652 | chr7 | CGCTCTTGATCATCGCGTTTTT | CTCCAGGCCAGGAAACGACAAGATA |
| 653 | chr7 | GCACCTCTTCTTCCTCTTCTCCTT | GCTTATGCGTACATCTGGATTGTAACTT |
| 654 | chr7 | GACCATGTAATGGCTGCAACAA | TCATGCATCATCATCTTGCTAACAA |
| 655 | chr7 | ATGTGAAACTAAAAACAGCCTTTGT | CTATTAGCATGCGGCATACATGAAG |
| 656 | chr7 | GCTGTGTGCACATGTGTAGTACCA | CCTCATGTGCCATGCACCATAT |
| 657 | chr7 | CGACCTTTTATTCTTTGCTTATTGAAATGA | CTGATGATCGGTCACTGGAATTAGG |
| 658 | chr7 | CTCGTTGTGTTTCTGTAGAAAACCA | AATTGGAAGCAATTCAACATGCATG |
| 659 | chr7 | TCGCTTCTCTCCTAGAACAACTACTTTG | GGTAAACCCTGGTACTATCTCCGTTCT |
| 660 | chr7 | GCTTAATTGTACTACCATGGCCACAT | AGGCTCTACCAGGGTTACTGAC |
| 661 | chr7 | TCTCTAAAGAACTCTGATGTTAAGCGTGT | TTCACGTCCCAAAATCACATCA |
| 662 | chr7 | TTTGGAATGGAACTTGCAGTAAGAC | TAAAATCAGCCACAAAAGGGTTCTG |
| 663 | chr7 | AGTATAAAGCCACATCATCGCCTT | AATACACAGACCCAAAGAAACTAGACATC |
| 664 | chr8 | CACAATCACCTCTATTCACGGATTG | AGATGGAGCAATTACCTTATTGGGT |
| 665 | chr8 | CAAGCCAAACATAGCAAACCGTA | ATGGATAACCATCTAGTGTTTGTGTACTG |
| 666 | chr8 | GAGATAAATCGGAGAAGCGACAAGT | CTCCCTCCATCCCAAAGTAACTTTATAAAG |
| 667 | chr8 | CCCCATTCCCTCTCTCTTTCTCTC | AGAGATTCACAAGCATGCACATCT |
| 668 | chr8 | AACTAAACAGGCCCAAAATAGAAGC | CGTCTCCACGTTTCTACTACCTTTA |
| 669 | chr8 | CGAATAGCCTCCCTGTGACTGA | GTTCTTCCTCTGCTTCCTCTGTTC |
| 670 | chr8 | TGGGCAAGGGAAGGAATGTA | GGAAGTGCTAGTTCTGGGCTATGACT |
| 671 | chr8 | TTATTTGCTATGCTAAGGTCATGTTTGT | CTTGAAACATCTTGTGACAAATCCAC |
| 672 | chr8 | TCCGTTTGCTGAGGTCAACTCTA | TGTGATGTCTGATTTCCTGAAATCAAT |
| 673 | chr8 | CGGGTTAGCCATGGACAAGAAA | CCCTACTGTACACCACCAAAAGTG |
| 674 | chr8 | TTTTCATGCTATTTGTTGATCGACTTGTTT | GCTAACATATTCATTCTCAGACTTCGCAA |
| 675 | chr8 | TAGGTTTATGAACATGATGGCTTCAGTT | TTGACTTGATGCGTGTAGATAATAACATGA |
| 676 | chr8 | AAGATGTTCAGGGTTGTGACAAAGT | GGAATAAAGAAAAGGAAAAGGATGAGAA |
| 677 | chr8 | TCTACAAAGACATTTGAAAAACACGTG | CCCGTGTGTGCGTTCATTTATA |
| 678 | chr8 | GTTCTTTCAGAGTTTCAGAGATGTTAGCT | AACATGCATGCACTCTAGTACTCTAC |
| 679 | chr8 | TGTGCTATCATCTGTGTTGCCAT | AATTCGTCAGCTTTATTTTCAATCTCC |
| 680 | chr8 | TGAAATGCCTCATTTCAGCCA | CAATTTGGTCTTGGGTTCTAAATTCAG |
| 681 | chr8 | TGTCGTCTCAAGTTCTAGCTAGGT | AACAACGATATCAACGGTAGCGAT |
| 682 | chr8 | CCCACTAAAATGGAGTTTGGTGTTG | GAGGATACGGTTTGATGCAGGA |
| 683 | chr8 | GTACGCTAGAATTTGTCTTGATTGTCAC | AGTCTTTTTGGTCTATTTGGTTAACCGA |
| 684 | chr8 | ATGTGTTCTTGGATTTGGATGATGG | AATTTTATTTCGGTGCTGTTTCCTG |
| 685 | chr8 | ATCCATGATTGCCAATCTGTTTTGT | TCACTTCAGCTCAGATCTCTTTTCA |
| 686 | chr8 | CCATTTAGTAGCAAACTGGGAAGCAT | TGTGAGCTTGATAAAGCTTGTCGT |
| 687 | chr8 | GTGACCTACAAGGCTACAAGGAATAACT | CAACCATGGATGCTAATGGGAT |
| 688 | chr8 | GCTAATTAACTAAGTAGAGTAAGCACCAGT | AAAACAAGCTGATTTCAACTCTCTGAAAC |
| 689 | chr8 | ACTGCATCTCTACAAGCTTATCAGT | AAAGCGTTTCTTCATCAAATTTGCC |
| 690 | chr8 | AAGTGCTGGTGTAATTAGCTAATTAACCA | GCGTTTCCCGTCCTGTTTGT |
| 691 | chr8 | AGCTACAATGTCTATTTGCCCTACTATAG | TGGTTTAAAACCAAATTTTGCTAAGCCT |
| 692 | chr8 | GAGGCGCAGAGGTACCAACTC | CCTTTCCTCTACAGTAACCTCTCTGATTTC |
| 693 | chr8 | GCGATCGTACGATGTAGGCAAGT | AAATGTCCTGTAAACACTCCTACATTGTC |
| 694 | chr8 | CATAGATAGTGTAGTGCCTGATGACCA | CCCTAATGGTGTAACCATATTGCTTC |
| 695 | chr8 | TGAATCCCTTCATTTGTAGGAGTCA | TAGATCAAACACAAAGACAACAGGC |
| 696 | chr8 | GTTTACAGGTTTCATCATTTCTCCACATC | CCCATGGGTGTGTGTAGTTCAC |
| 697 | chr8 | TTTGCTAATTCGTGTGTAATTTTAGCGT | AAATAGTTGTTCATTCCTGTTTTAGCGAAG |
| 698 | chr8 | CGTAAGAAATACCAACAACCACCAA | GATCACTGCAACCACAACACTAAAT |
| 699 | chr8 | GCGAAATTGAAATAGCGTGGGT | CGTAAGTACGTACAATACCTCTACCA |
| 700 | chr8 | TTTCTTATTACACCAACCAGCAAACTAC | GATCTCGACGACGACAGATTCTC |
| 701 | chr8 | CACCCTGAAAACCTCAGCTGTTT | CAGAGTTGAAACTCTGACGTGATTAGTTA |
| 702 | chr8 | GCTCAAGTTTGATGATCTTCATTTGCT | CCACAGGGAAGAGAATAATCCACAG |
| 703 | chr8 | ATTGGGTTGAGGAGAGAAGGGAATA | CCGTTTCTCTCCAGTGTGTAGG |
| 704 | chr8 | GGCATCTCTTAAAAACCGATCTTATCAA | TGCGATAATTTTTCAGATCCACAATT |
| 705 | chr8 | TCCCTTGACTTCAAAATTGACGATG | TCTCCAGATTTTATGGATCCCAGAC |
| 706 | chr8 | TGGTTTTCGTAGTAGTGGTACTTGT | GGTACGTATCCAACATAGTAAGTACA |
| 707 | chr8 | CTGTATAAATCCTTGTGTCCGCATC | GCAAACTTTGGGTGCTTATTTGTTT |
| 708 | chr8 | AGCTGGTGGATAGAATGACATGTG | GATAAGCCTGTTACAATTTCTCTCCATCA |
| 709 | chr8 | TTGTCGACAAATTCAGTCCCAAGT | GCTGATGTGATTGTCTGATGAATCC |
| 710 | chr8 | TCTTCACATGCACTCACATGCA | ACAAAATTTCCGAAATTTTGGTCCTATTGG |
| 711 | chr8 | CCAAGTCATGCATAGAAATCACATGA | TGAGTTCAGATTACAGCCTATACTGCA |
| 712 | chr8 | GTTGGATATAGAGGCCGGGTAAAAA | ATTGCCGAAATGCTGGTCCATC |
| 713 | chr8 | TCTCCTGATTACTTTACTCACTCTGTGT | CCTATTGACCATTGAACTACCATTTCTGTT |
| 714 | chr8 | GGAAAGACCGTACAAATTCAAGACAAG | GCAGAAAAACCCTAGCTTGCTCAT |
| 715 | chr8 | CCAGATACAGAACTGCGAATGATTG | CAGAAAACATGCATTATGTTTGTAGCTAGA |
| 716 | chr8 | AACACAACGAAAGCTTTTGACGA | CTCCATCTTGATAGGCTGATAGTATCAAT |
| 717 | chr8 | TGATCATCCATGCATGCATTC | CTGAGTCAAAAGCTTAAACCTTAGTGGT |
| 718 | chr8 | TGCTCAAAGACAGGTCGAACATATA | GTGCTCTTTGTACAACCCATCTTAG |
| 719 | chr8 | GTTTTTAGAGTAAATTGCATCAACGGTACA | TGATGGCAGCACCGGTTC |
| 720 | chr8 | AGCCATATTCTAGCTCTTCCCTTAT | ACACATGGAAAAATGTTCACTCGAA |
| 721 | chr8 | GGAGGCCAGTGGTACGAT | CCTAATCTTATCTTCTTCCTAACCTCTCCT |
| 722 | chr8 | TTGCTGACTCAAAGTCAAGAGCT | GTTGTGGTTGCCAAGTGGAA |
| 723 | chr8 | AGGGTGGGTTGTGGAGAGATAT | AATCATGTTAGCAAGATCAGAAGAAGCT |
| 724 | chr8 | CTATTTCATCTGCGGCTTCCCT | TTTAAAAGACCATGAGACCAGCAAC |
| 725 | chr8 | GGTGAATAGAGAAACCCAAAAATTCC | GCAAGACTTTTGAGGTGTTCCTAAATC |
| 726 | chr8 | GCGATGATGCGATGAGAATGA | AGCCCATGACTGGTGATGATAAG |
| 727 | chr8 | GAAAACCCCGGCATTGATAAACTAA | TTGAGGACACTATGGTTGAAGGG |
| 728 | chr8 | TCAGGAACAGCTACACAAGAGTAAA | TATTCATGGATGAGCCTACATCTGG |
| 729 | chr8 | CCATCGCACATATAGGGTCTGTT | ACATTTTCCTCACCATCCCAACT |
| 730 | chr8 | ACGGCACAACAATAACAACACATG | GGATCTGAGCGGGATCAAGAAC |
| 731 | chr8 | TCGCGACCTTCAAATGCAA | TGTCTCTGGCCAAACATACAGAGAG |
| 732 | chr8 | AATAACTAGGTCATATAAGGCTTGTGTGGTT | CCAAGCTGATGATGTCCTTATCAATACT |
| 733 | chr8 | ATGTTGATAATAAAATTGAAGCCATACTTCAGC | GGAAATAAAAGATCTTTTCACTTAAACATTGGC |
| 734 | chr8 | TGCCAAGAAATTCGAGTCACCAA | AGGAGAAATTAAATCACCTCGGATGTTG |
| 735 | chr8 | AGCAGATACACGTCGATCGAGTA | GATCAGGACGAGAATGTAGTATTACAGAG |
| 736 | chr8 | GATTTGAAAATTGTCTCAATCATGTGGGTT | GTCACCCTCAATTTTTACCTGTGAAAAAT |
| 737 | chr8 | GGAATCGAAGCTAACAATCTGCAAA | ACCTGATAAGAAGCATGGAGAAACA |
| 738 | chr8 | TGTGTACAAAAGAGAGAAAGTACAACCTCA | TTTCCTTGTCTTCCTTATTCACACG |
| 739 | chr8 | CTTGTAAACTTCACTGAGATCTGCTCA | CATTGCGCATGCTTCCTTTAG |
| 740 | chr8 | CCGGCACCAGAATAATAAGCAG | TCATGCTGCCTGCCCTTATTTT |
| 741 | chr9 | CCCACACTCAGAGCATGGATTG | GGAAACCACTATTAGTGTTGGTTTTTGG |
| 742 | chr9 | TCTCAATAGATCAGATTGTCCAAGCTACT | AGAAAATAAAGTCCAGCAATCATCTTCAGA |
| 743 | chr9 | ACAATTAGACAGAGGGAGAGAGAGA | CCCATGATAAGCTCAATTGGTTACC |
| 744 | chr9 | CGACAGGTAACAGAGTCGCAAAAC | CATGTTACATGTGCGCTTTAGCCT |
| 745 | chr9 | GGAGTACTAAATTGGAACTCCAAGATGAGT | TCTGTCATGGACTCCCAATTTAGC |
| 746 | chr9 | CATACAAGAACTTCAGCCTGACCAA | GCACACAATAGGTTTCCTAAGTATCGAC |
| 747 | chr9 | TTTGAGCTAACATGGCAGCTTCT | AAAACCACGACCTCCACCATTA |
| 748 | chr9 | CTTGAACATTTCACATGCTCACCTT | CAACAGTGTTAAACTGTCCGTTTGTATAC |
| 749 | chr9 | GACAGGGCTGGAGTGACTTCATA | TCAAGTACTACAAGGGCACTCACAGT |
| 750 | chr9 | TTTCTTGTTGCAGTCGACTGATACA | CCAGAAAAACAAAAACTTGGACAATTC |
| 751 | chr9 | CCAGATTCACCTCCTCTCCTCAA | GATGGACGTCAAGATTCGTGCTAT |
| 752 | chr9 | AATGGATTGTTCCTCGCTCGTAT | TTGAGGTTTGGTAGTTGTGGAATCTAA |
| 753 | chr9 | ACTGTCCAGTATTGTGGTAGGTCT | GCTACTGAAGGAGCCTTCTTCTCA |
| 754 | chr9 | TTTTCCTGAACCATTCATTATGCA | AAGCATTGGACCTGTTACAATTGAA |
| 755 | chr9 | TAGATTTTCACCAATAAGCTAGCTTCCTTT | CCCTTCATATTTCTACTACCGCTAACTG |
| 756 | chr9 | CCTGCAAAAGAGAGTCCATCTGGT | TCAAGTTGTATTGGCCAAGAGATACA |
| 757 | chr9 | GATATGGAGTTGGTGGGACGAC | GATGGCCACAGAATAGTCCATGA |
| 758 | chr9 | CATTTGAGTGGTTAGAAGGCTTAGGA | TCACATATGCATTTATCTCTTTTCCCT |
| 759 | chr9 | GGAGCACATGCCCAGGTAATAGA | CGAACAAAATCTGATGCGATCTAATTAA |
| 760 | chr9 | TGGAGAGATGGTTGTATATTATGCACC | CCTCTAGTGTTGACCAGGGAACAAC |
| 761 | chr9 | AGCACATTGTATTTTAGACTTAGTGGTGT | TGAGTAAGGGCAAAAAGGACATTTTATACT |
| 762 | chr9 | TTTTGGTAGATCATGCTCCTTTCAG | CCATTGCATTGACTTCATTTTACTGT |
| 763 | chr9 | TCGTGCACTTCATGGCCAC | CTGTAGGTCTTGACCGCATATACG |
| 764 | chr9 | GTTTCTCTTGAGCAAGGAATCCGA | TTCTATCTGCTTAACGCTCCACATTATC |
| 765 | chr9 | AGTCCCTTAAGAAAATGCAACGAGT | AATGCTTCGCTTGTAAATTAAGCGTAAT |
| 766 | chr9 | ACCCGCTTGCACCCTTAAAAATA | GTTCACGTGGCTTGACACATTG |
| 767 | chr9 | ACATGGAGAACGCATGTAGCAA | CGAAGCGTCGCTTCCTCTAAAT |
| 768 | chr9 | CACGTATCAAATATCCAAAGAAGTCATG | GGTGAAAATCAATTGGTCGATTTTG |
| 769 | chr9 | AACGGGACTCAAAACGAATTTCT | CAGGTAGGGCCATGAGTACTGATTT |
| 770 | chr9 | GCATCATTTTTGGGATTTGGGT | CAGTGATGACCTTCTCAGTGTCATTT |
| 771 | chr9 | GCACAAATTGGTACGTGCACTT | TGTAACTAGGCCTGTGGTGTACATA |
| 772 | chr9 | TGGAATATAGGTTTGTGTCCCTCTAGA | CCATAGTTAATGCTTGGATAAGCACAATT |
| 773 | chr9 | TTGTTATCTATATGGTTTGCATTGCCT | TTACTACTAGGTGTCTTGGGTCATGGT |
| 774 | chr9 | AGTTGAAAGGAAAATCAGCTCTTACCT | TCAAAACATGCCTGCTCCTATGA |
| 775 | chr9 | TTGTTTTGCTCAAGCCAAGATCA | GCTGCTGCTAACTAAGCAAAGCCTT |
| 776 | chr9 | CCGGAGAAGACATCAAACACCTATA | GGTGCCTTTTACTCATTCAATAGGG |
| 777 | chr9 | TGGCAGAACAACGGACATTGT | TCCTTCGATTCCTCTCTTTCCA |
| 778 | chr9 | GAGATTCGATTGAGACCCATGCAT | AGCAGTTTGAAGAATGTGCTAATGAAA |
| 779 | chr9 | GCTAATAAGGTTTATCGTTTTGTTAGCAA | GGAACTAAACAAGGCCATTGTTACC |
| 780 | chr9 | GCCTCTTCAGTTTGGTCCATTTTG | GGCATAATCCTGTTGCACAGATG |
| 781 | chr9 | CCTGTGAGGTCGCAGAGGTACTCTA | CGGCTTCCATGTCGTAGATTTAA |
| 782 | chr9 | GGCCCAACTTAAAGGTGATATAAGC | TCTTCTTCTTGGTTTCTACTGGTGG |
| 783 | chr9 | TCAATAAAATCAGCTGGGAGGATCA | CTCCTCTACTTCCGATGGGTAGATC |
| 784 | chr9 | GTGACTACAACTCAAATAGTCACACTATGGT | TGAGGAAACTGGAAAGGCGTTA |
| 785 | chr9 | GTCACAAACTGTTCGAATTTTACATACTCA | GTTATGAACGTGCACAAGAGGGTA |
| 786 | chr9 | TCAAGTTTGCTTTAAGGTACAGACA | GGACAACAGGGTACTCACATGAAAT |
| 787 | chr9 | CCCCACGTTATACCCTACCATCCT | CTTCTCGTCCATACCTCACTAAAAAGC |
| 788 | chr9 | CACAACTATCGCTTCATTACTCCATCA | GACTTGGTATAAGTTTCTGGTCGGAAT |
| 789 | chr9 | GAAAGGCTACTGTACCAAACTGTATGC | TGTGTGTAGGATTACCCATTTCATAGG |
| 790 | chr9 | ACAAGTATTGGTAGCAAACTAAACATTGC | CCCTAGAGGTACAAAGTTAGGCCAT |
| 791 | chr9 | TGGTAAACACAAATTCAACACGGG | TTCTGGTTTTGAAAGGTTGCTTCTT |
| 792 | chr9 | CGCCTTCCTGGAGCAATATGAG | TGTGGCAAGTTCTTGATCTTTCC |
| 793 | chr9 | GCCATAACCACGTTGGCAGACTA | ATGGGCTATGGAGAAGCTTTTGT |
| 794 | chr9 | TCCACTAAAGAACCGTACCAAATTTTA | CAGATAAAACATGGAGGCTGCCTAT |
| 795 | chr9 | AAAGGGTAGGAGAGGTAGCAGAA | AACATCCATGCATATCGTCGACA |
| 796 | chr9 | AAAACTTTTGGCAAAACATGAACCG | GTTCCTGTATCAAGAATGAGACTTGT |
| 797 | chr9 | CATAGCATGCTAGTGCTTCTTTGTCTC | CCTTGGAGTTCAGGTCGATGAAG |
| 798 | chr9 | CTAGCTAGGGCCTTTCATATGTCG | GATCAGTCAGGCGTTGTTAGCT |
| 799 | chr9 | TGATCGATCACAGATTCACAGTTGA | TCGGACATGTACTCTTCTTGTTCAT |
| 800 | chr9 | GACAAGAGGGTCTACTACCTCAACCAT | CGCGACGGTGATGCGGAAT |
| 801 | chr9 | CATGTGTCATAGCAGTAAATTTGCAAG | CCAAACAGTTTTGCAGAAATAGCAA |
| 802 | chr9 | GAACCGAACGAGCCCTTAACA | CAAAAGGCTAAAACCCTTTCTTCAA |
| 803 | chr9 | TTTGCTCTCGTAACTGTCTCTGCTT | GGCTATTTGGCCTTGACAAGGTT |
| 804 | chr10 | GGCTCATCAGTCCTTAGGGTGA | ACCATGCATCGAGAAGAAAAGG |
| 805 | chr10 | CTCATACACCCTCCTGTTCGATCT | GGTTTACCTCACATATACTCTGAACAATGA |
| 806 | chr10 | TTGCATGTTATATTTAAGGCATCCAGGA | GATACTGTTCCGGCTGGCA |
| 807 | chr10 | CAAACCGTTCCATATTAACTTGAAGG | GCTGTGTTGACAGCTGTCATAGTACTTCTAC |
| 808 | chr10 | GGTCATGTGAATATAGCCGGTGAT | CTGCTAATCACATAGAAAACATACCAAACC |
| 809 | chr10 | CAAACATATGTCCACCAAAAAGAACA | GGAAAAGAGGCATTGCTTATGGAG |
| 810 | chr10 | GACCCTGTAACCTCAGCTACAATACC | CACCACCAAGGACATAAGCGA |
| 811 | chr10 | TTGTGTAATGCTCCAAAAGGCTAGTA | CATGTGTGAATTAAGGAAGCAATCTTAGA |
| 812 | chr10 | TCCGATGGCGACACATATTG | GAAAAGAGAAGCTAGCTCCAAGCAT |
| 813 | chr10 | AGAGATCTTGGAAATCTCGAAACCT | ACGCAAATAGACCCAGAATTTTGTT |
| 814 | chr10 | GAGTGGGTATGGATGTGCAAGG | CGAGGTTGAGGTTGAGGTTGAG |
| 815 | chr10 | CTGAATTCTGAAATACTTAGCACGGTT | TGCAGATGAAGCAAGAACTTATAAAACTG |
| 816 | chr10 | TGCAGTATGTATCGGATGATCCA | GCACCAACTAGCAACCTTGCTGTAC |
| 817 | chr10 | GCCCATAATGGGTTACCTGTATCC | GGCTAGGGTCAATCCACTTATAAATTGAAT |
| 818 | chr10 | CAATAAATATCGTGCATACATGCATG | CATCAAGCATTGTGTGATATATTGTCCT |
| 819 | chr10 | AAGCGATGCCTATAGGGATGAAC | CCTTCCTTCTCTTCTAGCATATTGTGC |
| 820 | chr10 | GCTACTCGCAAGGCTCAACTGAT | CGGTGCTGATGCAGCATTAATC |
| 821 | chr10 | AACCCATATTGGCTATGTTTTGGTG | CTGGCGGGATCAGATATTGGATG |
| 822 | chr10 | CCGGTCGGTTTCCTAACATACA | CTATAAAAAAGTAGTAGCGACTGCCACAT |
| 823 | chr10 | GCTATGTGTTATCAACCGCTTGTTA | GCCTTTTCAATTGAATATGACGGGA |
| 824 | chr10 | CGAATCGCTTCTAGACCTGCAA | GCAATAATTCGGGAGTAATTCGTACTT |
| 825 | chr10 | CAACCAATTCCTCCAAGAAAGCATC | TCACCATACCTTCATTTTGGGCA |
| 826 | chr10 | TGGTTTTCACGGGCTTTTCTAGA | CGATCCTACACACATAGCACAGAT |
| 827 | chr10 | CGTAGTTGCTGACTGTCGTGTGAATT | TGCAGCAGGTGCGAATGTATTA |
| 828 | chr10 | TCTCTCTCACTCCTCCACCTCAA | TCCCTCATCAACTATGATTATAGAGCATC |
| 829 | chr10 | ACGTACGTGTCCAGCGTTTACAT | GAATCATGTATTTTGTCGATCGGTT |
| 830 | chr10 | GGGTTAGTTACAGTTGGGCCTAAT | GCTCGATGTAAAACCAATGGTGAAT |
| 831 | chr10 | CTGGCTGCCAGCTTATTATATATGC | TCTCATAGTCACATGCATGTACTGT |
| 832 | chr10 | CAGGGGATTGATTTGCACATTTTTG | TTCTAGTCACTATCGCTATTGCCTC |
| 833 | chr10 | AATGGAAATCTGTTTGTGCGGAAT | TAGAAGTCAGTTGATATAGCCGCAA |
| 834 | chr10 | AACTCCCTTACCTAGTTGTTCTCTTCG | TGTTTCTCTTTCTCTTTCAGCTCAAAAC |
| 835 | chr10 | CTGCTGCTGATTCAGTTGATCG | TGCCATTTCATTTTTGGTGTTGT |
| 836 | chr10 | GGACTACAAATTTGACCATCAGGACA | TTTGCATCTTGCATTTGTAATGTGT |
| 837 | chr10 | CCCACTTGACAAAATTGAGCGA | TGTTACTAGCATGTTTAGGGAAAGTGTC |
| 838 | chr10 | TGGGACGGAGGGAGTATGTTATTAC | CAAGAGCACCAAATTCTCAATTTTG |
| 839 | chr10 | CACCCGAGTGTGTCTAATTGCAG | TGCGTGTAGCAGTTAAGTGTAAACAATATAC |
| 840 | chr10 | TCCGGCTCAAATATCCGAATC | TTGTTGTAGAACACCGAGTTGGAGT |
| 841 | chr10 | GGACAAAACCGCTCTGGATTAGA | AAAATTGACCCTAGCTACTCCATTCAT |
| 842 | chr10 | CCGTGTGCTCGTCCTAAGTG | GACCATAGTGAGCTCTGGCTTT |
| 843 | chr10 | TCCCACCGATGCGCTATACTA | GCATTGATGATGAATGAATAACGG |
| 844 | chr10 | TCTTAATCTTTTGAAAATTTGATGCCGCT | ATCCATGTACGTAACTCCAAGCC |
| 845 | chr10 | CGAGGCAATATCGCCATCTCTT | AAAGACAACTATGTGCCACCAAGA |
| 846 | chr10 | GGTGTTGGTTCTTTAATTAGCACCA | CATGCCATTTACAATCTTCGTCTTCT |
| 847 | chr10 | ACAAACTCCACTCTAGCCACCTCTT | GTGAAAATCCAGTCTCAGCTCTCTTT |
| 848 | chr10 | CAAGAGTAAACAAAGAGCAGTTTCTTACAGT | TCCCTGGAAATTGTGAAAGCA |
| 849 | chr10 | ACAAAAATCGATCCATGCCACTA | CAGACGTAGCTGCTATTGGGAAG |
| 850 | chr10 | GTTTTTGTTCTTTCAGTTCCAACCCAA | GTCTCATCCATCTCCATGAAACCTC |
| 851 | chr10 | CACTGTGTTAAACAGTGCTACACAAACA | CCATACCGAGTGATCACATACATCC |
| 852 | chr10 | GTATGGGGGTTGGTGGTGTATG | AGCTTCAATCAAGGTAACCAAACAC |
| 853 | chr10 | TGTGTCGGTTAGACCGTCTAGT | TGGCCCAATCTTTTAGTGAGTTAAGATAAC |
| 854 | chr10 | ATATACACACACACACATATGCCCT | CTACGTAACCCATTCTCAACTGGTA |
| 855 | chr10 | GGCCATAAGAAAACCCTCGTGTT | CCGGAACCTTTTGGCAAATTAAA |
| 856 | chr10 | AGACCCTGCAGCAACAATTTCT | AGAAATGAACGACCACTTTGGAAC |
| 857 | chr10 | TAACTATAGCCAGACCTTGCCTTTT | TAGAGCTCACTCAAATCGATCTCTC |
| 858 | chr10 | AAGTCGTCCCTCCTGAATTGC | GGCTAACTCCAAGGCCCATA |
| 859 | chr10 | GACACAGTGATGCAATTTGTGGA | CATTGGCTGCTTTCCTGCATAG |
| 860 | chr10 | AATTGCGCTATTTTGTACTAGCTTGTG | AGGTTGTCTCTTAGGTAGACCCAGATAATAC |
| 861 | chr10 | AAAAGAGGCAGTTTTGACCAAGATAAT | TGTTGTTTCGGTTACTGTTGTATTGG |
| 862 | chr10 | CCTCCCTTCTCCCTTCATTAGTCC | CTTTTTAGAGCATGCGGATTGAG |
| 863 | chr10 | CACCCGAAAACTAAGTGGCTGATA | CATCAATTAAAACCTCGTTGCGAT |
| 864 | chr11 | CCACAAAACTGTCGGTAATAATCAGG | GCTAGCTAACCAGATTAGTTCCTTGCTATAA |
| 865 | chr11 | ACCCGTAGAAAAGATAAGAGAGACG | TTCGCCCATGTCAAGCTTATTTTT |
| 866 | chr11 | GCGTGGTGTTCGACGAAAC | CTTCCTTGCCTTCGCTGTCTTA |
| 867 | chr11 | TGCTGAATCTATACTGTTGAGTTTGCA | GCAAGTCTTTCCTTCTTCACATGCT |
| 868 | chr11 | AATACCAATAGTCGAGGACATCCAC | TACTCCCGAACAGGTTGATGAGAAG |
| 869 | chr11 | ATGATCAAACGTCACATCAAAAGC | CGAGTACACCGTCGTCCATGT |
| 870 | chr11 | CAACAACAACAACAACGATGATGA | GGTGATCGAGCTGCACAACTACT |
| 871 | chr11 | CCACCGAGACAGGGAAGATG | AGATTCGTGTAAATCCTTAGAACCGTAA |
| 872 | chr11 | TTCATTCATGCAGACTCGCAA | TGGAATGCATTGTCGTTCTGA |
| 873 | chr11 | CCAATTTCAGTTTTTAGTTCTTACCGC | GTCGAAGTCCAGCACCATCG |
| 874 | chr11 | CTGAGCTCGAGTATGTTCATGGTG | AAAACCACTCAATACTAAGTGCGTG |
| 875 | chr11 | CAACAATTAAAGGCTCCTGTGTACGT | AAGAACCAGAGAAAGTAGACATGTAACTGAT |
| 876 | chr11 | TGTTAGTTGTTGTTATGGGTTGTGTATTTG | GGGTTCTATCTTGTCTGCTCAAATTACA |
| 877 | chr11 | TTCACGGGAAATTTCAGAGAGTACA | AGTTGACTTGAAGAACTCAAAGCGA |
| 878 | chr11 | AAAAGAAAAACCAACCCAATCACCT | CTCCACCATCATCGATCTTCAACA |
| 879 | chr11 | CGATACTCTTTGTCATCCTCTCTCT | CTCCCCTCAACTTCATGCACTAG |
| 880 | chr11 | TTTAAACTCTCCATCTCCGTCCATC | ACAGGAGAAGAATTGCTAGGGTTAG |
| 881 | chr11 | AAGGAAAGGATCCTTTTGAGTTAAGGAAAT | TCGATGAGATCTATGGGCGAATTG |
| 882 | chr11 | AGAACGGGTACCAATATTTGCTTCC | ATCTGCTTGGAAAATTTAAGCTCTCAGATA |
| 883 | chr11 | CCCAAGGCTCAGATATTTCAGAAGC | GTCACCTTTTTCTGTGATGACAAGTTC |
| 884 | chr11 | CCTCTTCCCTACCGGTTATGCT | CGACACCCGATGGGTTTTTACTC |
| 885 | chr11 | ATCACGATCAGGATCCTCAAGTTT | GCACGCAAGAAGTATAAAACCACAG |
| 886 | chr11 | GCAACAGATGAACCGGACAATG | GTGAGGTGTCTCCATGAACTGGT |
| 887 | chr11 | CCATATGTATGCAACTGGGGGTAAT | AAAGACACTTGTTGCAAGATAAGGG |
| 888 | chr11 | GGTTTTTCCAATCATCTCTGTTTCA | AAGAGGAACATGCTGAGACTCTTACC |
| 889 | chr11 | GGCCCATAGGGAAGCATTCTA | GCTTACTGGCTTGTTTGCAAAAG |
| 890 | chr11 | CCTCAGTACGTCTATCACTCCCTT | TGCTCTTAGGATCTACTTATTGTCTCCTAC |
| 891 | chr11 | TTTAAGGATAACCAGATAGTTAAATCCGGT | ACGAAAGAGATGCCAGAAGGAGA |
| 892 | chr11 | ACACACCCACTAAGACAAATCCTTA | TATGTCCTGCCATGCTCCTTCATC |
| 893 | chr11 | TTCGAACCCACGCGCACTC | AATTATTCTTTTCTTGAGGAACAACAGTTTCT |
| 894 | chr11 | CACCTGCAAACACTGGATGTTC | CTAGCAAAGCCTTCTTCATGCTCT |
| 895 | chr11 | TCAATCTCAATCAATCACCATTTACCAAGT | GTGATGCTTGAAGTCATTAGGAGTCA |
| 896 | chr11 | GTCCATGTGGTGTGCATGTAG | AGAGGTGGCATTAGAAATCCATAGCTATA |
| 897 | chr11 | TCTTTTTGTGTGTAGGACAAAGGTG | TGGCTCGAAATGTCAAACCAAATTA |
| 898 | chr11 | AGAGGAAGGAAAAATCACACGGTT | ACCCATCCTCCGTCCATATGA |
| 899 | chr11 | TCATGACAACCACATATCTCCAACTTC | TCTAGGATGAATCTGTTTCCTCGTCT |
| 900 | chr11 | CTCTCCCTACGGTTGTTTCTACATT | CTGATATCCCCAATTGACACACATG |
| 901 | chr11 | GCGTATTTGTTTTTGTTTCATTCGATAC | CATACACCAAAAATGATGACTATGTGCT |
| 902 | chr11 | CGTCAACAACGGCAAGGACAT | CAACCTGCCTACCATGGTAAAATAA |
| 903 | chr11 | GATTGGTTACTCGTAGACTAGAGATAGGAG | CGGGTGTATTATTGATCTCACAATCTTAGT |
| 904 | chr11 | AATTCCCTATCAGGTGGATTCTATAGACAA | ACTCCCTGTTACCTCCCTTGAT |
| 905 | chr11 | CTGTCTTGTAGCTGGAGTGACT | TGAGTAATTTGAGCTACTTGCAGTATCTC |
| 906 | chr11 | TACACCAACATTCTCTTCTCAACTAATCAG | CTGTGCGGTGCCAAAACAATAA |
| 907 | chr11 | CATCGTTCGTCAGACTATGCAGA | AGAGATCCAGGAAGAACTACCGTGT |
| 908 | chr11 | CGTATTCTGTCCTGTGTGAATTTCG | GCAAATAAAACAAGTGCCTGAATTACA |
| 909 | chr11 | CAGACTTTTCCTCCTGATTGGATGA | GATTCAGCAGCAATTTTGAAGAAATGTG |
| 910 | chr11 | GTACAAGAAGGCACCATGCCAT | GAACATACAGACGTTGATAGTGTAATGGA |
| 911 | chr11 | GCTTACTTTGGATGAAATTGTGTGTG | TGGCCAAAATGCAGATTCACTAAT |
| 912 | chr11 | CTTGATGCAGAAACAAGCAAAGCT | ACTACCATGATTAGGCCTCTCTTTC |
| 913 | chr11 | AGGTGACTATGTCTACAAACACCTATGAAC | CATATGGTGGCCATGGATTTAATC |
| 914 | chr11 | CACATGTGATCGACGTCTTAATAGAAG | TCACCTCTAAATTCACCACTCTTCAAA |
| 915 | chr11 | GGGTTATACTGCTAGGTTGCTACAA | TAGAGAGACTTACTACATGGCAACC |
| 916 | chr11 | CTATAAAATCATGCTACACCATTAATATCCGG | TTTTACGTTAAATAAGCTTAAAGCCCAAAC |
| 917 | chr11 | CATCTCCTCCTGAACACAACTTTGAC | GCATGAGTGAAGATGTCGATGAGT |
| 918 | chr11 | TTCTTTAACTGCGTACATGATCTCGT | TGTTCATAGCTGAAGACAAAGATACTGG |
| 919 | chr11 | TTCTCTGAGTGCAATCAACTCCTCT | AGTTCCTGCCTGACAGAAAACCT |
| 920 | chr11 | TCCTCCAAAACCTTAAATTCACTGC | CAACATCTAGATTCGTGGGTCCTAT |
| 921 | chr11 | GTCCAGTCCATTACTCCCTCCAT | AATCTAAACACGGCCTCTATATTGCA |
| 922 | chr11 | CGGTTGGTTAATCTCTCGGTAGTGT | AAATGAGCCTTTTATGTCCAGAAAATAG |
| 923 | chr11 | CACAACAACAATCCCCAAAGTCATA | TTTGACTGTGCCAAGATCTCATCTA |
| 924 | chr11 | TCGGCAGGCGTATTATTTTCA | AATGGGTCCACTAAAACCAATGG |
| 925 | chr11 | GACATAACGCGTGATGATTTACTGT | CTGCTCGATAACCTTCATCTGAAAT |
| 926 | chr11 | GGAAGATTGTTGGGTTTAGTCCCA | CGTGTTTCCTGCTCCACTTGTCT |
| 927 | chr11 | AATACAGTGCGGGAAAAAGACAAG | ATCTAGCTGGAATAAATATCCCGGC |
| 928 | chr11 | TCTCGGATTGGTTTGTTTTGAGTAC | GCAGCACAATCTTGAATAATCGGTA |
| 929 | chr11 | GTGTGAGCAGCGGAAGAACTAAC | GCACTACTCAATGATCCAGCATATTACAC |
| 930 | chr11 | CCGCCTGTTGTTGATGTTGAAT | CAAATCTGAAAAGAGCAAGTGTGGTAC |
| 931 | chr11 | TGGGCCAAAATCGACTAATACATATGTT | GATGTATGTACCACGATCCATTTCTTACT |
| 932 | chr11 | CCATGTACAGTATTATTACATGGGAGCTT | CTAATTTAGCACAACAGCAACATAATGAC |
| 933 | chr11 | CGAATTCAGCTCGATTCGAACTTC | CCTTGGGTTTCACTGATCGATC |
| 934 | chr11 | TGTTGTTTTACCCCACTTTTTAGGG | CTAGGGTTTTGGGTGTTCACATCTC |
| 935 | chr11 | ATGAGCAAGAGCTCATTGTGGT | AACGTAGATGAGGACCTGAGGAA |
| 936 | chr11 | GCTAAGCGAGCGAGGTGATATG | CATAGCGTCTTTACGTACCTCAGAGATAT |
| 937 | chr11 | GTTGCTATTTGTTGAAAGCTTTAGTCG | TTACCTATAGCGGTTCTCAGAGAAGATT |
| 938 | chr11 | GCAGTCAAAATCAGAAAAGAGAAGT | GTGGGTGCCTAGGTATGGATATATT |
| 939 | chr11 | CAGCGATGGAGAGTGAGGCA | GGGAAAAAGTTTATATTACCCTTTTGAACTT |
| 940 | chr12 | AGAACTGCTAGAGATGCACACCAA | TGGAGTGCTGAAACCTGATGTG |
| 941 | chr12 | GTACGAGGAACATATTTTGTTCAAACAGTT | CTACCTGAGCGACAGAAAGAACA |
| 942 | chr12 | GCTTGTGGATTTTAAGCCTGCA | TTCTAGCTAGCTTCTTTCAGTTATTTTCAACA |
| 943 | chr12 | CAGGCTCACTGTAAACAAGAGACTCTACT | AATTCAATTTTGCTTGCTGATAAGATG |
| 944 | chr12 | AGAGAGCTTACAAATTGATAATTTTCACA | CCACTCAAAAATGATGTGGAAGACA |
| 945 | chr12 | GACCAAATCGGGATTAGTCATGAAC | GACACATTTCCGTCTTGTTTCATCT |
| 946 | chr12 | TTATACTTTACAGCTGTCATGTGAACAAGAA | GGCCTTGATGACCATAACCTTTG |
| 947 | chr12 | CAGTGCTATCCAAATTGACACAACT | CTCAATGCCCATTTACATTTGCTTG |
| 948 | chr12 | TGGATGACGCATCAGAATGTCA | GCTGCTGATGTTATATGGAGGAAACTATC |
| 949 | chr12 | CCCAGCAATGATAGTTTGTAAACTAAATCA | CATTCAAAAGAAGAAGAGGACGAGGT |
| 950 | chr12 | CAGTATGATGTGTATTGCAAGTATGGCTA | GAGGACTAATTTGTCCATGTGCATTT |
| 951 | chr12 | CTATCTCCTAGCGAACGTTAGCTACCT | ACCGGATCTGGTTTGTAGATAGTAAAAA |
| 952 | chr12 | AGAACTGGGCAAAGTCGATTTGT | CTTGATGAGATGCTTTCCATGCTTG |
| 953 | chr12 | GGATTCAGTGGCAGCATGGTTA | AACCTCTGAGAGACATGACACTAAACC |
| 954 | chr12 | ACATCGAATTAAGGATGCACACAA | GCCAAAATTTGAATTTTTAACGCTAA |
| 955 | chr12 | GATAGGGTTCGGAAACTAATTCTCCA | CCATAAGTCTCGTGGTGTTTGCT |
| 956 | chr12 | GCACATACCGATGATGCAGAAGTAGA | GGATGGATGGGATACCTTCCCTT |
| 957 | chr12 | ATTTTGTGGCACCATCGAATATGC | CTGGGAGGACCAAAAGATACAACTAG |
| 958 | chr12 | TGTTCTATCCCTATAGCATAGGGAACTTG | TAAGAGCAGCTAGCGATAGATCTGTAG |
| 959 | chr12 | TGCTTGATGTAAGTGGCAACCAT | GTTCAGATAGTTTGATCAATTGCATGA |
| 960 | chr12 | GCCAGCAAGTAATAACTCTGAGCT | CAACAACAAGCTCAATTCCTTGCTT |
| 961 | chr12 | TTAATTACATCGATCAATACGTGTTGCCTA | TATGCTCTGTCACTTCGTATTATGCG |
| 962 | chr12 | ACAAAAATTGGAGATGATGCGAAA | CTTTATTACCGTGATCGAGTCCAAGA |
| 963 | chr12 | ATGAAAGCGATGGAAAGAATGTG | TCGTGAGCATCCTAATCTCTCTTTC |
| 964 | chr12 | GATAATCCTGGCCTTCTACTTCTCCT | CGCATGTGCATTTTGCTATACCTC |
| 965 | chr12 | CTATTGGCTGGTTCTGTAAATTTGGT | CATTATCAAGATACAGGACATTGTCTTGC |
| 966 | chr12 | GTATAATTCATGGCTCGATCGAATCGTA | GTCTTCGGATGTTTGGGAGGTT |
| 967 | chr12 | GAAAATCCAAAACTTCATCCGGTATTTCT | AAATATGGCTATCTTTAGTCCCACGTAAAA |
| 968 | chr12 | GAGAATGCGGGAATGACTTCAC | CACAACCTTTGCATCCTTGTCA |
| 969 | chr12 | TGCAGGATAGTTAGGAGGAAAATTAGATG | AAAACTTCAAGTGGGTGTTCAACAA |
| 970 | chr12 | GGTGGGCATGTCTTCTTCGATA | GCCAAATACCCATACTGAGCCTATTA |
| 971 | chr12 | GGCGTTTAAATTTATTGAGCATGTAGGT | GTATTGTGATTTTCAGTGCTAGTTTGTGAT |
| 972 | chr12 | CCAGGGAGGTATATTTTGGATGGA | CCCTGTCTCAGTCCTCTGAAGGTT |
| 973 | chr12 | CAAGAGAAACGATCAAGCAAGATGT | ACATCAAATTGAAACATGGCACTCA |
| 974 | chr12 | CCAGGGAATGTTTGGACATGGT | TATGTGCAGGAGGCCAACAAGGT |
| 975 | chr12 | TGGATGTAGAGGCCTGTTTAATTCA | CTTGGTTTAAGTCGTCTGAAGACCA |
| 976 | chr12 | AAAGCAAGCTTGTTCAGGACAGTTA | CCAAAGTAATGGTAAACGGAAGCTT |
| 977 | chr12 | CCTTTCGAGAAAAAGGAAAATGTCA | TTTCAAGATTTGCTATTTGACATTCG |
| 978 | chr12 | CCTTTTCAAGATAATGTAGGGGCTT | TTTCTACAGCATGTTCATCGACAAG |
| 979 | chr12 | TGCCTCGAGTTTAGTGATGTAGGGT | TTTACGTCAAAGGAGTTGCTTTCC |
| 980 | chr12 | CATCAGTTTCTGCTGTCCTGGTA | TGGTTGTAGGACATCCGGGTATT |
| 981 | chr12 | AGTGTTCCAACCCTGTCTCCTTA | CATTGCAGTCATGCAAATTTCCCA |
| 982 | chr12 | CTGAAATGACCTTATTGCATTTGGC | GACAAGAGAAACGTGGGCTTAAATG |
| 983 | chr12 | GTAAGGAGAAGCTGTGTGCCTT | AGCTCGTAGTCATCCAGTTCACTA |
| 984 | chr12 | TCTATGGCTCGTGGGCCTATAA | GACCTAGCTTGTTTCCATGGAAAC |
| 985 | chr12 | CAACGATGGCATTTGTGGGA | GCCACGCCCATTTTTAATTTTAC |
| 986 | chr12 | AGACTTTAACATGCACCTCATGCA | AAAGCCTTTAGGAGCATAATATAAAGCC |
| 987 | chr12 | AGTTGGATTTTTATAGCTCTCGTAAACAGG | CGTTAGGTTGAAGTGTTCATTCAATGAA |
| 988 | chr12 | TACTAGCTCCAAATCATCTAGAGCCAAATA | AGAGAGAGTATTTGCTTAGGAGTACGT |
| 989 | chr12 | TCAGGGACAAACTTGATGAGACCT | TGCTTCAGGAGAGAAGTTGATGATG |
| 990 | chr12 | CACTGTTTGTGCATGGCTGATT | CACACCAGAACCAGATCCCTCTT |
| 991 | chr12 | GGGCCTCGTTGGACTTGATC | CACGACCTATCTGGCACCAAT |
| 992 | chr12 | TACGACAATCTAACCTGCCCAAATA | TCCCCTAAATATGGGCATTGTAACA |
| 993 | chr12 | TTGTAACAGAACGAAACATGACCTG | CAAAACTTCCTTGCAATTTCAGCAT |
| 994 | chr12 | CGCAGCAAAGATTCTTCAGGTT | TTCCACAGGTGAAACTCGTTGA |
| 995 | chr12 | CCACATTAATGTTGTGATTACCAACG | CACTTTCAAACTAAACCTACCTAGCTAGCTT |
| 996 | chr12 | TCAGGGATTTCTTTGTTGGAAAGGA | TGTATGGTAAGCTCAATATCTCTCGATTCT |
| 997 | chr12 | AAAGGATACTATAGTGCATACACCTTTCG | GAAGTTAAATGTTATTGTTGTGACCCTGAA |
| 998 | chr12 | TTAGAAAGCATAACAATCCGTCACG | GCTTTATGCACGGAAAATTGACATA |
| 999 | chr12 | TCTACTCTGCCTAAACAAATCTCAACC | CCTCTAATGTTCTTTCAGTCACAAGATCAC |
| 1000 | chr12 | GGACCAAGCAACTTTTGCTTCA | ACATGACCATCTTCTGAAACTACCCT |

A.2 玉米MNP标记引物

表A.2 玉米MNP标记引物

|  |  |  |  |
| --- | --- | --- | --- |
| 位点编号 | 染色体 | 上游引物序列 | 下游引物序列 |
|  |  |  |  |
|  |  |  |  |

A.3 棉花MNP标记引物

表A.3 棉花MNP标记引物

|  |  |  |  |
| --- | --- | --- | --- |
| 位点编号 | 染色体 | 上游引物序列 | 下游引物序列 |
|  |  |  |  |
|  |  |  |  |

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