# GWAS OF HUMAN BITTER TASTE PERCEPTION IDENTIFIES NEW LOCI AND REVEALS ADDITIONAL COMPLEXITY OF BITTER TASTE GENETICS

## *SUPPLEMENTARY DATA*

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**Figure S1. The study panel represents a continuous admixture of diverse genetic ancestries.** A scatter plot of principal components one (PC1) and two (PC2) of study participants' genotype data show the admixed nature of the study population's genetic ancestries. Comparison to HAPMAP population data sets (not shown) indicate that PC1 represents the African-European axis while PC2 represents the European-Asian axis.

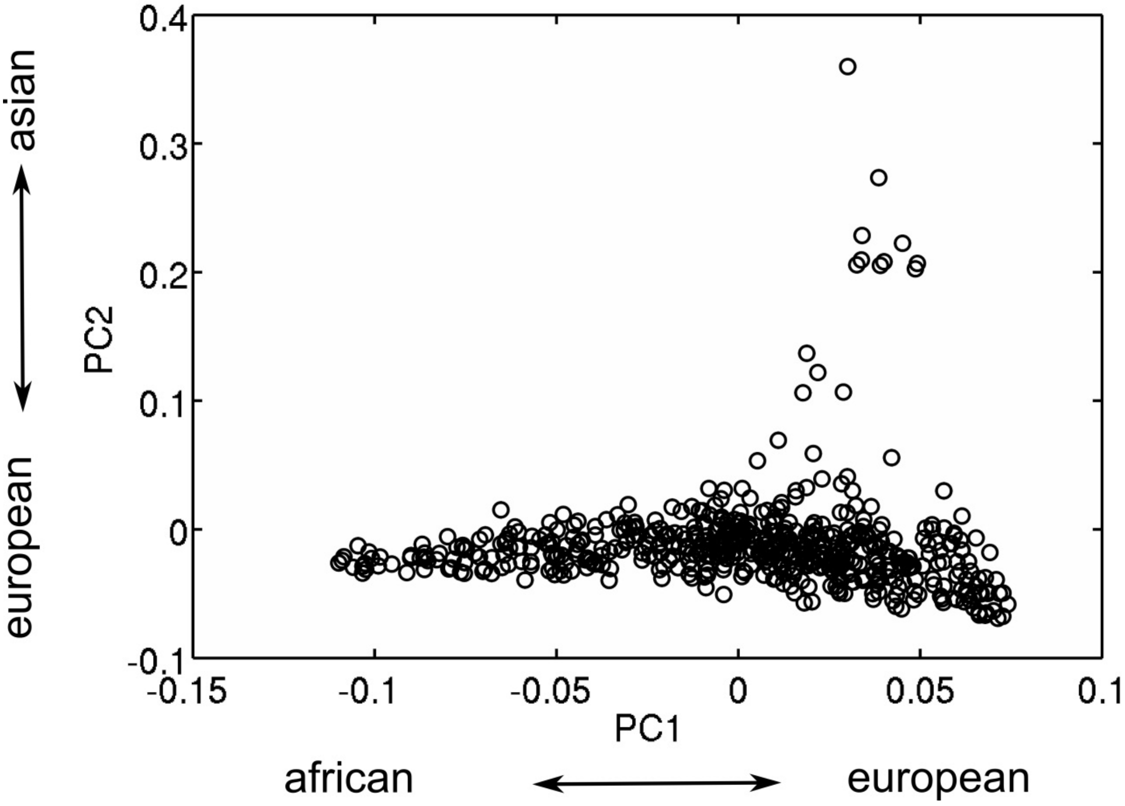

**Figure S2. Graphical representation of the overall taste sensitivity parameter concept.** Taste detection thresholds tend to be log-normally distributed. Detection thresholds are therefore log-transformed prior to the subsequent steps (note log-scale of x-axis). Panel **(a)** shows distributions of the detection thresholds for three different taste compounds (red, green and blue). The detection thresholds of one selected individual for these three taste compounds are shown by large dots. **(b)** The distribution curves are aligned along the x-axis so that their peaks fall onto the zero position. **(c)** The distributions are now stretched along the x-axis so that they all have unit width. This step converts the x-axis values into z-scores. The individual's overall taste sensitivity is then computed as the average of the z-scores for the three compounds.

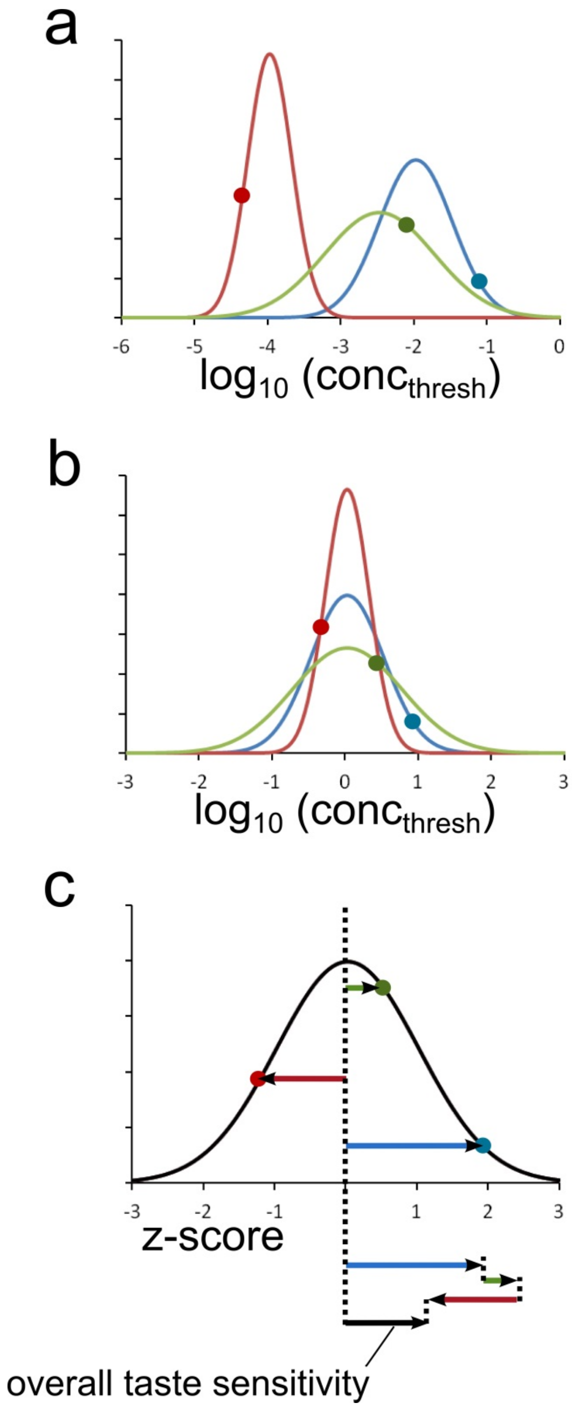

**Figure S3. Effect of OTS correction on GWAS p-values for PROP, quinine and caffeine detection thresholds.** The panels show scatter plots in which the changes in p-value resulting from OTS correction ($\Delta p = p_{\text{OTS corrected}} - p_{\text{non-corrected}}$) are plotted against the respective p-value prior to correction for each of the SNPs included in the GWAS. Positive Δp-values indicate an association that is strengthened as a result of OTS correction. The dotted line represents the threshold for genome-wide significance and highlighted in red are SNPs showing genome-wide significance after OTS correction. The plots were generated using the results from the discovery cohort (504 subjects). Panels **a**,**b** and **c** show the results of this analysis for PROP, quinine and caffeine detection threshold respectively. Panel **d** shows the results of a bootstrapping test to determine if the observed boost for highly associated p-values could occur by chance. For this we randomly shuffled caffeine detection thresholds across subjects followed by a GWAS with both uncorrected and OTS corrected randomized thresholds. This procedure was repeated 100 times and all p-values were plotted.

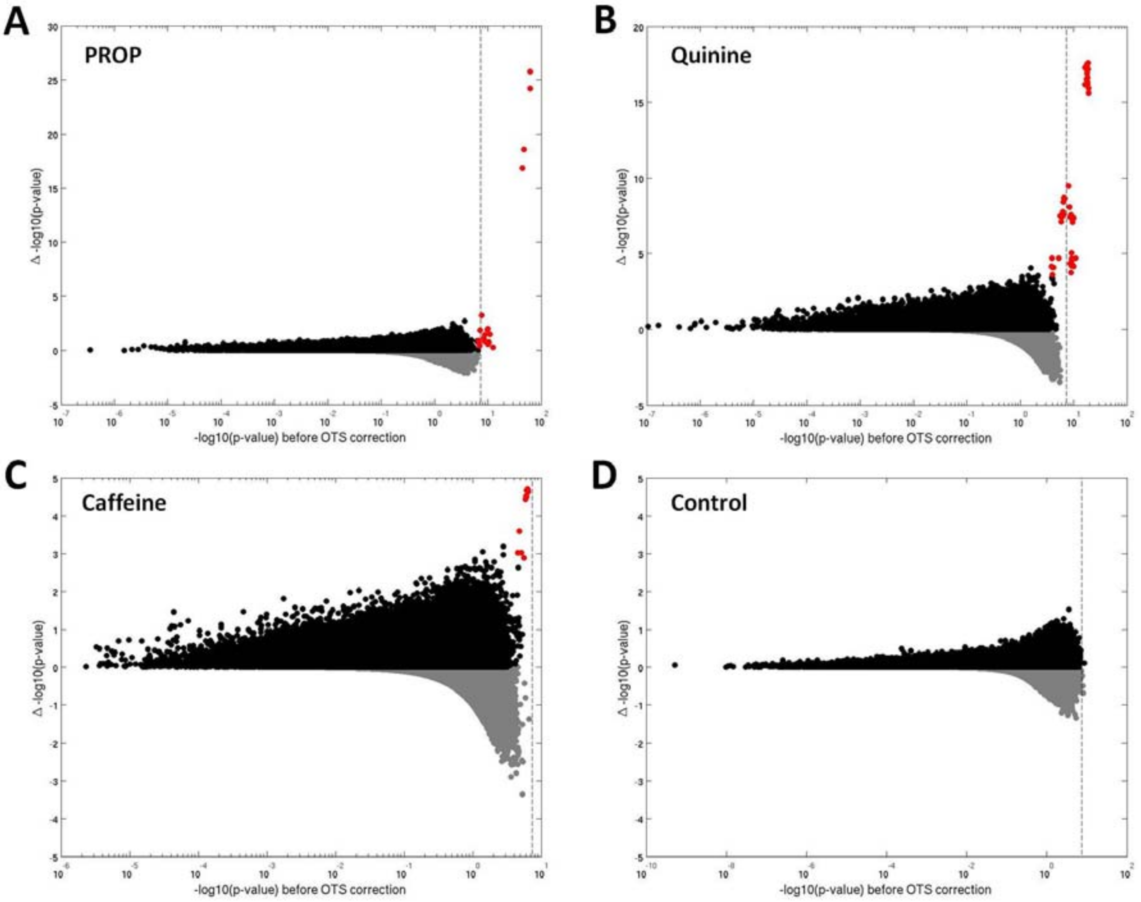

**Table S1.** GWAS results with $\log_{10}$-transformed caffeine and quinine thresholds for all sequenced SNPs in the bitter taste receptor cluster on chromosome 12 (104 subjects). Associations are filtered for MAF > 5%, pHW > $10^{-5}$ and call rates > 0.90.

MAF : Minor allele frequency ; pHW : Hardy-Weinberg p-value

* Based on human genome build 36.1

| | | | | | | Caffeine | | Quinine | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SNP name | Chr* | Position* | MAF | pHW | Call rate | p | $r^2$ | p | $r^2$ | Function | Functional class |
| **NRC932** | 12 | 11081963 | 7.0% | 3.5E-01 | 0.91 | 4.5E-01 | 0.6% | 1.4E-01 | 2.4% | intron | neutral |
| **NRC65** | 12 | 11129812 | 8.9% | 2.2E-01 | 0.91 | 9.5E-01 | 0.0% | 5.4E-04 | 12.1% | intron | |
| **NRC415** | 12 | 11066845 | 9.5% | 1.9E-01 | 0.91 | 3.3E-01 | 1.1% | 8.0E-03 | 7.5% | | |
| **NRC795** | 12 | 11142550 | 10.1% | 1.6E-01 | 0.91 | 9.6E-01 | 0.0% | 3.6E-01 | 1.0% | intron | |
| **NRC2065** | 12 | 11142551 | 11.4% | 1.1E-01 | 0.91 | 9.7E-01 | 0.0% | 7.2E-01 | 0.1% | missense | |
| **rs35972994** | 12 | 11081079 | 13.3% | 5.4E-02 | 0.91 | 8.0E-01 | 0.1% | 1.6E-01 | 2.2% | intron | |
| **NRC204** | 12 | 11081594 | 16.5% | 1.3E-02 | 0.91 | 4.3E-02 | 4.5% | 1.0E-02 | 7.0% | | |
| **NRC1789** | 12 | 11129152 | 19.6% | 2.2E-03 | 0.91 | 4.8E-01 | 0.6% | 6.9E-01 | 0.2% | intron | |
| **rs11054160** | 12 | 11053800 | 26.6% | 1.0E-05 | 0.91 | 5.7E-02 | 4.0% | 1.1E-02 | 6.9% | intron | |
| **rs7135941** | 12 | 11042236 | 29.1% | 4.3E-05 | 0.91 | 5.1E-02 | 4.2% | 8.6E-03 | 7.3% | intron | |
| **rs2888682** | 12 | 11093467 | 38.0% | 1.5E-02 | 0.91 | 4.1E-01 | 0.8% | 6.6E-06 | 18.9% | intron | |
| **rs2600333** | 12 | 11142297 | 39.2% | 1.0E-02 | 0.91 | 5.0E-01 | 0.5% | 4.1E-05 | 16.2% | | |
| **rs2255156** | 12 | 11110793 | 49.4% | 8.3E-04 | 0.91 | 2.3E-01 | 1.6% | 4.7E-02 | 4.3% | missense | |
| **rs2255155** | 12 | 11110795 | 49.4% | 8.3E-04 | 0.91 | 2.3E-01 | 1.6% | 4.7E-02 | 4.3% | intron | |
| **NRC1768** | 12 | 11076728 | 5.0% | 5.1E-01 | 0.92 | 3.8E-01 | 0.9% | 2.8E-01 | 1.3% | intron | |
| **NRC1974** | 12 | 11066827 | 9.4% | 1.9E-01 | 0.92 | 6.5E-01 | 0.2% | 1.1E-02 | 7.0% | | |
| **rs2597994** | 12 | 11097484 | 40.0% | 3.5E-02 | 0.92 | 2.9E-01 | 1.3% | 2.2E-05 | 17.2% | intron | |
| **rs2599410** | 12 | 11110929 | 49.4% | 5.0E-04 | 0.92 | 3.6E-01 | 1.0% | 2.4E-03 | 9.6% | | |
| **rs2597977** | 12 | 11081128 | 15.4% | 2.0E-02 | 0.93 | 1.2E-01 | 2.7% | 9.5E-02 | 3.1% | missense | |
| **rs10772398** | 12 | 11030856 | 24.1% | 1.5E-01 | 0.93 | 1.0E-01 | 2.9% | 4.7E-01 | 0.6% | intron | neutral |
| **rs12311490** | 12 | 11038848 | 28.4% | 2.4E-05 | 0.93 | 1.7E-01 | 2.1% | 1.3E-02 | 6.6% | missense | |
| **rs11054158** | 12 | 11053554 | 28.4% | 2.4E-05 | 0.93 | 2.3E-01 | 1.6% | 9.5E-03 | 7.2% | intron | |
| **rs10772419** | 12 | 11064757 | 37.7% | 1.9E-02 | 0.93 | 3.5E-01 | 1.0% | 2.6E-05 | 16.9% | intron | |
| **rs2599394** | 12 | 11092896 | 38.3% | 3.7E-02 | 0.93 | 4.6E-01 | 0.6% | 6.7E-06 | 18.9% | | |
| **rs2708363** | 12 | 11144422 | 41.4% | 7.2E-03 | 0.93 | 3.0E-01 | 1.2% | 3.4E-06 | 19.9% | intron | |
| **rs10845298** | 12 | 11112695 | 49.4% | 3.0E-04 | 0.93 | 2.5E-01 | 1.5% | 7.2E-03 | 7.7% | intron | |
| **NRC1323** | 12 | 11099244 | 9.8% | 1.7E-01 | 0.94 | 3.6E-01 | 0.9% | 5.2E-01 | 0.5% | intron | |
| **NRC2107** | 12 | 11142729 | 13.4% | 4.7E-02 | 0.94 | 6.6E-01 | 0.2% | 1.6E-01 | 2.3% | intron | |
| **rs12371085** | 12 | 11068028 | 15.2% | 2.1E-02 | 0.94 | 2.4E-01 | 1.6% | 8.2E-02 | 3.4% | intron | |
| **rs3911150** | 12 | 11093515 | 15.9% | 2.7E-01 | 0.94 | 2.4E-03 | 9.6% | 9.8E-01 | 0.0% | intron | |
| **rs9803044** | 12 | 11122809 | 17.1% | 8.4E-03 | 0.94 | 4.3E-02 | 4.5% | 1.4E-02 | 6.4% | intron | |
| **rs7959172** | 12 | 11145474 | 18.3% | 4.4E-01 | 0.94 | 5.6E-01 | 0.4% | 2.8E-02 | 5.3% | intron | |
| **NRC246** | 12 | 11083263 | 21.3% | 5.1E-04 | 0.94 | 2.3E-02 | 5.6% | 2.4E-02 | 5.5% | intron | |
| **NRC2260** | 12 | 11135775 | 22.0% | 3.2E-04 | 0.94 | 3.0E-01 | 1.2% | 2.2E-01 | 1.7% | intron | |
| **rs7304447** | 12 | 11055369 | 26.8% | 5.0E-05 | 0.94 | 2.4E-01 | 1.5% | 8.5E-03 | 7.4% | intron | |
| **rs2597961** | 12 | 11149770 | 37.8% | 4.5E-03 | 0.94 | 4.4E-01 | 0.7% | 2.0E-05 | 17.3% | intron | |
| **NRC2687** | 12 | 11093113 | 5.4% | 4.6E-01 | 0.95 | 4.7E-01 | 0.6% | 9.0E-01 | 0.0% | coding-synon | |
| **NRC437** | 12 | 11143054 | 6.0% | 4.1E-01 | 0.95 | 3.7E-01 | 0.9% | 1.4E-01 | 2.4% | intron | |
| **NRC2622** | 12 | 11099157 | 6.6% | 3.6E-01 | 0.95 | 6.1E-01 | 0.3% | 2.4E-02 | 5.6% | intron | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **NRC1191** | 12 | 11135737 | 7.2% | 3.2E-01 | 0.95 | 3.8E-01 | 0.9% | 1.7E-02 | 6.1% | intron | |
| **NRC342** | 12 | 11093513 | 8.4% | 2.4E-01 | 0.95 | 4.4E-01 | 0.7% | 5.8E-01 | 0.4% | intron | |
| **NRC1309** | 12 | 11135750 | 8.4% | 2.4E-01 | 0.95 | 5.9E-01 | 0.3% | 5.7E-02 | 4.0% | intron | |
| **NRC1526** | 12 | 11030814 | 9.6% | 1.7E-01 | 0.95 | 4.5E-01 | 0.7% | 4.8E-01 | 0.6% | intron | |
| **NRC542** | 12 | 11082011 | 10.2% | 1.4E-01 | 0.95 | 4.9E-01 | 0.5% | 2.0E-02 | 5.9% | intron | |
| **NRC1651** | 12 | 11106661 | 11.4% | 9.6E-02 | 0.95 | 8.6E-01 | 0.0% | 4.3E-01 | 0.7% | intron | |
| **rs35353142** | 12 | 11081113 | 13.9% | 3.8E-02 | 0.95 | 4.1E-01 | 0.8% | 2.3E-01 | 1.6% | | |
| **rs2418305** | 12 | 11109820 | 16.3% | 1.2E-02 | 0.95 | 4.6E-02 | 4.4% | 6.2E-01 | 0.3% | intron | |
| **NRC2566** | 12 | 11135645 | 20.5% | 1.7E-05 | 0.95 | 3.2E-01 | 1.1% | 2.5E-02 | 5.4% | intron | |
| **rs7311538** | 12 | 11055064 | 27.7% | 1.3E-05 | 0.95 | 1.9E-01 | 1.9% | 8.3E-03 | 7.4% | intron | |
| **rs7301234** | 12 | 11042151 | 29.5% | 1.7E-05 | 0.95 | 1.4E-01 | 2.4% | 5.4E-03 | 8.2% | intron | |
| **rs2708366** | 12 | 11142361 | 39.8% | 1.2E-02 | 0.95 | 3.2E-01 | 1.1% | 1.8E-06 | 20.8% | intron | |
| **NRC12** | 12 | 11122800 | 46.4% | 7.4E-02 | 0.95 | 3.5E-01 | 1.0% | 1.5E-02 | 6.4% | intron | |
| **rs3983334** | 12 | 11109786 | 48.2% | 1.0E-03 | 0.95 | 1.9E-01 | 2.0% | 3.6E-02 | 4.8% | intron | |
| **NRC1634** | 12 | 11090715 | 5.4% | 4.6E-01 | 0.97 | 7.1E-01 | 0.2% | 9.4E-01 | 0.0% | intron | |
| **NRC554** | 12 | 11099170 | 6.5% | 3.6E-01 | 0.97 | 3.7E-01 | 0.9% | 1.3E-01 | 2.6% | intron | |
| **rs58622223** | 12 | 11055359 | 7.1% | 2.6E-04 | 0.97 | 2.9E-01 | 1.3% | 4.2E-01 | 0.7% | intron | |
| **NRC73** | 12 | 11055706 | 7.1% | 2.6E-04 | 0.97 | 3.0E-01 | 1.2% | 4.1E-01 | 0.8% | | |
| **NRC941** | 12 | 11081998 | 8.9% | 2.0E-01 | 0.97 | 1.8E-01 | 2.0% | 1.5E-03 | 10.4% | intron | neutral |
| **NRC593** | 12 | 11133701 | 10.7% | 1.2E-01 | 0.97 | 7.5E-02 | 3.5% | 7.8E-01 | 0.1% | intron | |
| **NRC103** | 12 | 11138363 | 13.1% | 5.1E-02 | 0.97 | 6.7E-01 | 0.2% | 1.6E-01 | 2.3% | intron | |
| **NRC1920** | 12 | 11069804 | 13.7% | 4.0E-02 | 0.97 | 5.8E-01 | 0.3% | 6.6E-01 | 0.2% | intron | |
| **rs11612527** | 12 | 11072815 | 14.3% | 1.1E-01 | 0.97 | 9.9E-01 | 0.0% | 1.2E-02 | 6.8% | | |
| **rs7315455** | 12 | 11076336 | 17.3% | 5.9E-01 | 0.97 | 5.2E-01 | 0.5% | 1.2E-02 | 6.8% | coding-synon | |
| **NRC2316** | 12 | 11093523 | 18.5% | 3.4E-03 | 0.97 | 4.5E-01 | 0.6% | 2.5E-01 | 1.5% | intron | |
| **rs10431300** | 12 | 11109681 | 19.0% | 2.3E-03 | 0.97 | 6.5E-02 | 3.8% | 1.6E-02 | 6.3% | intron | |
| **rs2708381** | 12 | 11105412 | 20.8% | 2.1E-01 | 0.97 | 5.7E-01 | 0.4% | 7.9E-03 | 7.5% | intron | |
| **NRC230** | 12 | 11083519 | 21.4% | 4.1E-04 | 0.97 | 3.3E-02 | 5.0% | 3.0E-02 | 5.2% | intron | |
| **rs11054152** | 12 | 11050779 | 28.0% | 3.3E-05 | 0.97 | 2.1E-01 | 1.7% | 8.0E-03 | 7.5% | intron | |
| **rs2597963** | 12 | 11149278 | 39.9% | 1.9E-02 | 0.97 | 4.2E-01 | 0.7% | 2.3E-06 | 20.4% | intron | |
| **rs2708358** | 12 | 11149520 | 39.9% | 2.8E-03 | 0.97 | 3.8E-01 | 0.9% | 1.7E-06 | 20.8% | intron | |
| **NRC319** | 12 | 11091336 | 5.9% | 4.2E-01 | 0.98 | 7.1E-01 | 0.2% | 7.4E-01 | 0.1% | intron | |
| **rs56985810** | 12 | 11066344 | 7.1% | 2.3E-04 | 0.98 | 2.8E-01 | 1.3% | 4.7E-01 | 0.6% | utr-3 | |
| **NRC892** | 12 | 11136001 | 8.2% | 2.4E-01 | 0.98 | 8.3E-01 | 0.1% | 7.9E-02 | 3.4% | intron | |
| **NRC2651** | 12 | 11107247 | 9.4% | 1.8E-01 | 0.98 | 5.8E-01 | 0.3% | 9.6E-01 | 0.0% | intron | |
| **NRC2161** | 12 | 11109780 | 10.6% | 1.2E-01 | 0.98 | 7.7E-01 | 0.1% | 1.6E-02 | 6.3% | utr-5 | |
| **NRC874** | 12 | 11083465 | 15.3% | 1.9E-02 | 0.98 | 6.8E-01 | 0.2% | 5.3E-02 | 4.1% | missense | |
| **rs7296803** | 12 | 11143041 | 15.3% | 1.9E-02 | 0.98 | 7.3E-01 | 0.1% | 7.2E-03 | 7.7% | missense | |
| **NRC1621** | 12 | 11135393 | 17.6% | 4.0E-04 | 0.98 | 6.9E-01 | 0.2% | 1.1E-03 | 10.9% | | |
| **rs4763611** | 12 | 11056384 | 19.4% | 7.8E-02 | 0.98 | 6.1E-01 | 0.3% | 3.7E-03 | 8.8% | intron | |
| **rs11560811** | 12 | 11110637 | 19.4% | 1.7E-03 | 0.98 | 4.2E-02 | 4.5% | 1.0E-02 | 7.1% | utr-3 | |
| **rs3983335** | 12 | 11109802 | 20.0% | 1.1E-03 | 0.98 | 1.7E-01 | 2.1% | 8.4E-02 | 3.3% | intron | |
| **NRC1550** | 12 | 11083314 | 20.6% | 7.2E-04 | 0.98 | 6.2E-02 | 3.9% | 3.2E-02 | 5.0% | missense | neutral |
| **NRC801** | 12 | 11083336 | 20.6% | 7.2E-04 | 0.98 | 3.0E-02 | 5.1% | 1.4E-02 | 6.5% | intron | |
| **NRC939** | 12 | 11083575 | 21.2% | 4.6E-04 | 0.98 | 4.1E-02 | 4.6% | 1.9E-02 | 5.9% | intron | |
| **NRC670** | 12 | 11093748 | 24.1% | 3.4E-05 | 0.98 | 4.7E-01 | 0.6% | 2.2E-01 | 1.7% | missense | |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **NRC1123** | 12 | 11135723 | 27.1% | 1.2E-02 | 0.98 | 8.4E-01 | 0.0% | 3.0E-02 | 5.1% | intron | |
| **rs7304936** | 12 | 11055749 | 27.6% | 2.4E-05 | 0.98 | 1.9E-01 | 2.0% | 6.7E-03 | 7.8% | | |
| **rs2597975** | 12 | 11144064 | 32.4% | 1.9E-05 | 0.98 | 2.9E-02 | 5.2% | 2.1E-01 | 1.8% | utr-3 | |
| **NRC2694** | 12 | 11135657 | 37.1% | 2.7E-01 | 0.98 | 3.0E-01 | 1.2% | 6.3E-03 | 7.9% | intron | |
| **rs2443739** | 12 | 11149713 | 39.4% | 2.1E-03 | 0.98 | 4.4E-01 | 0.7% | 2.4E-06 | 20.4% | intron | |
| **rs10743937** | 12 | 11064722 | 40.6% | 1.5E-03 | 0.98 | 3.1E-01 | 1.2% | 2.4E-06 | 20.3% | intron | |
| **rs2600334** | 12 | 11142972 | 40.6% | 1.1E-02 | 0.98 | 3.4E-01 | 1.0% | 1.2E-06 | 21.3% | missense | |
| **rs12313469** | 12 | 11066354 | 41.2% | 3.7E-03 | 0.98 | 3.3E-01 | 1.1% | 6.4E-06 | 19.0% | intron | |
| **NRC581** | 12 | 11121610 | 47.1% | 8.2E-02 | 0.98 | 4.9E-01 | 0.5% | 4.4E-04 | 12.4% | intron | |
| **NRC2081** | 12 | 11090850 | 5.2% | 4.7E-01 | 0.99 | 7.4E-01 | 0.1% | 6.5E-02 | 3.8% | intron | |
| **NRC1249** | 12 | 11100769 | 5.2% | 4.7E-01 | 0.99 | 1.9E-01 | 2.0% | 6.9E-01 | 0.2% | intron | |
| **NRC1272** | 12 | 11083138 | 5.8% | 4.2E-01 | 0.99 | 9.5E-01 | 0.0% | 1.7E-01 | 2.2% | intron | |
| **NRC2032** | 12 | 11090836 | 10.5% | 1.3E-01 | 0.99 | 5.8E-01 | 0.4% | 3.4E-02 | 4.9% | intron | |
| **rs2708379** | 12 | 11106296 | 10.5% | 1.3E-01 | 0.99 | 1.9E-01 | 1.9% | 9.3E-01 | 0.0% | intron | |
| **rs55748583** | 12 | 11030979 | 14.5% | 1.5E-01 | 0.99 | 9.6E-04 | 11.1% | 7.7E-01 | 0.1% | intron | |
| **NRC982** | 12 | 11149337 | 14.5% | 2.6E-02 | 0.99 | 6.6E-01 | 0.2% | 1.9E-01 | 1.9% | intron | |
| **NRC239** | 12 | 11029834 | 15.7% | 1.5E-02 | 0.99 | 6.3E-01 | 0.3% | 4.9E-01 | 0.5% | intron | neutral |
| **rs11054149** | 12 | 11046217 | 17.4% | 5.1E-01 | 0.99 | 5.7E-01 | 0.4% | 8.9E-03 | 7.3% | intron | |
| **NRC1381** | 12 | 11103640 | 17.4% | 5.6E-03 | 0.99 | 5.6E-01 | 0.4% | 6.2E-02 | 3.8% | intron | |
| **NRC1241** | 12 | 11083478 | 18.6% | 2.7E-03 | 0.99 | 9.3E-02 | 3.1% | 3.1E-02 | 5.1% | intron | |
| **NRC1553** | 12 | 11093692 | 18.6% | 2.7E-03 | 0.99 | 2.1E-02 | 5.8% | 6.9E-01 | 0.2% | intron | |
| **NRC1089** | 12 | 11105627 | 18.6% | 3.3E-01 | 0.99 | 5.2E-01 | 0.5% | 6.9E-03 | 7.7% | intron | |
| **rs11533164** | 12 | 11110698 | 18.6% | 2.7E-03 | 0.99 | 8.5E-02 | 3.3% | 1.3E-02 | 6.6% | intron | |
| **rs35860793** | 12 | 11147923 | 18.6% | 3.3E-01 | 0.99 | 5.2E-01 | 0.5% | 6.9E-03 | 7.7% | missense | |
| **NRC1833** | 12 | 11083608 | 19.2% | 1.8E-03 | 0.99 | 5.3E-02 | 4.1% | 7.6E-03 | 7.6% | missense | |
| **rs7136962** | 12 | 11032237 | 20.3% | 1.8E-01 | 0.99 | 6.6E-01 | 0.2% | 3.6E-03 | 8.9% | | |
| **rs12581501** | 12 | 11045061 | 20.3% | 1.8E-01 | 0.99 | 6.4E-01 | 0.3% | 4.2E-03 | 8.6% | | neutral |
| **rs2597990** | 12 | 11094726 | 20.3% | 2.2E-02 | 0.99 | 3.8E-03 | 8.8% | 6.1E-01 | 0.3% | intron | |
| **rs11531976** | 12 | 11110607 | 20.3% | 1.4E-01 | 0.99 | 4.5E-02 | 4.4% | 2.5E-03 | 9.5% | intron | |
| **NRC1311** | 12 | 11100785 | 22.1% | 2.0E-04 | 0.99 | 2.7E-01 | 1.4% | 3.0E-01 | 1.2% | utr-5 | |
| **NRC913** | 12 | 11092349 | 23.3% | 7.1E-05 | 0.99 | 8.7E-01 | 0.0% | 1.0E-01 | 3.0% | intron | |
| **NRC2721** | 12 | 11092361 | 23.3% | 7.1E-05 | 0.99 | 4.4E-01 | 0.7% | 3.5E-02 | 4.9% | intron | |
| **NRC1551** | 12 | 11099328 | 24.4% | 2.3E-05 | 0.99 | 1.4E-01 | 2.4% | 4.1E-01 | 0.8% | intron | |
| **rs10845284** | 12 | 11049566 | 27.3% | 1.8E-05 | 0.99 | 2.5E-01 | 1.5% | 4.9E-03 | 8.4% | intron | |
| **rs10732561** | 12 | 11062104 | 32.6% | 6.9E-04 | 0.99 | 2.6E-02 | 5.4% | 2.8E-01 | 1.3% | intron | |
| **rs2597984** | 12 | 11091001 | 32.6% | 4.4E-05 | 0.99 | 3.1E-02 | 5.1% | 2.4E-01 | 1.5% | intron | |
| **rs2708377** | 12 | 11107582 | 32.6% | 6.9E-04 | 0.99 | 3.6E-02 | 4.8% | 2.1E-01 | 1.8% | intron | |
| **rs2597981** | 12 | 11083557 | 38.4% | 1.3E-01 | 0.99 | 3.5E-01 | 1.0% | 9.2E-07 | 21.7% | intron | |
| **rs2708319** | 12 | 11092308 | 39.0% | 5.8E-02 | 0.99 | 4.1E-01 | 0.8% | 8.2E-07 | 21.8% | intron | |
| **rs2443094** | 12 | 11142205 | 41.3% | 6.3E-03 | 0.99 | 3.6E-01 | 0.9% | 6.3E-07 | 22.2% | intron | |
| **rs2597973** | 12 | 11144393 | 41.3% | 6.3E-03 | 0.99 | 3.7E-01 | 0.9% | 3.7E-07 | 22.9% | intron | |
| **rs2708361** | 12 | 11147927 | 41.3% | 6.3E-03 | 0.99 | 3.6E-01 | 0.9% | 6.0E-07 | 22.3% | | |
| **NRC958** | 12 | 11135699 | 46.5% | 1.1E-01 | 0.99 | 1.2E-01 | 2.6% | 7.0E-03 | 7.7% | intron | |
| **rs9777856** | 12 | 11094589 | 5.2% | 4.7E-01 | 1.00 | 6.7E-01 | 0.2% | 5.3E-02 | 4.1% | | |
| **NRC1821** | 12 | 11105566 | 5.2% | 4.7E-01 | 1.00 | 4.7E-01 | 0.6% | 1.3E-01 | 2.6% | intron | |
| **NRC869** | 12 | 11110575 | 5.2% | 4.7E-01 | 1.00 | 1.0E-01 | 3.0% | 3.3E-01 | 1.1% | intron | |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **NRC1757** | 12 | 11058487 | 5.7% | 4.2E-01 | 1.00 | 5.5E-01 | 0.4% | 1.2E-01 | 2.7% | | |
| **NRC988** | 12 | 11109747 | 5.7% | 4.2E-01 | 1.00 | 2.7E-02 | 5.3% | 6.1E-01 | 0.3% | intron | |
| **NRC1727** | 12 | 11092430 | 6.3% | 3.7E-01 | 1.00 | 5.7E-01 | 0.4% | 3.5E-01 | 1.0% | intron | neutral |
| **NRC1663** | 12 | 11110574 | 6.3% | 3.7E-01 | 1.00 | 6.4E-02 | 3.8% | 4.6E-01 | 0.6% | intron | |
| **NRC673** | 12 | 11105713 | 6.9% | 3.3E-01 | 1.00 | 6.3E-01 | 0.3% | 6.6E-01 | 0.2% | intron | deleterious |
| **NRC488** | 12 | 11074360 | 8.0% | 2.5E-01 | 1.00 | 7.2E-01 | 0.1% | 2.1E-01 | 1.8% | | |
| **NRC1341** | 12 | 11067579 | 9.8% | 1.5E-01 | 1.00 | 3.6E-01 | 1.0% | 7.1E-01 | 0.2% | intron | |
| **NRC1900** | 12 | 11074336 | 9.8% | 1.5E-01 | 1.00 | 7.6E-01 | 0.1% | 8.0E-01 | 0.1% | intron | neutral |
| **NRC2307** | 12 | 11099384 | 9.8% | 1.5E-01 | 1.00 | 8.9E-01 | 0.0% | 3.4E-01 | 1.0% | intron | |
| **NRC1696** | 12 | 11147880 | 9.8% | 1.5E-01 | 1.00 | 9.3E-01 | 0.0% | 5.2E-01 | 0.5% | intron | |
| **NRC663** | 12 | 11067557 | 10.3% | 1.3E-01 | 1.00 | 3.3E-01 | 1.1% | 7.6E-01 | 0.1% | intron | |
| **NRC2184** | 12 | 11105889 | 10.3% | 1.3E-01 | 1.00 | 3.4E-02 | 4.9% | 9.3E-01 | 0.0% | intron | |
| **NRC1102** | 12 | 11092390 | 10.9% | 1.1E-01 | 1.00 | 6.8E-01 | 0.2% | 8.2E-01 | 0.1% | intron | none |
| **NRC2555** | 12 | 11099402 | 11.5% | 8.7E-02 | 1.00 | 7.3E-01 | 0.1% | 2.7E-01 | 1.4% | intron | |
| **NRC647** | 12 | 11098032 | 12.1% | 7.0E-02 | 1.00 | 4.9E-01 | 0.5% | 3.2E-01 | 1.1% | intron | |
| **NRC2182** | 12 | 11142997 | 12.1% | 7.0E-02 | 1.00 | 4.1E-01 | 0.8% | 2.2E-01 | 1.7% | utr-3 | |
| **NRC112** | 12 | 11058671 | 12.6% | 5.6E-02 | 1.00 | 1.2E-02 | 6.8% | 1.5E-01 | 2.3% | missense | |
| **NRC2200** | 12 | 11041321 | 13.2% | 5.0E-02 | 1.00 | 6.4E-01 | 0.3% | 2.5E-01 | 1.5% | intron | |
| **NRC273** | 12 | 11094917 | 13.8% | 3.5E-02 | 1.00 | 8.7E-02 | 3.3% | 7.5E-01 | 0.1% | intron | |
| **NRC908** | 12 | 11065569 | 14.4% | 2.7E-02 | 1.00 | 8.7E-01 | 0.0% | 1.4E-01 | 2.5% | intron | neutral |
| **NRC341** | 12 | 11074458 | 14.4% | 1.4E-01 | 1.00 | 8.5E-04 | 11.4% | 8.0E-01 | 0.1% | coding-synon | |
| **NRC2591** | 12 | 11135912 | 14.9% | 2.0E-02 | 1.00 | 4.5E-01 | 0.6% | 4.6E-04 | 12.4% | coding-synon | |
| **NRC868** | 12 | 11094932 | 16.1% | 1.1E-02 | 1.00 | 1.5E-02 | 6.4% | 3.7E-01 | 0.9% | intron | deleterious |
| **NRC476** | 12 | 11030202 | 16.7% | 5.2E-01 | 1.00 | 7.8E-03 | 7.5% | 9.3E-01 | 0.0% | | |
| **NRC2154** | 12 | 11065639 | 16.7% | 8.3E-03 | 1.00 | 3.8E-01 | 0.9% | 5.5E-02 | 4.1% | intron | |
| **rs7978808** | 12 | 11143651 | 17.2% | 6.0E-03 | 1.00 | 2.9E-01 | 1.3% | 1.9E-02 | 6.0% | utr-5 | |
| **rs10845294** | 12 | 11074553 | 17.8% | 6.8E-02 | 1.00 | 5.2E-01 | 0.5% | 4.8E-03 | 8.4% | intron | |
| **NRC2401** | 12 | 11105295 | 17.8% | 4.2E-03 | 1.00 | 5.5E-01 | 0.4% | 9.5E-01 | 0.0% | intron | |
| **rs10845289** | 12 | 11058493 | 18.4% | 3.4E-01 | 1.00 | 4.6E-01 | 0.6% | 8.9E-03 | 7.3% | coding-synon | |
| **NRC328** | 12 | 11083774 | 18.4% | 3.4E-01 | 1.00 | 4.6E-01 | 0.6% | 8.9E-03 | 7.3% | intron | |
| **rs10845288** | 12 | 11055798 | 19.0% | 2.7E-01 | 1.00 | 4.7E-01 | 0.6% | 9.5E-03 | 7.2% | intron | |
| **rs7966304** | 12 | 11094968 | 19.0% | 2.7E-01 | 1.00 | 4.9E-01 | 0.6% | 7.1E-03 | 7.7% | intron | |
| **NRC2621** | 12 | 11135992 | 19.0% | 2.0E-03 | 1.00 | 6.0E-02 | 3.9% | 7.3E-03 | 7.6% | intron | |
| **rs11054148** | 12 | 11045311 | 19.5% | 1.1E-01 | 1.00 | 7.5E-01 | 0.1% | 2.6E-03 | 9.4% | intron | |
| **NRC1374** | 12 | 11074957 | 19.5% | 1.4E-03 | 1.00 | 2.0E-01 | 1.9% | 6.6E-01 | 0.2% | intron | |
| **rs34373072** | 12 | 11080752 | 19.5% | 1.1E-01 | 1.00 | 7.5E-01 | 0.1% | 2.6E-03 | 9.4% | intron | |
| **rs35304582** | 12 | 11091123 | 19.5% | 1.1E-01 | 1.00 | 7.5E-01 | 0.1% | 2.6E-03 | 9.4% | intron | |
| **rs35062230** | 12 | 11092677 | 19.5% | 1.1E-01 | 1.00 | 7.5E-01 | 0.1% | 2.6E-03 | 9.4% | intron | |
| **rs7973242** | 12 | 11099772 | 19.5% | 1.1E-01 | 1.00 | 7.5E-01 | 0.1% | 2.6E-03 | 9.4% | intron | |
| **NRC1681** | 12 | 11105653 | 19.5% | 1.4E-03 | 1.00 | 2.1E-01 | 1.8% | 9.1E-01 | 0.0% | intron | |
| **rs61912112** | 12 | 11147851 | 19.5% | 1.1E-01 | 1.00 | 7.5E-01 | 0.1% | 2.6E-03 | 9.4% | intron | |
| **rs35683753** | 12 | 11051659 | 20.1% | 1.6E-01 | 1.00 | 6.8E-01 | 0.2% | 3.5E-03 | 8.9% | intron | |
| **rs12370363** | 12 | 11074779 | 20.1% | 1.6E-01 | 1.00 | 6.8E-01 | 0.2% | 3.5E-03 | 8.9% | intron | |
| **NRC1750** | 12 | 11080220 | 20.7% | 5.8E-04 | 1.00 | 6.5E-01 | 0.2% | 4.6E-01 | 0.6% | intron | |
| **NRC2115** | 12 | 11106124 | 20.7% | 5.8E-04 | 1.00 | 3.7E-02 | 4.8% | 7.3E-01 | 0.1% | intron | |
| **rs35720106** | 12 | 11135433 | 20.7% | 5.8E-04 | 1.00 | 4.5E-02 | 4.4% | 1.5E-02 | 6.4% | intron | |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **rs11526470** | 12 | 11074808 | 21.3% | 3.7E-04 | 1.00 | 8.1E-01 | 0.1% | 3.5E-06 | 19.8% | intron | |
| **NRC2043** | 12 | 11105722 | 23.0% | 8.2E-05 | 1.00 | 4.3E-01 | 0.7% | 5.4E-01 | 0.4% | intron | |
| **rs11054143** | 12 | 11041586 | 24.1% | 9.5E-01 | 1.00 | 1.1E-01 | 2.8% | 3.4E-02 | 4.9% | intron | |
| **NRC251** | 12 | 11135461 | 24.1% | 1.1E-03 | 1.00 | 2.2E-01 | 1.7% | 1.2E-03 | 10.8% | intron | |
| **NRC1933** | 12 | 11106137 | 24.7% | 1.5E-05 | 1.00 | 1.4E-01 | 2.5% | 5.9E-01 | 0.3% | intron | |
| **rs12226919** | 12 | 11041300 | 28.7% | 1.7E-05 | 1.00 | 1.6E-01 | 2.2% | 2.2E-03 | 9.7% | intron | |
| **rs1817043** | 12 | 11107119 | 32.2% | 5.3E-04 | 1.00 | 3.0E-02 | 5.2% | 2.5E-01 | 1.5% | intron | |
| **rs2257110** | 12 | 11093789 | 32.8% | 9.7E-05 | 1.00 | 3.2E-02 | 5.0% | 2.4E-01 | 1.6% | intron | |
| **rs2597974** | 12 | 11144112 | 32.8% | 9.7E-05 | 1.00 | 3.2E-02 | 5.0% | 2.4E-01 | 1.6% | intron | |
| **NRC287** | 12 | 11121430 | 33.9% | 5.0E-05 | 1.00 | 2.1E-01 | 1.8% | 2.8E-04 | 13.2% | intron | neutral |
| **rs1868769** | 12 | 11066020 | 34.5% | 1.8E-03 | 1.00 | 3.8E-02 | 4.7% | 2.1E-01 | 1.8% | intron | |
| **rs2597991** | 12 | 11094910 | 36.2% | 7.9E-01 | 1.00 | 4.2E-01 | 0.8% | 7.4E-07 | 22.0% | intron | |
| **rs11533168** | 12 | 11117688 | 36.2% | 2.6E-03 | 1.00 | 7.9E-01 | 0.1% | 1.1E-07 | 24.5% | | |
| **rs10845295** | 12 | 11075099 | 37.4% | 1.2E-02 | 1.00 | 4.6E-01 | 0.6% | 2.7E-06 | 20.2% | intron | |
| **rs10772423** | 12 | 11074484 | 38.5% | 4.7E-02 | 1.00 | 3.9E-01 | 0.8% | 1.5E-06 | 21.1% | intron | |
| **rs7134036** | 12 | 11076851 | 38.5% | 4.7E-02 | 1.00 | 3.9E-01 | 0.8% | 1.5E-06 | 21.1% | missense | |
| **rs7134148** | 12 | 11076915 | 38.5% | 4.7E-02 | 1.00 | 3.9E-01 | 0.8% | 1.5E-06 | 21.1% | coding-synon | |
| **rs2708380** | 12 | 11105479 | 38.5% | 4.7E-02 | 1.00 | 4.7E-01 | 0.6% | 2.8E-07 | 23.3% | intron | |
| **NRC2023** | 12 | 11137838 | 38.5% | 1.3E-02 | 1.00 | 6.2E-01 | 0.3% | 9.5E-04 | 11.2% | intron | |
| **rs6488334** | 12 | 11031711 | 39.1% | 1.9E-05 | 1.00 | 7.2E-01 | 0.2% | 4.3E-01 | 0.7% | intron | |
| **rs10772418** | 12 | 11062010 | 39.1% | 8.4E-02 | 1.00 | 3.9E-01 | 0.8% | 1.9E-06 | 20.7% | intron | neutral |
| **rs2597985** | 12 | 11092754 | 39.1% | 8.4E-02 | 1.00 | 4.0E-01 | 0.8% | 7.4E-07 | 22.0% | intron | |
| **rs2044826** | 12 | 11099773 | 39.1% | 8.4E-02 | 1.00 | 4.0E-01 | 0.8% | 7.4E-07 | 22.0% | missense | neutral |
| **rs2597997** | 12 | 11099817 | 39.1% | 8.4E-02 | 1.00 | 4.0E-01 | 0.8% | 7.4E-07 | 22.0% | missense | |
| **NRC1005** | 12 | 11137826 | 40.2% | 1.3E-04 | 1.00 | 6.5E-01 | 0.2% | 3.3E-04 | 12.9% | coding-synon | |
| **rs2599395** | 12 | 11143746 | 40.2% | 1.9E-03 | 1.00 | 4.5E-01 | 0.6% | 3.8E-07 | 22.9% | coding-synon | |
| **rs10772420** | 12 | 11065543 | 40.8% | 4.6E-03 | 1.00 | 3.5E-01 | 1.0% | 1.1E-06 | 21.5% | coding-synon | |
| **rs10845293** | 12 | 11074522 | 40.8% | 4.6E-03 | 1.00 | 3.5E-01 | 1.0% | 1.1E-06 | 21.5% | intron | |
| **rs2443093** | 12 | 11142160 | 41.4% | 1.0E-02 | 1.00 | 3.6E-01 | 1.0% | 5.4E-07 | 22.4% | | |
| **rs2600335** | 12 | 11143187 | 41.4% | 1.0E-02 | 1.00 | 3.6E-01 | 1.0% | 5.4E-07 | 22.4% | | |
| **NRC1108** | 12 | 11121486 | 42.0% | 6.7E-01 | 1.00 | 4.1E-01 | 0.8% | 1.6E-03 | 10.3% | | |
| **NRC227** | 12 | 11135457 | 42.0% | 2.9E-01 | 1.00 | 2.4E-01 | 1.6% | 3.7E-06 | 19.8% | intron | |
| **NRC55** | 12 | 11135416 | 43.1% | 9.2E-01 | 1.00 | 3.0E-01 | 1.2% | 1.8E-02 | 6.0% | intron | |
| **NRC321** | 12 | 11121437 | 44.8% | 3.6E-01 | 1.00 | 4.4E-01 | 0.7% | 6.6E-04 | 11.8% | | |
| **rs10772408** | 12 | 11042866 | 48.3% | 6.6E-01 | 1.00 | 8.8E-02 | 3.2% | 5.2E-01 | 0.5% | intron | |
| **NRC2130** | 12 | 11117757 | 48.9% | 2.2E-02 | 1.00 | 1.3E-01 | 2.6% | 3.4E-03 | 9.0% | utr-3 | neutral |
| **NRC1656** | 12 | 11121670 | 49.4% | 1.4E-03 | 1.00 | 3.7E-01 | 0.9% | 2.9E-03 | 9.3% | | |
| **rs6488335** | 12 | 11031750 | 50.0% | 4.9E-02 | 1.00 | 1.5E-01 | 2.3% | 1.0E-03 | 11.1% | intron | |
| **NRC1312** | 12 | 11121636 | 50.0% | 4.9E-04 | 1.00 | 2.5E-01 | 1.5% | 4.1E-03 | 8.7% | intron | |