Supplemental material

York, J.M. Temperature activated transient receptor potential (TRP) ion channels from Antarctic fishes. *Open Biology*. DOI: 10.1098/rsob.230215
Raw data can be found at the United States Antarctic Program Data Center (https://doi.org/10.15784/601695).

Supplemental Figure Captions

Figure supplement 1: Voltage current relationships for TRPA1b (A, top row) and TRPV1a (C, second row from bottom) across multiple temperatures. Blank, water-injected controls from oocytes incubated at the same temperatures for each respective channel are shown in the second and bottom rows. Colors indicate holding temperatures. Middle panels (B) show TRPA1b and blank curves at 25°C (left side) compared with staurosporine treated oocytes (center, green). Right center plot shows TRPA1b relative conductance curves at 25°C and then at 25°C treated with staurosporine; there was no significant difference between these curves. Reliable conductance curves could not be calculated for TRPV1a so these are not shown.

Figure supplement 2: Increasing osmolarity and pH changes leak and maximum current but not threshold or Q10. Panels show control conditions of 250 mOsm pH 7.4 in black compared to 500 mOsm pH 8.5 in purple for TRPA1b (left side) and TRPV1a (right side); p-values indicate the effect of experimental condition on the dependent variables of threshold (top), Q10 (second row), leak (third row), and maximum current (bottom). Grey bars indicate the percent of cells measured that had no distinct threshold. Note maximum current is not plotted for TRPV1a as it was not a robust measurement given that the threshold of this channel was close to the maximum tested temperature.

Figure supplement 3: Effects of the addition of trimethylamine oxide (TMAO) to the incubation solution. Panels compare oocytes incubated in control incubation solution (black) with incubation solution in which 15% of the osmolarity was from TMAO (orange) for TRPA1b (left side) and TRPV1a (right side); p-values indicate effect of TMAO on the dependent variables shown: threshold (top), Q10 (second row), leak (third row), and maximum current (bottom). Grey bars show the percent of oocytes measured that had no distinct threshold.

Figure supplement 4: TRP channel associated factors (TCAFs) in notothenioids. (A) Maximum likelihood gene tree for TCAFs. Reference TCAF sequences from Gkika et al. (2015) are in black, notothenioid sequences are in blue. Tip labels that are accession numbers refer to accessions from *H. antarcticus* transcriptome (PRJEB26835). Other notothenioid sequences are from NCBI. Support values are from 1000 bootstrap replicates. (B) Count data showing expression of the c40238_g1_i3 isoform that showed expression in the neural tissue but not non-neural tissue in *H. antarcticus* (count data from York and Zakon, 2022; PRJNA758918).

Figure supplement 5: Co-expression of TCAF does not change threshold, Q10, or maximum current of TRPA1b. Comparisons of TRPA1b (black) controls with TRPA1b co-injected with TCAF from G. acuticeps (pink) showing threshold (top left) and Q10 (middle left). P-values indicate significance of co-injection on the dependent variables. Maximum currents of water injected blank oocytes are compared with oocytes injected with TCAF alone and TRPA1b alone and co-injected (bottom left), p-values indicate pairwise comparisons. Example individual response curves are shown on the right, with temperature stimuli in red and current response in black, top panel is a water-injected control, second panel is TCAF alone, third panel is TRPA1b alone, and the bottom panel is TRPA1b co-injected with TCAF.

Figure supplement 6: Oxidation with 1 mM H_2O_2 decreases threshold of activation for TRPV1a but not TRPV1a. Effects of 1500 nM (light blue), 100 µM (medium blue), and 1 mM H_2O_2 (dark blue) are compared to control conditions (black) for TRPA1b (left side) and TRPV1a (right side). Significance of the experimental condition on the dependent variable is indicated by the p-values, the dependent variables shown are threshold (top), Q10 (second row), leak (third row), and maximum current (bottom). Data shown for first activation only.

Figure supplement 7: Kinase inhibitor staurosporine lowers threshold and Q10 of activation for TRPA1b but not TRPV1a. Controls (black) are compared with oocytes treated with staurosporine (light green) or DMSO only (dark green) for TRPA1b (left side) and TRPV1a (right side). Effect of treatment on the dependent variables or the pairwise significance are indicated by the p-values; dependent variables plotted are threshold (top), Q10 (second row), leak (third row), and maximum current (bottom). Grey bars indicate the percent of tested oocytes that showed no distinct threshold.

Figure supplement 8: Reducing cholesterol in the oocyte membrane lowers threshold for TRPA1b. Effects of cholesterol supplementation (dark red), cholesterol reduction with methyl-β-cyclodextrin (MBC; light red), and additive effects of MBC and oxidation (brown) are compared with control oocytes (black). P-values indicate significance of condition on the dependent variable or pairwise comparisons as indicated. Level of current at 10°C is also compared (bottom right). Grey bars indicate the percent of oocytes that show no distinct threshold.

Sequences

>hantTRPM4

ATGAGAGACACAGGAGAAGGAGGAGGCGAACATAAAATCGGCAAATCTGAGAAGGACCAG
AGTTGGATCCCCAAGATCATCAAGAAGAGAGTGTGCACCACCTTTGTAGAAGATTCTCTCAG
TAATGGCGCGCGTTGTCAGTGCGGGGGTGCGAGAGATGACCACGGCTCTGTGGCTCTTGG
AGACTACTTCAGCACAGCGATTGTCAACCGCTGGGACAGTGCCCAGCACTCCTCTGAATAT
CCCACTGATGCCTTTGGGGAGTTGCAGTTTGCAGGAGCCAGCAAGAGGCACAGCTATTACC
TGCGTCTGTCATGGGACACCCAAGCGTCTATGGTCTACACCCTGATGACAGCTCACTGGGG
TCTTTCTGCTCCTAACCTGGTGGTCTCTATAGTGGGTGGAGAAGGCAGGACAAAGGTGAAG
ACTTGGGTACGAGAAGTCCTCCGGCAGGGACTGGTGAAAGCCTCACAAAGCACAGGAGCG
TGGATCCTGACGGCCGGCCTGCGTGAAGGCGTGGGCAGGTGTGTTGGAGAGGCGGTGAG
GGATCATGCCACCGCAGCCTCGTCTGTGTCCCTCAACAAGGTGGTGGCTCTGGGTATCGC
TCCCTGGGGCTTCGTCCACAACCGAGAGCAGCTGGTCAACCCTCAGGGCAGCTTTCCCGC
TAAGTACTACGTTCAGAACACGTCCCGGGACTCCTGTTGCCTGGACAACAACTACCAGGCC
TTCCTGCTGGTGGACGACGGGAGTGTTGAGCGCAGGCAAGAGACTGGATTCAGAGCCAAA
CTGGAGGACTACATCTCCCATCAGCGCACAGGCATCTGGGGCAGCGGCAGCATCGACATC
CCAGTCCTATGTATGCTGATATCAGGGGCGGCAAGCAAGCTGGAGAGAGTGGACCTCTCTC
TGAAGACCTCCATGCCCTGGCTGGTGCTGGCTGGCTCTGGAGGGCTGGCTGACTTCCTGA
GCGACGTCCTGGAGAACCTGTCCTCTGCCCCCACTGCCCAGTCCTCCTCAGAGGGGGAC
GGCGAGGCGGGGCCAAGCGTGGATCTCAAAGACAGAGTCGCGGAACGGGTTAAGAAGCA
CTTCCCCTCTGAAGTGGAGACGGATAAACTAGTTGAGCAGGCTCTGAGCATCTACCAAAAC
AGAGACTTAATTACAATCTACCATGGAGAGCAGGAGAGCCCCAATGAATTTGACACAGTCCT
GCTCAAGGCACTGGTGGGAGCCAGTAAGCATCGAGCGTCTGTTGATGACAGTCCTTACAAT
GAAGAGCTGAAGCTAGCGGTCACATGGAACAGGGTCGACATCGCCAAGAGTGAACTCTTC
AATGGAGACATCCAATGGAGGTATGAAGACTTGGAAGACTCCATGACAGACGCCCTGGTCA
ACGACAAGCCTCAGTTTGTGCGCCTCTTCACGGAGAATGGTCTCAACATTCTGGACTACCT
GACGTATGGCCGGCTGGAGAACCTCTACCGCTCCGTGGCCGACGGGACGGTGCTTTACCA
TCTGCTTCAGCGCCATCTAGTGGAGCGGCTGGGGTATGCAGCCCCTGGACCCACATTAAAC
CTGCAGGACTCCACTAAAGTTGCAGCAGAGAACGTACACAGTGGCAGAGAGACGGATATCA

GCCTTTTTGAGGTTGCAAGGGTCCTGGAACTGTTGATGGGTGATGTCTGCCAGCCGTTTTA
CTACGAAGCCTTGGGATTAGAACAGATCTCATCCAAGAGGAGAGCTCTTAGGCGGGCCAGT
AAGGTGCTGCGAGGAGACTGCGTGTATCGGGACAAGCGCTGTCTCTTCCCCTGGGCTTCG
CTCTTCATCTGGTCTGTCCTCCAGAACCGCAGCAACATGTCCACATTCTTCTGGGAGATGG
CAGCGGAGTCGGTGCTGTGTGCTCTGAGTGGCTGTAAGATCCTGAGGGAAATGTCCAAGC
TGGAGGCCGAGGCTGAGACCAAACTGTCCATGAAAGAGCTGGCCCAGAGGTTTGAGAACC
TGGCACACGACGTCTTCAGCTCTTGCTATCGGAGCGATGAGAGTCGCTCCTTCACGCTGCT
GATTAGGAAATCTCCAGTTTGGGGGGGCACCACCTGCTTACAGATGGGCATGGGCGCTGAT
GCACGACTTTTCTTCAGCCATGACGGAGTGCAGTCTCTGATGTCTCAGATCTGGTGGGGTG
ACATGAAGAGGAGCACAGAGGTGTGGAAGCTCCTGCTCGCCTTCTTCTGCCCCTTCCTCT
GCTACACCAACCTCATCCCCTTCAGGAAACAGAATGACCCGCACCAGGAGGATGAGGGGA
AGCCTAGCGATGACGGACCGGGCCGCGACAGCGACAGCCTCTATGGCGCCACCATCTTCT
CTTTCTCAGACATCAAGCACATTGAAGCTGACACGCAAGGATCACACACTCCAAGGACCGC
AACCATCAAAGGCATACGCCAGACTCACAGACCTCCAAAGCGTCCGTTCATCGTGTCAAGA
TGGCGTCAGTTCTGGTTCGCTCCGGTCACCGCATTTTTGGGCAATGTTATCATGTACTTCCT
GTTCCTGCTGCTCTTTTCCTATGTGCTGCTGGTGGACTTTCTGCCCCCGCCTCCTGCTGGT
CCAGCCATCACTGAGTATGTGTTGTACTTCTGGGTATTCACCATCGTGTGTGAGGAGTTCCG
AGAGACGTTCTTTTTGGGGACAATGAAGACTCTGCGTCAGAAGATCAGAGTGTACATTCAG
GACGTGTGGAACAAGTGTGACCTCGTCGCCATCGTGCTCTTCATCGTAGGAGTAATCCTCA
GGATGTTCGACTGGTCCTATGAATTAGGCCGCGACATCCTGTGTGTGGACTACATGGTCTTC
ACTCTGCGTCTCATTCACATCTTTGCCATTCACAAACAGATGGGACCAAAGATCATCATTGTT
GGCAAGATGATGAAGGACATCTTCTTCTTCCTGTTCTTCCTCATGGTGTGGCTCATGGCATA
CGGAGTAGCCAATCAGGCTTTGCTGTACTCCTACGACCCCAGCTTGGAGCGCATCTTTCGC
CGGGTTTTCTACAGGCCGTACTTGCACATCTTCGGACAGATTCCTGTGGAAGAGATGGATG
TGGGGAAGGCCTGGGACATGCCTTGCACACACAACGTGACATTGATTAAGATGGGCGAGG
AGCCCTGCAGGACGATGTCTAGCAACTGGCTGGTCGTTATTCTGCTGATTGTTTATCTACTG
GTCACCAACATCCTGCTCATCAACCTGCTCATCGCCATGTTCAGCCACACCTTCACTGAAGT
GCAGGGTAACAGTGACATCTACTGGAAGTTCCAGCGCTACAACCTGATCGTTCAGTACCAC
TCCCGTCCTTCCCTGGCTCCTCCGTTCATCATCCTCTCTCACATCAATCTCTTTATCAAGAG
GGTAATCCGCAAGGTGCCTTCTATCAAGATCTACCACTTTGTGTTGCAGTTAAAAGGGAAAG
CAGCCAACAGGCTCATGACGTGGGAAACCATTCAGAAGGAGGACTTCCTGACCGCCCAGA
ACAAGATCCAGAAGAGCAGTGACAGTGAGAGGCTCAAACAGATGTCTGTCAAAGTGGATG
GTGTACTTAAACACATGAGTGAAGGCAGAGACTTCGACCACAGGCTGAGGGCTCTGGAGA
ATGAGATGGAGTACTGTTCGAGTGCTCTCAGCTGGATTGTGGATACTTTGGCACAAGGCAG
CACGTTCAAACCTCCTCGGCCTCCTCCTACAATAAGAGAGGCGTTCCCCTCCTCTTCCCAC
ACTGCC

>gacuTRPA1b
ATGAACTTCGGCAGAGATCTGACCCGACAGACCAGTTGTTACACGTACGTGATTGAAGACG
AAGATCAAGCCCTGGCACCTCTAGATGTATTCGAGTTGGCTGAGAAGGGGGACCTGGCGC
TGCTGGAGAACCTGGTCAGGAAGAACCCTGAGGTCCTGAGTGAGAAAGATGAGTGTGGAG
CGACTCCTCTTCATCACGCCGCCGCGGGGGAACACATCCCCCTCATCCTCTTCATCAACTC
TGTCATCGAGGCGCAGGGTGTGAACAGCTGTGATGAGCATGGGAACGTGCCTCTTCACTG
GGCCGTGGAGAGGAACCGGACGGAGAGCTGCCGGGCGCTCCTGGACCTCGGGGCGGAC
CCAAACCTCCTGAACACGGCCCTGATGTCCCCGCTGCACCTGGCCGTCAGCCTGGGGCAC
AACGACCTGGTGGAGCTGCTCTTGTCCCACAGCACTACGGACATCAATCTGCAGGGAGATC
TGGGAAACACCCCTCTGATCCTGGCCTGCTCCCTCAATAACTACGAGGCTCTCAGCACATT
GATAAAGTATGGAGCGAAGCTTTGCAAACAAAACAAACTCGGACATTTCCCCATTCACGCAG
CTGCCTTCTCCGGTGCAAAAAAAGCCATGGAGGTGATCCTGAACGCCGGTTCGAAGAAAG
GCCACGACATCACGGCTCACATCAACTACCTGGACAAGTCCAACAGCAGTCCTCTGCACCT
GGCCGTACGAGGAGGGAACATCGAGGCCATCACCTTCTGCATCGCTAAAGGGGCCAAAGT

GGACCAGCAACAGCATGACAGGTCGACTCCGCTCCACTTGGCGTGCACGCAGGGAGCCAT
GGAGGTCGTGAAGCTGATGCTCTCCTCTGTAGAACGAGTGGAAGAAATTATCAACCTGACG
GATGGAGCCAATCAGACGCCTCTCCACAGAACCACCATATTTGACCACAAAGAGCTGGCGG
AGTACCTCATTTCTTTGGGTGCAGATCTGAACAGCGTGGACTGTAAAGGACACGCTCCTCT
GCTGCTGGCCACGAGCTGTGGAGCGTGGAGGACCGTCGCTCTTCTTCTGTCCACAGGGG
CGAACGTGAACGTGACAGACCGATGCGGCTGCAACTTCCTTCATCTGGCCATCCTCCAGC
CCAAAGGCCTGAAGAACCTCCCTGAAGAGGTCCTGCAGCTGAGCAGTGTGAAGGGTCTCC
TGAGCTGCAAGGATAGCGACGGCTGCACCCCGCTGCACTACGCCTGCAGACTGGGGGTC
CACGAATGTGTGAAGAACATGCTCGGTCTCTCGGGGCAAGTGGGCCTCGCCTGCAAGTCC
AAGGACAAGAAGTCCGCTCTGCACTTCGCCGCTCAGTTCGGGCGCATCAACACGTGTCAG
CGGTTACTGGAAAGCATCATGGACTCTCGTATTCTGAACGAAGGAGACGAGCGAGGCCTGA
CTCCTCTGCACCTCGCCTCCAGAGAGGGCCACACCAAGGTGGTCCAGCTGCTGCTGCGC
AAAGGAGCCCTCTTCCACAGTGATTACAAGGACTGGACGTGTCTGCACCACGCTGCCTCTG
TAGGATACACACAGACGATGGAAATCCTGCTTTCAGCCAACATCAAGTTACTGGATAAAAAG
GACGAGGACGGGAGCACGGCCCTGCACGTGGCGGCGAAAGCAGGTCACGTTGCTGCGG
TGAACCTCCTGCTGGCTCGGGGTGCAGAAATCACTTTGAACAACAACGACAGCTCCTTTAT
GCACGAAGCTCTGCAGAACGGGAGGAAAGACGTGGTGAACGCAGTCATCGATAGTGACAG
AGTGAGTGAGTCTCTGATCACGTTCACCCCCGGCTCCAGCCGTGAGTGTCCCATATTGGAA
ATGATTGAGTTTCTGCCTGAGACCTACAAGCACCTGATGGACTGCTGTGTGACCGAGTCTG
AGCACGACCACAACAGTCCTGATTATCATATTGATTACAGTTTCCAGTGGCTCCAGGCTCCA
CTCAAAGCCATGAAAATGTATAAAGACAAGAACGTGAAGATCCAGCCGCTCGCTGCGCTCA
ACGCGATGGTGAAGTACAACCGCATCGAGCTCCTCAACCACCCCGTGTGCAAAAAGTACCT
CGCTATGAAGTGGTTTGCGTACGGCAGCACGATTCACATCCTCAACATGGTGATGTACCTGA
TGGGTCTGCTGCCCCTCACTCACCTCATCGTGATGCAGAGACCGGCTCTGAACACCAGCG
ACACCGGAGAGCATCACGTCGTCATGGTGCCCACCTCCTTCGTCGAGCAAACCGTGTTCC
TGTCCTTCTGCATGATGATGGTGTTTGTGATGAACATCTACTTCATAGGGAAGGAGCTGGTG
CAGATATCACAACAGCGCTGGAATTACTTCAAGGATTATTCCAACCAGAGCGACTGGTTTTC
CGCCGTGCTCTCGCTCCTCTTCATCGTCCCCACCATGATGAACGCTGAAGGCTCTCTGCAC
TGGCAGGCTGGATCTCTGGCTGTGTTGAGCTCCTGGATCGGATTCCTGCTTTACCTGCAGA
GGTTTGAAGGTGTAGGAATCTACGTGGTGATGTTCTGGGAGATCATGAGGACGCTGATACG
CATCGTGATGATTTTCCTGTACCTGATGCTAGCGTTCGGATTGGCTTTCCACGCTCTGATGC
TCAACCAGAGAGAGTTTGACAGCGTGCCTCTGTCGGTGGTCCAGACCTTCGTGATGATGGT
GGGCGAGCTGAACTACCAGAACAACTTCCTGGACACGTACCTGAAGAACGAGCTGCCCTT
CGGAGTCCTGACCTACACAATCTTCATAATCTTTGTTCTGCTCATGCCCATCCTGCTGGTCA
ACCTGATGATTGGTTTAGCCGTTGGAGACATTGCTGAGGTGCAAAGAAATGCTGCTCTAAAA
AGAATAGGCATGCAGATTGAGCTGCACACCTCTCTGGAGGACAAGCTGCCGTACTGGTTTA
TGAAGCGAGTCGACAAACCCTCCATCACCGTCTACCCCAACCGCTACTGCTCCAGGAACTT
CCTCAAGGAGTTTTTCACAGGAGAGGAGGAGTCACATGACGTGTGGAGCCGCATGCAGAT
GAAGTCTCAGACCTGCTCCATGCTGGAGAGCGAGATCAAGAAGCAGAAGCTCAGGATGAA
GGAGGTGTCCTGCTTGATGGAGAAGCAGCACACCCTCCTGAAGCTCATCATCCAGAAGATG
GAGATCACGACGGAGGAGAGCGAGGTGGACGGGCCGGCTAACGTCCGAGGAAACGTTTG
GCCGAGCATACCGAAGGCCAAACCTCACGCTCCAGGAATGTCTCGCTGGGTCCCGCTGAT
GAAGGCCCTCGAGGGAAAACAGAGTACGATAAAGAAAGTGTCTTCA

>ncorTRPV1a
ATGGAGAAGTCAGAGATGTTTGGCATCTCTTTGGAGACAGACAACAGGACGATGGAGGAGA
AAGCGCGGCACAGAGCTGCGCATAAGGGCGGTTCAGGCAATGAGCCGCCCAAGGCTCCA
ATGGACACTGATTACCAGGAAGAGATGGAGATCCCCAAGCCTAAAATCAGAATGAATGCCAA
CTTTGACAAAGAGATTCAAGGATTGGATCCCAGTGGAAGCACAGACAACAGGTTTGGTATC
GACAGGCTGTTTGAAGCGGTTGCCAGCAGGGACGTCCAAAAGCTGGACGGCCTGCATCAG
TACCTGCATCGGAACAGGATGAAACTGTCCAACTCTCTGTATCAGTCTTACGGTAAAACGGC

CCTCATGAAGGCTCTGCTGCACCTCATGGATGGCAAAAACGAGACGGTGGAGCTTTTGATC
GACATTTCAGAGAAGATGAAAGACATTAATGAGTTTGTAAATGCGGCCTACACTAACGTCTAC
TACAAAGGTCAGACAGCTCTTCATATAGCCATTGAGAGGAGGAGTCTCTCCTATGTGGAGCT
GCTGCTCAGTAAAGGAGCAGACGTCCACGCCAAAGCCTGCGGAACTTTCTTCCAGCCACA
CGATGGCCCCAACTTCTACTTTGGTGAGCTGCCTCTGTCTCTGGCAGCCTGCACCAACCAG
CCCGACGTAGTGGACTTCCTCATGAAGAGCGAGTACCAACGCGCAAGTGCTGAGCTAACT
GACTCTCATGGAAACACTGTGCTGCACGCCCTGGTGGTGGTGGCTGATAACTCTGCCGATA
ACACAGAGTTTGTTACCAAAATGTATGACCGCATCCTCAAGACCAATGCCGAACTTCACCCC
AAGTCGAAGCTGGAGGACATCGAGAACAACAATGGGCTGACGCCTCTCAAAATGGCTGCC
AAGACTGGCAAGATTGGGATTTTTTCACACATCCTAAAACGTGAATTCCAAGAGAACAAAGC
CAAACATCTGTCCCGTAAGTTCACAGAGTGGGTTTACGGGCCCGTCCAGAGCTCCTTGTAC
GACCTGGCCTCGGTGGACTCGTACCAGGAGAACTCAGTCTTGGATATTCTTGTGTACGGCA
GTGACATTCCTAACCGCCACGAGATGCTCCAGATGGAGCCTCTGAGCCATCTGCTGGACGA
GAAGTGGAAGAAGTTTGCTGGTCGAATGTTTTTCCTCAACCTCCTGGTCTACATCCTGTACC
TGATCAATTTCACCCTTGTGGCCTACAACAAGAAATTTGGGCTGCCGCCGTTTACCCTCGAA
CACACCACTCTGGGTTACCTGTACGTTTCAGGCCAGCTAGTGACAGCGCTGGCAAACTGCT
ATTTCTTTGTCATAGGGGTCATGGACATGTATAGGAAACGGCCGAAGCTGCAGACGTTGCTG
ATTGACGGATATTATGAGATTCTTTTTTTTTTTCAGGGCTTCCTGTTCCTGTTCACAGCCGGG
CTGTATTGGTCGGGGATGGAGCAGTACCTCAGCGTAATGGTGGTGTGTCTCGCTCTCAGCT
GGGTCAACATCCTCTATTTCTCCAGGGGCGACAGACACATGGGCATCTACAGCATCATGATA
CAGAAGATGATCCTCTGTGATATCATGCGCTTCCTCCTTGTCTACATTGTCTTCCTCTTTGGA
TTTTCAGCAGCGGTGGTCAGTCTGCTCATAGAGCCTGCGGGAAACACCACTGTGGTTGAG
ACGCCGGGAAAGGGGCGTTTGTATATTACAGTTGCTCCTGAGGATTGTGTAAAGCCCTCCTA
CAGGAGCATCACCTTCACCATCCTGCAGCTCTTCAAGTTCACAATCGGCATGGGGGACATG
GAATTCATCCAGGACCACAAGAGCAGTGAGGTCTTCTATGTGCTCCTTATCGGGTACATCAT
ACTCACCTACATCCTGTTGCTCAACATGCTCATCGCCCTCATGAACTGCACCGTGGAGAAG
ACCACCAAGGAGAGCACCAGCATCTGGAAGCTACAGAGGGCCATCACCATCCTGGACATG
GAGAAAAGGCTGTCTAGCTGTCTGAGGAAGAGGTTTCGCTGTGGGGTGGAGAAGAACCTC
AGGACTACTCTTGGAGACGACCGTCGCCGGTGTTTCAGAGTGGAGGAAGTCAACTGGAAC
AAATGGAACAGCAACCTGGGCAAAATCAATGAGGATCCGGGGTGCTGGGATCGCGCCCAG
CAGCCTGCAGCGCACACCCCGCCCAACAGAGGGAGGAGCTGGAGAGGCTTTTTCACAGA
GGGCAGTCGGCAGCAGGCATATCAGTCCTCAGAGATGAATCTTCTGAACCCCCCATCGGTC
TAA

>gacuTCAF
ATGTCCAACCAACCCACCCAAAATCAAAATGAAGGGGCCTACCTGTCCCTGATGAAAGGCT
TGAAAGAGCTGGACCTTCGTGGCCCTTGTGTTCCCAGTGACTTGTTGCTGATTGGAGACCA
TTCCTTTCCTTTAGCAATGAACAGCCAAGGCCAGACCCTGATGGCAGCCTCTCTGTACGGC
AGTGGGAGGATTGTGGTCCTCGGTCATGAGGGCTATCTGACCGCTTTTCCTGCTCTGGTAG
AGAACGCTCTGACCTGGCTGAGAGGAGAAGGATCTGACAACCTCACTGTGGGGGTCAACA
ATAAAGTGAAGGCTGTCGCTGATAACCTCAGCAAATCCAGTTTCCAGGTCAAAATGGTTGGT
TCTTTAGGTGACAGCCGGGAGTTTGGTGTCTATGTGACAGATGCCTACAGCATGGGTGCTG
ACATAAAGAACCTGGTGGCATTCATGAAAGCTGGAGGAGGAGTGCTGATAGCCGGTCAGG
CGTGGCACTGGGCTGCAAACCATCCGAAAGAGAACGCGCTGCTGCAATTTGAGGGAAATA
AAGTGTCTGGTGTGGCGGGGATCTACTTCTCTAAGAGTCGTGGTGAGATAGAGTATCTACCT
GTCTACCCTCAGGTTCCATCGTCATGGATGGCTGTGGTAAACGGTAAGGATTTTGAGGATGA
CTTGGAGTTTTTACTCACGGGGGTTTCAGAGTTTGACCTCCAGGGTTCAGCAGTAAGTTCT
GAGATTCTGGTCCACGGCTCGCTTGCCTTTCCTATTGGTACCACCAAGGATGGACAGACGT
TCCTGGCAGGATCCTACTATGGGCAGGGACGAGTCATTGTGATTTCACATGAAGGATTTCTG
GGACGACAGACACTGGCTCCGTTTTGGAACAATGCCATTCATTGGCTGGATGAAGGTCGGC
AGGGGGTCGTTGGAGTAGCATCAGAACATCCCCTCGCTATTCTCAGCAATTCAGGGTTAAA

GTGTGAGAGGACAGAGTTCAAGGAAGGTCTGAGTGTTTTTGTGAGCACAGCGTACAGCAAT
AAACATGCGAAGGAAATCCAAGAGTTTGTGGCAGAGGGAGGAGGCCTGCTGATTGGTGGA
CATGCCTGGAATTGGGCACAGGTACACCCTGGGCAAAACGAACTAACACATTTCCCAGGTA
ACCATATCCTGAACACAATGGGCTTGAGTCTGTTGAGAGGAACAATCGGAGGAGGTTTACA
CAAGGCCCCTGAGCCTAAACAGTTCATCAAAGACAACTACCACTTCCGCCACCTTCTCCAC
CGCTTCTCTGGCCATGTAGCCCATGGGGAGAAACTAAGCAAACATGAGGAGGAAAACCTCA
AACGGCTGGGCAGAGACTGCTCCATCTTCTTGCACATGGATGCCAAGGAATGCTCCTCCTA
TATACAAGTGGTGTCCTCCCTCACTGCCATTGTGATGAAGTCAGGTATGCCTCAGGTGTGTG
ACAGCTGCCCTGTGAAGACTCCCAAAGACCACCTGCTCCTCAGTTTGGCGACAGAGATTTA
TAAGGTCTGCCCAAACCCTGATGCTCTCCTGCCGTACCTCATCAAGGATAACCCCTTGATGC
CGGTTGTCTATAACCACAAAATCAAGACTGATGTTGACACAGCAGCCGAGGAGTGGATCAG
TACAGGTCTCTATCTCTCTCCTGGTATGAAGACCTACATTGCCATGCCTGAAGAGATTGTCAA
CAAGGGCTGGAAGATCCAGATAGGTTGTCAAACAGACCACCTAAATGCTGGAGTGGTAAAG
AGAGCACCGTGTGTTCATGCGCGGTTTACTATAACCGCACAAATGATGCAGGTGTTCAACCT
GTGGGGGGGGCTCATCTACCTTGTGGCTCCTCCCAAAACAAAAGTGGAGGGCCTAGAGGT
CACCGTGCAGATGGCTGTACCTGCGCCATATTATAAATCAGGCGTGACCACACCAGCTGATT
GGTCGTTGCTGCGCACAGCTCCGTCACCCTGGGCAGAGTTGGAGTTTGAAAACATCATCCT
AACCGTACCATCAGATGTTGTTCGCAGTCTGGAGCGCCCTGATGAGCTGGCAACGCTGTG
GGATGAGATCATGAGGAGCATCGCTGATCTGGCGGCCAAACCACACAAATTTCCTCGCAAA
GAACGCTTTGTGACAGATGTGCAGATTTCCCATGGTTTCATGCATGCAGGTTATCCTATCATG
GCACAAAAGGCCACAGCAGCTCAGCTGGTCAGCACTGCCCATATTCGGGGGAAAGGCCTG
TGGGGGCCCATCCATGAACTGGGACACAACCAACAGAGAGGCTGCTGGGAATTCCAACCA
AACACCACAGAGTGCACATGCAACCTGTGGTCAGTGTATGTGCATGAAGAGGTGTTCGGGA
TCGAAAGGGGAAAGGCTCATGGAGCTATGGCTTTAGAAAAACGAAACGGACGGGCAAAGA
CTTACGCTGAGGGGGGCAAGAAACTCGCCACCTGGAGCATGTGGGTGGCCCTGGAGACAT
ACATGCAGCTCCAAGATAAGTTTGGCTGGGATGCCTTTAAGAAAGTGTTTGCTGCCTACTTC
AAGATCAGCTCTCCAAAGGACAACAATGGAAAGATGAACCTGTATGCTGTGACCTTCTCCCA
GACTGTGGGGATGAACCTGTCTGCGTTCTTTAAGTCCTGGGGCTGGCCCATCGACGCAGC
CACTGAGGAGAAACTCAGCACCCTGCCTCTCTGGAGCGACCACCCCATGGTCCAGTATGG
CTGA

>ncorTCAF
ATGTCACATCAACTGGCTCCTTTCTGGAAAAATGCCATCGATTGGTTGGACCAAAGCAGGAA
GGGGGTCATTGGTGTTCAGCCTAACCACAATCTTCTCAGCAAGTCAGGGTTAAAGTACAAG
GAGACGGCGTTCAGGACAGACCTGAGCGTATTTGTGTGTAGAGCGTACGACAATCAGCCTG
TGGAGGAGATCCAAGACTTTGTAGCAGAGGGAGGAGGCCTGCTGATTGGTGGGCATGCGT
GGAACTGGGCACAGTCACAACCTGGAAAAAACCCAATAACAGATTTCTCAGGAAACAAGAT
CCTGAACACATTGGGCTTGAGCCTTATGGCGGCAACCATTCCAGGAGGTTCCTACAAGGCT
ACTGTGCCCAGCCATGAAATGACGTACACCTGCCACTTTCGCAACCTCCTACGCAGCTTTG
CTGGTCATGTTACACAAGGCAAAGAACTCTCCAAGCATGAGGGAAAAAAACTTGAAAAACT
GGGCATGGAGTGTAGCAACTTCCTGATGATGAAGTCTTATGACAGCTACTCCTACACACAGG
TGCTGTCCATCCTCACTGACATTTTGAAGAAGTCTGGCATGCCACAGGTGAGTGTGAAGAA
TCCTGTGAAGAATCCGAAAGACCACCTACTCCTCAGTGTGGGGACAGAGGTTTATAAGGCG
TCCCTGGATCCTGATGCTCTCCTGCCGTACCTCATCAAAGATATTCCTGTGTTGCCAGTTGT
CAAAGAACACAGGATCAGGATTACTGTTAACACAGCAGATGAGAATGAGTGGATCAGTACAG
GTTTGTACCTCTCTCCTGGTATGAAGACAGAGATGATCCTACCAGCAAACATCGTCAACAAG
AACTGGACGATCCAGATAGGTTGCCAAACAGACTATCTGGAACATGATGAGTTGAAGAGAG
CAAGGTCTGTTCATGAGCGATTTCCTGTCACAGCAGAGAAGATGCAGGTGTGGAACCTGTG
GGGGGGGCTCATCTACCTGGTCGCTCCACCCAACACAAAGATGGAAGGGGTAGAGGTCGT
GGTGTCGTTGGCTGTGCGTGCTCCTTACTACAAGTCTGGTGTGACAACAGCAGCTGATTGG
TTGTCGCTGCGCACAGCTCCAGCACCCTGGGCAGAGTTTGAGTTTGACAACATCATCCTTA

CCGTACCATCGGATGTTGTTAGAAAGTTGGAGCGCCCTGATGAGGTGGCAGCGCTGTGGA
ACGACATCATGAAGGGCATTGCAGATCTGGCTGTCATACCACACAAATTCTACCGCAAAGAA
CGTATGGTAGCAGATGAGCAGATTTCTGCCGGTTGGATGCATGCAGGCTATCCAGTCATGAT
ACACACATATTCAGCTGCTGAGCTTTTCGAACCAGATGACGCCAGGGCTGCAGGCCTGTGG
GGAGAAGTTCATGAACTGGGACACAACCAACAGAGAAGCGGCTGGGAGTTCAGACCACAC
ACCACAGAGTGCACATGCAACCTGTGGTCAGTGTATGTGCATGAAGAGGTGCTGGGGCTC
AAAAGAGAAAAGGCTCATCCATCGATGATCTTGACAAATCGGAAGAACACTGTAGATAAGTAT
GTTAAGGGAGGCAAGAATCTCAGCGACTGGAATGTGTGGACGGCCCTGGAGACATACCTG
CAGCTCCAAGGAATATTTGGCTGGGATGCCTTTAAAAAGGTATTTGCTGCCTACCACAAGAT
AAGCAACTACCCCAGTGACAACAGTGGAAAGATGAACCTGTATGCTGAGACCTTCTCCCAG
ACTGTGGAGATGAACCTGTCTGCGTTCTTTAAGTCCTGGGGCTGGCCCATCGACAGAGCCA
CTGAGGAGAAACTCACCCCCCTGCCTCCCTGGAGCGACCACCCCATGCTCAAATATGACTA
A

>hant_c40238_g1_i3
ATGTCCAACCAGCCCACCCAAAATCAAAATGAAGGGGCCTACCTGTCCCTGATGAAAGGCT
TGAAAGAGCTGGACCTTCGTGGCCCTTGTGTTCCCAGTGACTTGTTGCTGATTGGAGACCA
TTCCTTTCCTTTAGCAATGAACAGCCAAGGCCAGACCCTGATGGCAGCCTCTCTGTACGGC
AGTGGGAGGATTGTGGTCCTCGGTCATGAGGGCTATCTGACCGCTTTTCCTGCTCTGGTAG
AGAACGCTCTGACCTGGCTGAGAGGAGAAGGATCTGACAACCTCACTGTGGGGGTCAACA
ATAATGTGAAGGCTGTCGCTGATAACCTCAGCAAATCCAGTTTCCAGGTCAAAATGGTTGGT
TCTTTCGGTGACAGCCGGGAGTTTGGTGTCTATGTGACAGATGCCTACAGCATGGGTGCTG
ACATAAAGAACCTGGTGGCATTCATGAAAGCTGGAGGAGGAGTGCTGATAGCCGGTCAGG
CGTGGCACTGGGCTGCAAACCATCCGAAAGAGAACGTGCTGCTGCAGTTTGAGGGAAATA
AAGTGTCTGGTGTGGCGGGGATCTACTTCTCTAAGAGTTGCGGTGAGATAGAGTATCTACCT
GTCTACCCTCAGGTTCCATCGTCATGGATGGCTGTGGTAAACGGGAAGGATTTTGAGGATG
ACTTGGAGTTTTTACTCACGGGGGTTTCAGAGTTTGACTTCCAGGGTTCAGCAGTAAGTTCT
GAGATTCTGGTCCACGGCTCGCTTGCCTTTCCTATTGGTACCACCAAGGATGGACAGACGT
TCCTGGCAGGATCCTACTATGGGCAGGGACGAGTCATTGTGGTTTCACATGAAGGATTTCT
GGGACGACAGACACTGGCTCCGTTTTGGAACAATGCCATTCATTGGCTGGATGAAGGTCGG
CAGGGGGTCGTTGGTATTGCAGCAAAAAATGCCCTCGCTATTCTCAGCAATTCAGGGTTAAA
GTGTGAGAAGACAGAGTTCAAGGAAGGTCTGAGTGTTTTTGTGAGCACAGCGTACAGCGAT
AAACATGCGAAGGAAATCCGAGAGTTTGTGGCAGAGGGAGGAGGCCTGCTGATTGGTGGA
CATGCCTGGAACTGGGCACAGACACACCCTGGGCAAAACGAACTAACACATTTCCCAGGTA
ACCATATCCTGAACACAATGGGTTTGAGTCTGTTGAGAGGAACAATCGGAGGAGGTTTACA
CAAGGCCCCTGAGCCTAAACAGTTCATCAAAGACAACTACCACTTCCGCCACCTTCTCCAC
CGCTTCTCTAGCCATGTAGCCCATGGGGAGAAACTAAGCAAACATGAGGAGGAAAACCTCA
AACAGCTGGGCAGAGACTGCTCCATCTTCTTGCACATGGATGCCAAGGAATGCTTCTCCTAT
ACACAAGTGGTGTCCTCCCTCACTGCCATTGTGATGAAGTCAGGCATGCCTCAGGTGTGTG
ACAGCTGCCCTGTGAAGACTCCCAAAGACCACCTGCTCCTCAGTTTGGCGACAGAGATTTA
TAGGGTCTGCCCAAACCCCGATGCTCTCCTGCCGTACCTCATCAAGGATAACCCCTTGATG
CCGGTTGTCTATAACCACAAAATCAAGACTGATGTTGACACAGCAGCCGAGGAGTGGATCA
GTACAGGTCTCTATCTCTCTCCTGGTATGAAGACCTACATTGCCATGCCTGAAGAGATTGTC
AACAAGGGCTGGAAGATCCAGATAGGTTGTCAAACAGACCACCTAAATGCTGGAGTGGTAA
AGAGAGCACCGTGTGTTCATGCGCAGTTTACTATAACCGCACAAATGATGCAGGTGTGCAA
CCTGTGGGGGGGGCTCATCTACCTGGTGGCTCCACCCAACACAAAGGTGGAGGGGGCAG
AGGTCGTGGTGCCGATGGCTGTGAGTGCTCCTTACTACAAGTCTGGTGTGACAACTGCAGA
AGATTGGTTGTCACTGCGCACAGCTCCAGCACCCTGGGCAGAGTTTGAGTTTGACAACATC
ATCCTTACCGTACCATCGGATGTTGTTCGAAAGTTGGAGCGCCCTGATGAGGTGGCAGCGC
TGTGGAACGACATCATGAAGGGCATTGCAGATCTGGCTGTCATACCACACAAATTCTCCCGC
AAAGAACGTTTTGTGGCAGATGTGCAGATTTCTGCTGGTTGGATGCATTCAGGCTATCCCAT

CATGATACACACAGATTCAGCTACAGAGCTCTTCAGACTATATTCTGCCAAGACTGCAGGCC
TGTGGGGAGAAGTTCATGAACTGGGACACAACCAACAGAGAAGCTGTTGGGAGTTTAGAC
CACACACCACAGAGGCCACATGCAACCTGTGGTCAGTGTATGTGCATGAAGAGGTGCTGG
GGCTCAAAAGAGAAAAGGCTCATCCATCGATGATCTTGACAAATCGGAAGAACACTGTAGAT
AAGTATGTTAAGGGAGGCAAGAATCTCAGCGACTGGAATGTGTGGACGGCCCTGGAGACAT
ACCTGCAGCTCCAAGAAAGGTTTGGCTGGGATGCCTTTAAGAAGGTGTTTGCTGCCTACCA
ACAGATGAGCAACTTTCCCAGCGAGAACGATGCAAAGATGAACCTGTATGCTGAGACCTTC
TCCCAGACTGTGGGGATGAACCTGTCTGCGTTCTTTAAGGCCTGGAGCTGGCCCATCGAC
AGAGCCACTGAGGAGAAACTCACCCCCCTGCCTCCCTGGAGGGACCACCCCATGCTCAAA
TATGACTAA