**Supplemental Figure 1.** Alignment of exonic sequences and splice junctions of the ARG gene from Mouse (Green), Marmoset (Black), Rhesus Macaque (Red), Chimp (Blue) and Human (Magenta). Sequences begin at the translation start site in Exon 1 and end at the translation stop site in exon 14. Exons are designated in upper case letters; flanking intronic sequences are lower case with ag/gt splice sites in bold,. Mutational changes in the primate genes include premature stop codons (exon 1; highlighted in cyan), frameshifts (exons 2,3,5,8,10, and 13; highlighted in yellow), and splice site changes (exons 5,8,9,10,13 and 14: highlighted in grey). The LINE elements in exons 6 and 11 of the primate genes are in italics and underlined. Exons 4, 7, and 12 are absent from primates. Sequence data is not available for the 3’ end of the marmoset (Exons 13 and 14) and Rhesus (Exon 14) genomes.

**Exon 1**

Mouse: ATGGAGGTTCTTAAAGCTCTACCCTTCATTGTTTTCTTCAGCTACAGTAAATGTGAGTC

Marmoset: ATGAAGACTGCTGAACTCACATCTTTTCTCATTTTCTTCAGCCACATTAAATGTCAATC

Rhesus: ATGAAGACTGTTAAATCCACATCTTTTCTGGTTTTCTTCAGCTACATTAAATGTCAATC

Chimp: ATGAAGACTGCTAAACCCACATCTTTTCTTGTTTTCTTCAGCTACATTAAATGTCAATC

Human: ATGAAGACTGCTAAACCCACATCTTTTCTTGTTTTCTTCAGCTACATTAAATGTCAATC

**Exon 2**

TCTCCAAACAAGTTTACTACATGCAG**gt**agg..........ccc**ag**CCAGGCAGCATGTCAGTGGGCAGG

TCTTTAGAGAAGTTTACTAGAGGCGG**gt**gag..........ctc**ag**CCATAGAGTATATTAATAGCCAGA

TCTTTAGAGAAGTTTATTAGATGCGG**gt**gga..........ttc**ag**CCATACAGTATATTAATAGCCAGA

TCGTTAGAGAAGTTTACTAGATGAGG**gt**gga..........ttc**ag**CCATACAGTATATTAATAGCCAGA

TCGTTAGAGAAGTTTACTAGATGCGG**gt**gga..........ttc**ag**CCATACAGTATATTAATAGCCAGA

ATCACCTGGAGGAGAACTTAGGAGTCAG**gt**gag..........ttc**ag**TGTCAGCATTATGGTGGCTCAG

ATTATCCAGAG**-**AGAATATAAGACACAT**at**ggg..........ttc**ag**CCCCAACATTGTGGTTGCTCAG

ATTACCCAGAG**-**AGAATGTAAGAGACAT**gt**gag..........ttc**ag**CCCCAACATTATGGTTGCTCAT

ATTACCCAGAC-AGAATGTAAGAGACAT**gt**gag..........ttc**ag**CCCCAACATTATGGTTGCTCAG

ATTACCCGGGC**-**AGAATGTAAGAGACAT**gt**gag..........ttc**ag**CTCCAACATTATGGTTGCTCAG

**Exon 3**

TTTCTTCAGGATGCAGCTTATGACCAAGTCCAAACCATAGCTAAAGAGCTGCTGAAGCTTGCTGAAAAGT

TTTCTTCAGAAAGCAACTTATGAAGAAGTACAAACCACAGTTAGAAAGTTGAGAGATTTCAGTGAGAAGC

CTTCTTCAGAAAGCCACTCATGGAGAAGTACAAACCATAGTTAGAAAGTTGAGAGATTTCAATGAGAAGC

TTTCTTCAGAAAGCAACTCATGGAGAAGTACAAACCACAGTTAGAAAGTTGAGAGATTTCAATGAGAAGC

TTTCTTCAGAAAGCAACTCATGGAGAAGTACAAACCACAGTTAGAAAGTTGAGAGATTTCAATGAGAAGC

GTAAGCGTCTCAAACCTGA--GTCACCCTCAGAGTGTGCTCATCAACTG**gt**agg..........aat**ag**G

ACAGGAGCTTTAGGTCACATGGTTACCTTCAGAGTGCACTCACTAATTG**gt**gga..........------

ACAGGACCTTTAAGTCACATGGTTACCTTCAGAATGCACTCACCAATTG**gt**ggg..........------

ACAGGACCTTTAAGTCACATGGTTACCTTCAGAATGCACTCACCAATTG**gt**agg..........------

ACAGGACCTTTAAGTCACATGGTTACCTTCAGAATGCACTCACCAATTG**gt**agg..........------

TGGCTGCCTTCCTTATACACATTTGCAACAACCAAGGCCTGGTGGATAGTCACGTGTTCACTGACTGTTG--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

**Exon 4**

TAAGATGAAAACTGCAGCAAGACTCAGGTGCTTCCTCTCCTACAAGAAAGACGACGCAGACAGCCATGAT

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

ACACCCCTGATTCCAAGGCCTGAACTGACCTGTGAGGTGGCTGCAGAGAATAATGTGTCCCTGAAGGAGA

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

G**gt**aag..........tac**ag**GTTCAGCTATGAAATATCTAGAAGACACCCATTCTTATACGGACCCACT

------..........tac**ag**GTACAGTTATGAAATATCTAGAAGTCATCCATTCTTGTATAGACTCACT

------..........tac**ag**GTACAGTTATGAAACATCTAGAAGTCATCCATTCTTTTATAGACTTCCT

------..........tac**ag**GTACAGTTATGAAACATCTAGAAGTCATCCATTCTTGTATAGACTTACT

------..........tac**ag**GTACAGTTATGAAACCTCTAGAAGTCATCCATTCTTGTATAGACTTACT

**Exon 5**

ATCTTGAGCATGTCTGCTTGCTATGATACAGCTGTTCAGTCATGTTGTCAAGAAGAGAATGAAACAGAGT

CTGCTGACATGTCTACTTGCTAGGAAAACAGCTGTTTAGTAATGTTGCTAAGAAGAAAAGAAGACAGAAT

CTCCTGA-CATGTCTACTTGCTATGAAACAGCTGTTTAGTCATGTTGCCAAGAAGAAAAA-AGACAGAGT

CTCCTGA**-**CATGTCTACTTGCTATGAAACAGCTGTTTAGTCATGTTGCCAAGAAGAAAAGAAGACAGAAT

CTCCTGG-CATGTCTACTTGCTATGAAACAGCTGTTTAGTCATGTTGCCAAGAAGAAAAGAAGACAGAAT

GCCTGCGGACAAAG**gt**att..........tgc**ag**CTAGAACCCATCAGAAAATACATTAGAGGAATATCT

GCCTCTAGATAAAC**ga**ata..........cat**ag**CTAGAATGCA-TT-AAAATATATTAAAGAACTATC-

GCTTCTAGATAAAG**aa**ata..........cac**ag**CTAGAATGCAACA-AAAATACATTAGAGAATTACCT

GCCTCTAGATAAAG**aa**atg..........cac**ag**TTAGAATGCAACA-AAAATATATTAGAGAATTATCT

GCCTCTAGATAAAG**aa**atg..........cac**ag**CTAGAATGCAACA**-**AAAATATATTAGAGAATTATCT

**Exon 6**

GCAAGACATCATCACTTATGTGAAATT(------------------------------------------

TTGTGATATCATAATTCATATGAAATT*ATTTTGAAAAGTGTCAATTCATGTCTTTTGCCCACTTTTTGAT*

TTGAGATATCATAATTTATGTGAAATT*ATTTTGAAAAGTGTTTGTTCATGTCTTTTGCCCACTTTTTGAT*

TTGAGATATCATAATTTATGTGAAATT*ATTTTGAAAAGTGCTTGTTCATATCTTTTGCCCACTTTTTGAT*

TTGAGATATCATAATTTATGTGAAATT*ATTTTGAAAAGTGCTTGTTCATATCTTTTGCCCACTTTTTGAT*

-----------------------------------------------------)GGCACCAAATTCAACG

*AAGGTT----GTTTGTTTTTTCTTATACATTTGCTTAAGTGTCTTATAGATACT*ATAATTAAATTTAATT

*GG-----------CTTTTTTTCTTATATATTT----AAGTTTCTTATAGATGCT*GTAATTAAATTTAATT

*GGGGTT----GTTTGTTTTTTCTTATATATTTGTATAAGTTTCTTATAGATGCT*GTAATTAAATTTATTT

*GGGGTTGTTTGTTTGTTTTTTCTTATATATTTGTTTAAGTTTCTTACAGATGCT*GTAATTAAATTTACTT

AGAAAGTAGCAAGTGCAGT**gt**aag..........tacagAGAGTTGATTCTACTCACCAAAAAGCAACCT

ATGAAGTGGAAAAAGCAGT**gt**aag..........------------------------------------

ATGAAGTAGAAAAAGCAGT**gt**aag..........------------------------------------

ATGAAGTAGAAAAAGCAGT**gt**aag..........------------------------------------

ATGAAGTAGAAAAAGCAGT**gt**aag..........------------------------------------

**Exon 7**

AAAGCTAATTTTTCTGAAATCGCCAAATTGACCATGGATGTTAAAAATCTGCATGAGACCTGTTGTGAGG

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

GGAACACATTAGTGTGTGCCCTGGGCAGG..........ccc**ag**CGCCAGCTTATGAATTACACCTGCTC

-----------------------------..........tat**ag**AACTAGCTTATGAACTACCACTGCTC

-----------------------------..........tat**ag**AGCCAGCTTATGAACTACCCCTGCTC

-----------------------------..........tat**ag**AGCCAGTTTATAAACTACCCCTGCTC

-----------------------------..........tat**ag**AGCCAGCTTATAAACTACCCCTGCTC

TAACCAGGCCATCTTATCCAGCAAGTTTGCTGAGTGCTGTGAACAGCCAGAACCATTCCGCGGGGAGTGC

TAAACAGACTATCCTATCTAGCAAGATCACTCAATCATGTGAACAGCCCGTGCCATTCCAAGGGGAAGGT

TAAACAGGCTATCCTATCCAGCAAGATCACTCAATCCTGTGAACAGCCAATGCCATTCCAAGGAGAAGGC

TAAACAGGCTATCTTATCCAGCAAGATCACTCAATCCTGTGAACAGCCAGTGCCATTCCAAGGGGAAGGC

TAAACAGGCTATCCTATCCAGCAAGGTCACTCAATCCTGTGAACAGCCAGTGCCATTCCAAGGGGAAGGC

**Exon 8**

ATCGTCAACTCAGAAAATGACGACAAGCCTGACCTTTCACCCCTGCCGCTCACAAGGTTTACAGAAGACT

ATA-TCAACTCAGAAAGTGATCACACACCTGACTTTTCATCCCTGCCACTGAATAGTTCTACAGAAGACC

ATA-TTAACTCAGAAAATGCTGACACACCTGACCTTTCATCCCTGCCACT-AGTAGTTCTACAGAAGACC

ATA-TTAACTCAGAAAATGCTGACACACCTGACCTTTCATCCCTGCCACTCAGCAGTTCTACAGAAGACC

ATA-TTAACTCAGAAAATGCTGACACACCTGACCTTTCATCCCTGCCACTCAGCAGTTCTACAGAAGACC

GGTCTGTGTGCCAACAATTCAGCGGCAACCAGGACAGCTTTCTACAGGA**gt**aag..........tac**ag**G

AGTTTGTTTGCAAACAATTCACCTACAAGTAAGAC---TTCCTACAAGA**gt**aat..........tac**ag**G

AGTGTGCATGCAAACAATTCACTTACAAGCAAGAA---TTCCTACAAGT**gt**aat..........aac**ag**G

AGTTTGTATGCAAACAATTCACTTACAAGCCAGAA---TTCCTACAAGC**at**aat..........tac**ag**G

AATTTGTATGCAAACAATTCACTTACAAGCCAGAA---TTCCTACAAGC**at**aat..........tac**ag**G

**Exon 9**

TTTCTTTATGAATACTCAAGAAGACACCTGGAGTTGGCGGTTCCCGTGATCTTAAGAGTCTTTGAAACAT

ATTCCTCATGAATATTCAAAAAGGTATCCAAAGTTGGCAATTCCAGTGGTTTTAAGAGTGGATATAGTAT

TTTCCTTATGAATATTCAAAAAGATATCCAAAGTTGGCAGTTCCAGTGATTTTAAGAGTGGATATAGTAT

TTTCCTTATGAATATTCAAAAAGATATCCAAAGTTGGCAGTTCCAGTGATTTTAAGAGTGGATATAGTAT

TTTCCTTATGAATATTCAAAAAGATATCCAAAGTTGGCAGTTCCAGTGATTTTAAGAGTGGATATAGTAT

ACAAACGTGTATTGGAGAAATGTTGCAAGCTAGAAAACTCCTTGGAATGCCACCAGCCTGGG**gt**gaa...

ATAAAAGTTTATTGAGAAAGTGCTATAAATTAGAAAACCCTTTAGAATGCCATAGCTATGGG**gc**att...

ATAAAAATGGATTGACAAAGTGCTACAAGTTAGAAAACCCTTTGGAATGCTATAGCTGTGGG**gc**aat...

ATAAAAATGGATTGAGAAAGTGCTACAAATTAGAAAACCCTTTGGAATGCTATAGCTGTGGG**gc**aat...

ATAAAAATGGATTGAGAAAGTGCTACAAATTAGAAAACCCTTTGGAATGCTATAGCTGTGGG**ac**aat...

**Exon 10**

.......ttt**ag**AAAGAGATGTTCCAAAAAGTGA---TACTTGAAA-GCCGTGACCAAGTTAAA-ACTTA

.......ttc**ag**AAAAAGATTTTCCAAAGAGTGGTGGTATGTAAAA-GCAATTATTATGTAAAA-AATCA

.......ttc**ag**AAGGAGATTTTGCGAAGAGTGG---TATGTAAAAAGCAATTATCATGTAAAATAATCA

.......ttc**ag**AAGCAGATTTTGCAAAGAGTGG---TATGTAAAAAGCAATTATCATGTAAAA-AATCA

...,,,.ttc**ag**AAGCAGATTTTGCAAAGAGTGG---TATGTAAAAAGCAATTATCATGTAAAAAAATCA

CTGTGACTTACAGAAGCAGCTGGGCAGTAGCAGCTTCCAGGACAG**gt**gtg..........ttt**ag**GCTCA

TTATGATTTACATGAGAAGTCAGGAGATGGTAACTTCCATGACGG**gg**atg..........att**ag**GTTCA

TTACGATTTACATGAGAAGTTAGGAGATAGTAACTTCCATGACAG**gg**gtg..........ttt**ag**TTTCA

TTATGATTTACATGAGAAGTTAGGAGGTAGTAACTTCCATGACAG**gg**atg..........ttt**ag**GTTCA

TTATGATTTACATGAGAAGTTAGGAGGTAGTAACTTCCATGACAC**gg**atg..........ttt**ag**GTTCA

**Exon 11**

CGGTGCTTTATACTAAGAAAGCTCCGCAGCTGTCTGCCCAGGAGCTGGTGGTG(----------------

TAGTCCTTTACAATAAGAAAGCCCCACAATCGTCTGCTCAAGAGTTGGTTGTA*AAATT----AGGCATGG*

TAGTCTTTTACAGTAAGAAAGCCTCACAACCATCTGCTCAAGAGTTGGTTGTA*AAATTAGCCAGGCATGG*

TAGTCTTCTACAGTAAGAAAGCCCCACAACCATCTGCTCAAGAGTTGGTTGTA*AAATTTGGCAGGCATTG*

TAGTCTTCTACAGTAAGAAAGCCCCACAACCATCTGCTCAAGAGTTGGTTGTA*AAATTCGCCAGGCATTG*

----------------------------------------------------------------------

*TGGTGCACACCTGTAATCCCAGCTACTTGGGAGCCTGAGGCAGGAGAATCATTTGAACCCGGGAGATGGA*

*TGGTGCATGTCTATAATCCCAGCTACTTGGGAGGCTGAGGCAGGAGAATTACTTGAACCCGGGAGGTGGA*

*TGATGCATGCCTCTAATCCCAGCTACTTGGGAGGCTGAGGCAGGAGAATTACTCGAACCTGGGAGGTGGA*

*TGATGCATGCCTCTAATCCCAGCTACTTGGGAGGCTGAGGCAGGAGAATTACTTGAACCTGGGAGGTGGA*

----------------------------------------------------------------------

*GGTTGCTGTGAGCTGAGATTGTACCACTGCATATCAGCCAGTGAGACTCTGTCTAAAATAAACAGGCAAA*

*GGTTG*CAGTGAGCCAAGATCATGCCACTGCACTCTAGCCTGGGCAACAGAGTGAGACTCCCGTCTCAAAC

*GGTTGCAGTGAGCCAAGATCGCGCCCCTGCACTCCAGCCTGGGCAACAGGGTG-AGACTCCTGTCTCAAA*

*GGTTGCAGTGAGCCAAGATCGCGCCCCTGCACTCCAGCCTGGGCAACAGGGTG-AGACTCCTGTCTCAAA*

--------------------------------)TTCGTGAAGAAGATGGCAGCGGTTGCCAGGAGATGTT

*CAA---------------ACAAAAAGAGTTGTG*TTCACAAAGATAATGGTAGCTGCTGCCACCAAATGTT

AAAGAAACAAAGAAACAAACAGAGTAGATTGTGTTCACAAAGATGATGGTAGCTGCTGCCACCAAATGTT

*CAA---------------ATAGAGTAGATTGTG*TTCACAAAGATGATGGTAGCTGCTGCCACCAAATGTT

*CAA---------------ATAGAGTAGATTGTG*TTCACAAAGATGATGGTAGCTGCTGTCACCAAATGTT

GCCCATTAAGGGATGAGCTGCAGTCCGCTTGCGTGGAGGACCAG**gt**aag..........aca**ag**ACAAAG

GCCCACTGAGAGATGAGCAACATACCGTCTGCACTGAGAACTAG**gt**aag..........-----------

GCCCACTGAGACATGAGCAACAGTTTGTCTGCACTGAGAACTCA**gt**aag..........-----------

GCCCACTGAGACATAAGCAACAGTTTGTCTGCATTGAGAACTCG**gt**aac..........-----------

GCCCACTGAGACATAAGCAACAGTTTGTCTGCATTGAGAACTCG**gt**aac..........-----------

CTGATTCTTGGAGAGCTGTGCAGAAGACACGGTGGGAAGCCTGTCAATGCAGGAGTGGGCCACTGCTGCG

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

**Exon 12**

ACGACTCCTATGCCTTCAGAAAGCCGTGCTTTGATGACCTGCGAGTCGATGGCACTTACATCTCTCCACC

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

TTTATCTTGTGACCAAGCCATTAGTCTTAAAGAGGACTTGTGCCAAGCTCAGGACGAGGAACTGCAAATG

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

--------------------------------ABSENT--------------------------------

GAAAAGCAGAAgtaag..........ttt**ag**GCTCCTCAGCACCCTGGTGAAGCAGAAGCCCCATGCAGC

----------------..........???

----------------..........tgt**ag**GCTTCTCAGCAACCTTGTGAAGCAGGAACCATGTGCAAC

----------------..........cgt**tg**GCTTATGAGCAACCTTGTGAAGCAGGAACCATGTGCAAC

----------------..........tgt**cg**GCTTCTGAACAACCTTGTGAAGCAGGAACCATGTGCAAC

**Exon 13**

AGAGGATG-TGTTCCATTCCATTGGCGAGAATTTTGTGCAACTGGTGGAGAAGTGCTGCGGTGCACAGAG

-

AG-GGATGCAGTTCCCATCAATTTTTGTGGATTTGATTCACCTGTTGGAGATGTGCTGCCAAGGAAAGAA

AG-GGATGCAGTTCCAATCAATTTTTGTGGATTTGGTTCACCTGTTGGAGATGAGCTGCCAAGGAAAGAA

AG-GGATGCAGTTCCAATCAATTTTTGTGGATTTGGTTCACCTGTTGGAGATGAGCTGCCAAGGAAAGAA

GAGAG-ACGTGTGTTTTCAAGAAGAG**gt**atc..........cct**ag**GGACCTCAACTGATCACGAAGTGC

-

AAGTGAAAGTGTGTTTTCAAGACACA**cc**ctt..........???

AAGTGAAACTGTGTTTTCAAGAGACT**cc**ctt..........caa**ga**GAAAGCAGGAAAGATCAAAAATTG

AAGTGAAACTGTGTTTTCAAGACACT**cc**ctt..........caa**ga**GAAAGCAGGAAAGATCAAAAATTG

**Exon 14**

CAGTCCCTCTTAGAGGCCAGCTCATCCCAGAGCGGGTTGATGTAG

-

-

ACATCCTAA

ACATCCTAA