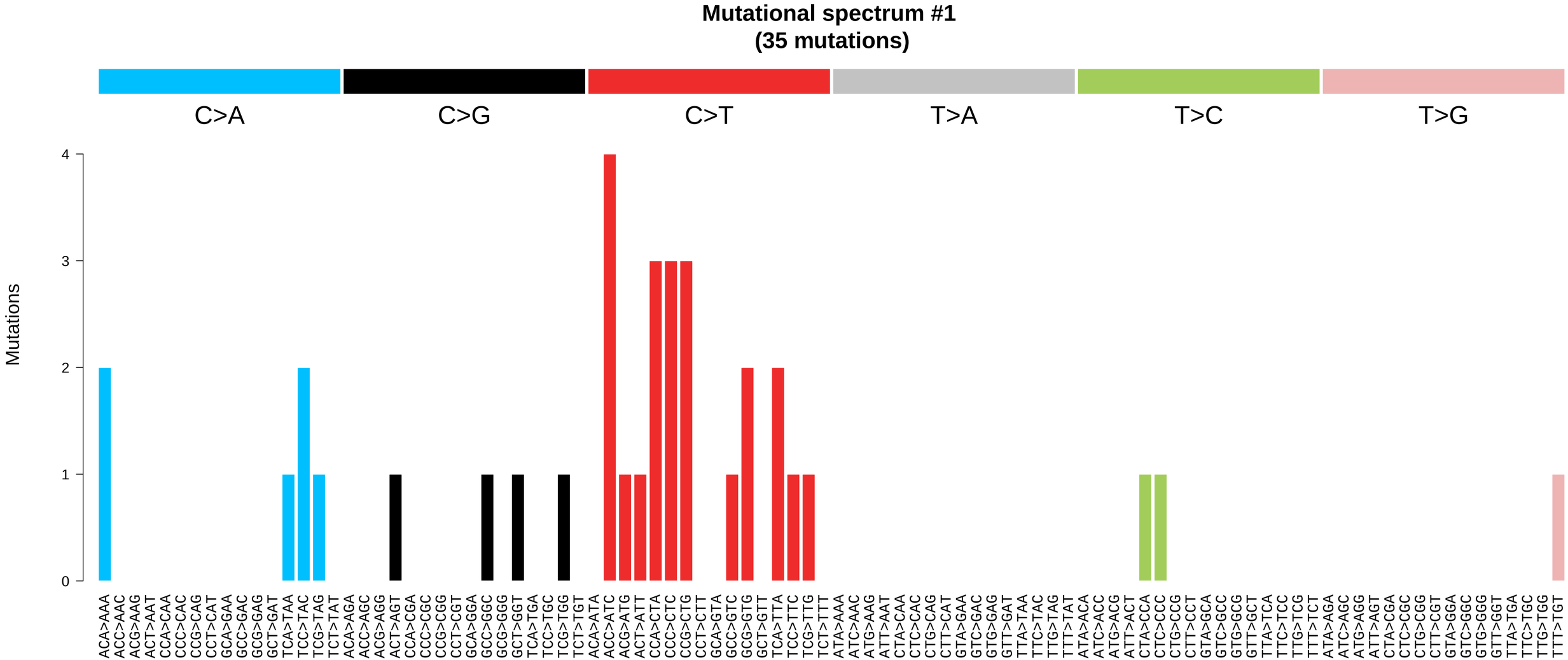
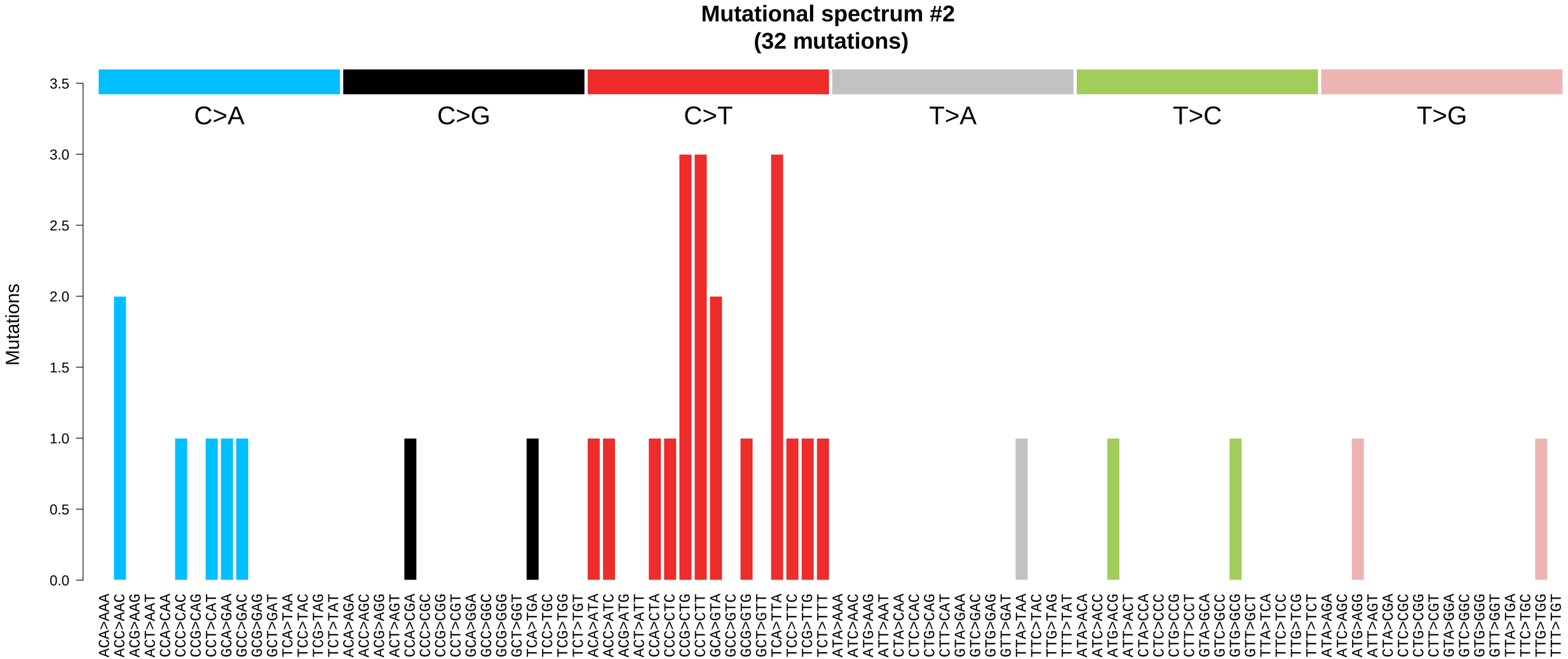
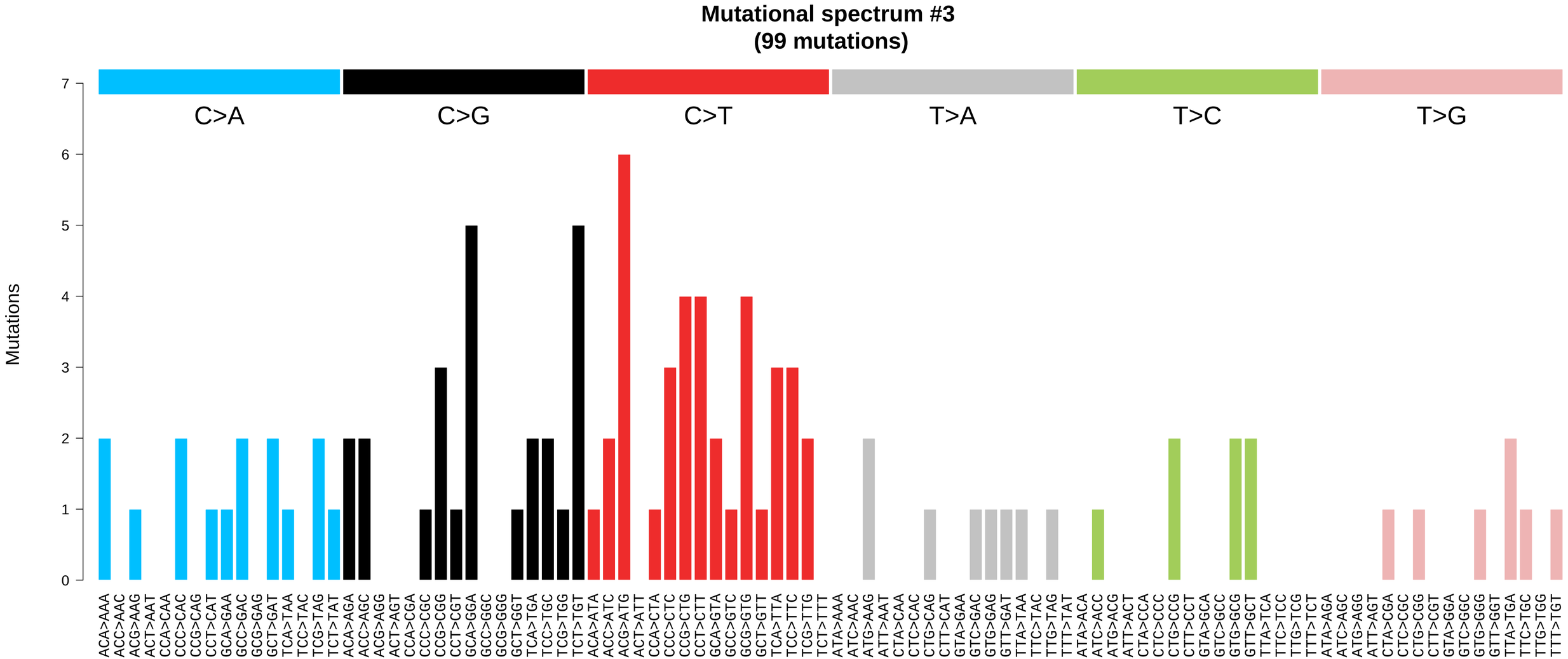
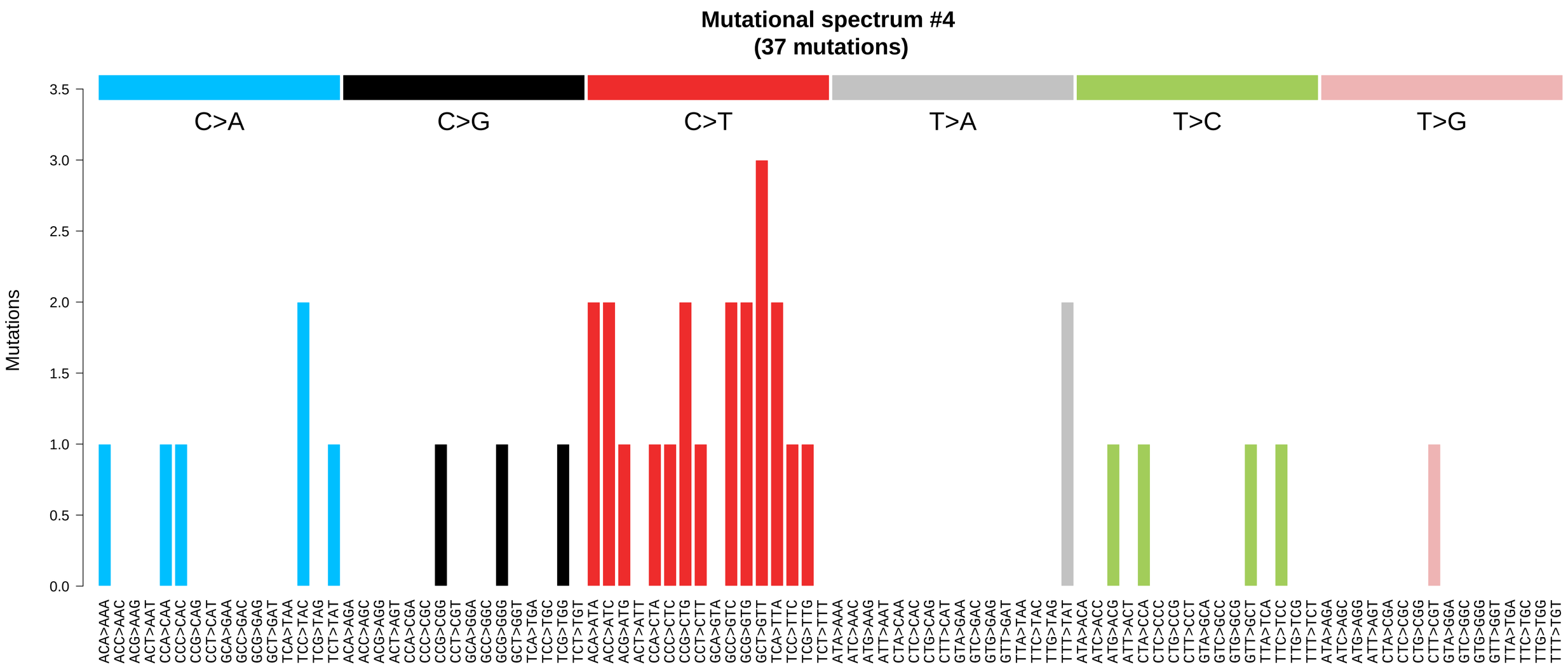
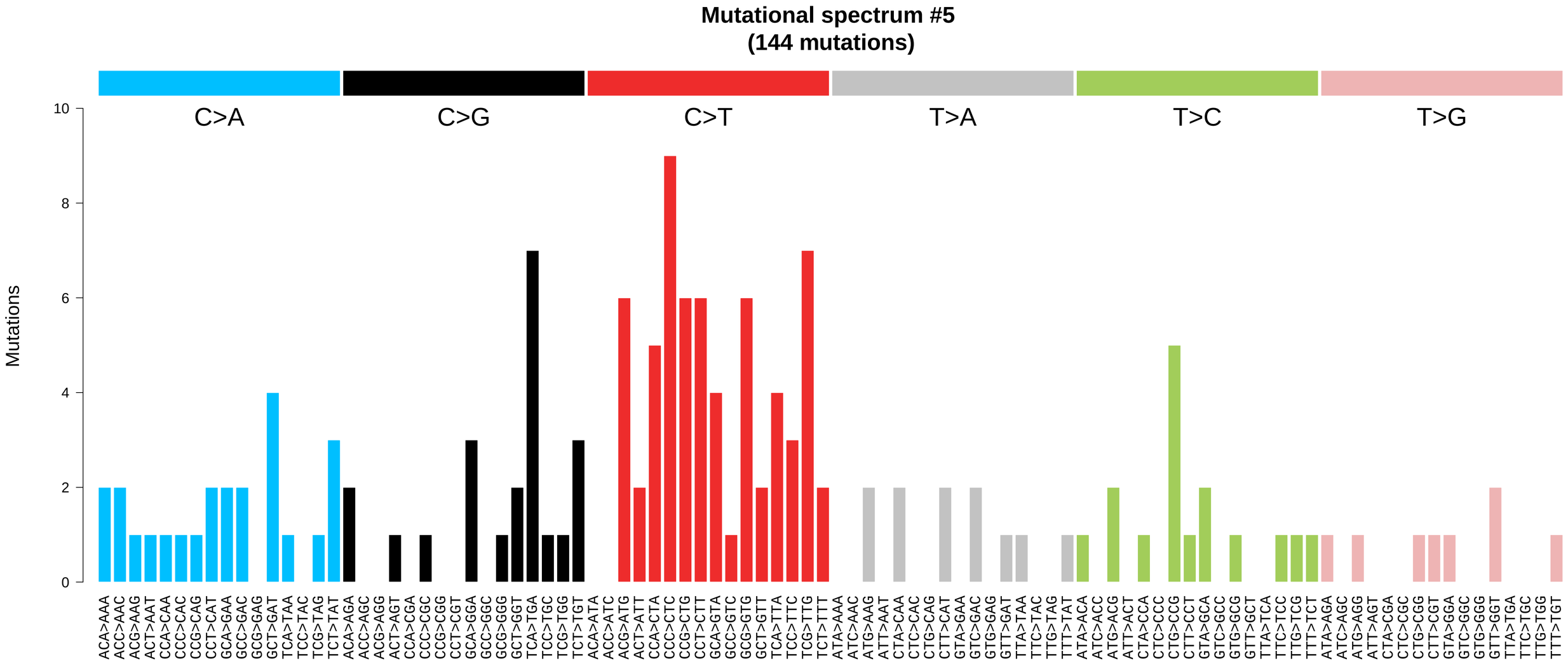
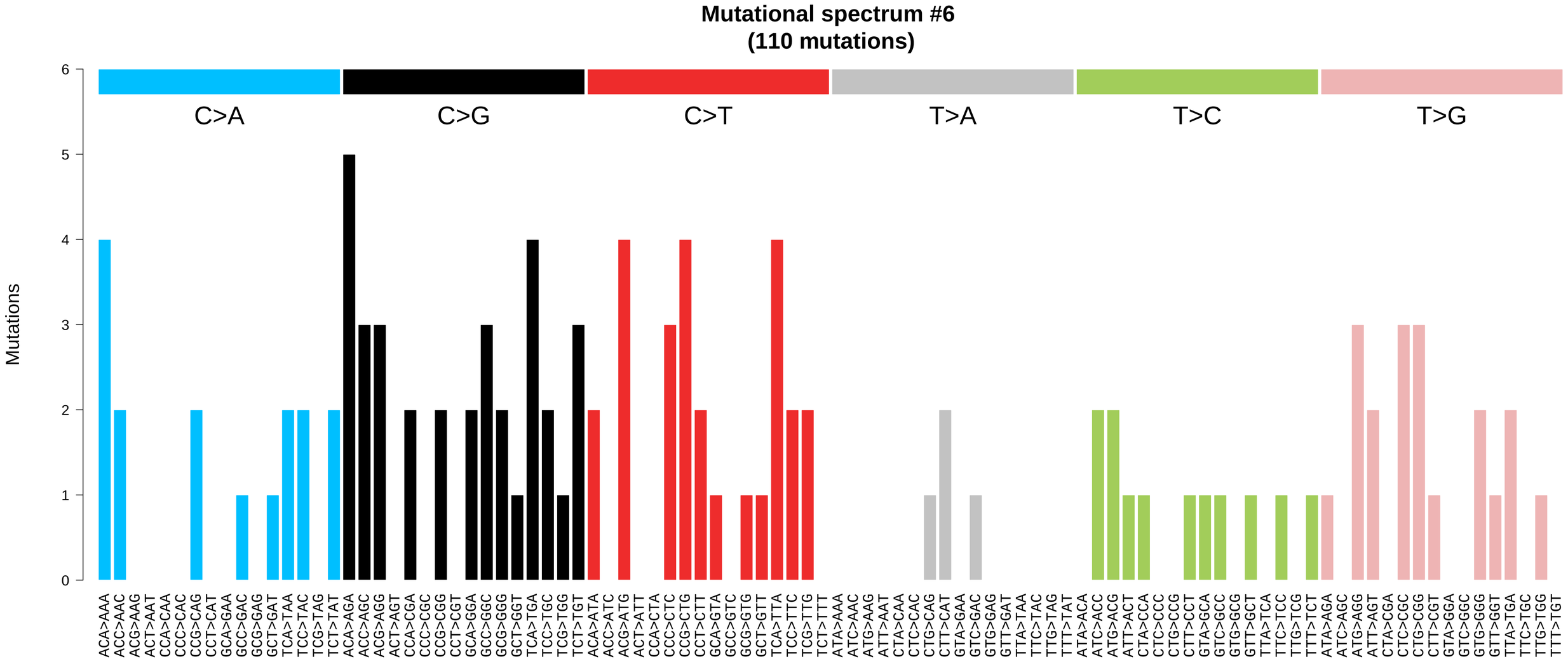

Mutational spectrum #1
(35 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

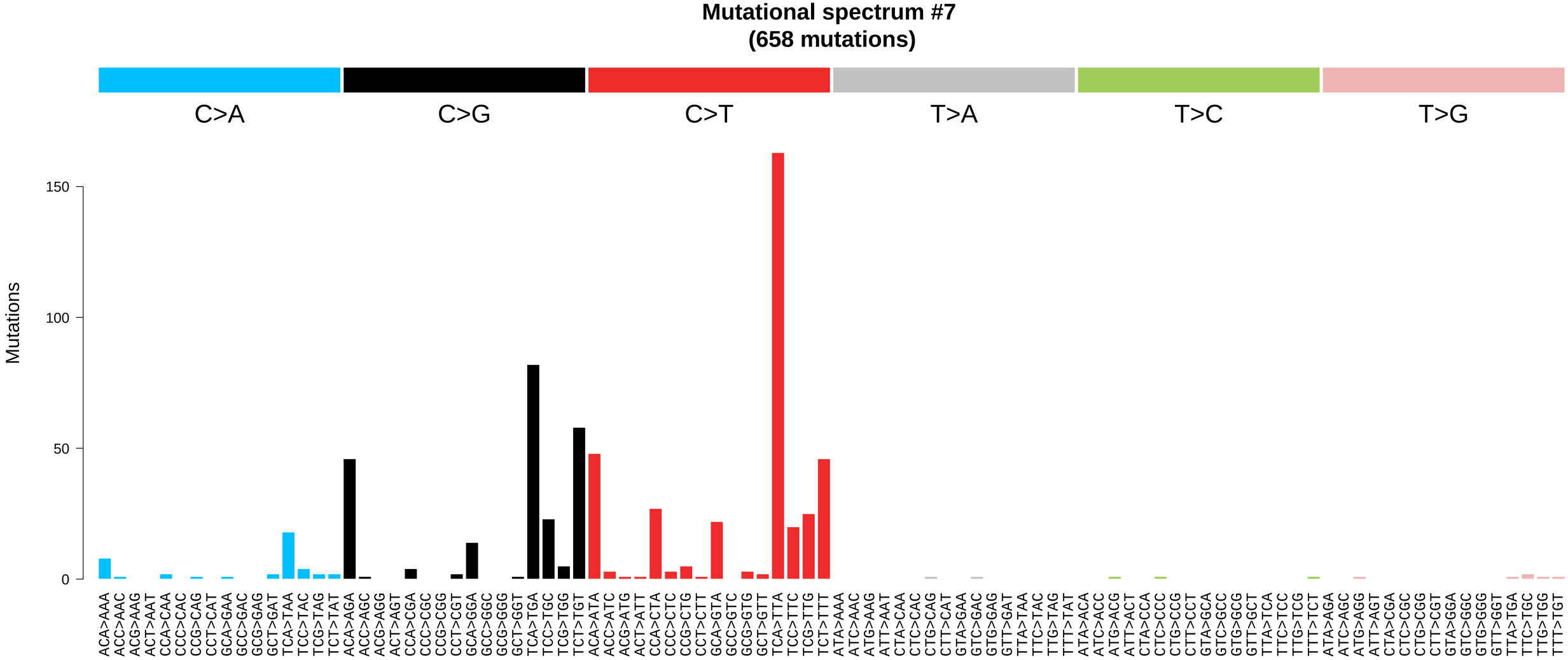

Mutational spectrum #2
(32 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

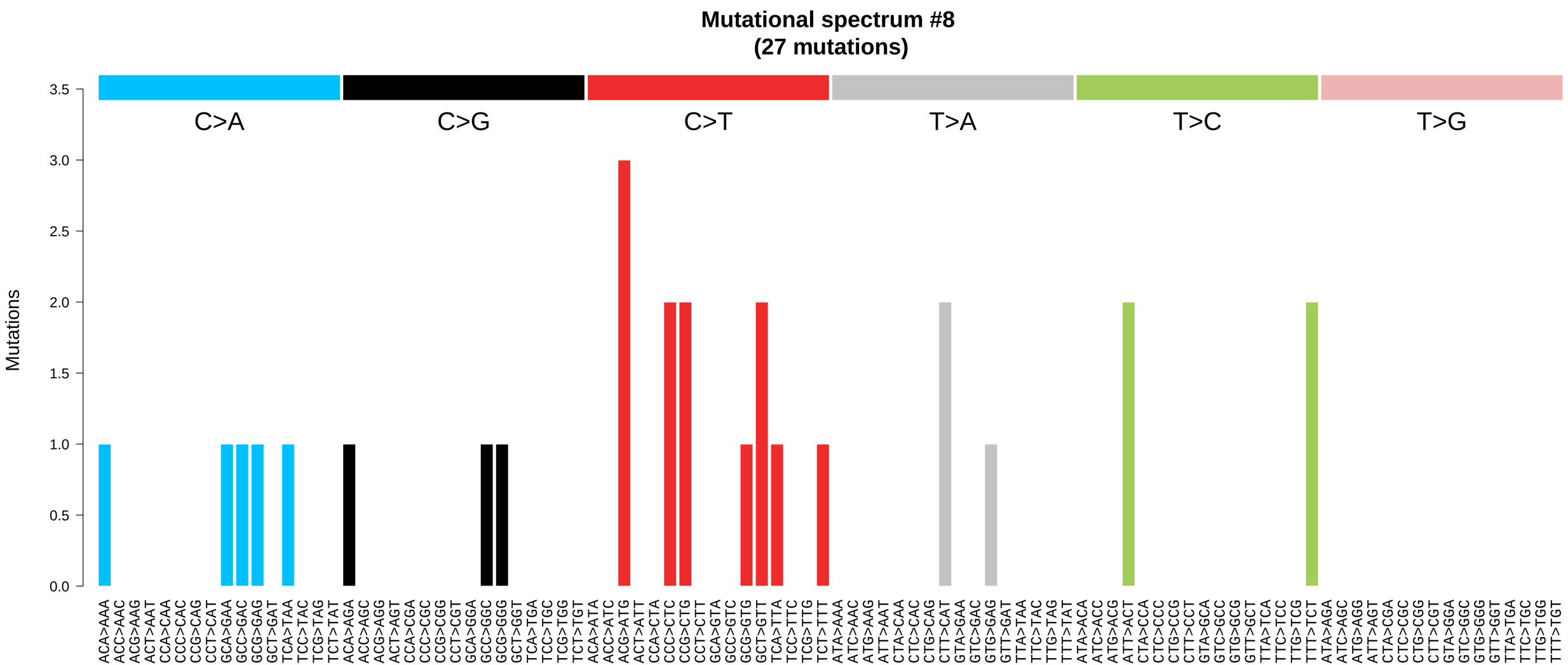

Mutational spectrum #3
(99 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

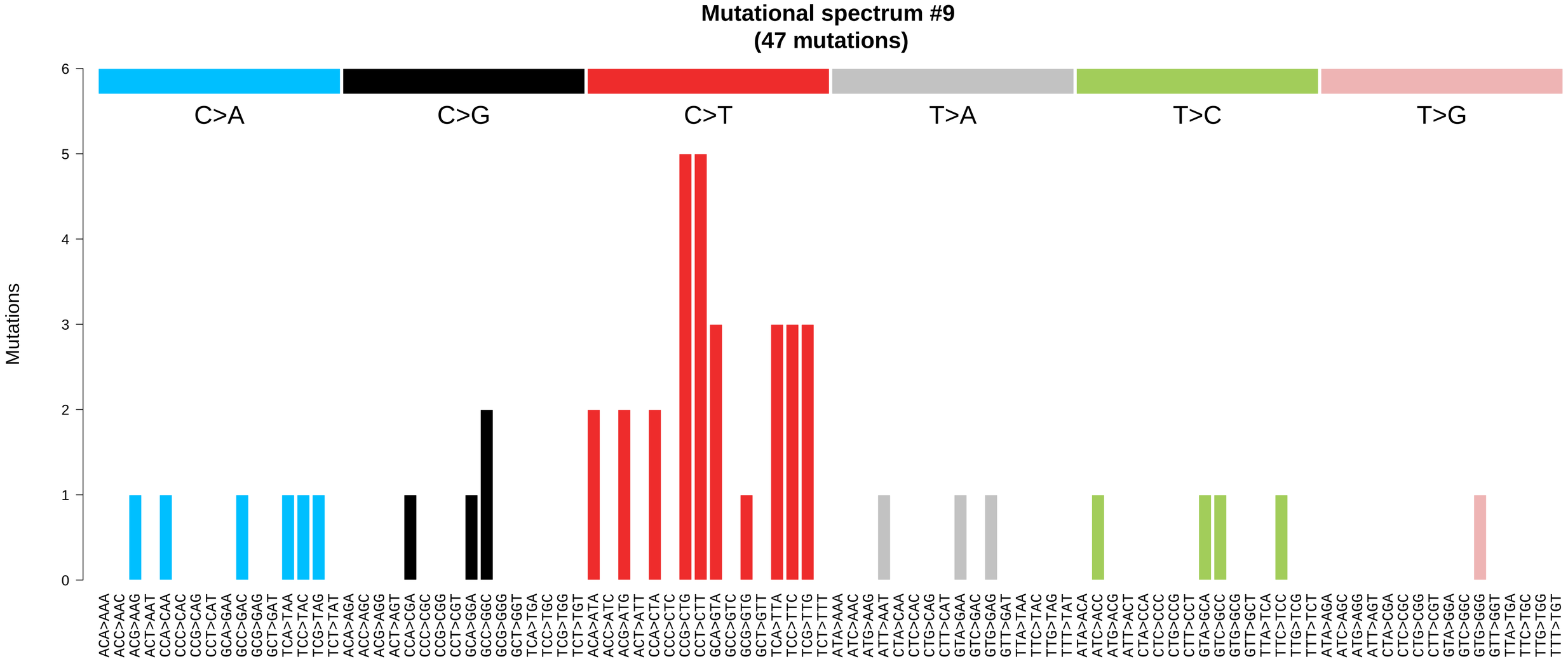

Mutational spectrum #4
(37 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

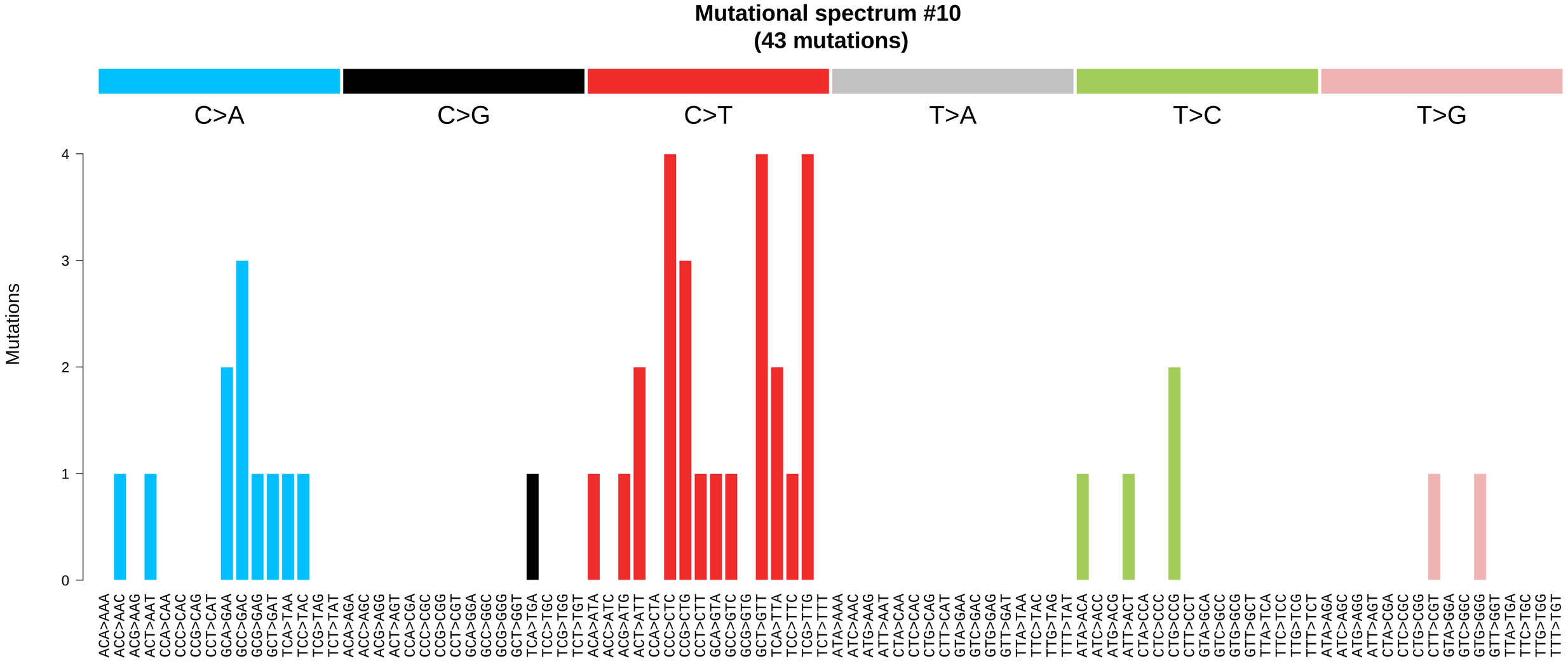

Mutational spectrum #5
(144 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

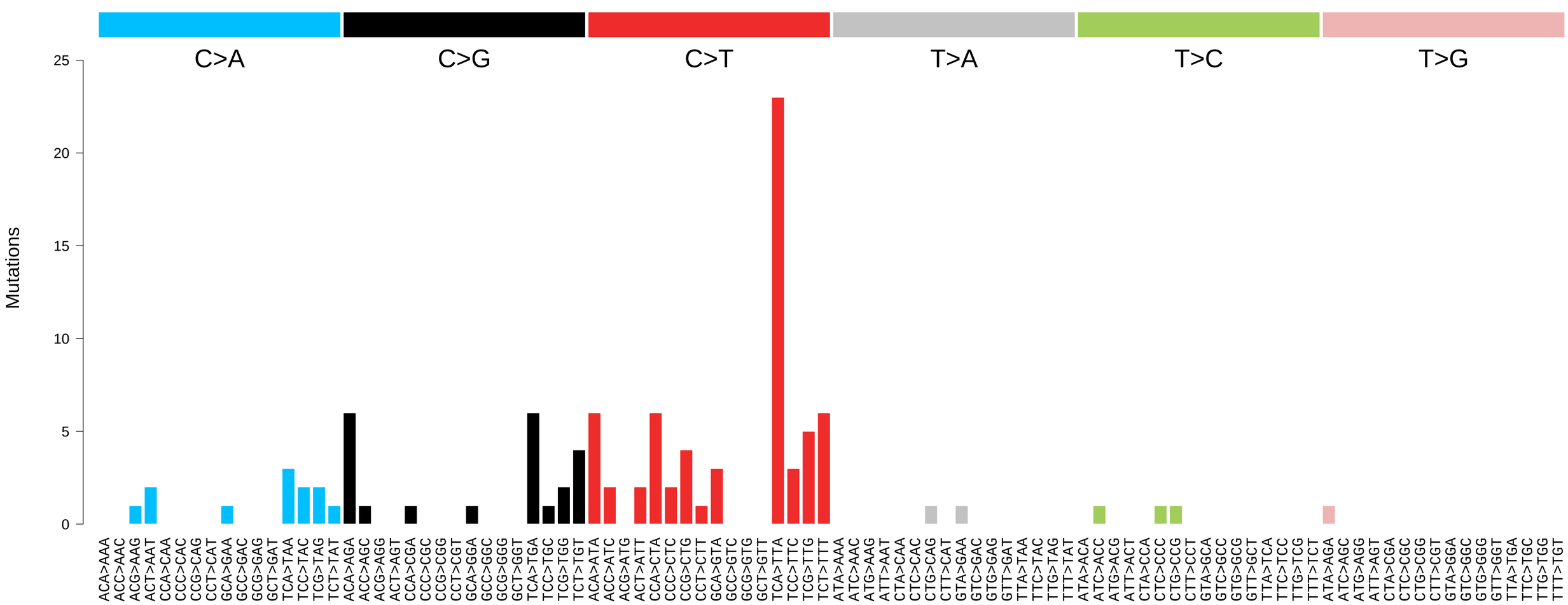

Mutational spectrum #6
(110 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

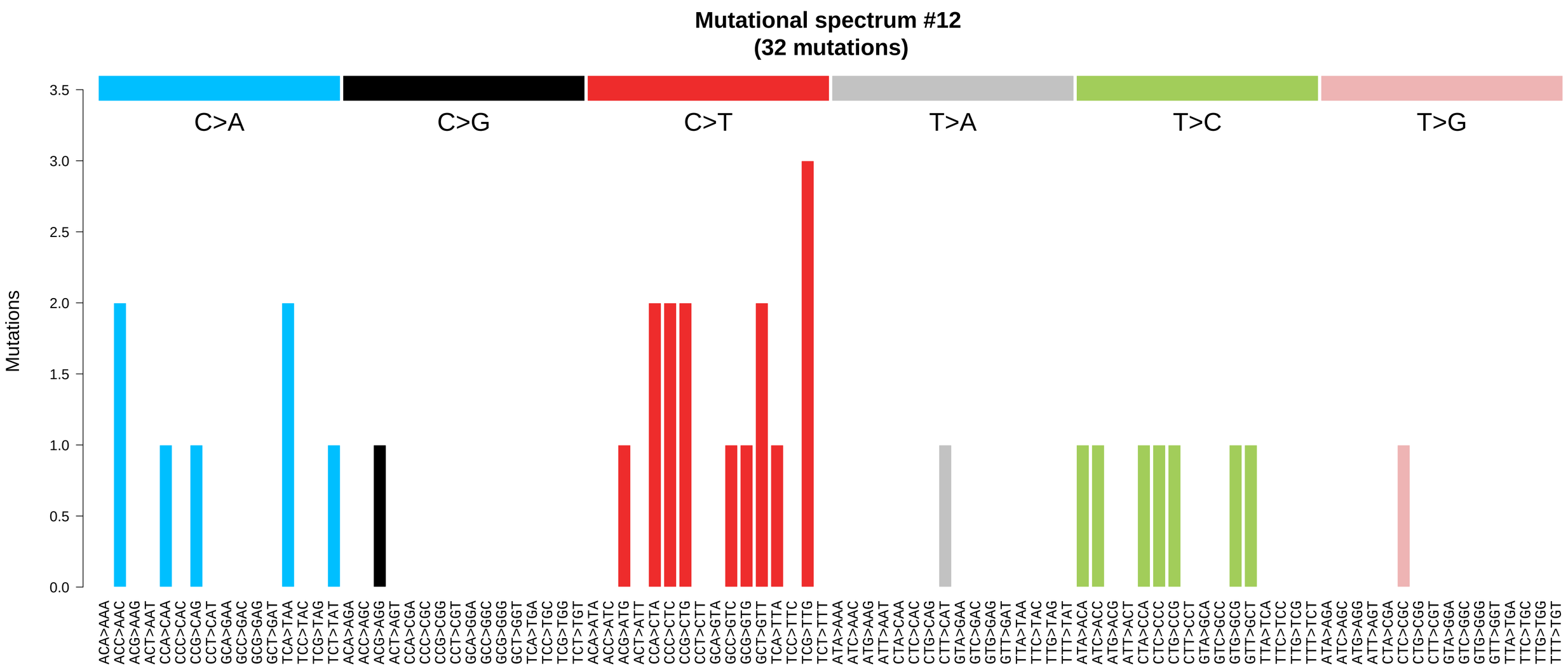

Mutational spectrum #7
(658 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
150
100
50
0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

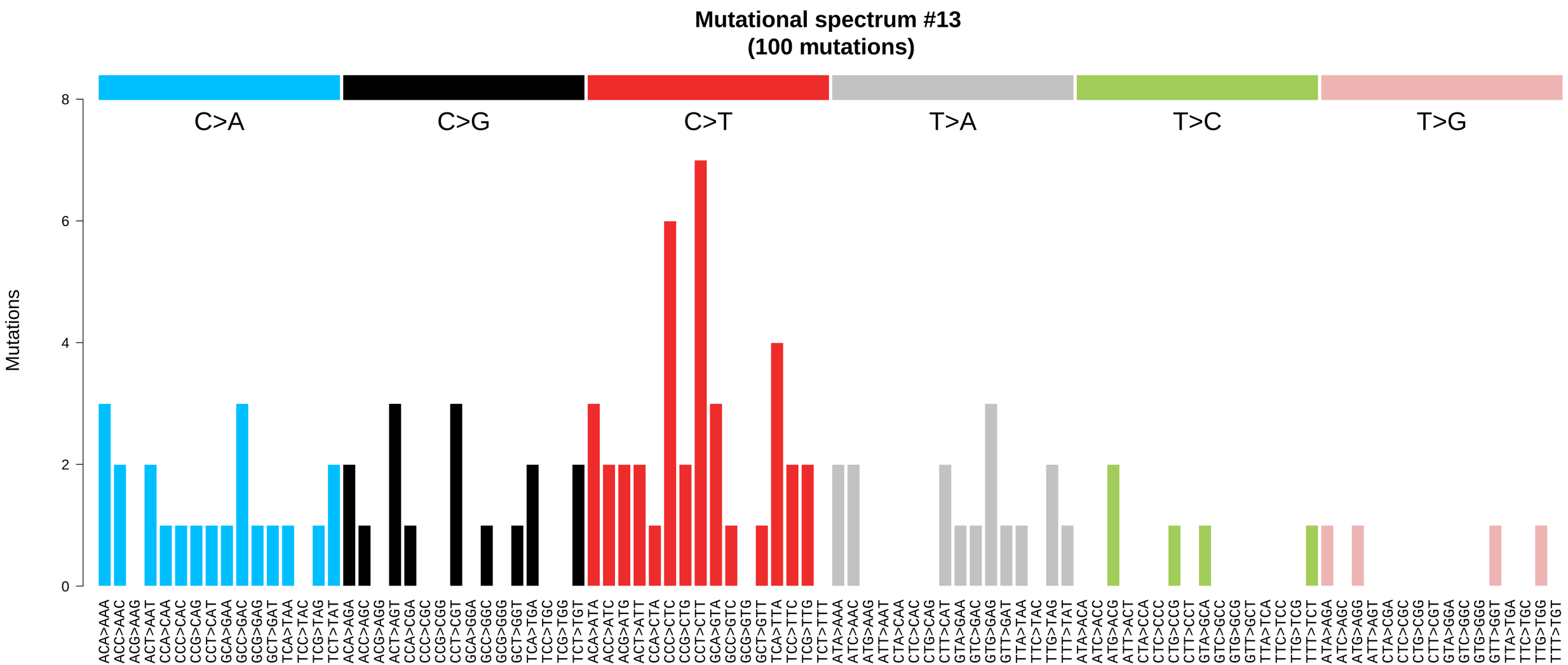

Mutational spectrum #8
(27 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

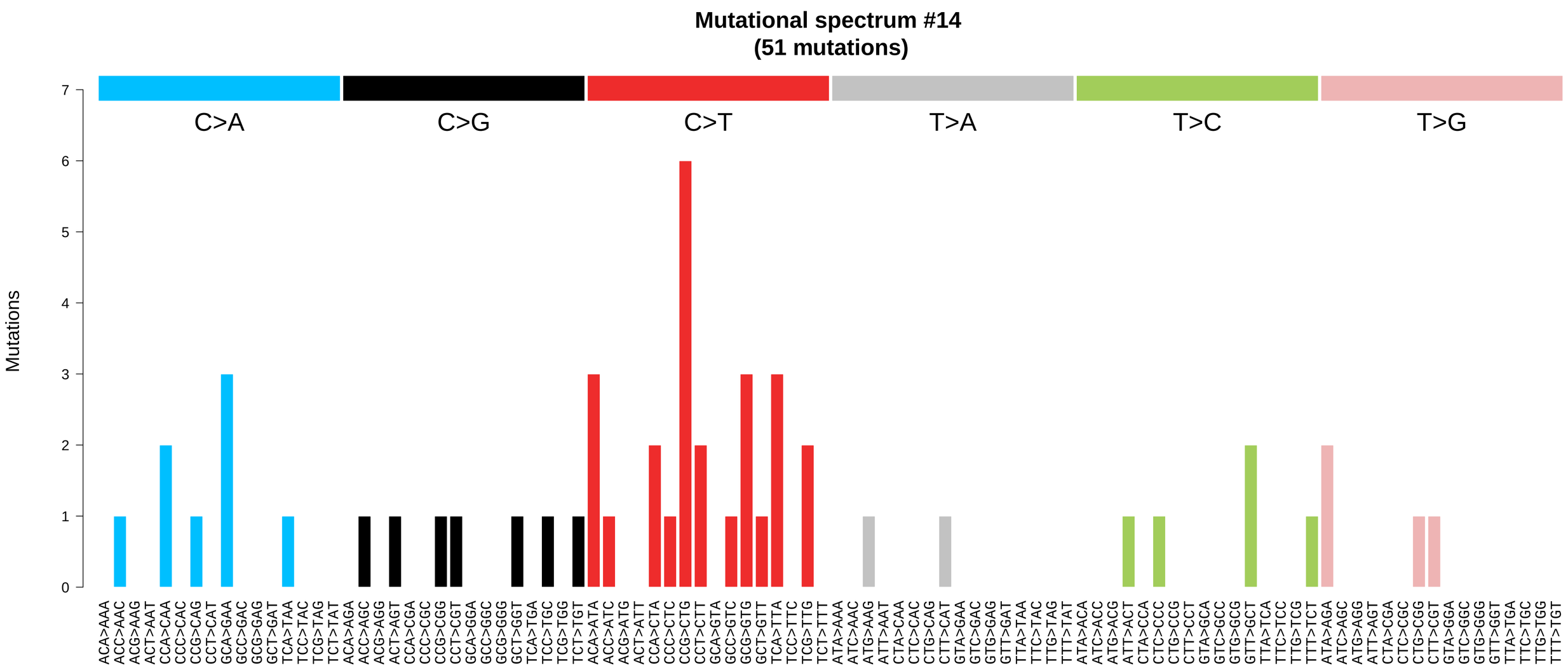

Mutational spectrum #9
(47 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

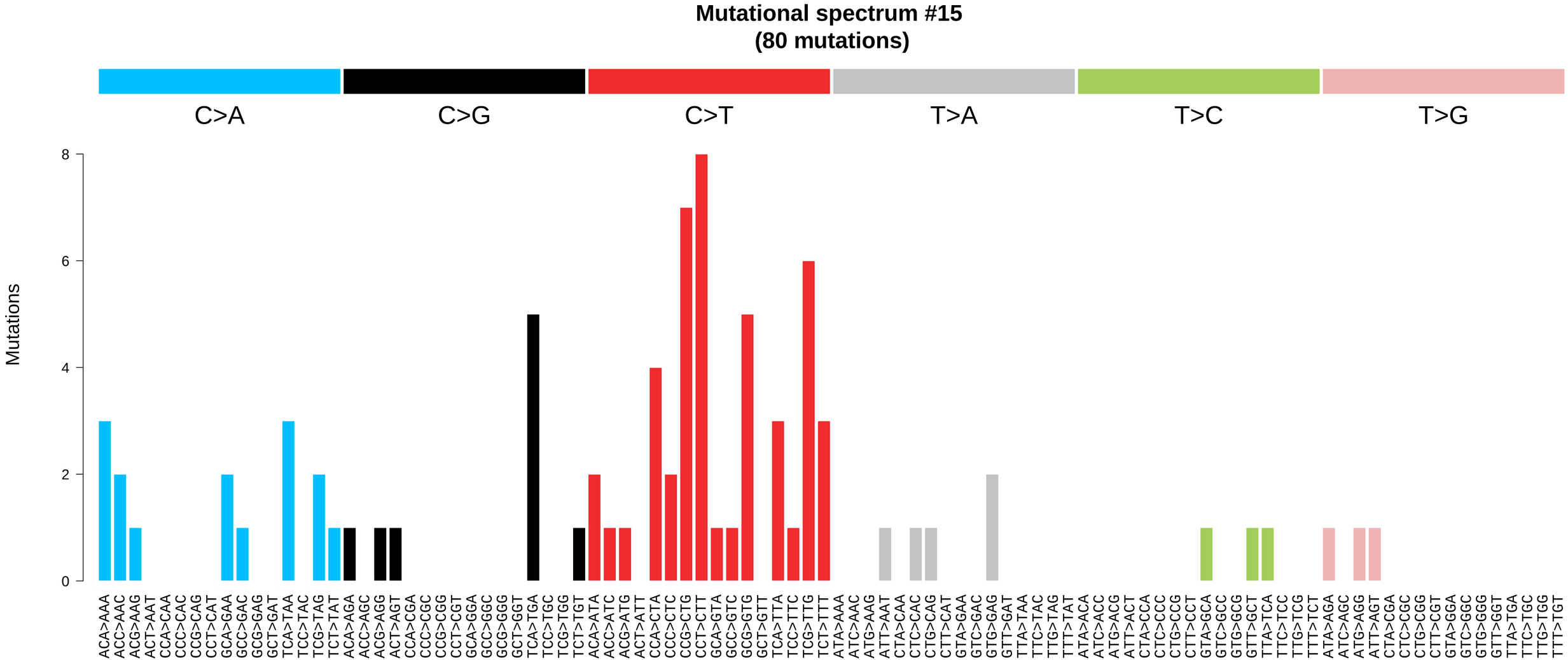

Mutational spectrum #10
(43 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

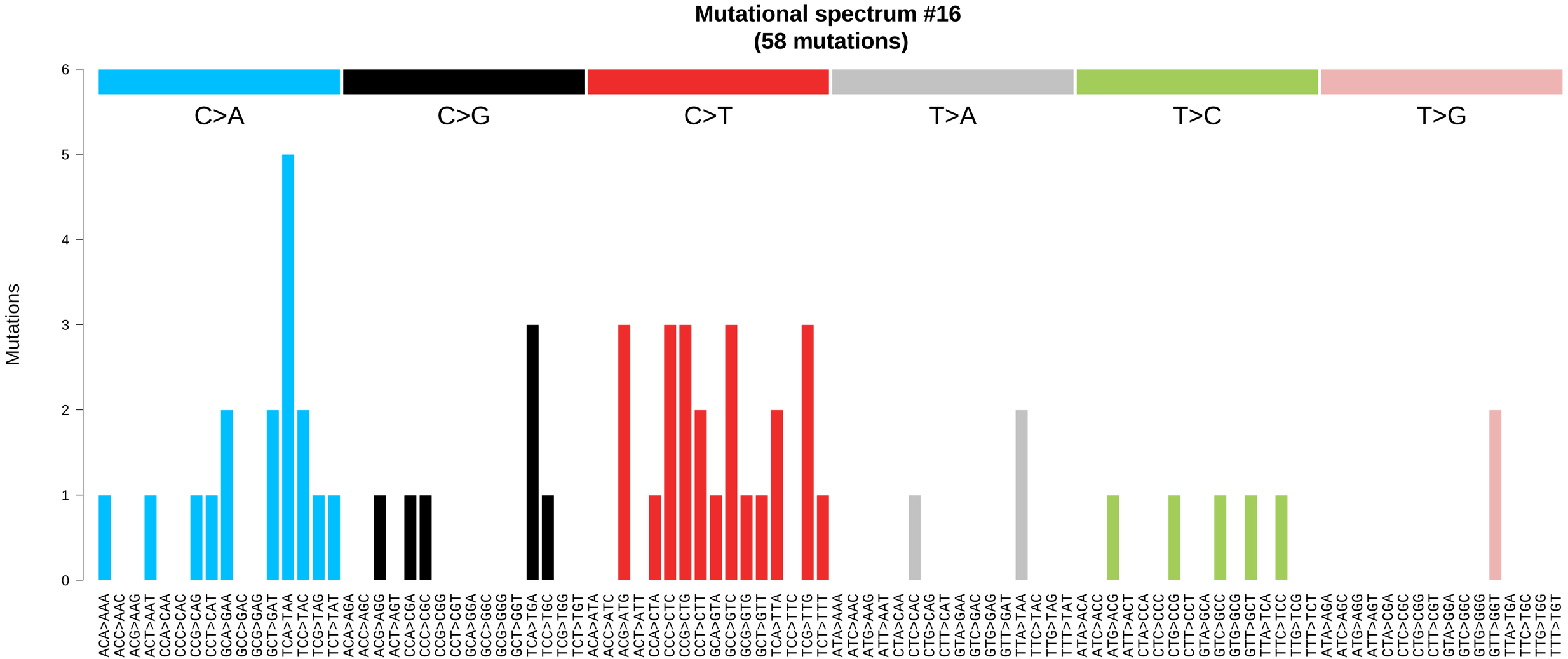

Mutational spectrum #11
(103 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
25
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

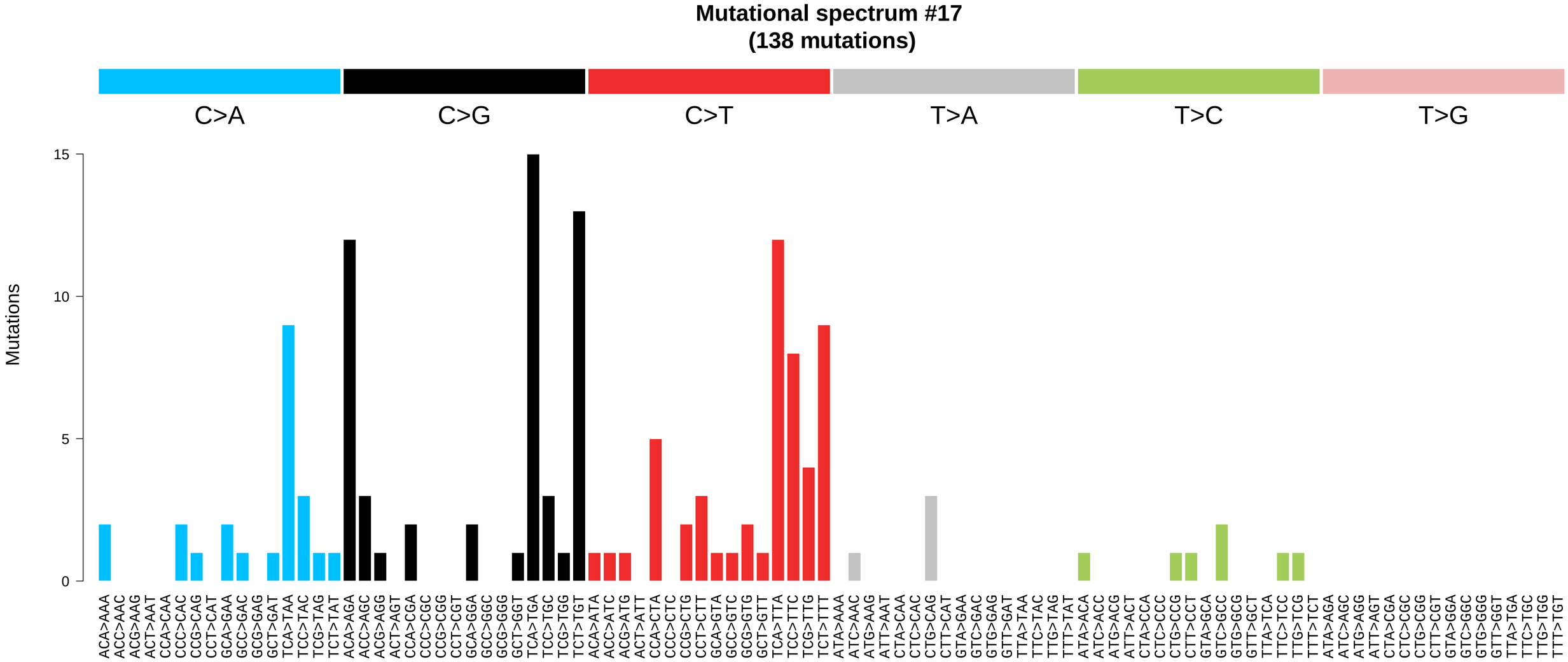

Mutational spectrum #12
(32 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

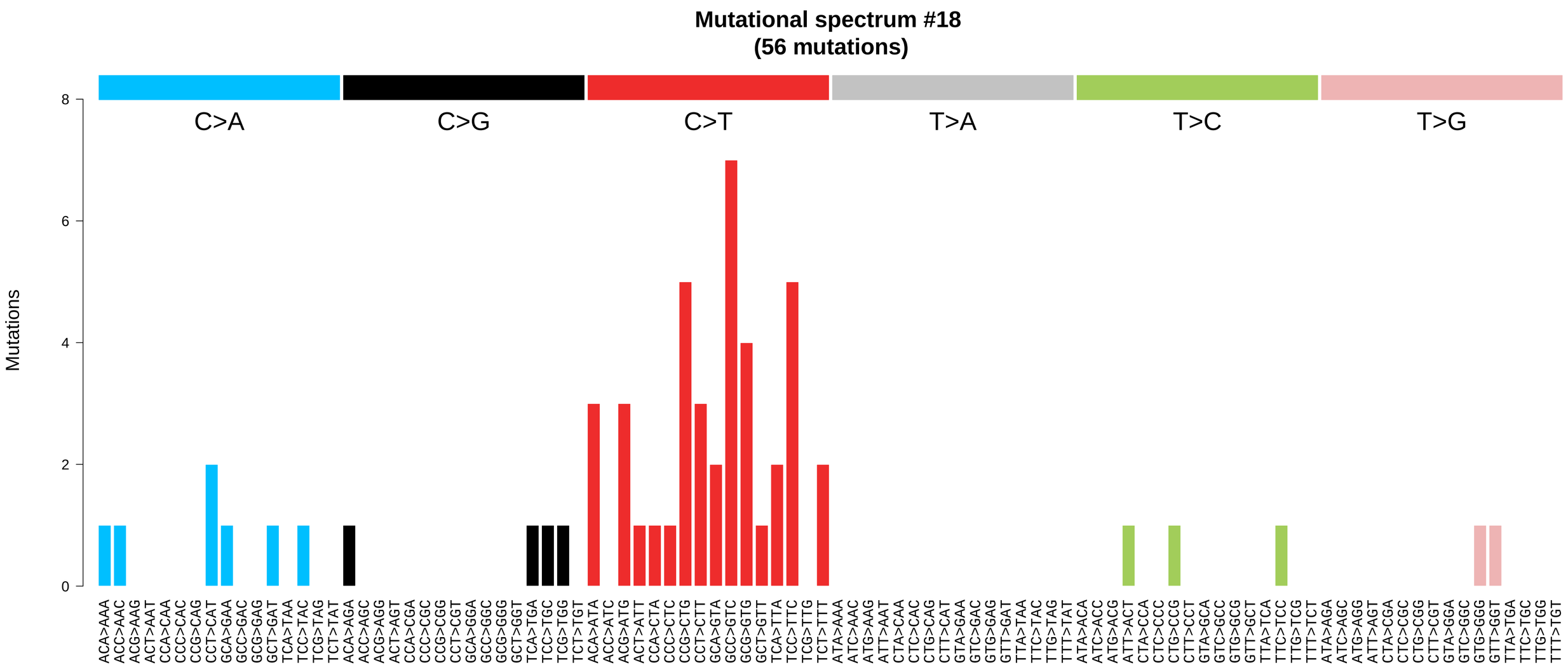

Mutational spectrum #13
(100 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

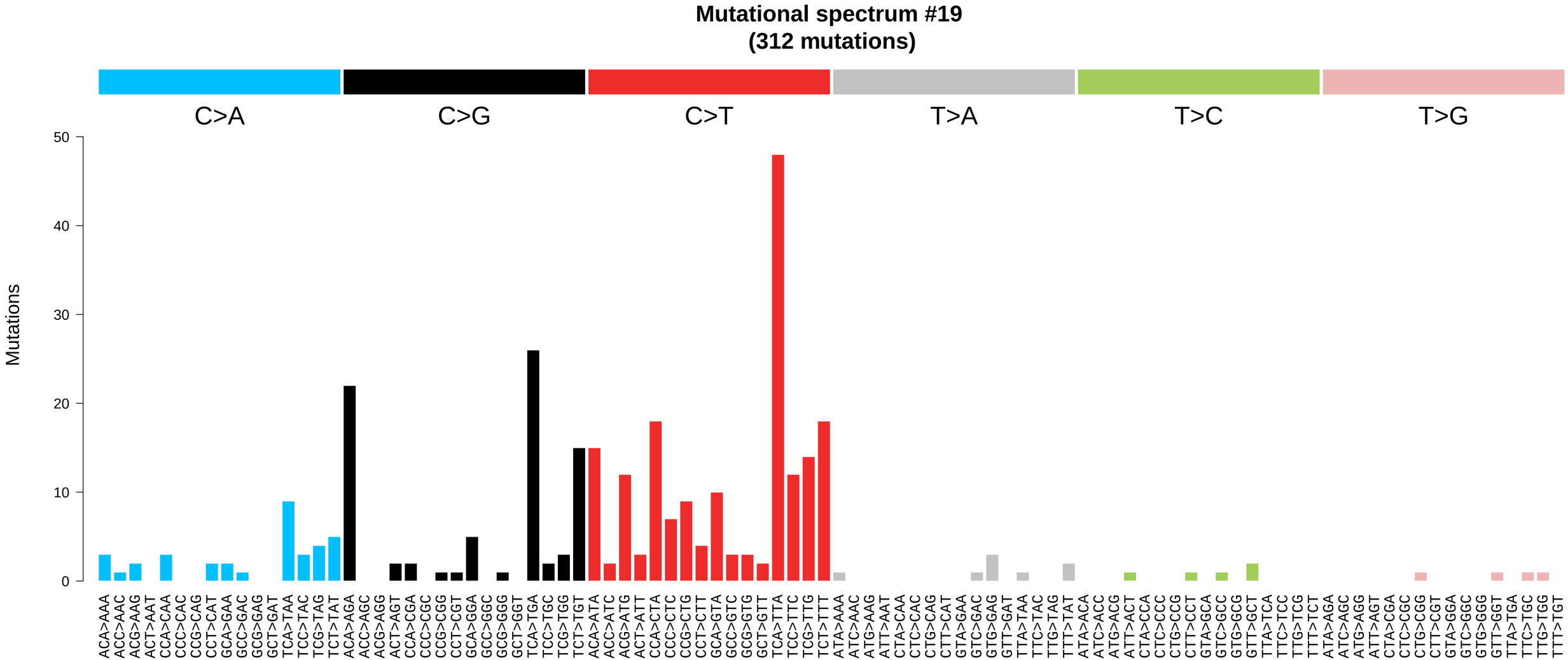

Mutational spectrum #14
(51 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

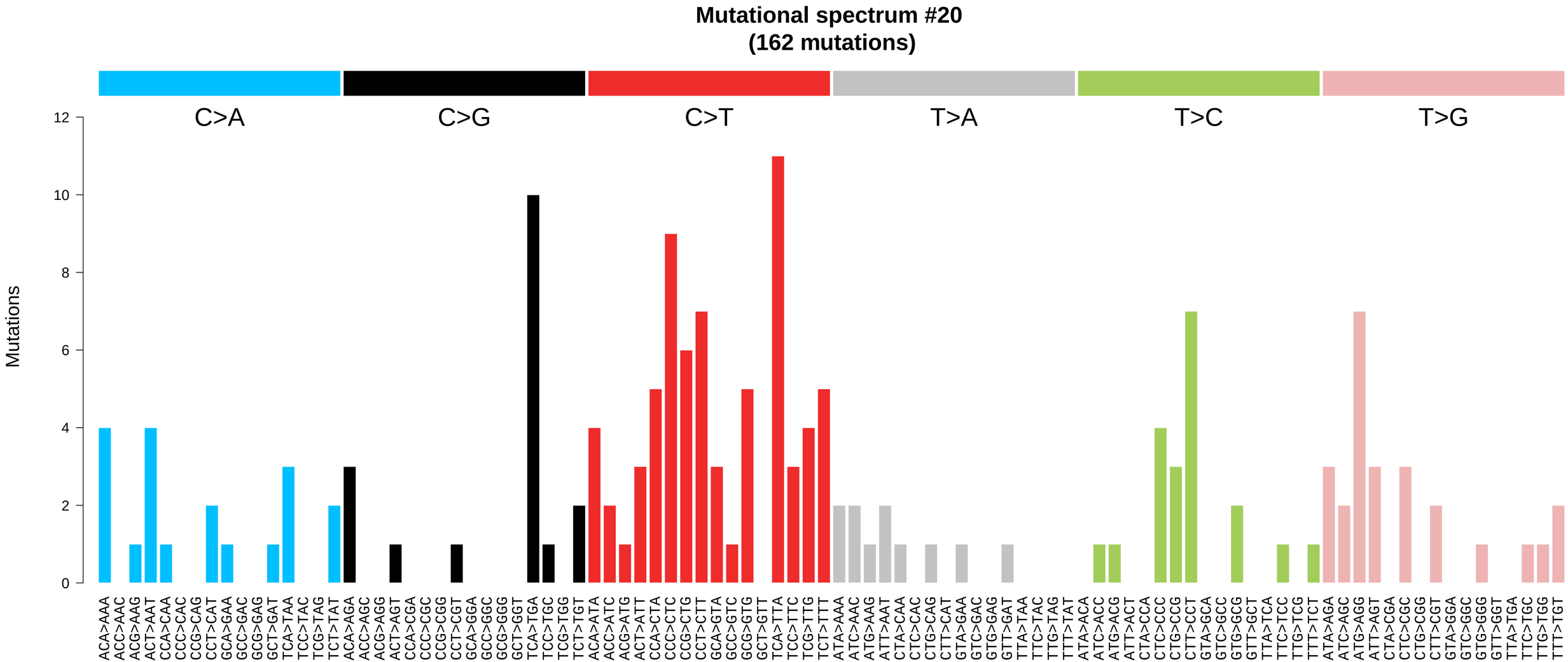

Mutational spectrum #15
(80 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

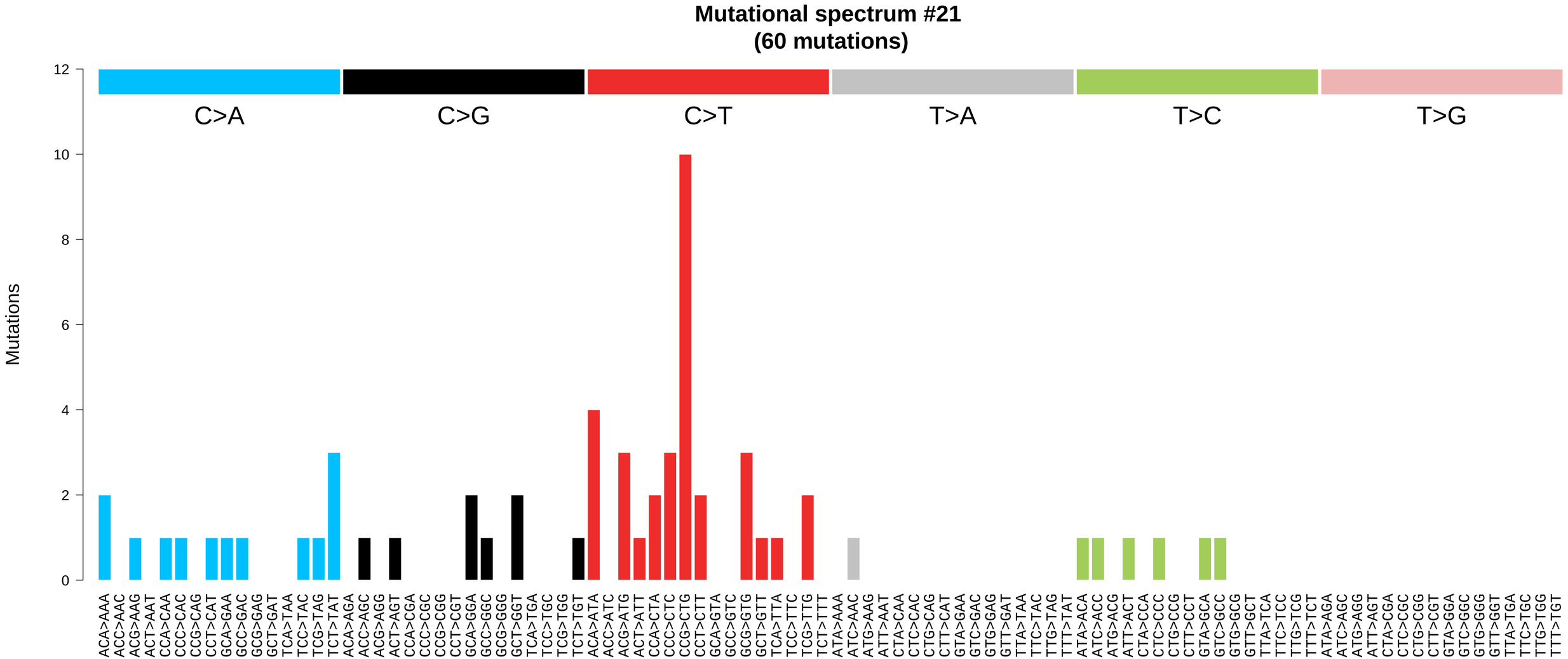

Mutational spectrum #16
(58 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

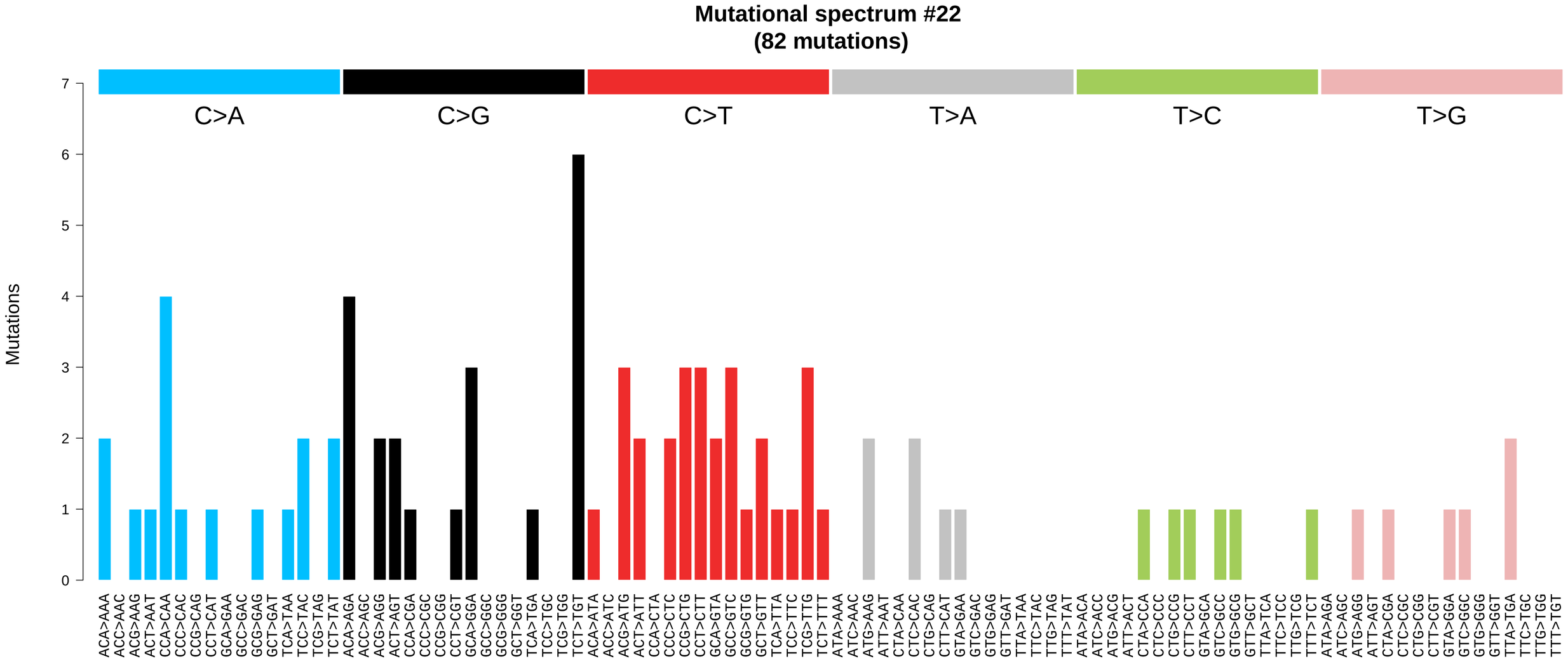

Mutational spectrum #17
(138 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
15
10
5
0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

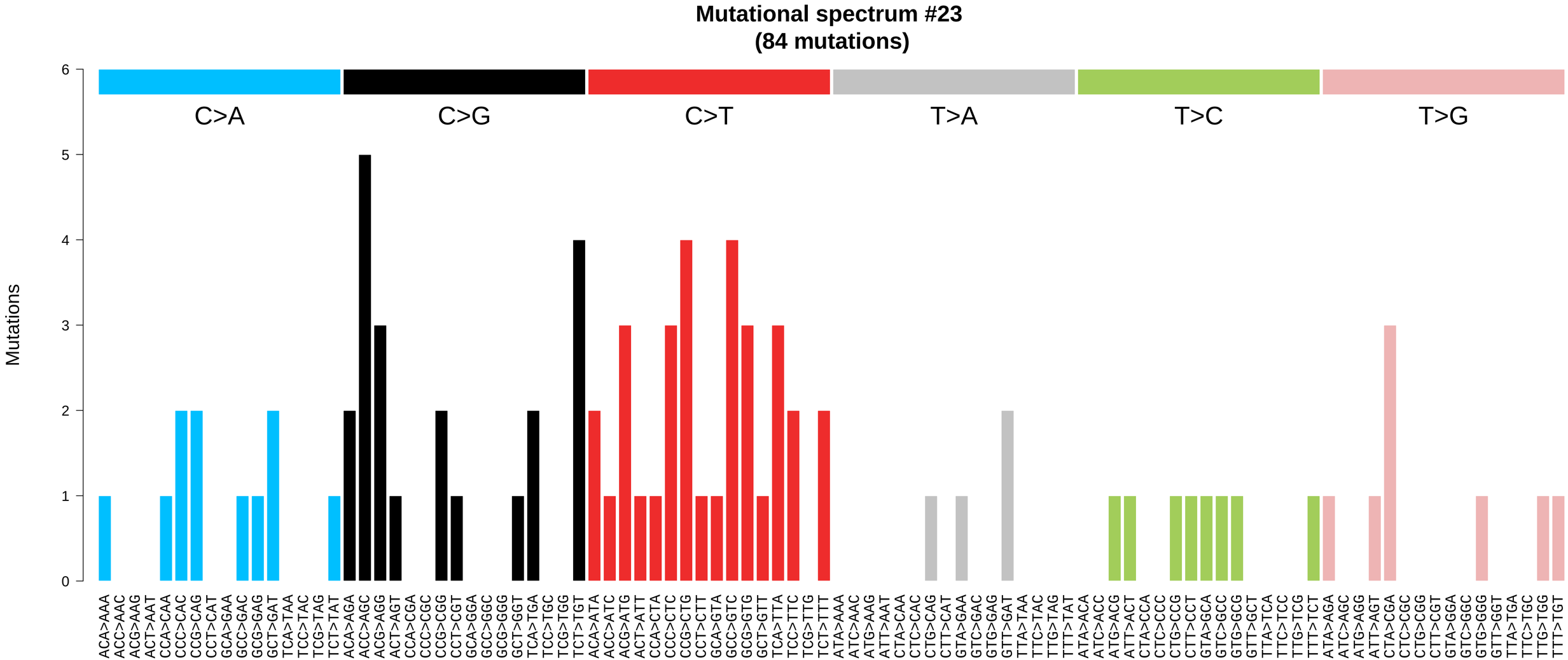

Mutational spectrum #18
(56 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

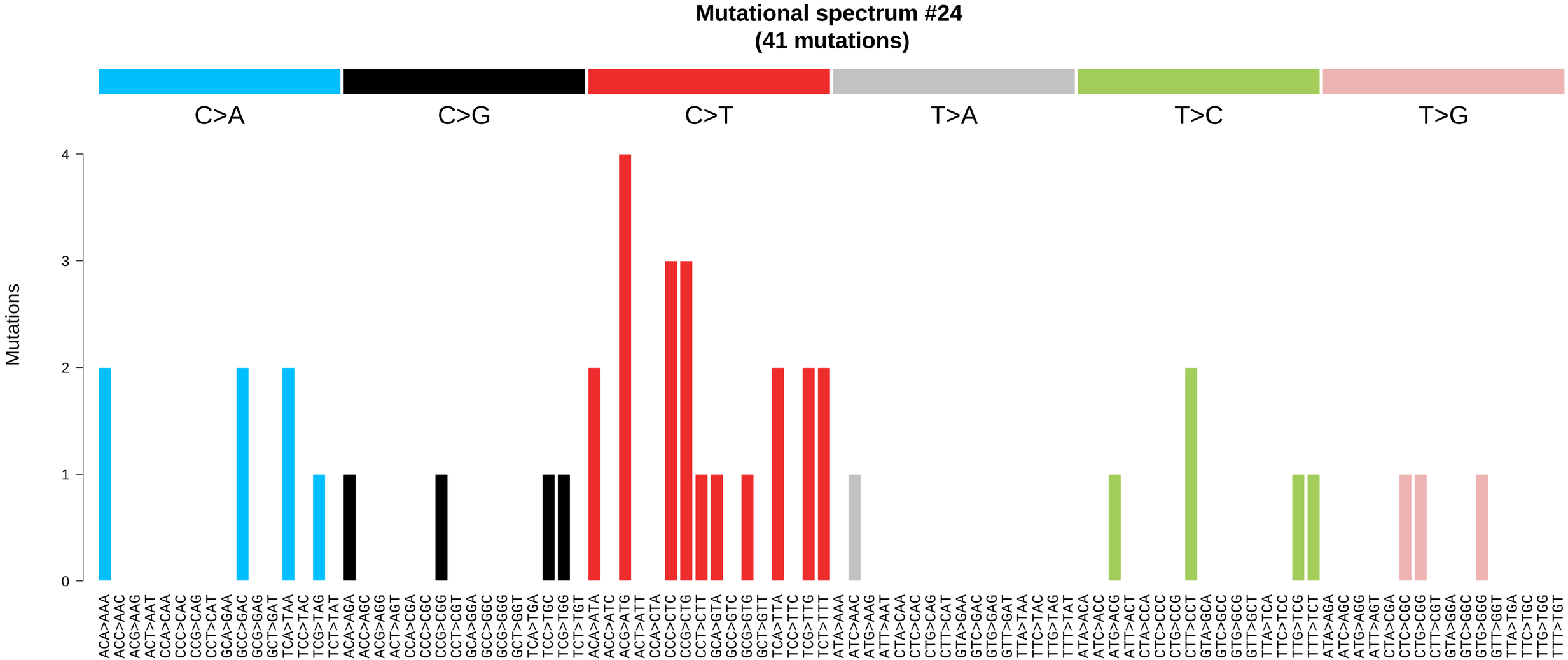

Mutational spectrum #19
(312 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
10
20
30
40
50
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

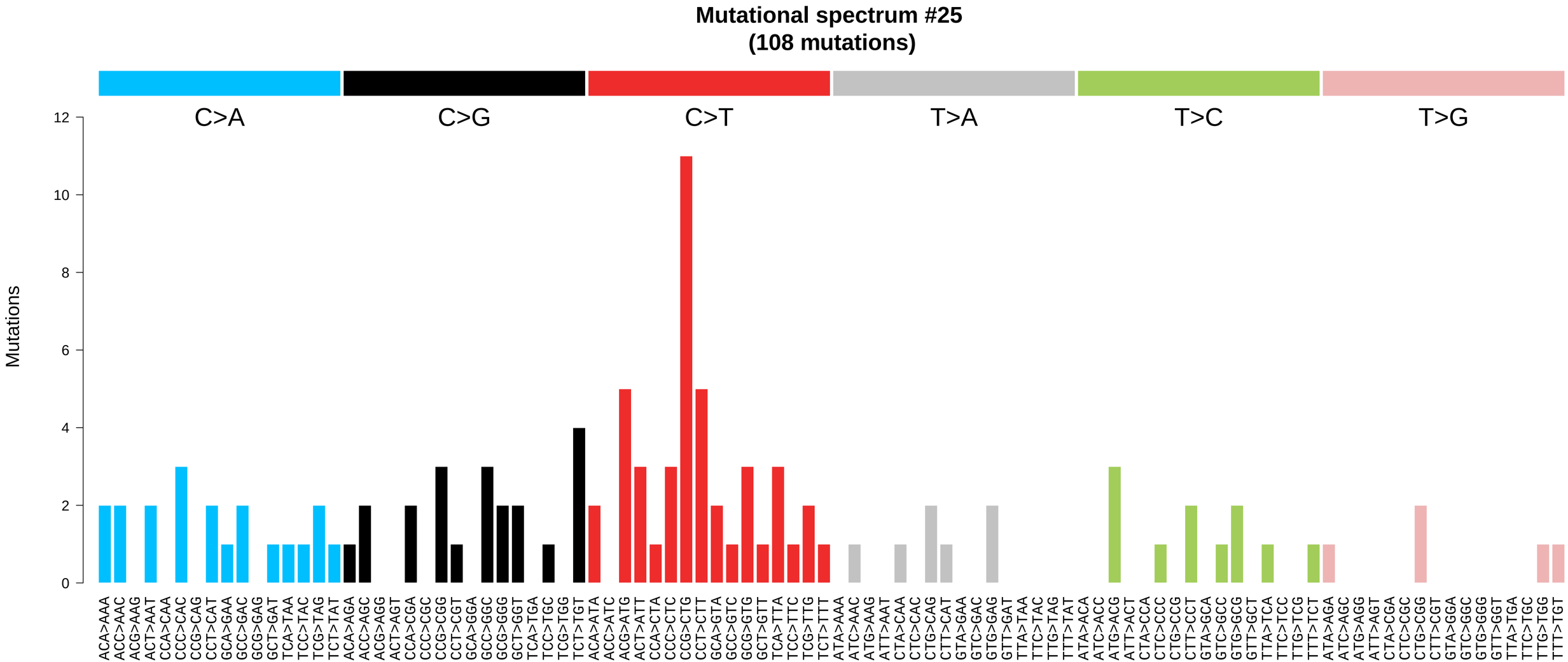

Mutational spectrum #20
(162 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

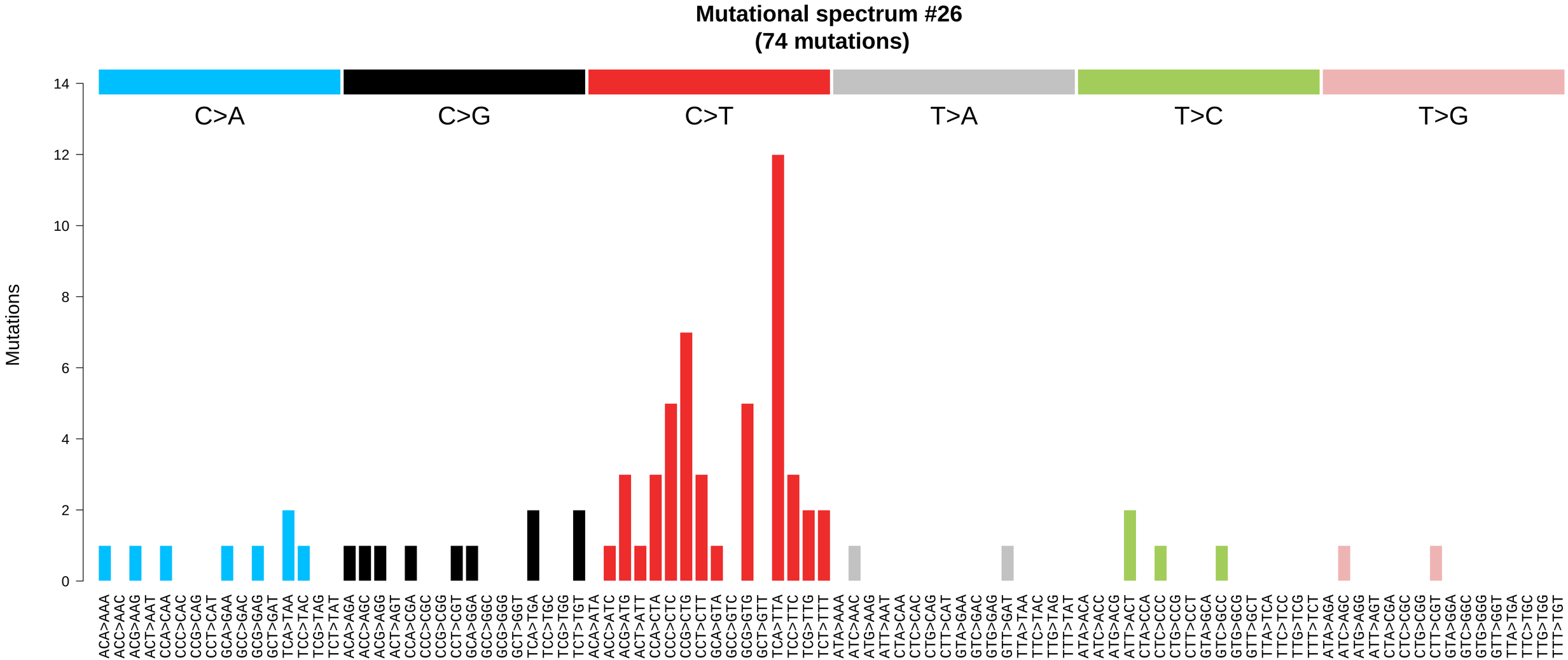

Mutational spectrum #21
(60 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

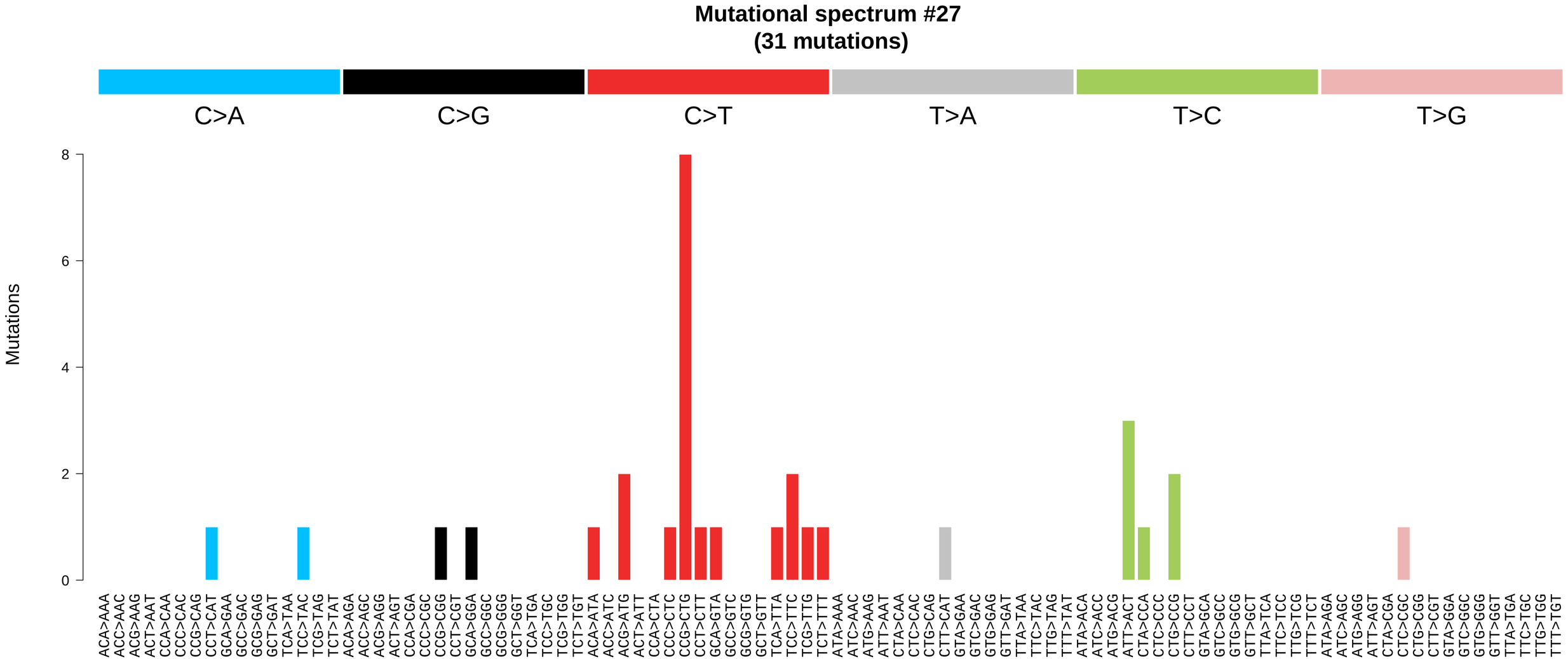

Mutational spectrum #22
(82 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

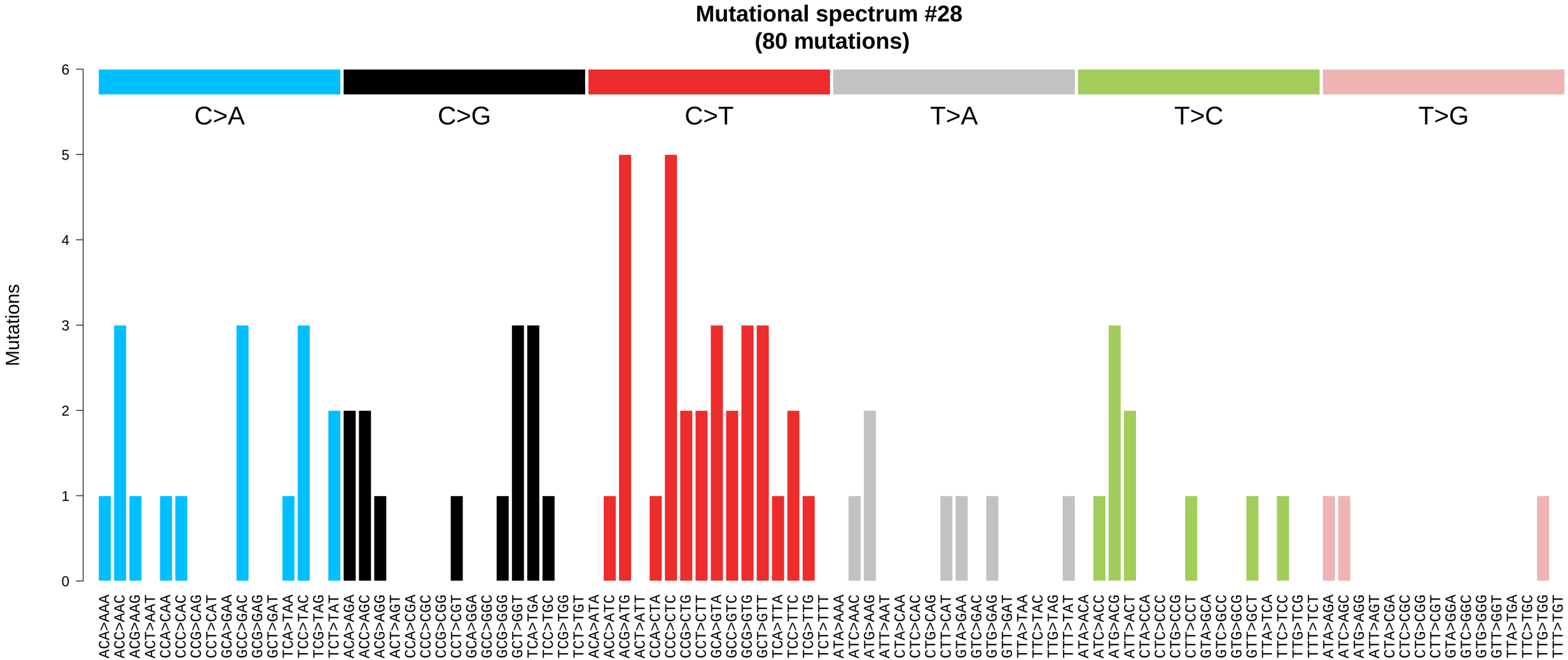

Mutational spectrum #23
(84 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

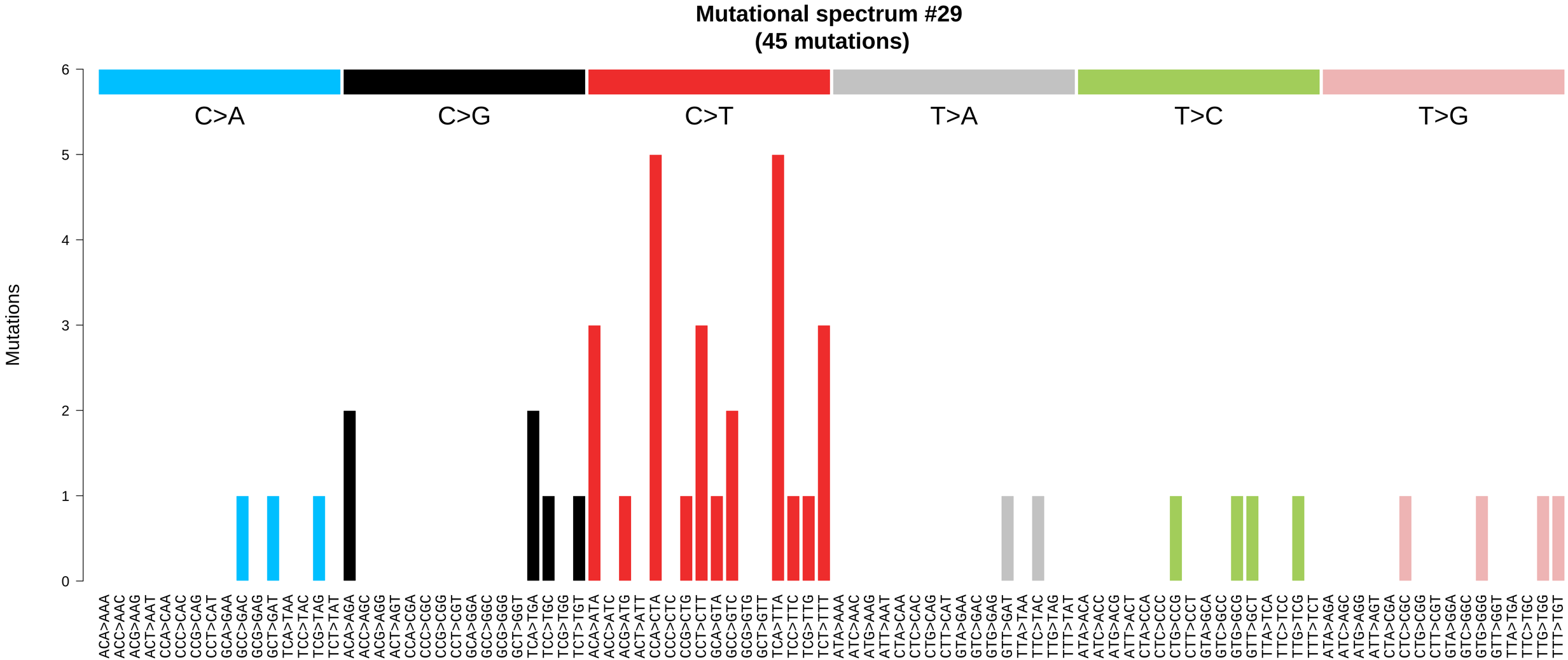

Mutational spectrum #24
(41 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

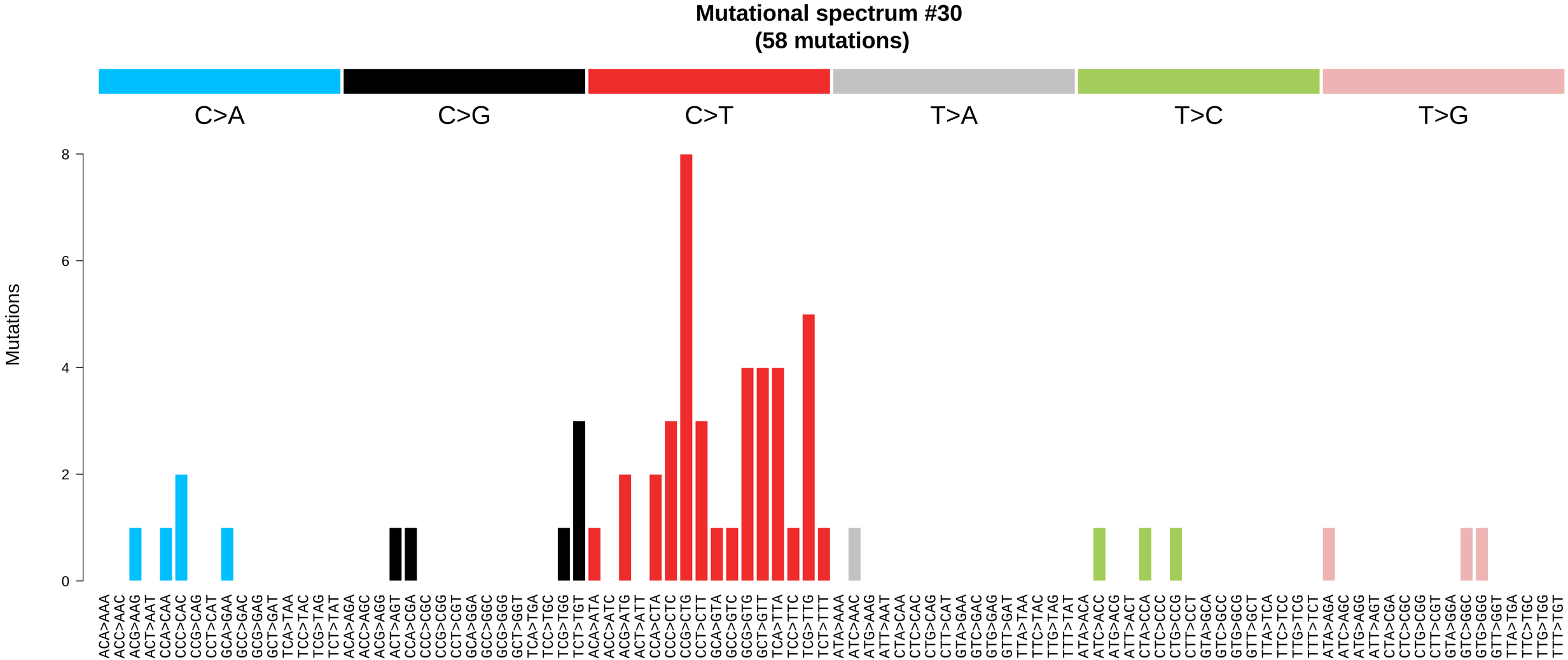

Mutational spectrum #25
(108 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

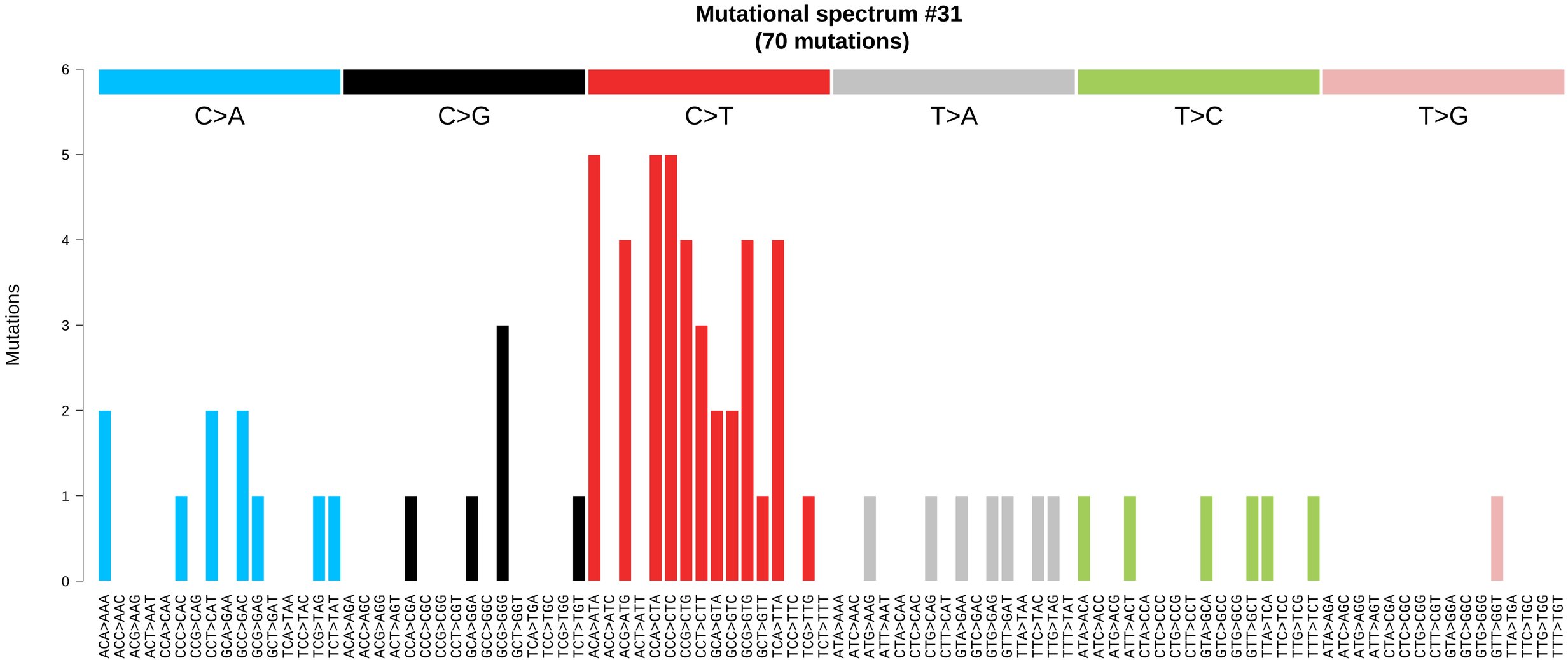

Mutational spectrum #26
(74 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
14
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

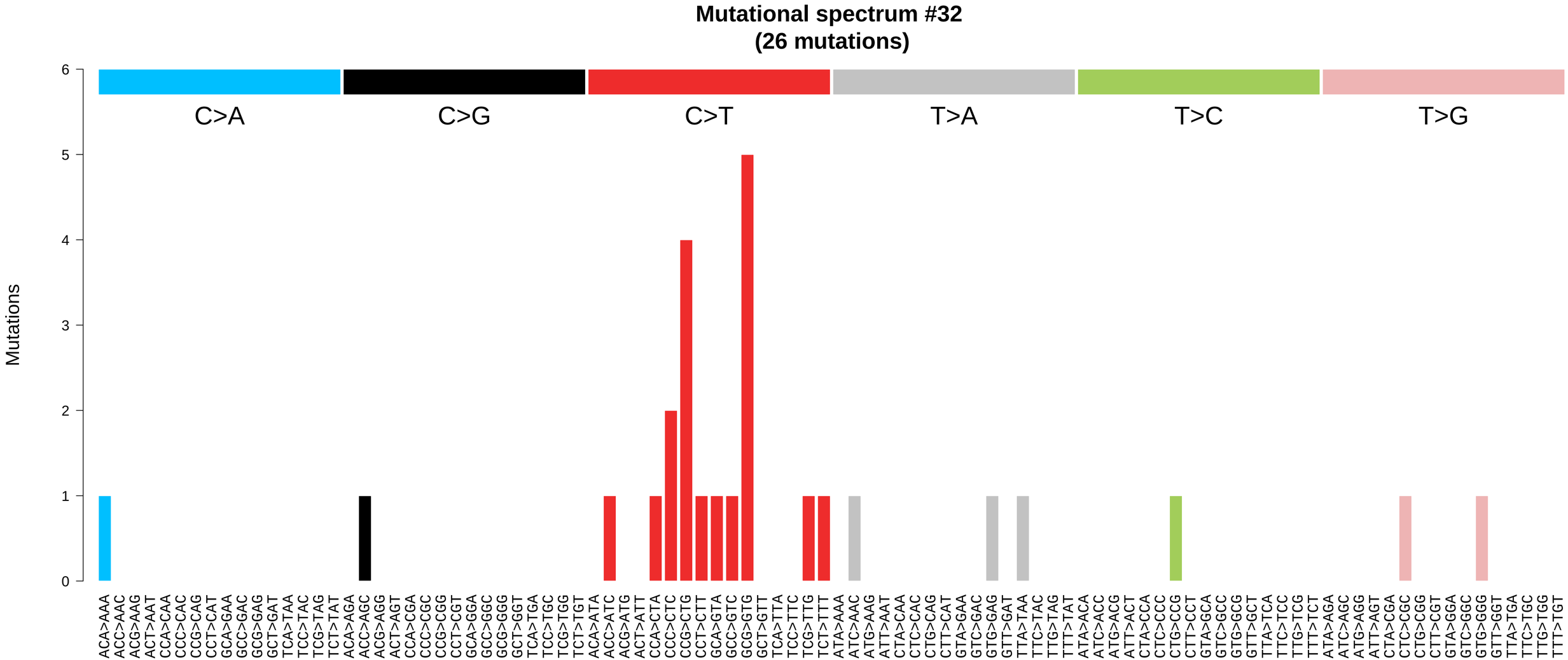

Mutational spectrum #27
(31 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

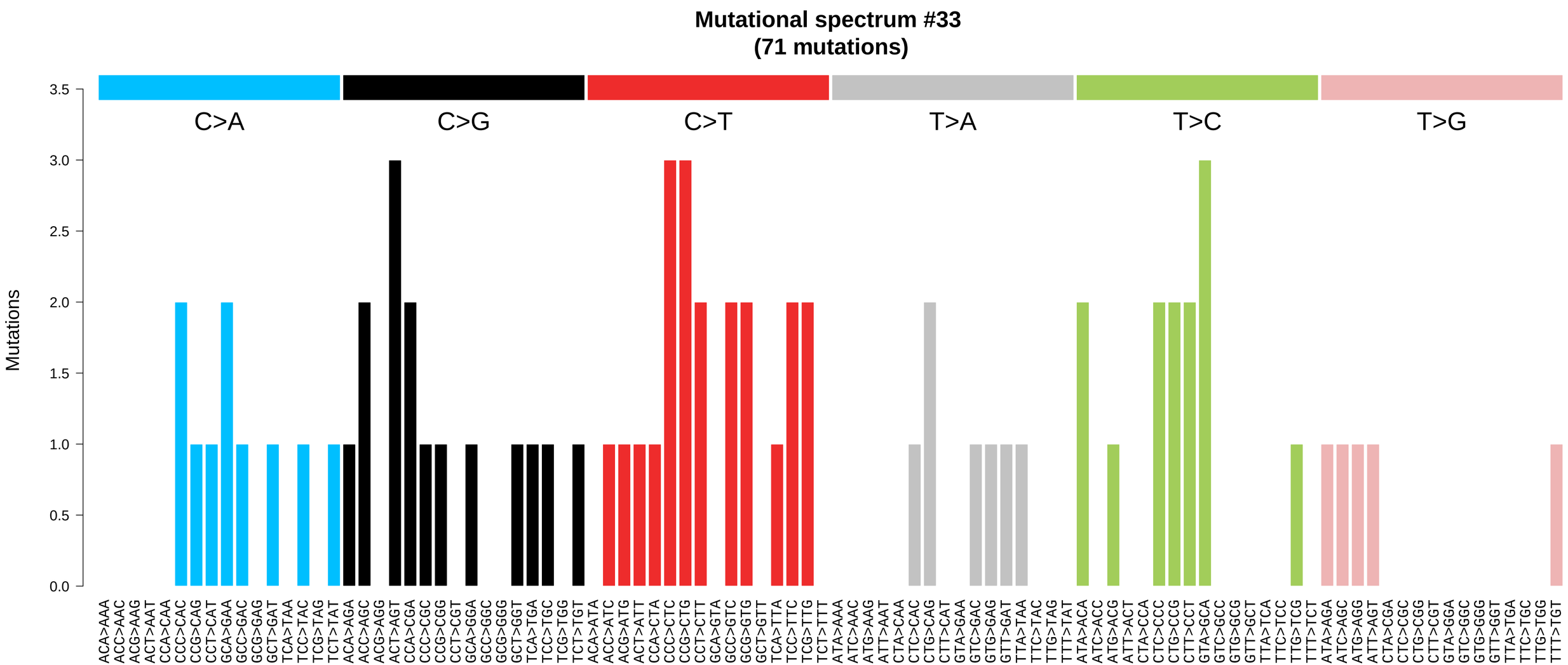

Mutational spectrum #28
(80 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

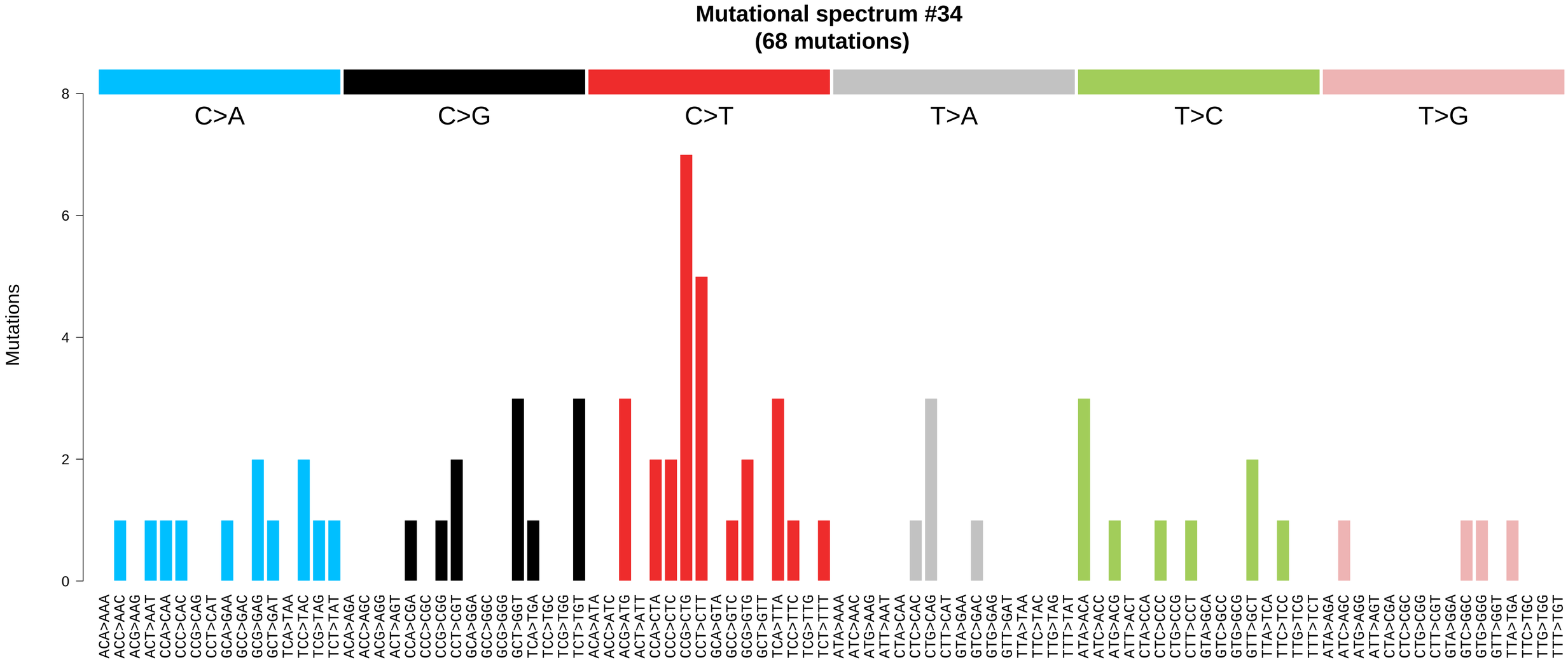

Mutational spectrum #29
(45 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

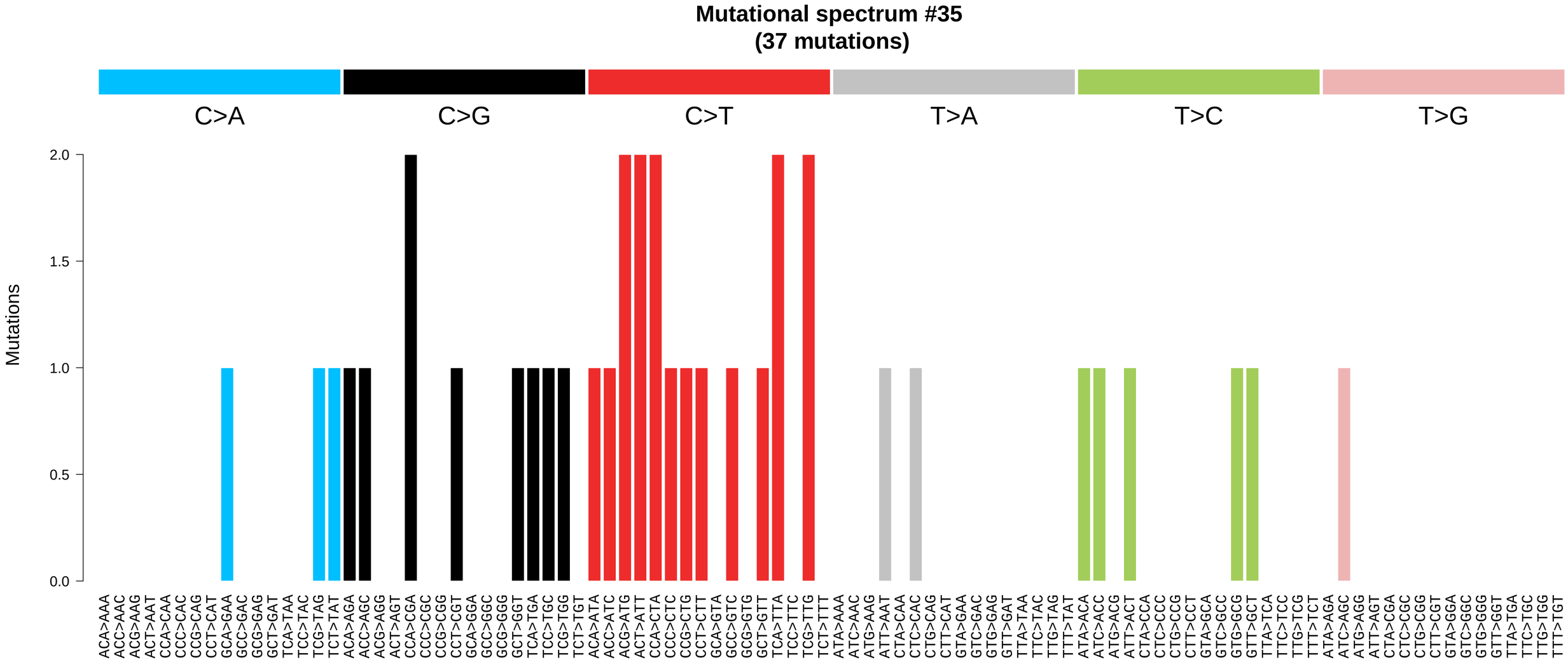

Mutational spectrum #30
(58 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

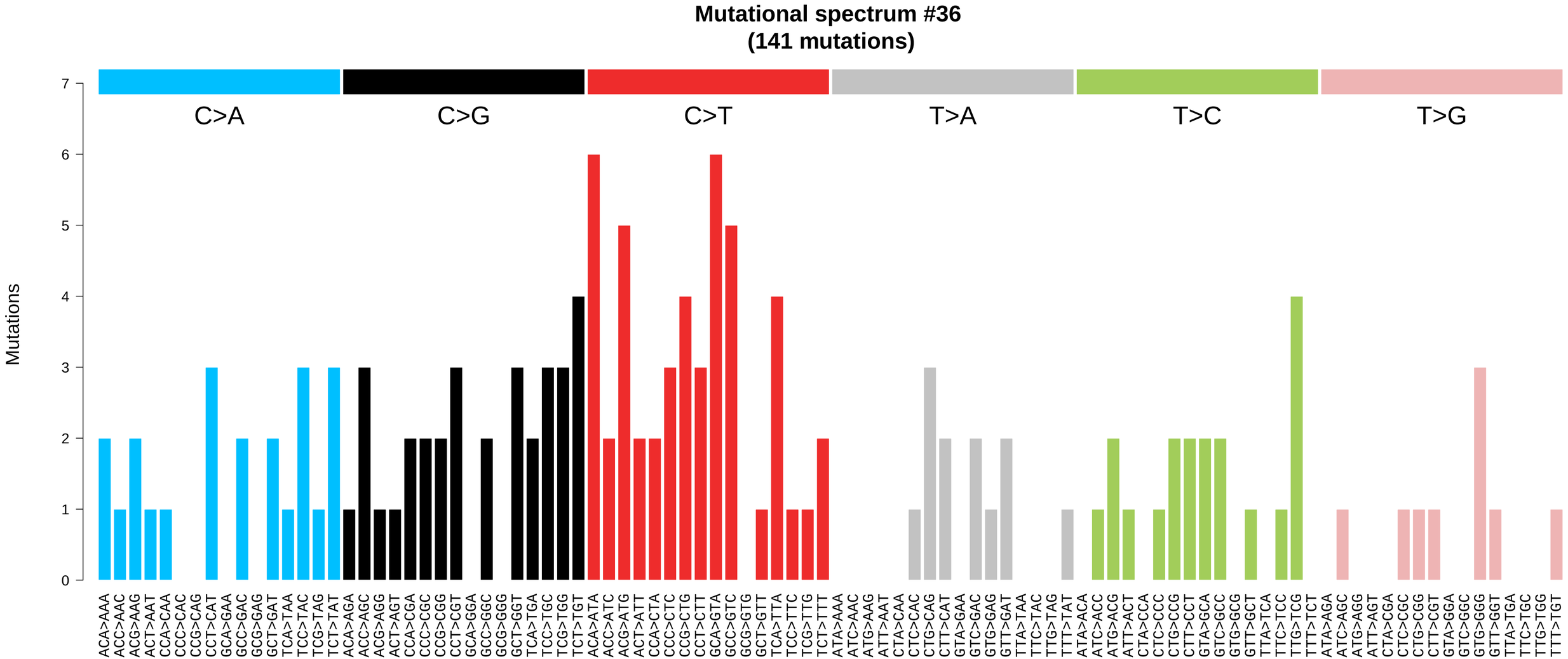

Mutational spectrum #31
(70 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

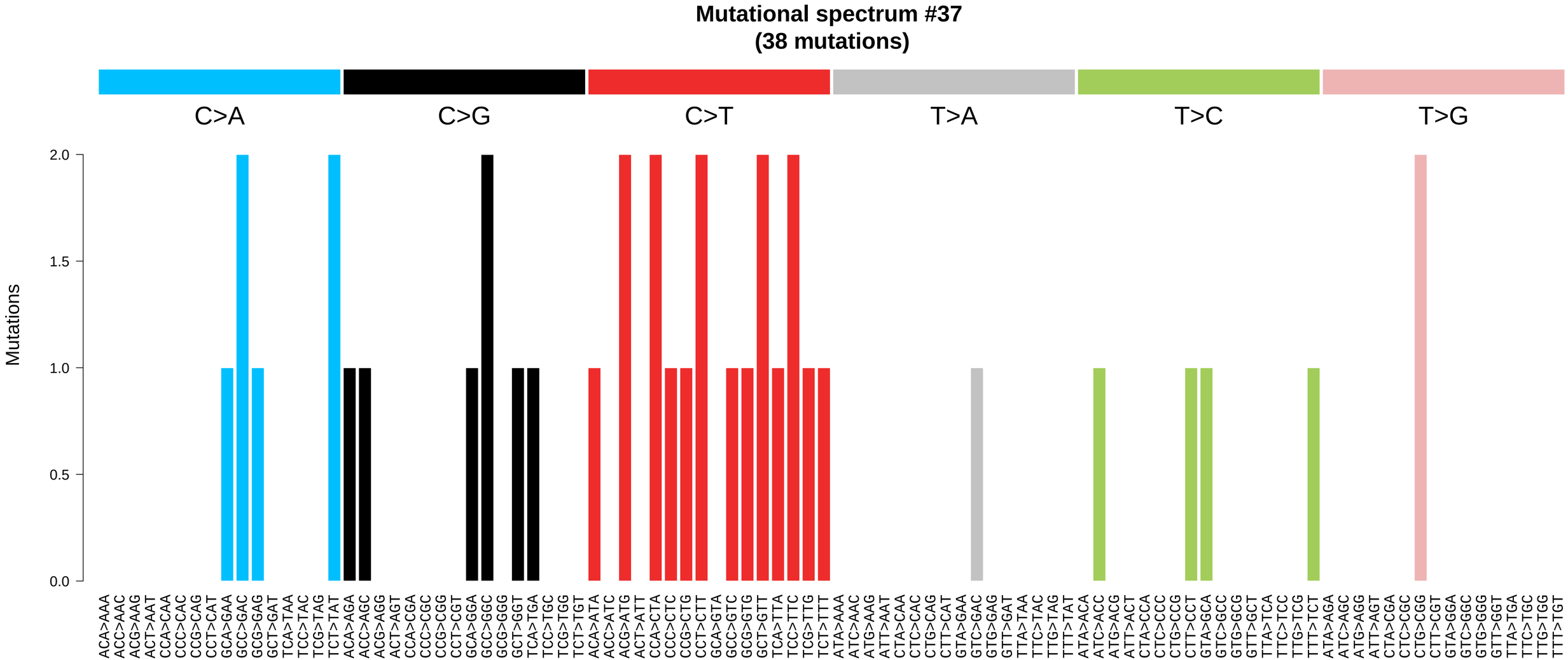

Mutational spectrum #32
(26 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

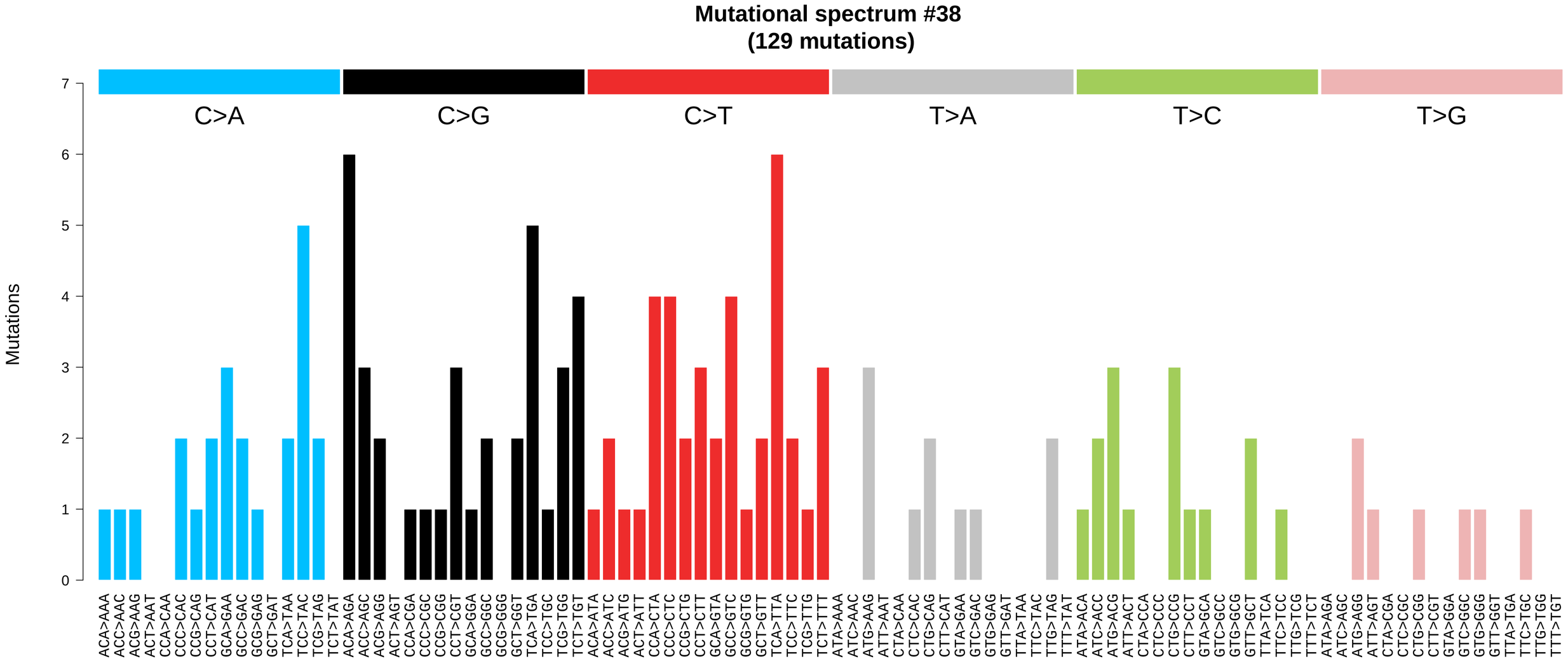

Mutational spectrum #33
(71 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

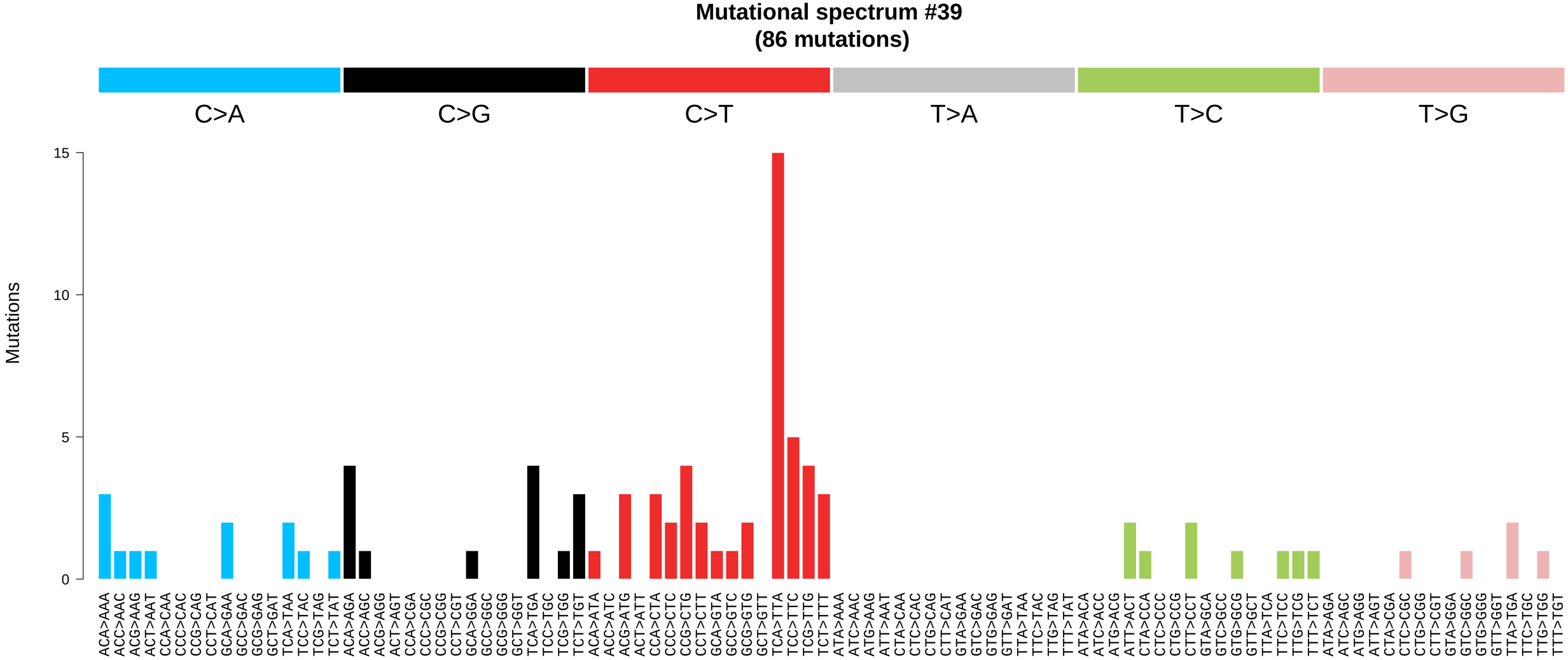

Mutational spectrum #34
(68 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

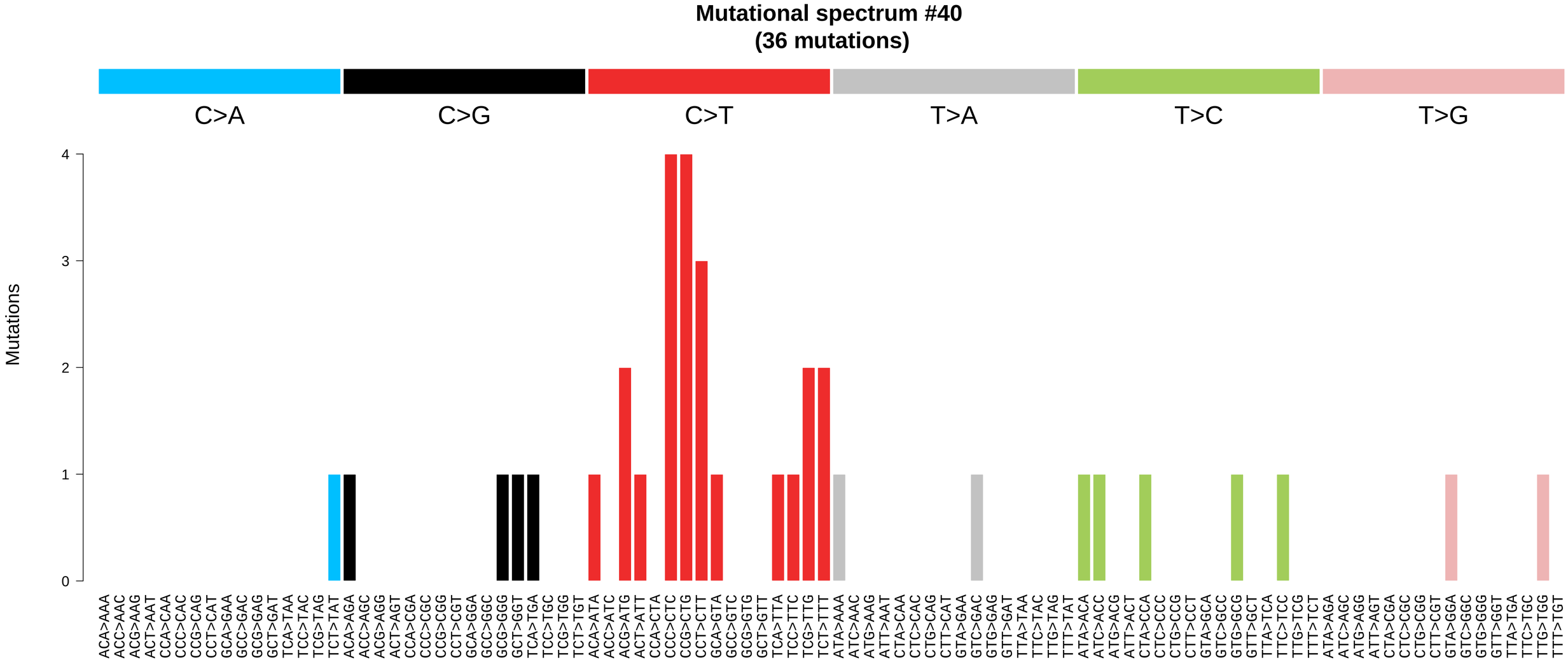

Mutational spectrum #35
(37 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

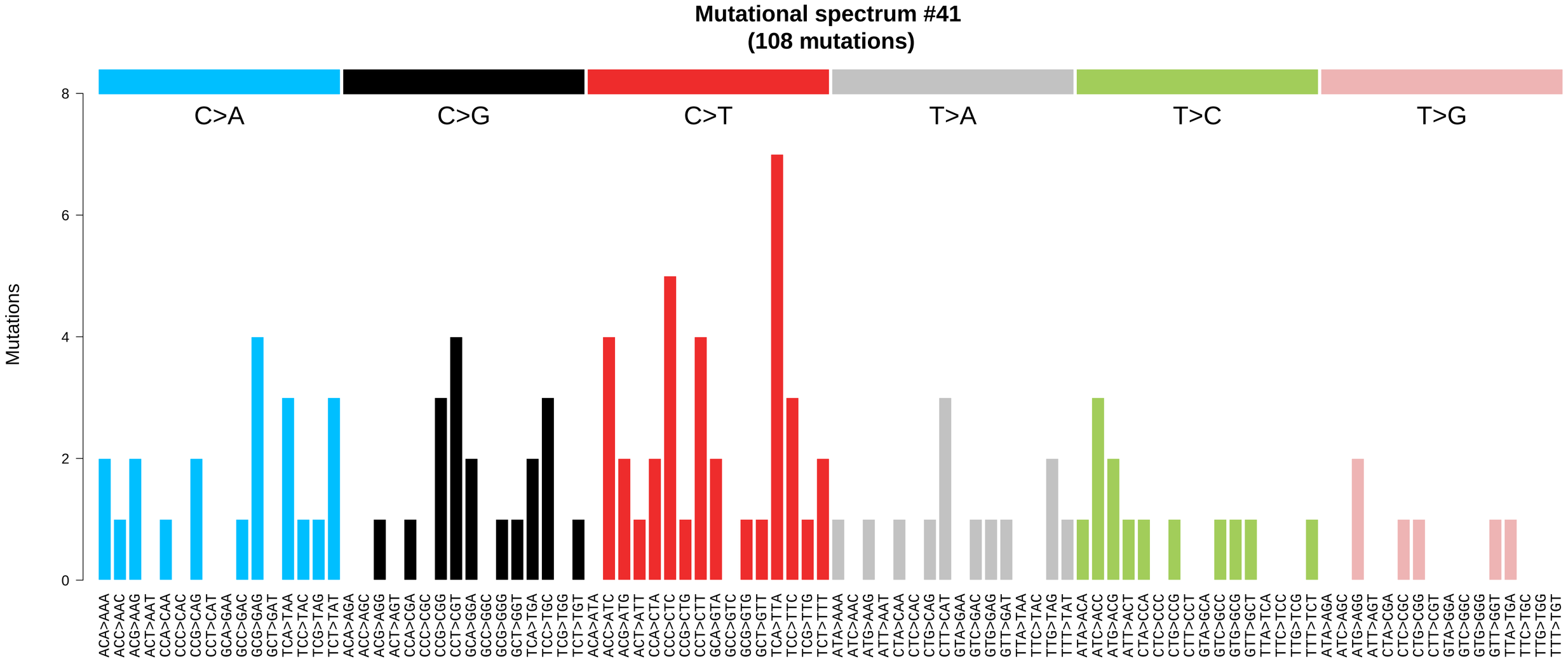

Mutational spectrum #36
(141 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

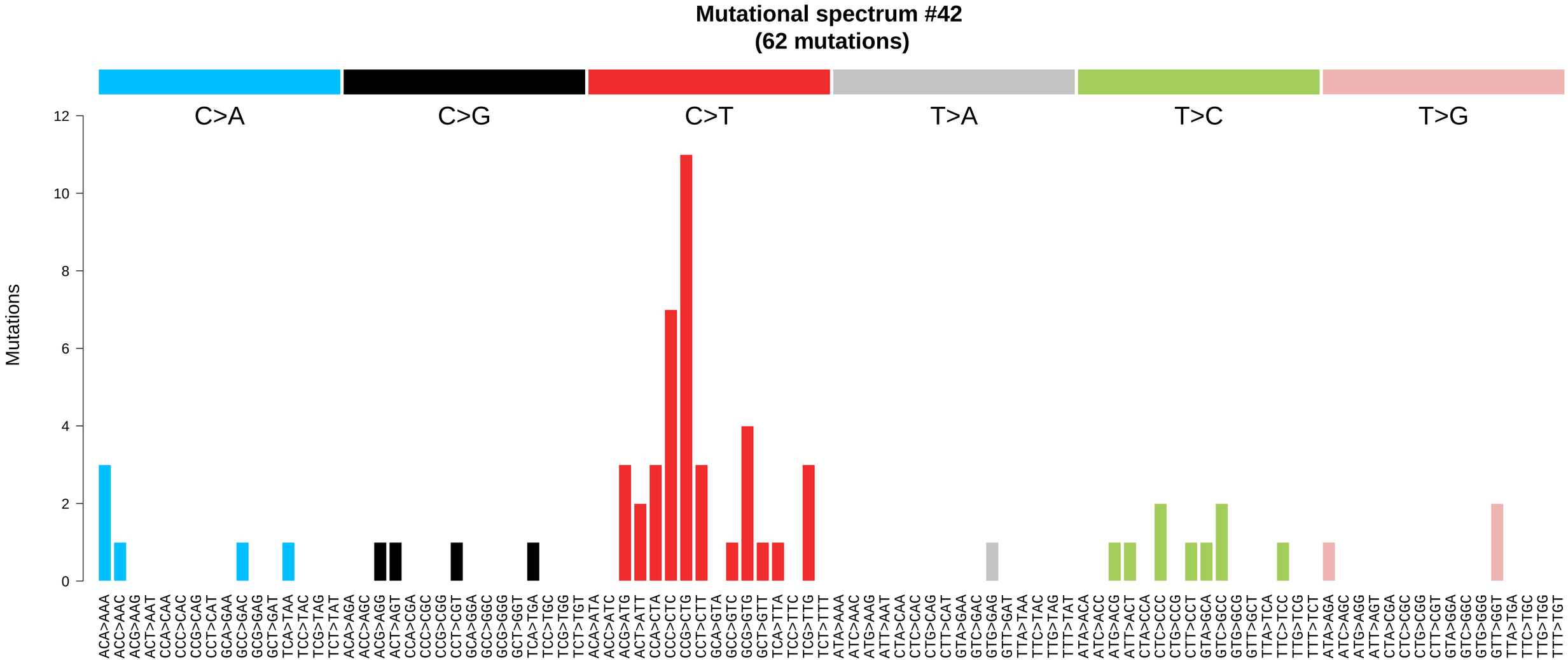

Mutational spectrum #37
(38 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

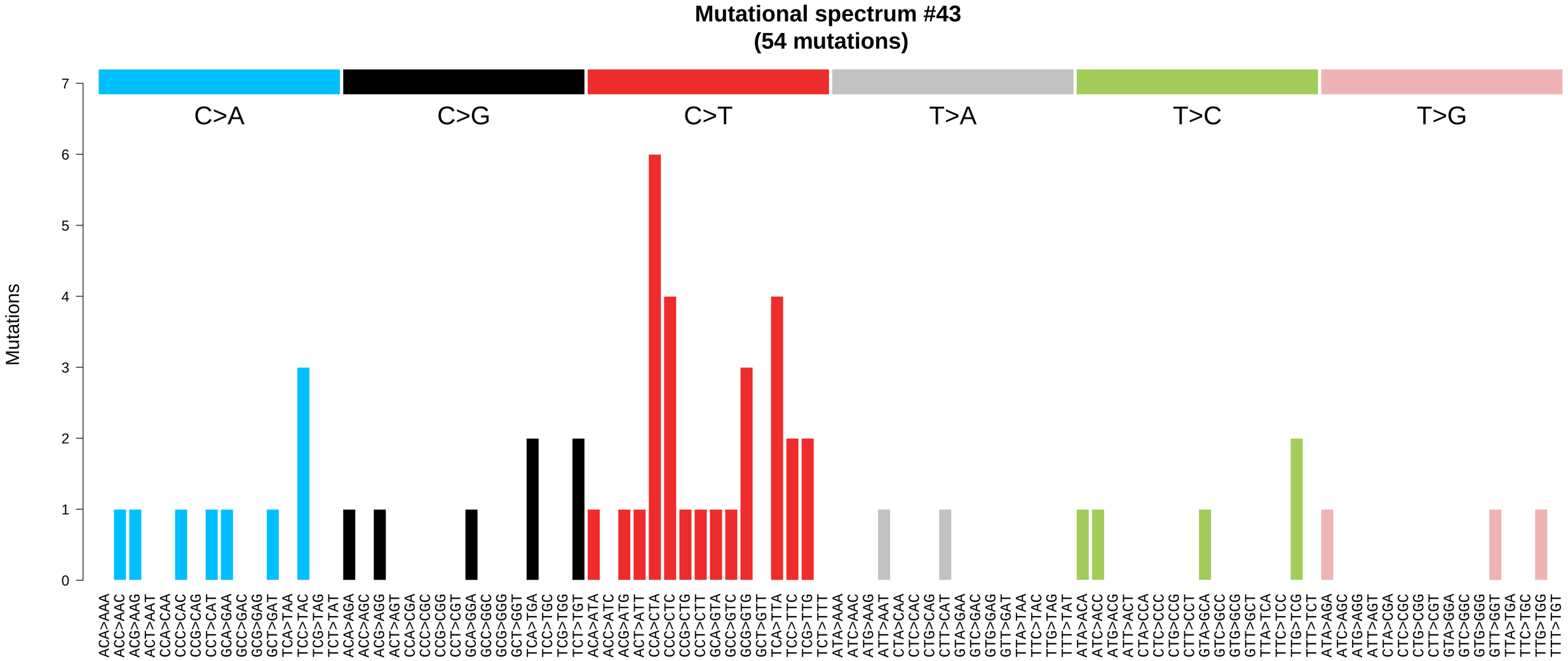

Mutational spectrum #38
(129 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

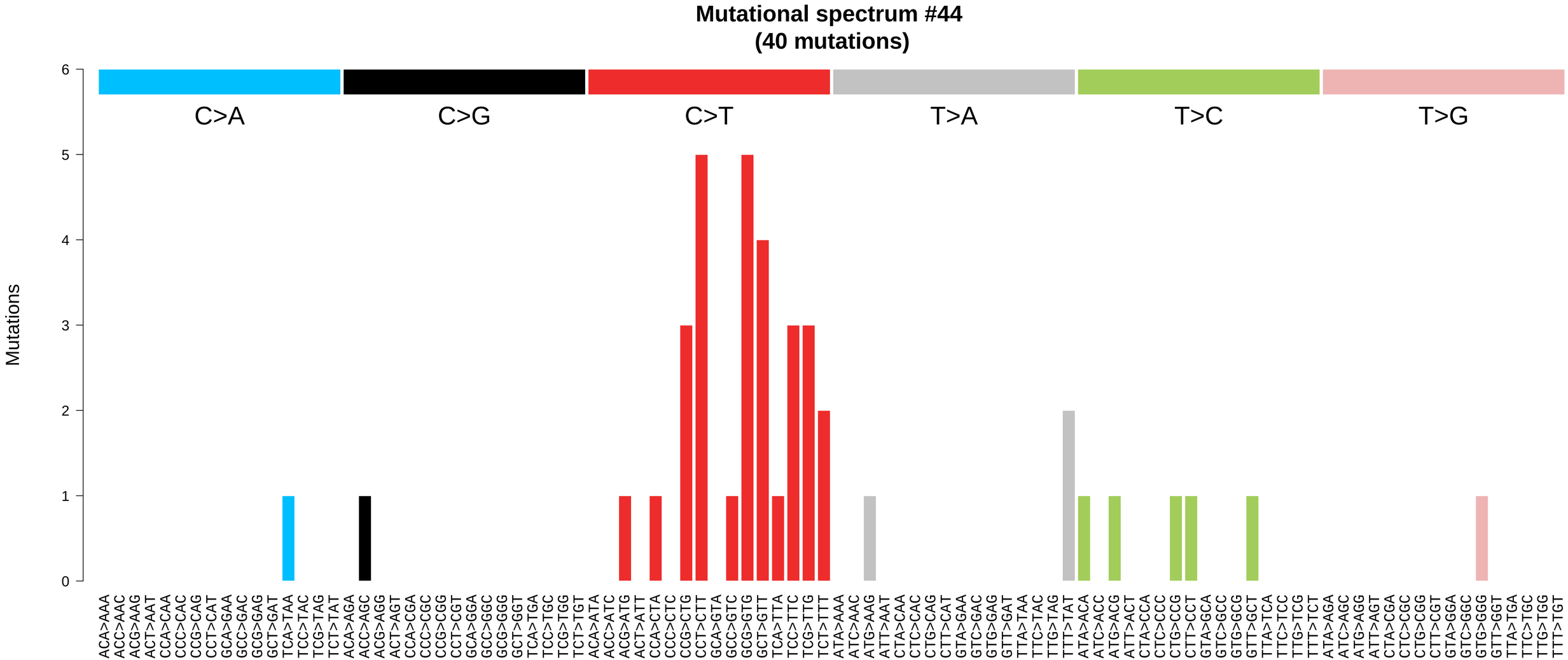

Mutational spectrum #39
(86 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
15
10
5
0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

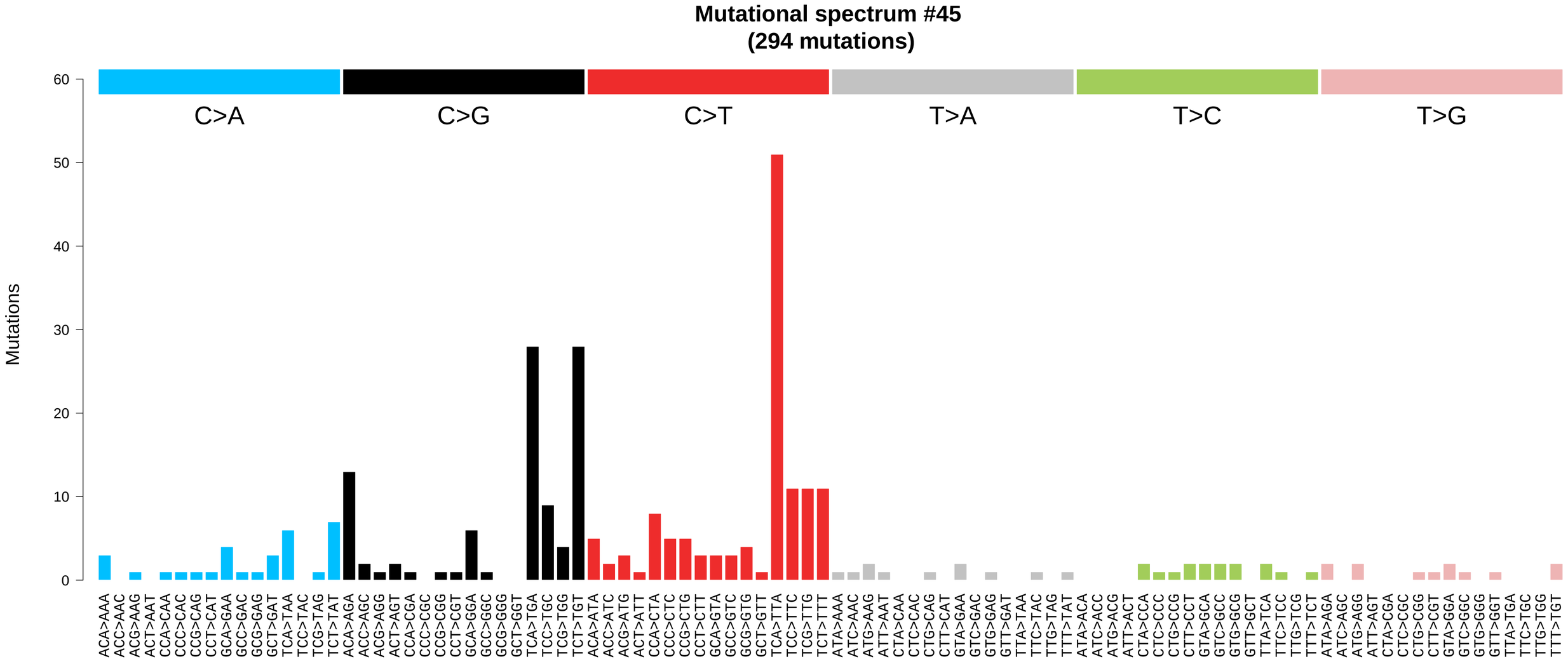

Mutational spectrum #40
(36 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

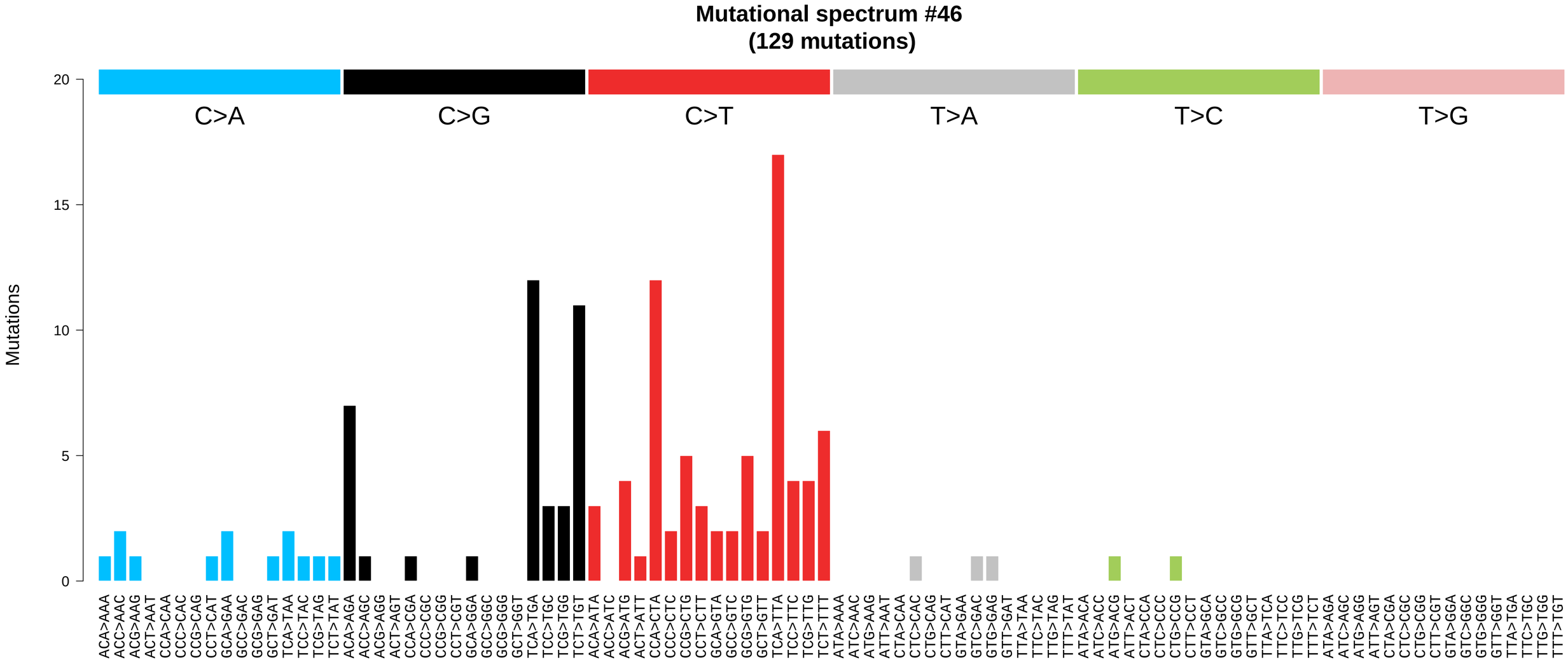

Mutational spectrum #41
(108 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

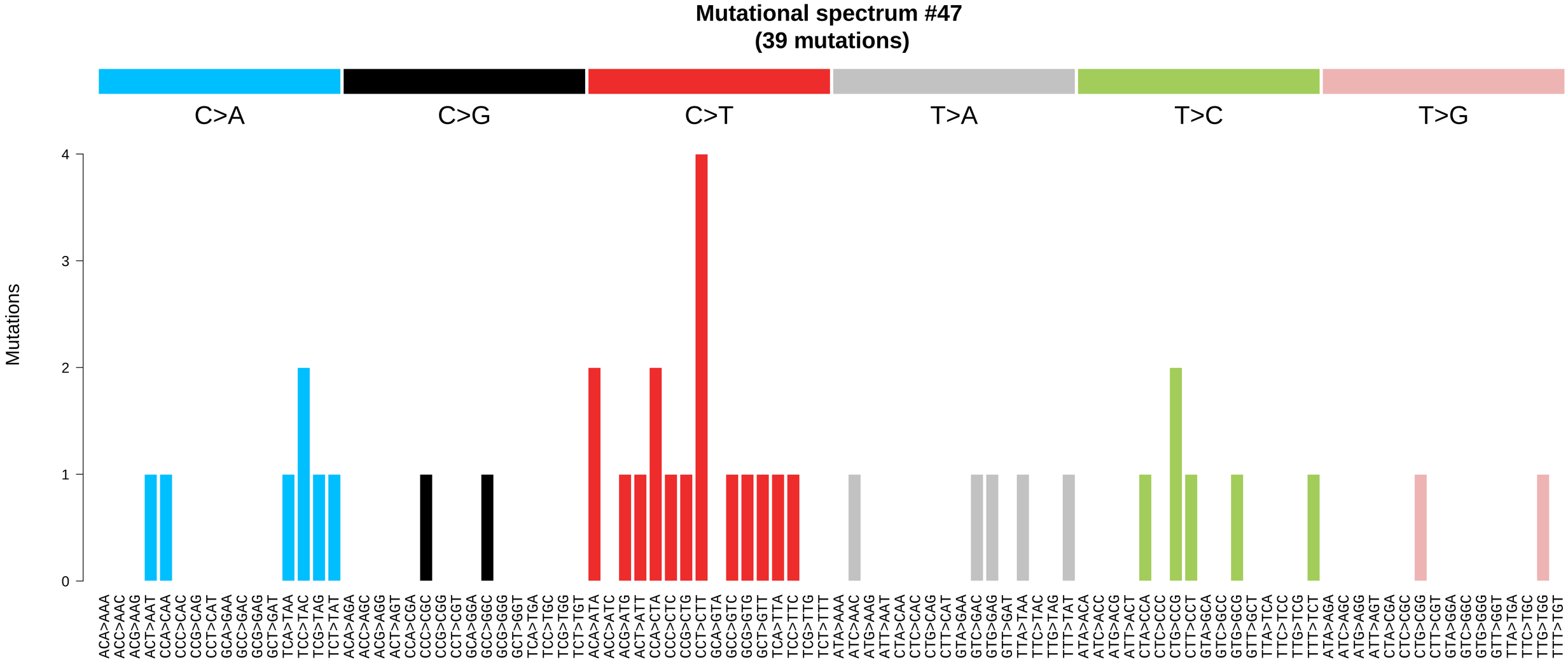

Mutational spectrum #42
(62 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

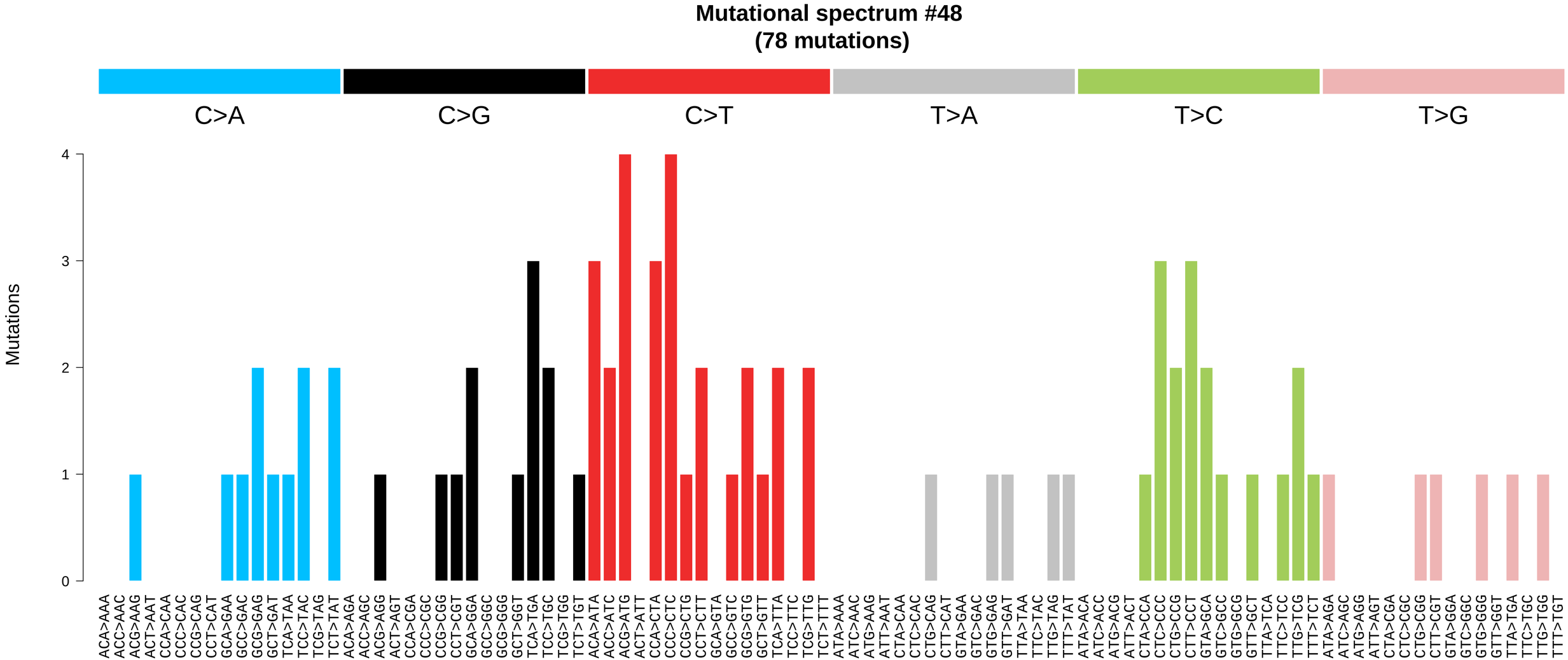

Mutational spectrum #43
(54 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

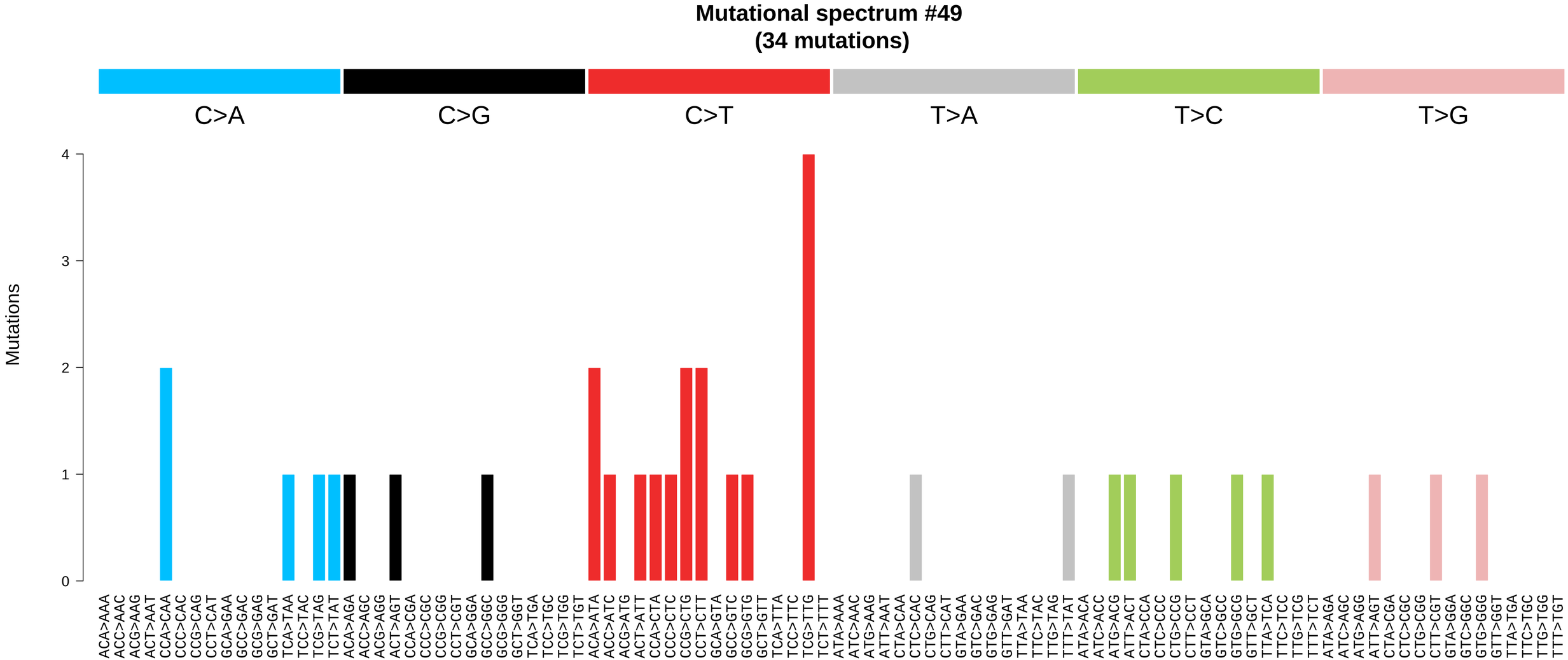

Mutational spectrum #44
(40 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

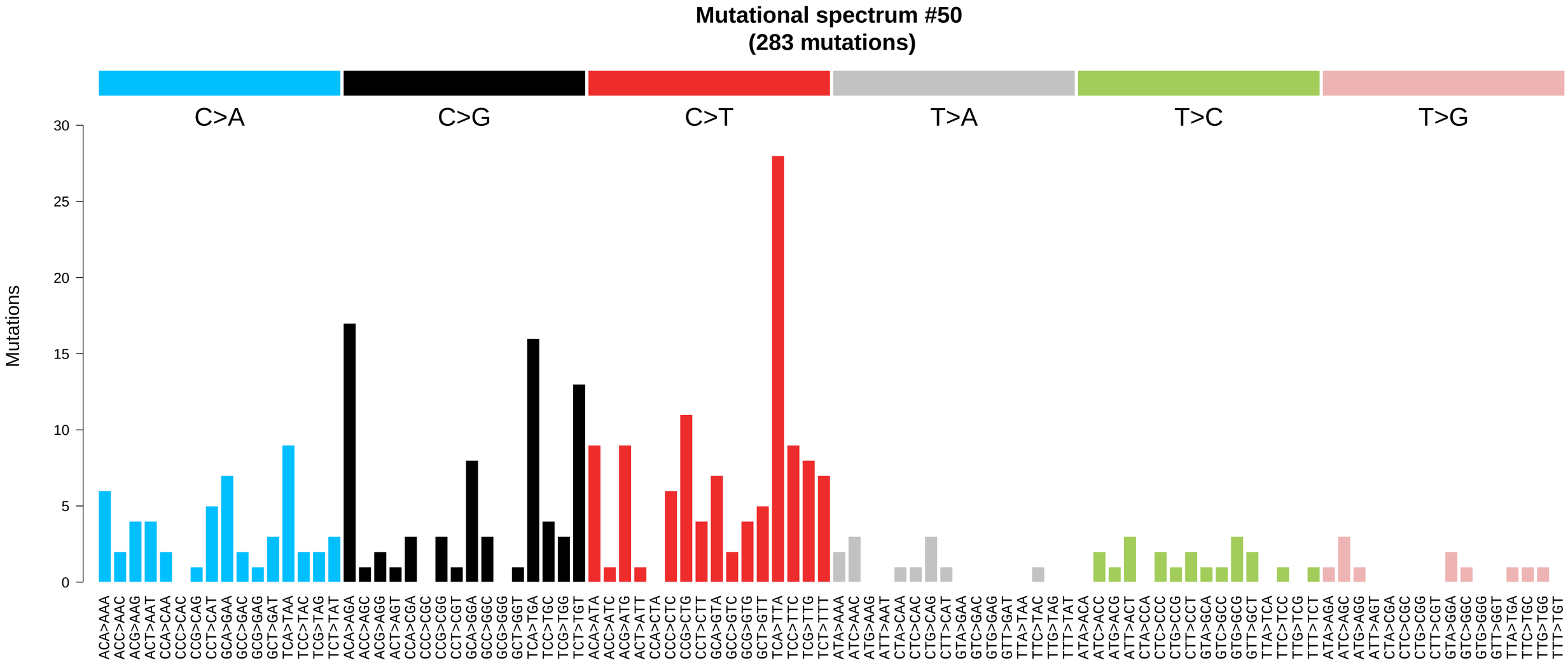

Mutational spectrum #45
(294 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
10
20
30
40
50
60
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

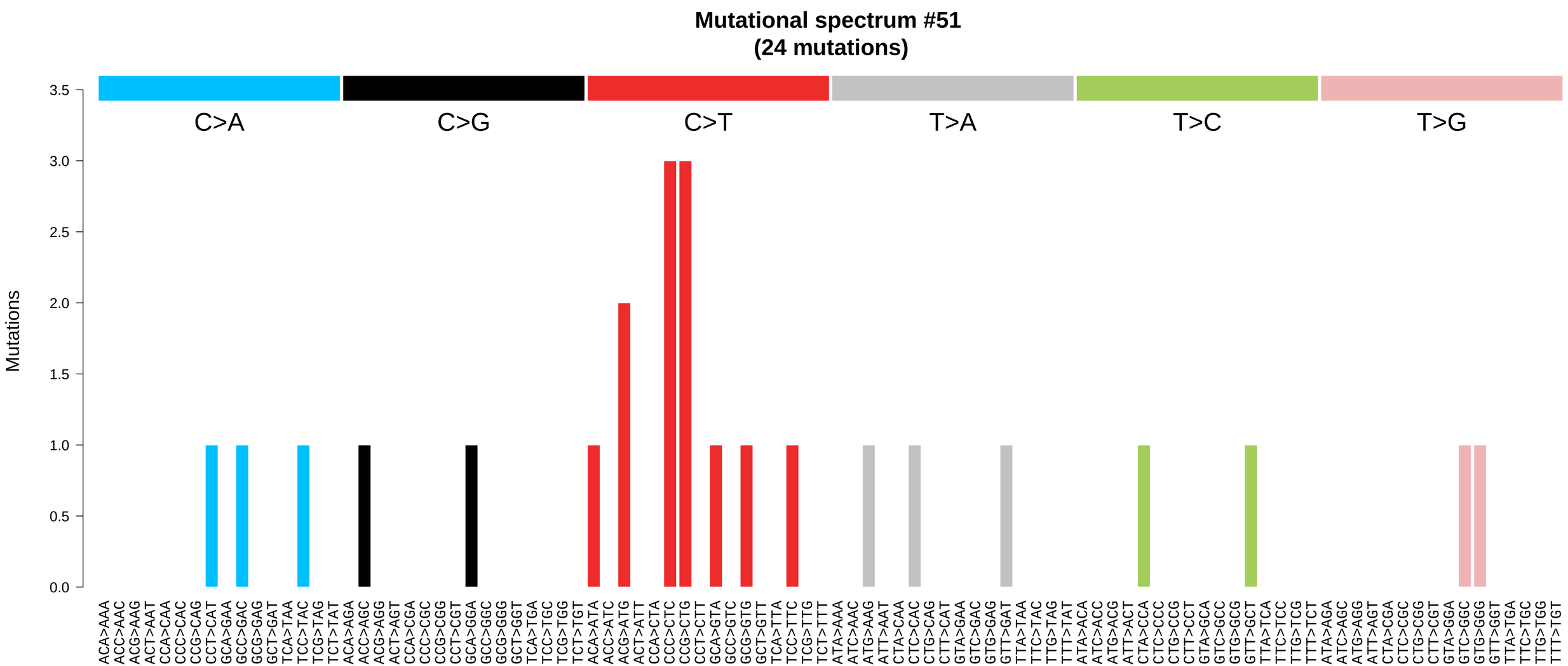

Mutational spectrum #46
(129 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

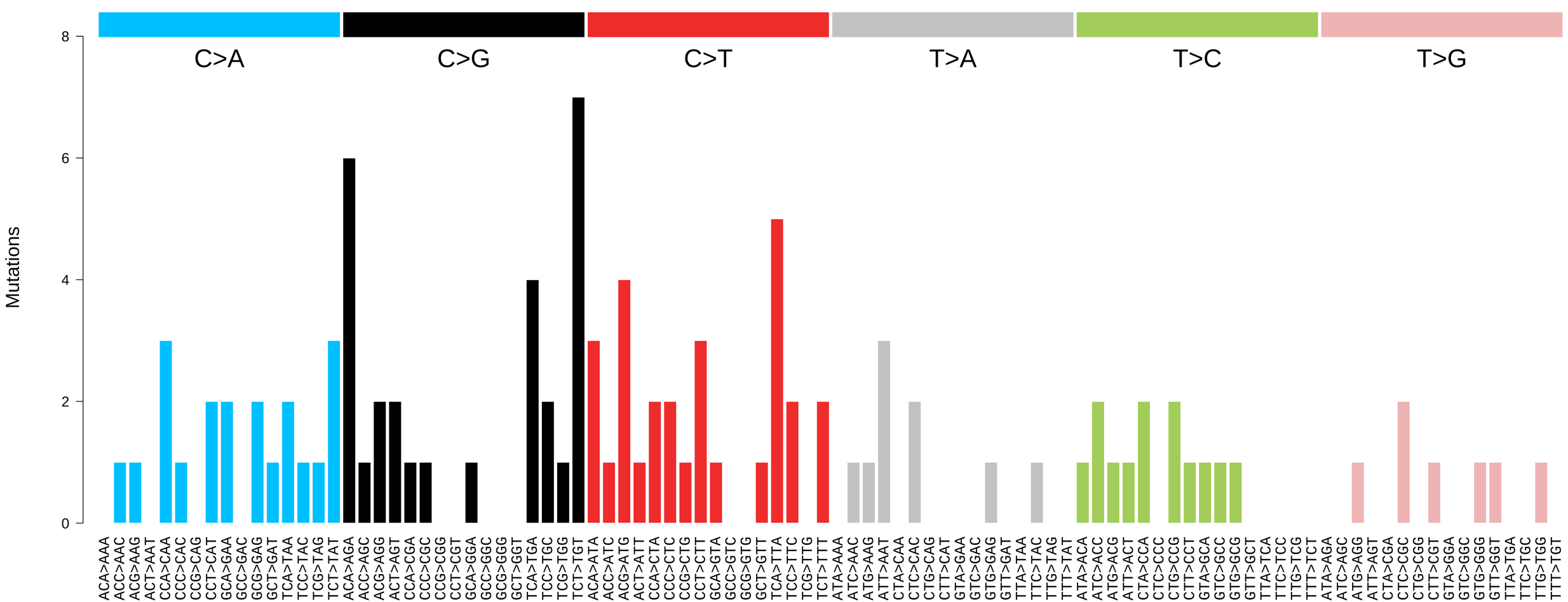

Mutational spectrum #47
(39 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

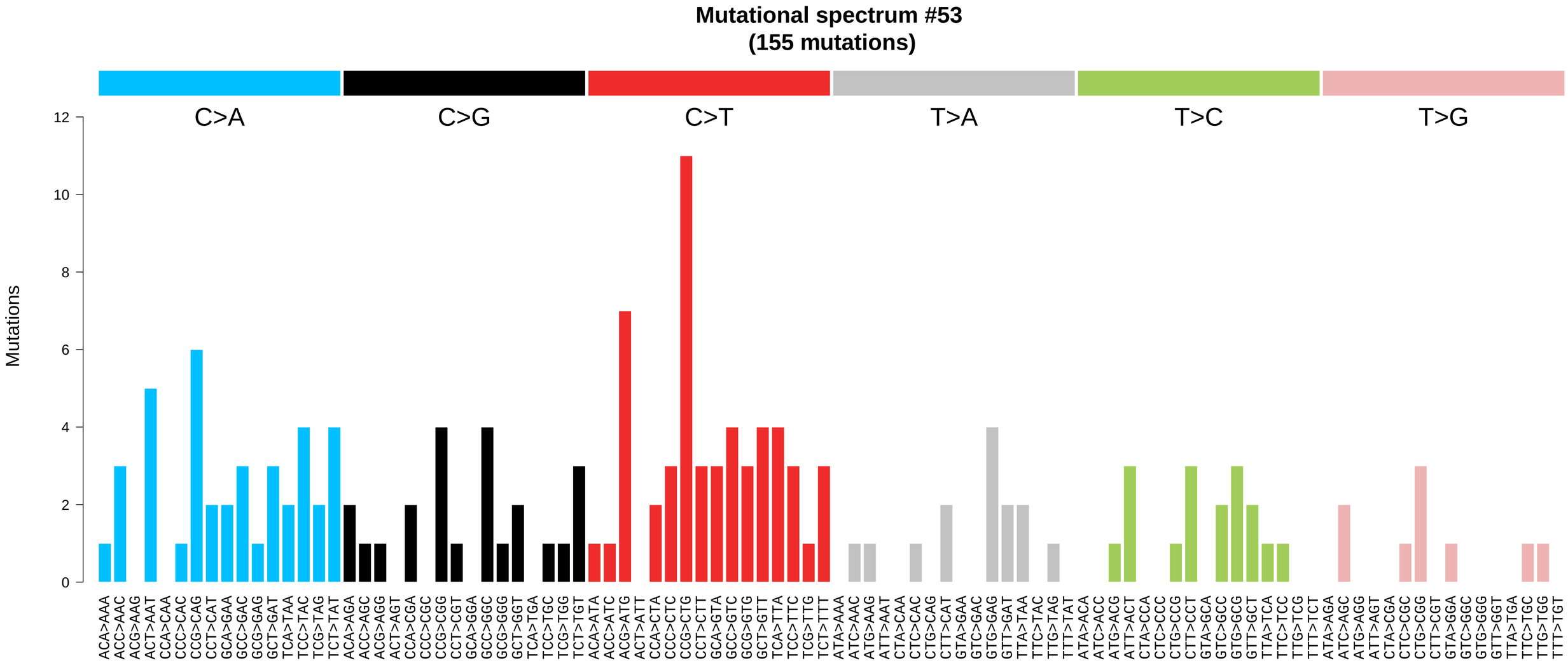

Mutational spectrum #48
(78 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

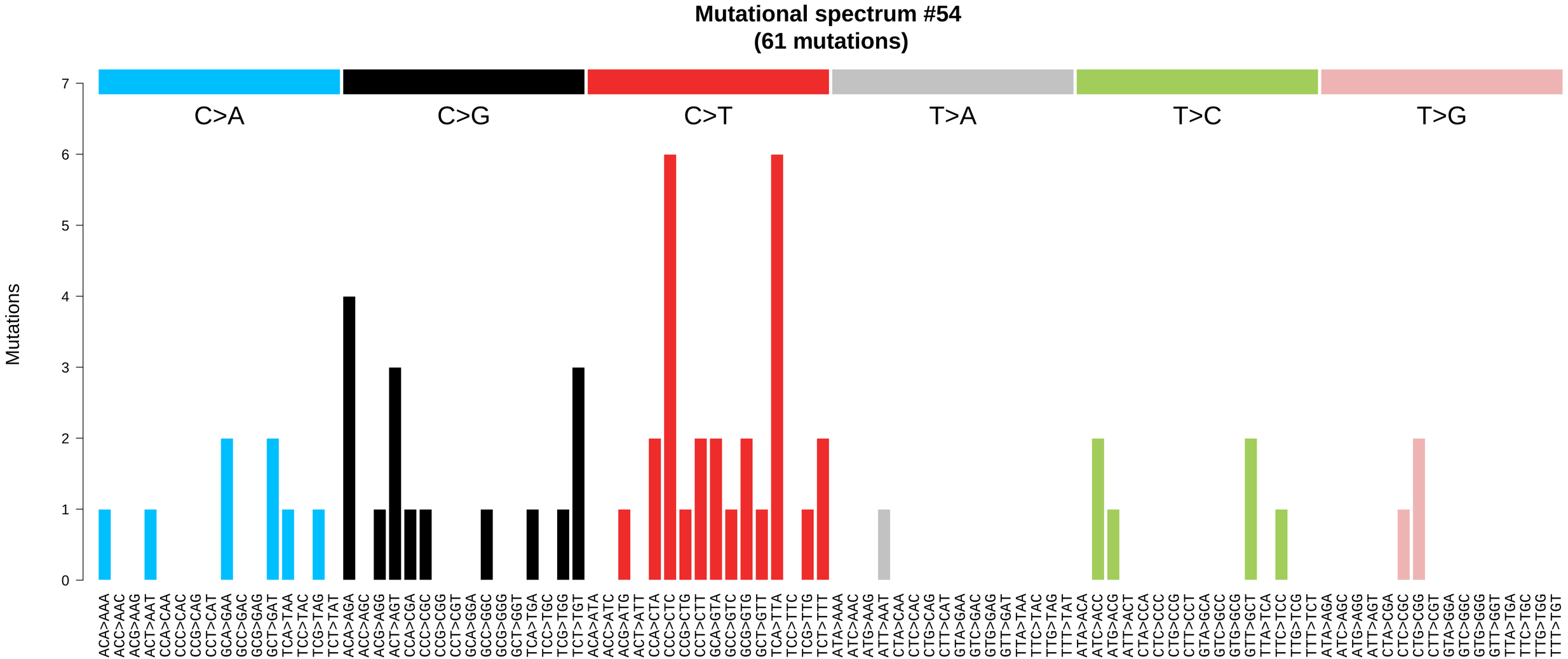

Mutational spectrum #49
(34 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

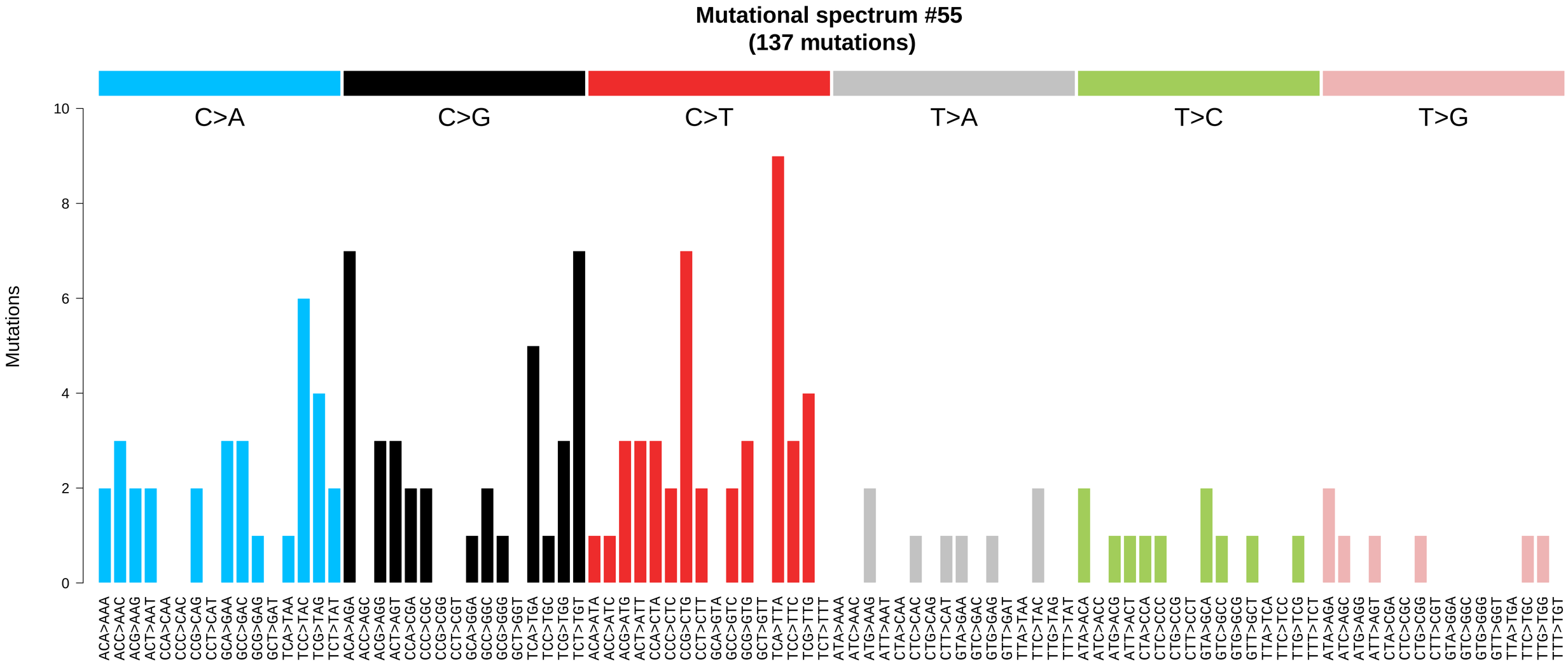

Mutational spectrum #50
(283 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
25
30
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

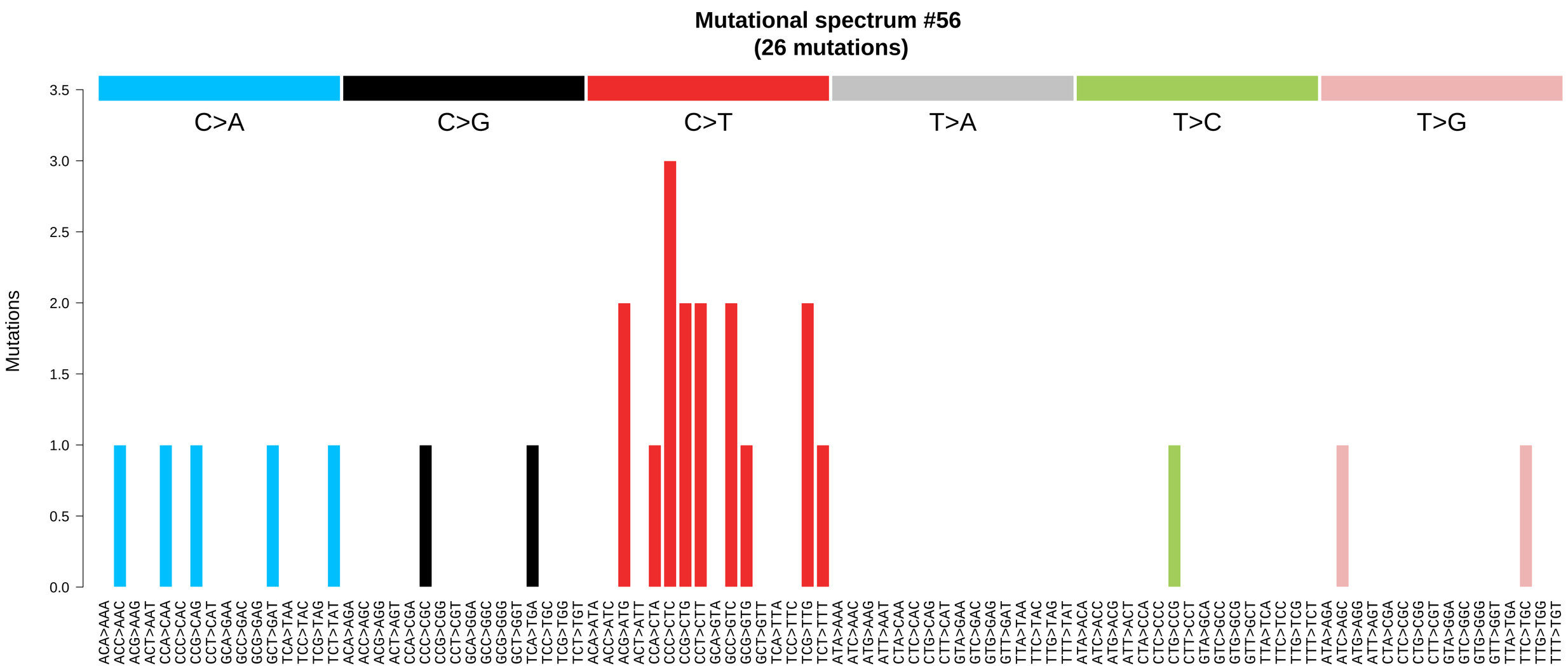

Mutational spectrum #51
(24 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

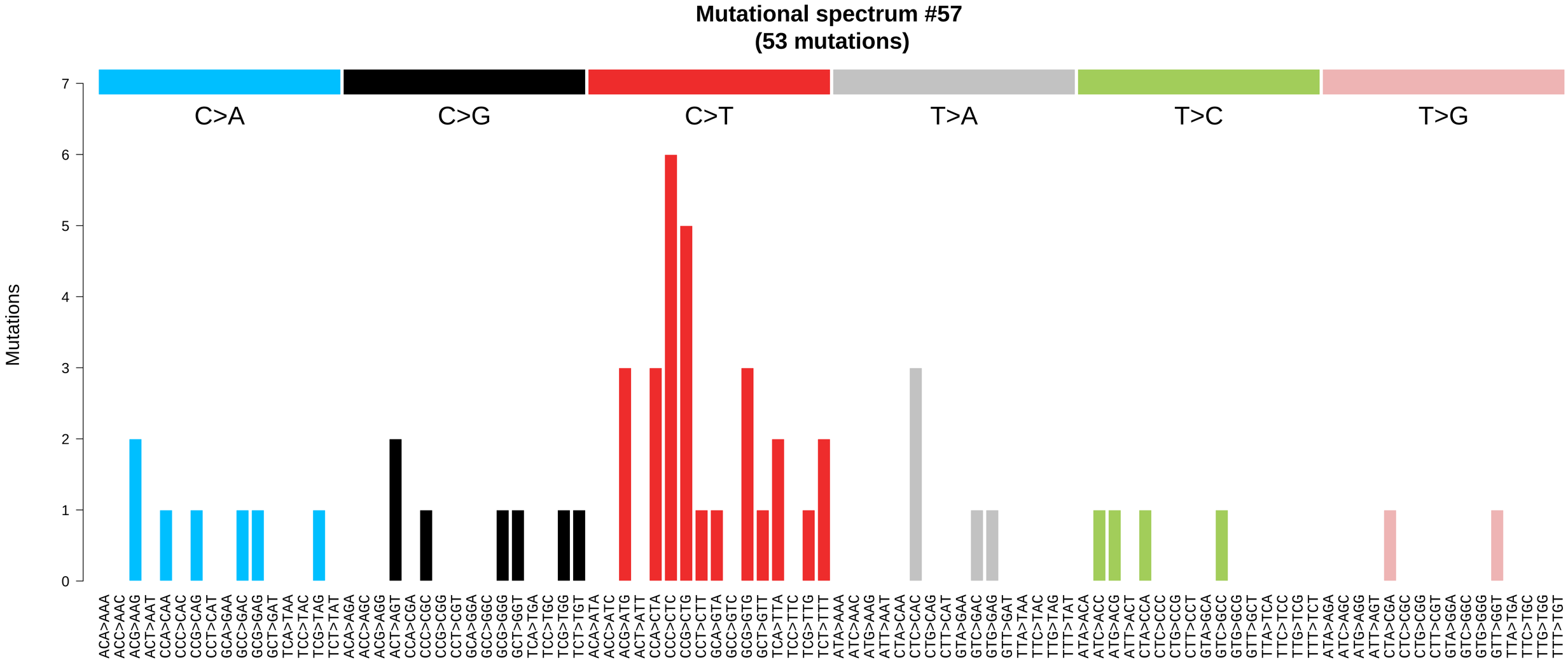

Mutational spectrum #52
(105 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

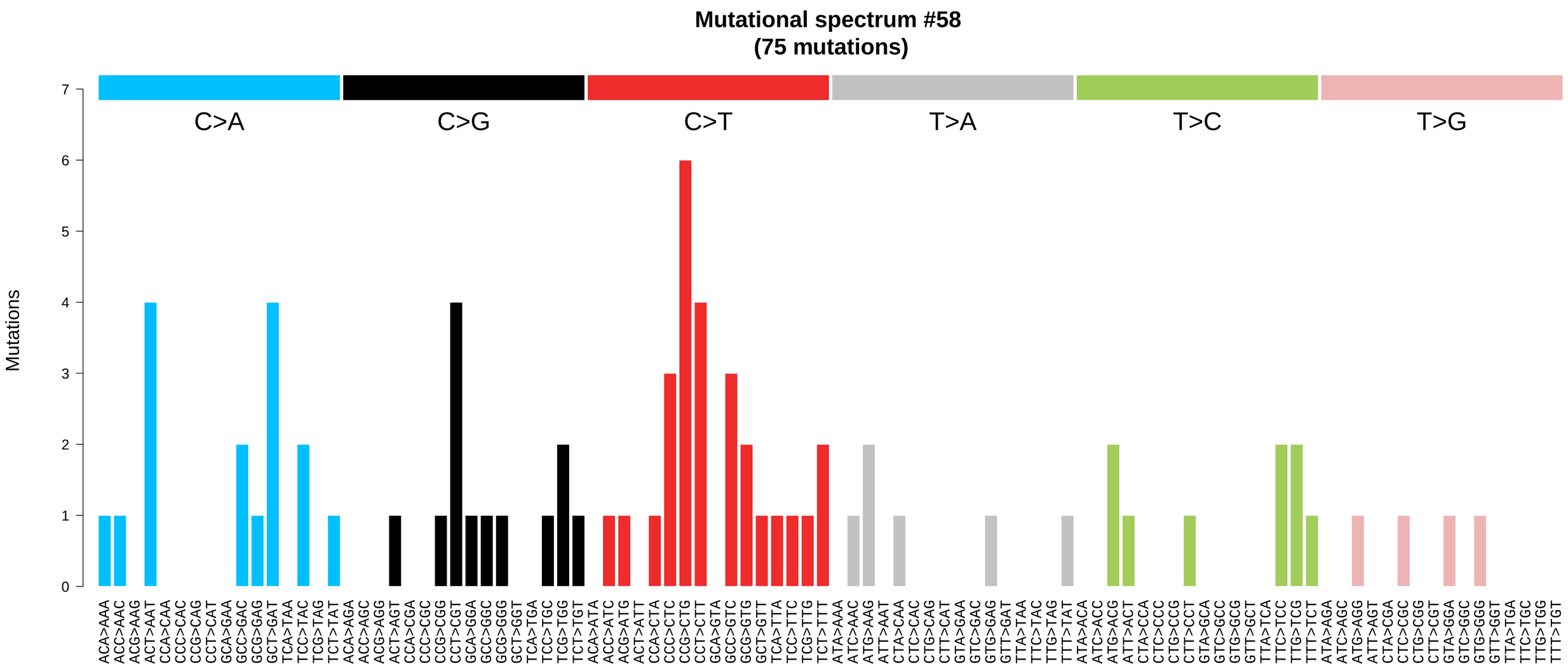

Mutational spectrum #53
(155 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

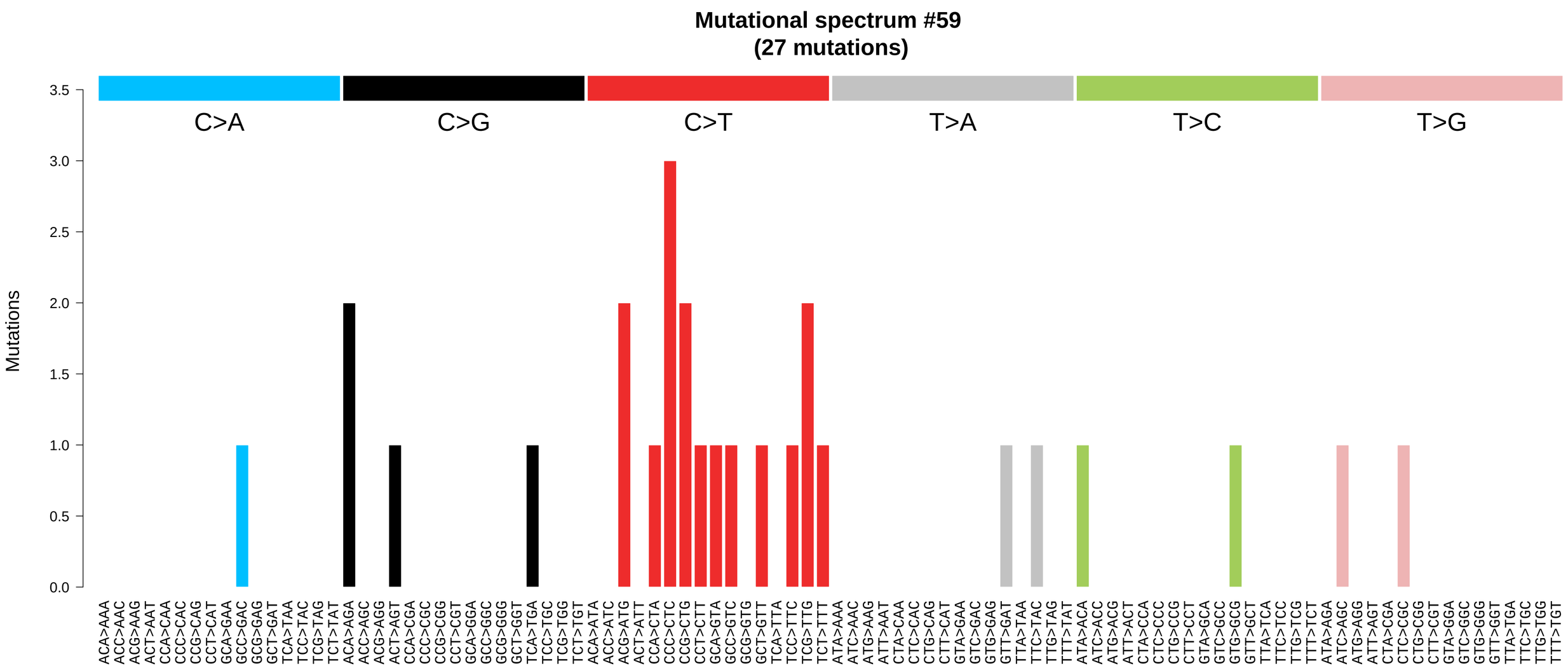

Mutational spectrum #54
(61 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

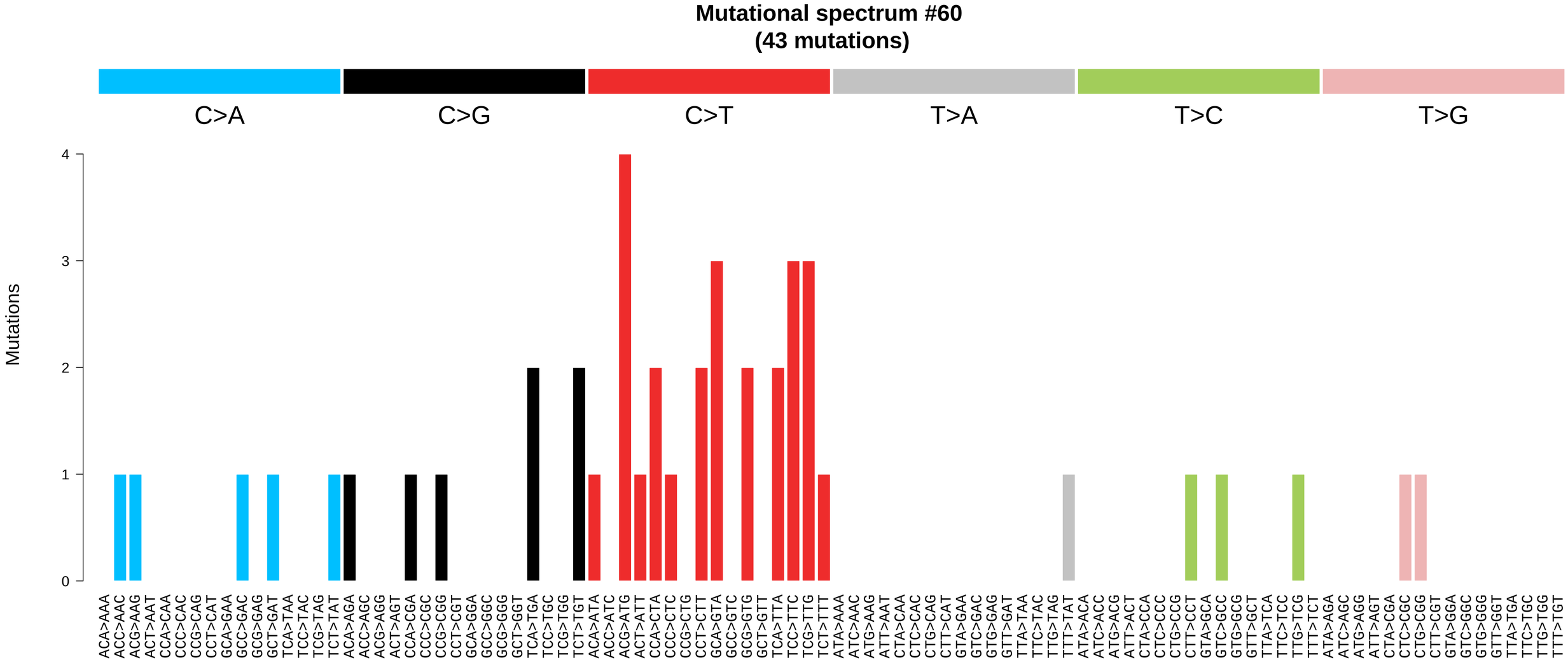

Mutational spectrum #55
(137 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

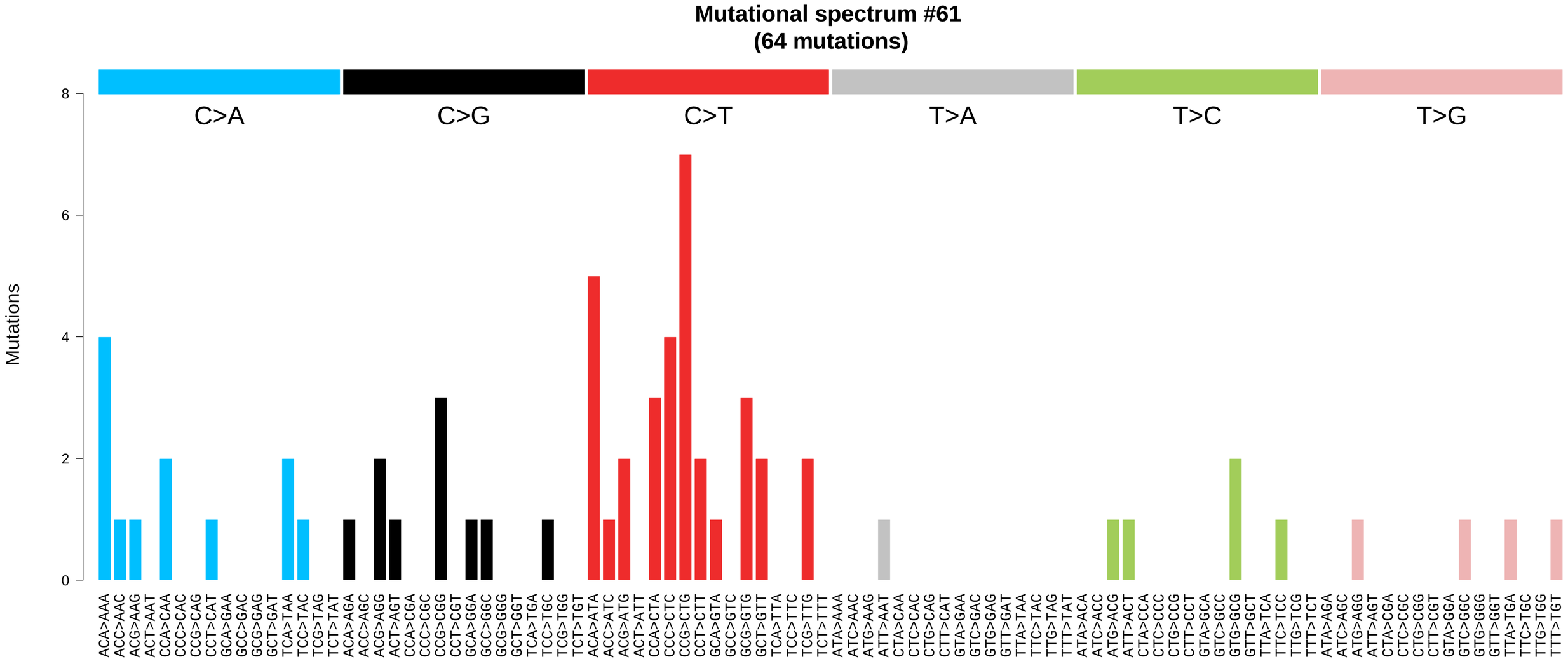

Mutational spectrum #56
(26 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

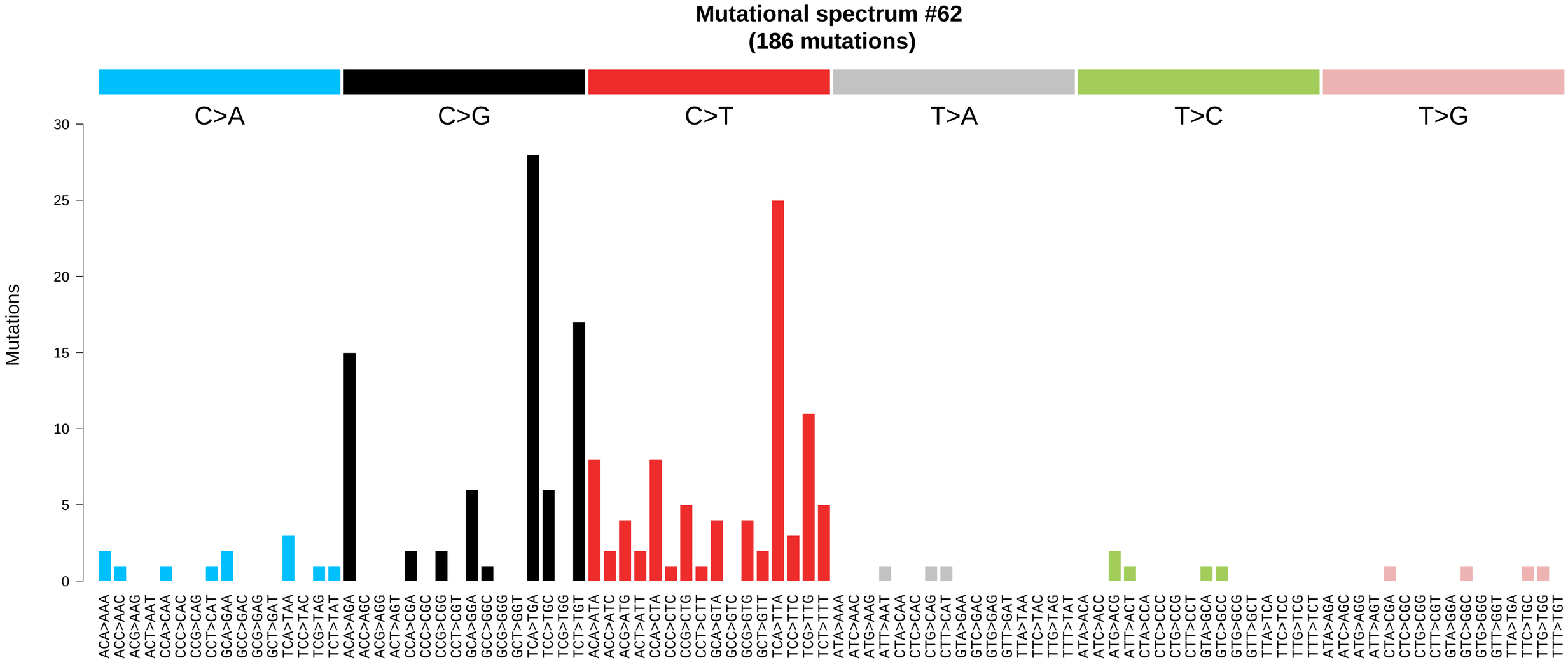

Mutational spectrum #57
(53 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

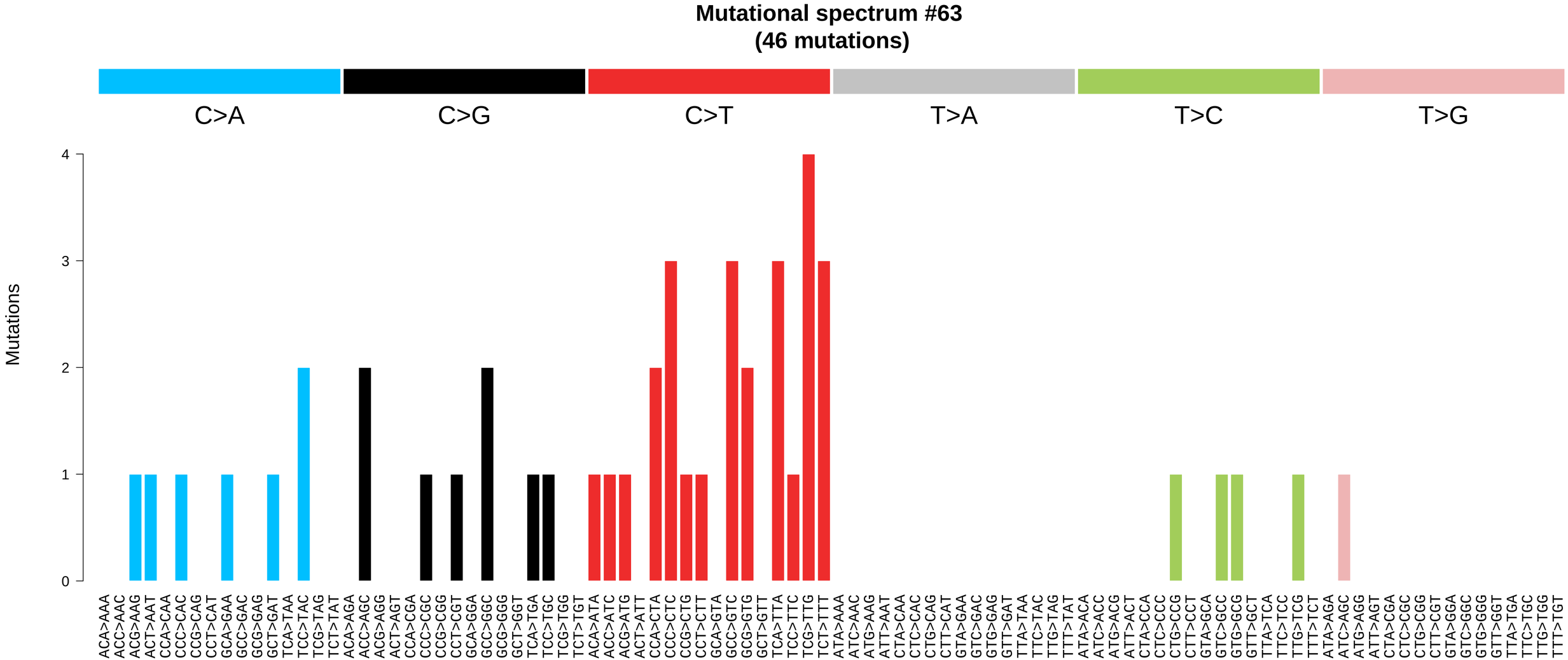

Mutational spectrum #58
(75 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

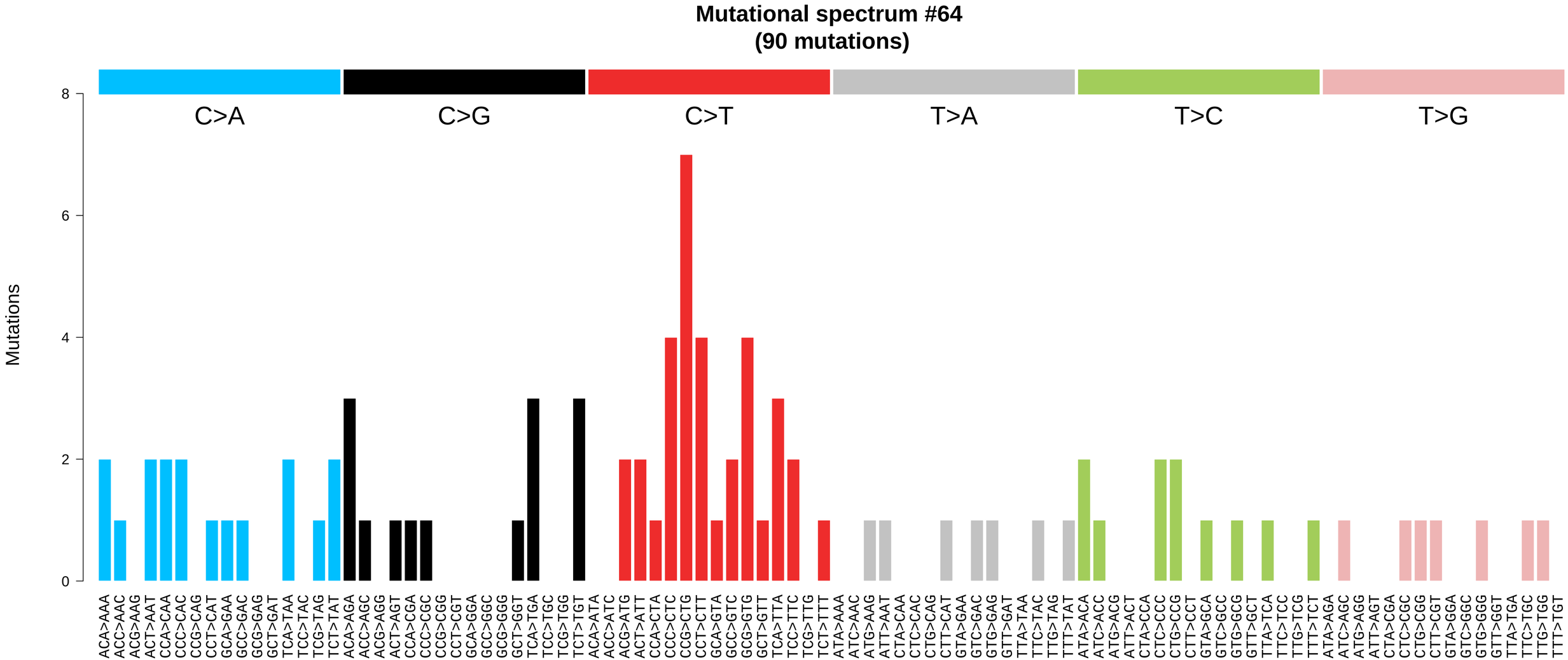

Mutational spectrum #59
(27 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

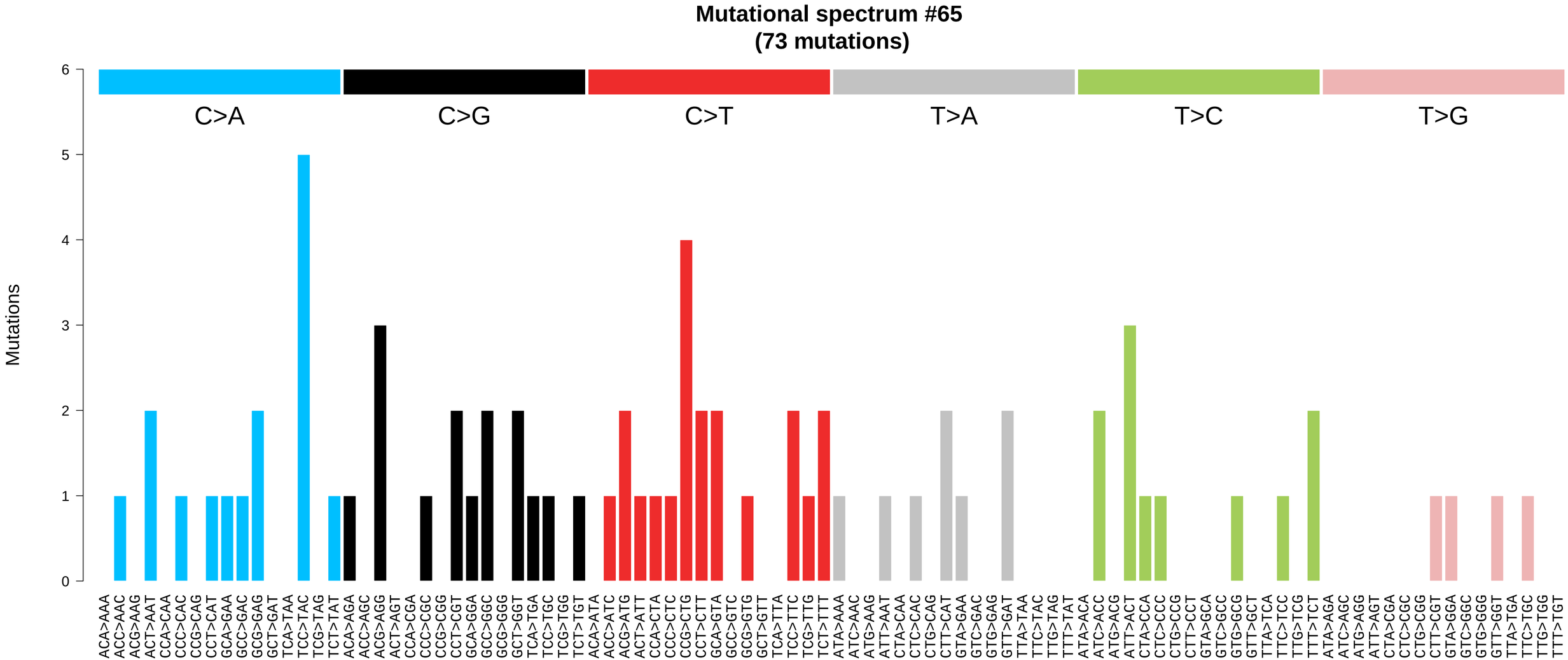

Mutational spectrum #60
(43 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

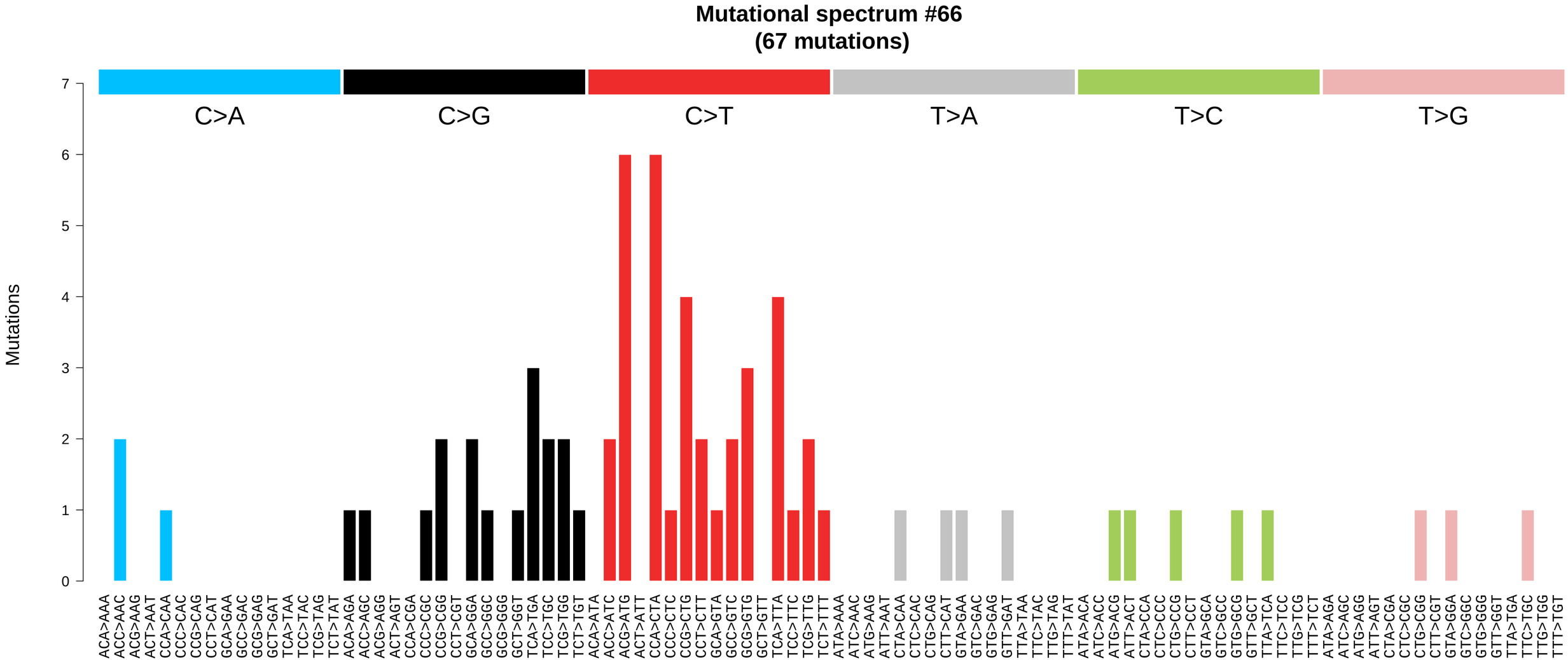

Mutational spectrum #61
(64 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

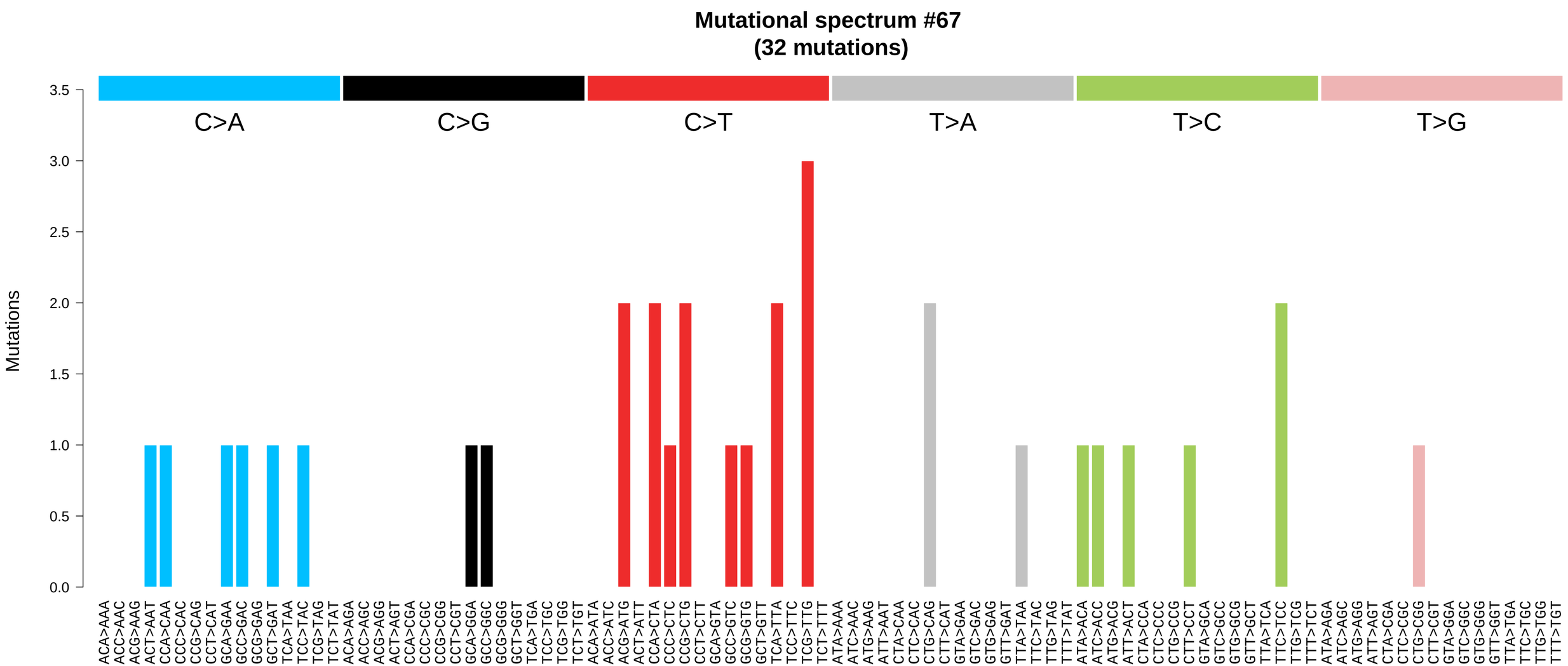

Mutational spectrum #62
(186 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
25
30
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

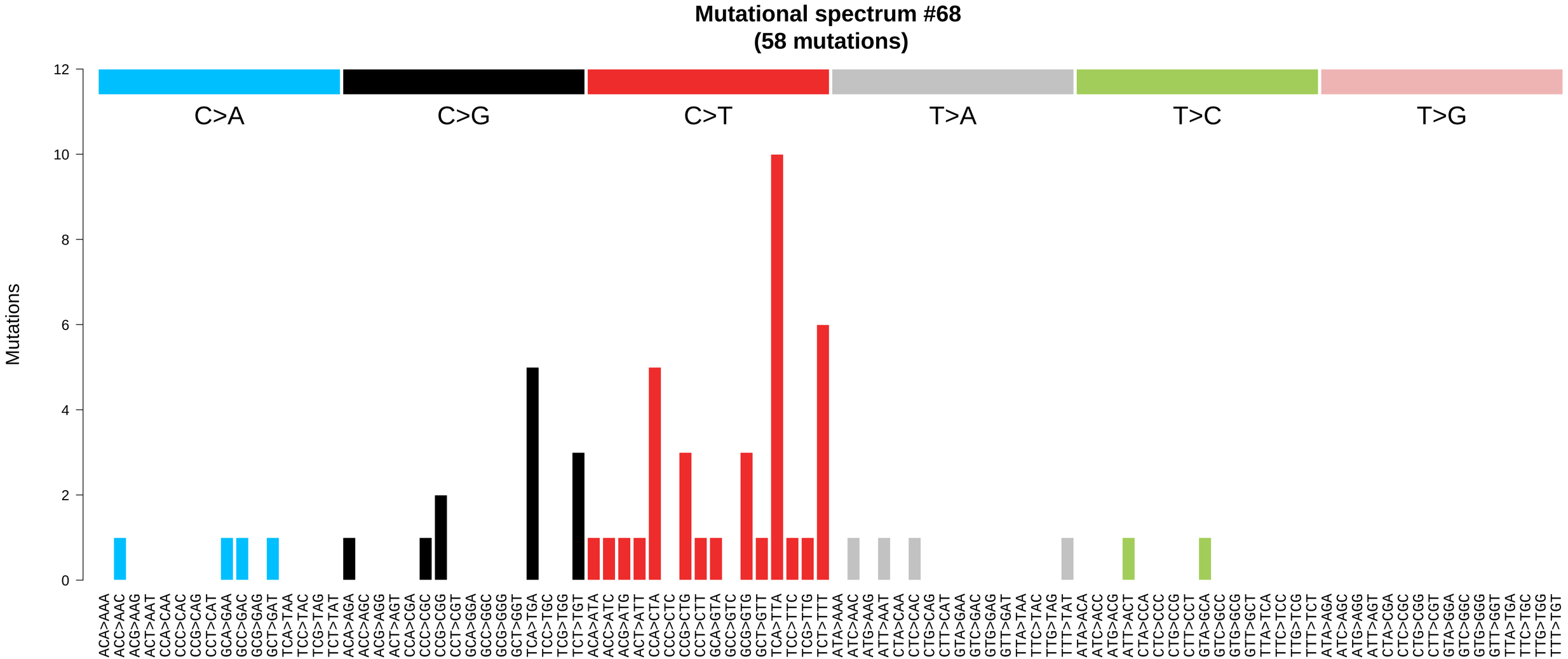

Mutational spectrum #63
(46 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

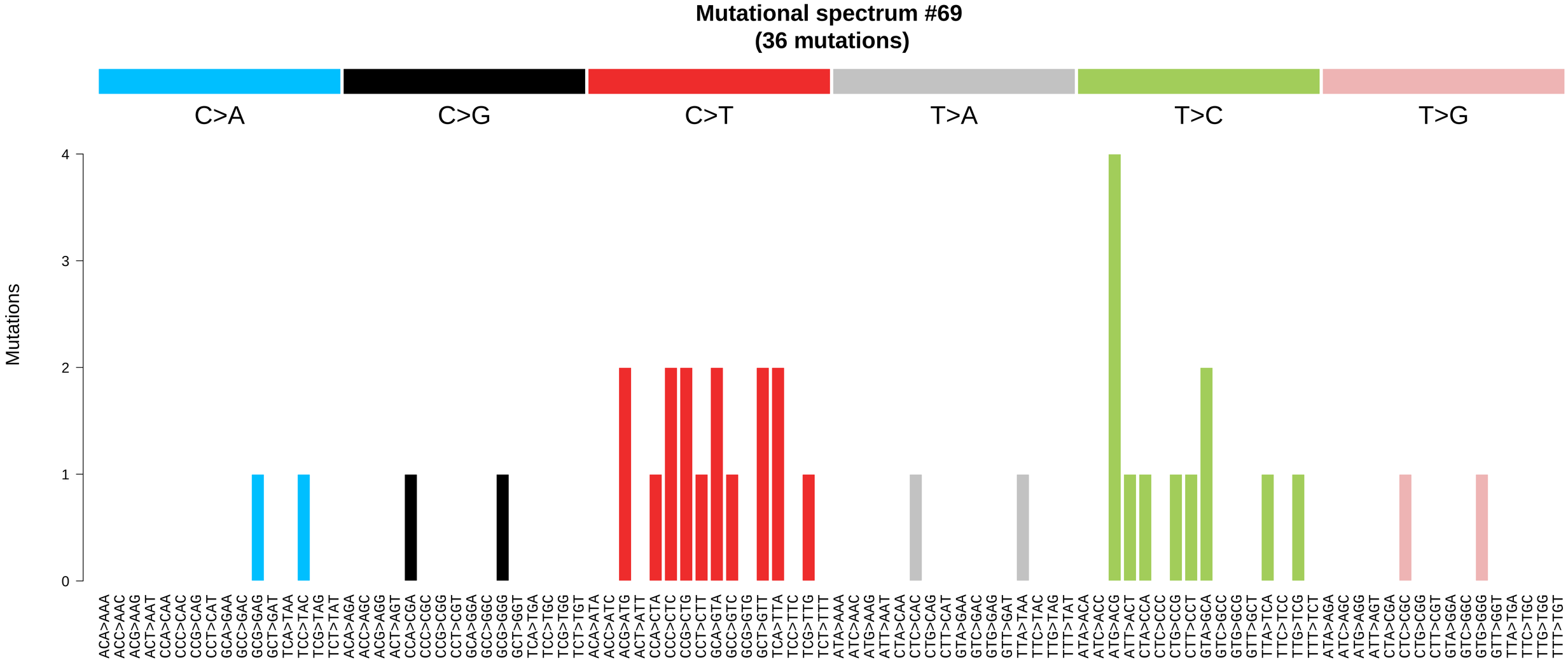

Mutational spectrum #64
(90 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

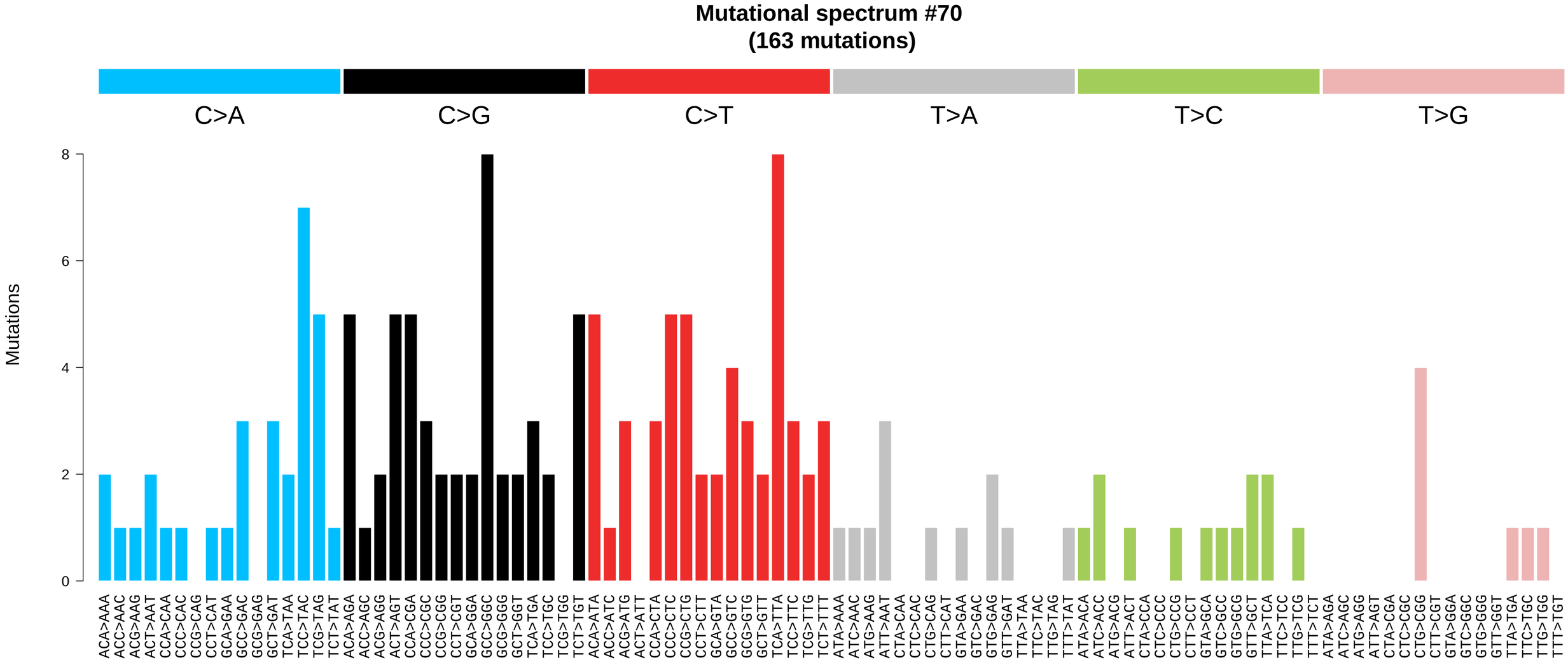

Mutational spectrum #65
(73 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

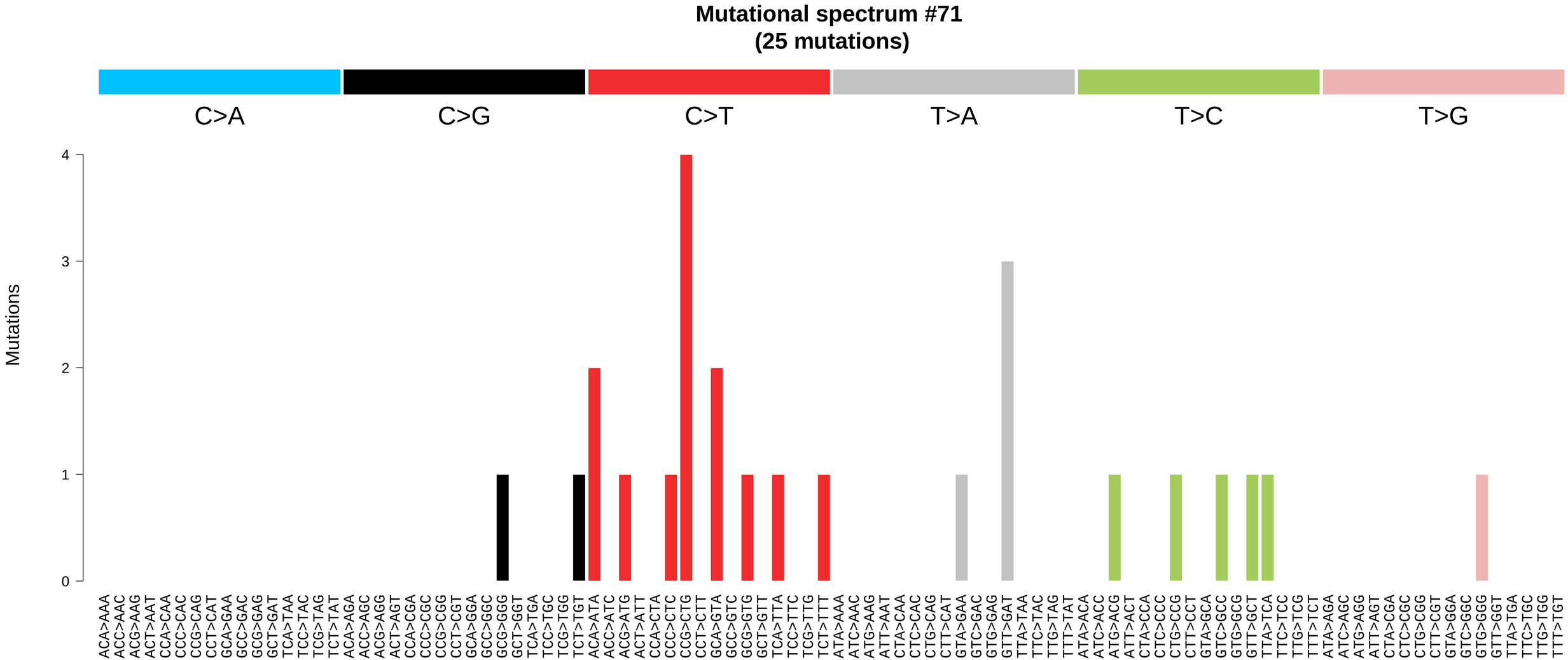

Mutational spectrum #66
(67 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

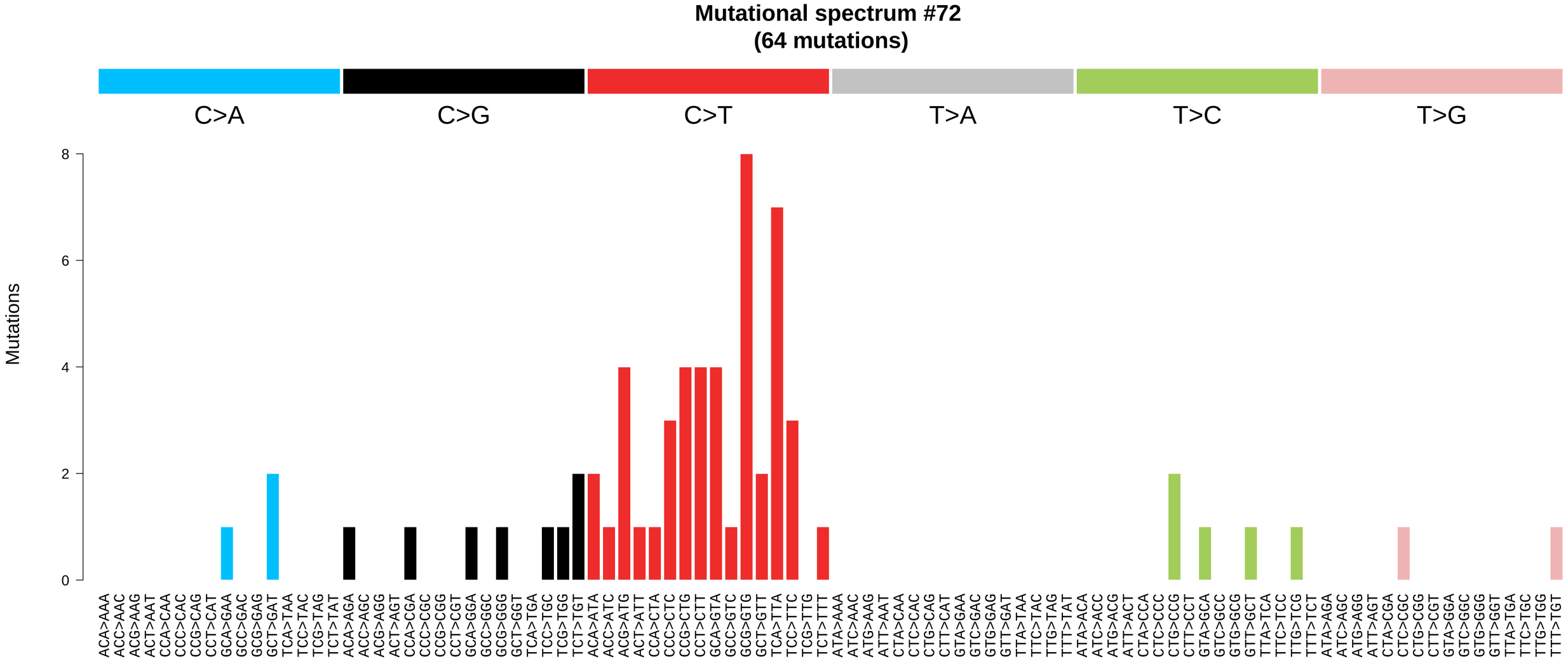

Mutational spectrum #67
(32 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

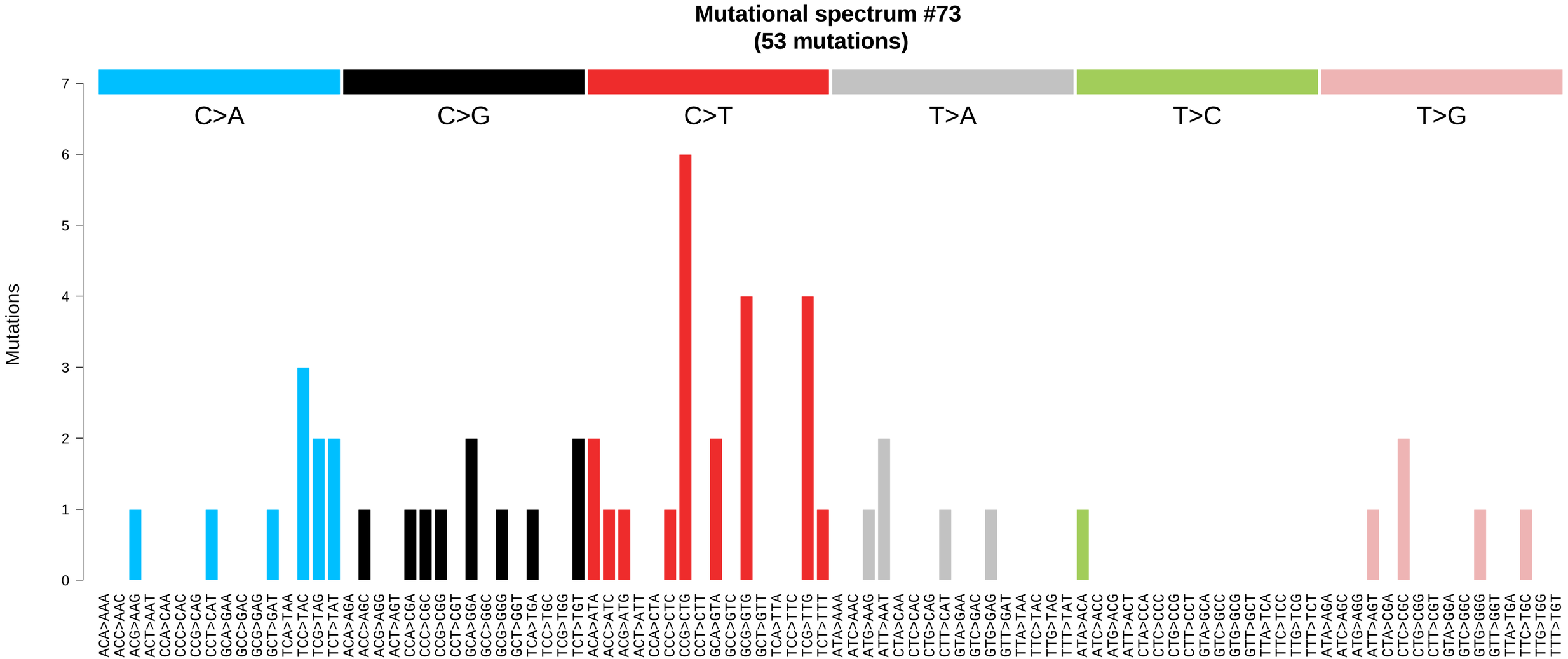

Mutational spectrum #68
(58 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

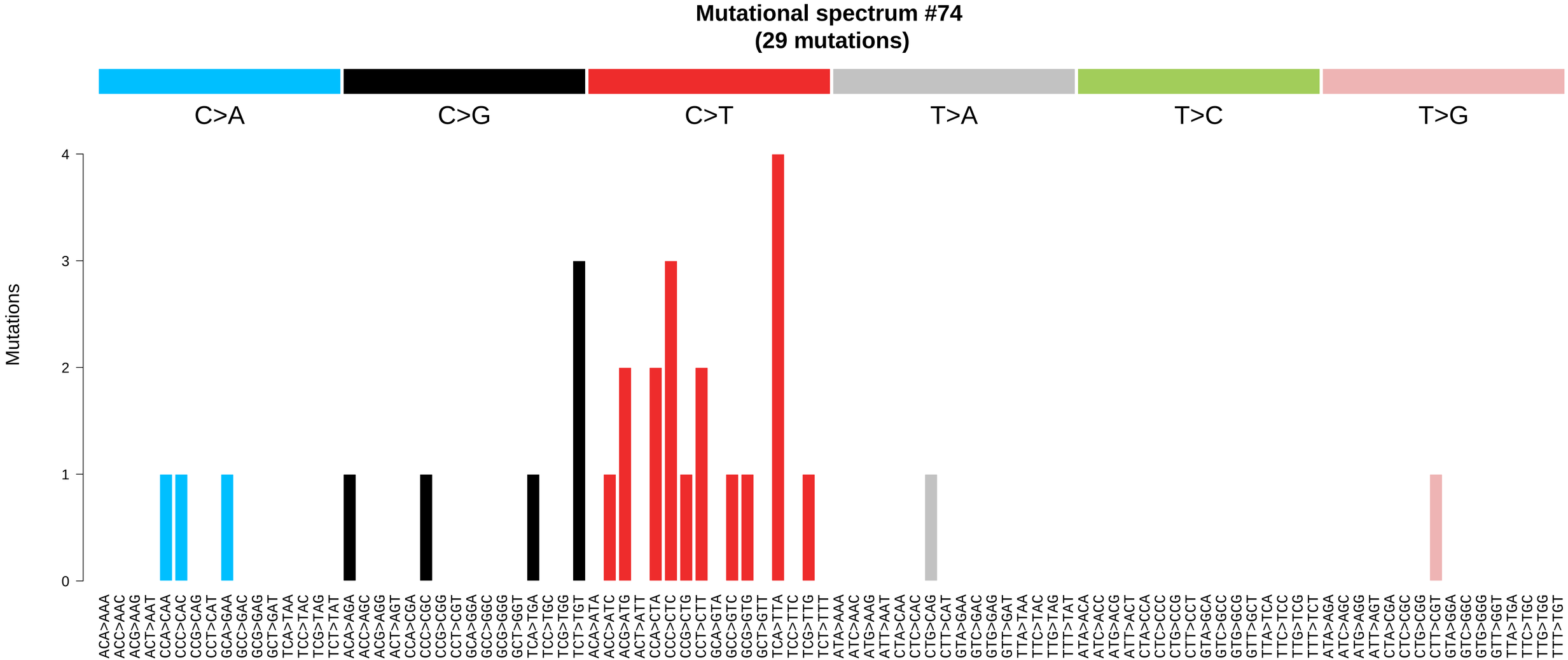

Mutational spectrum #69
(36 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

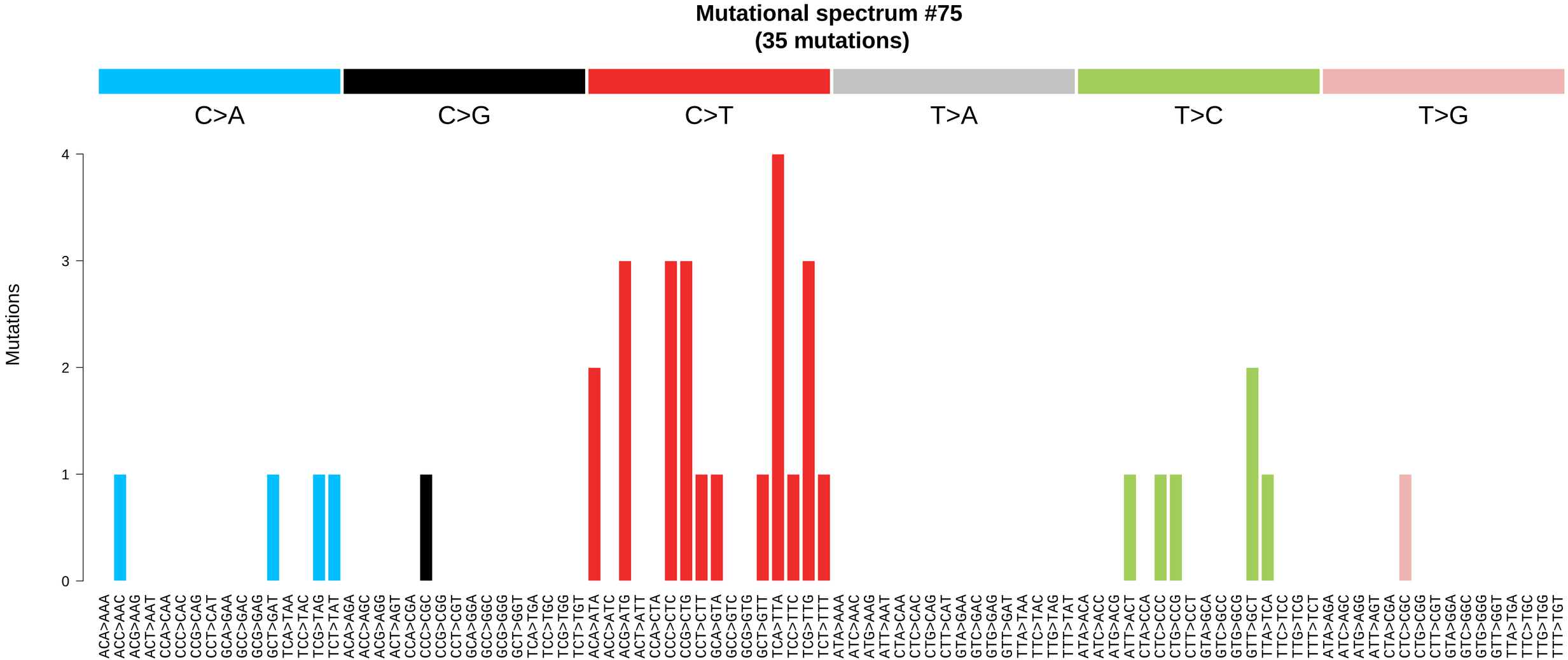

Mutational spectrum #70
(163 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

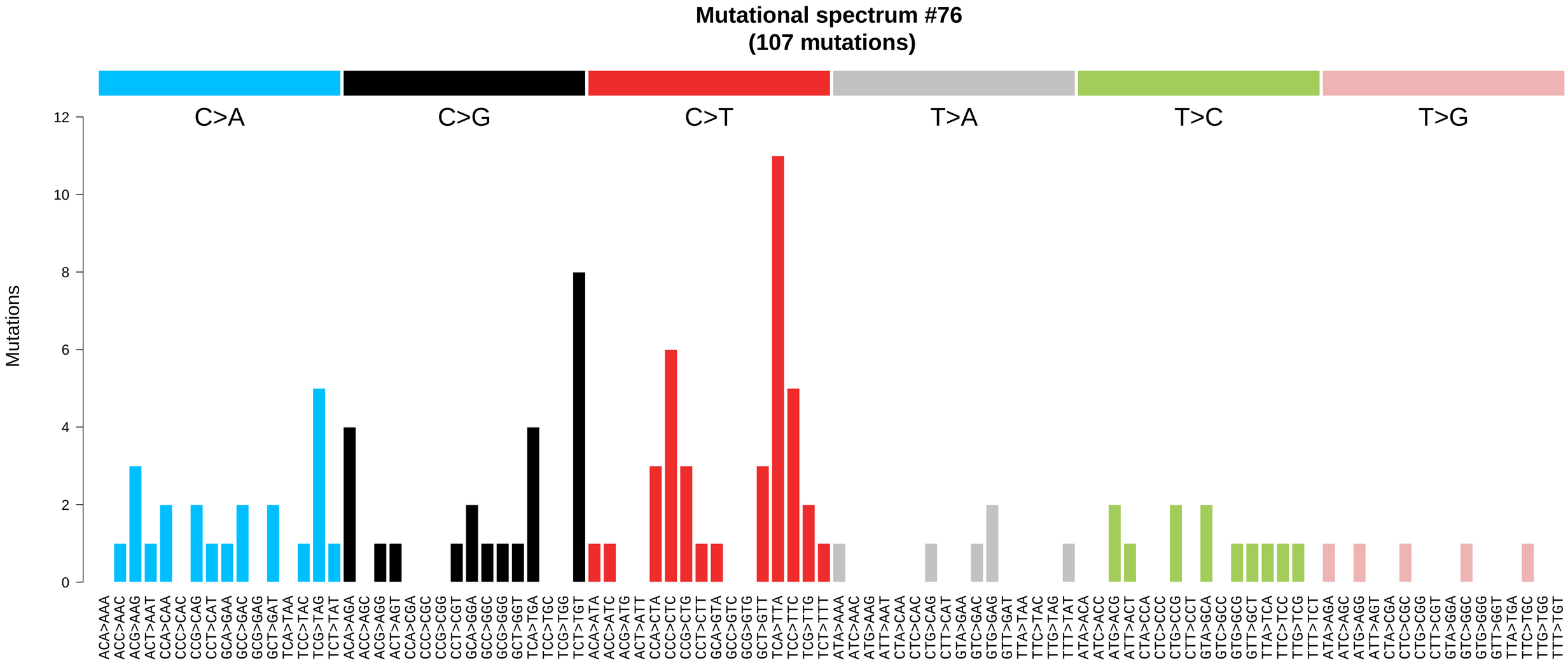

Mutational spectrum #71
(25 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

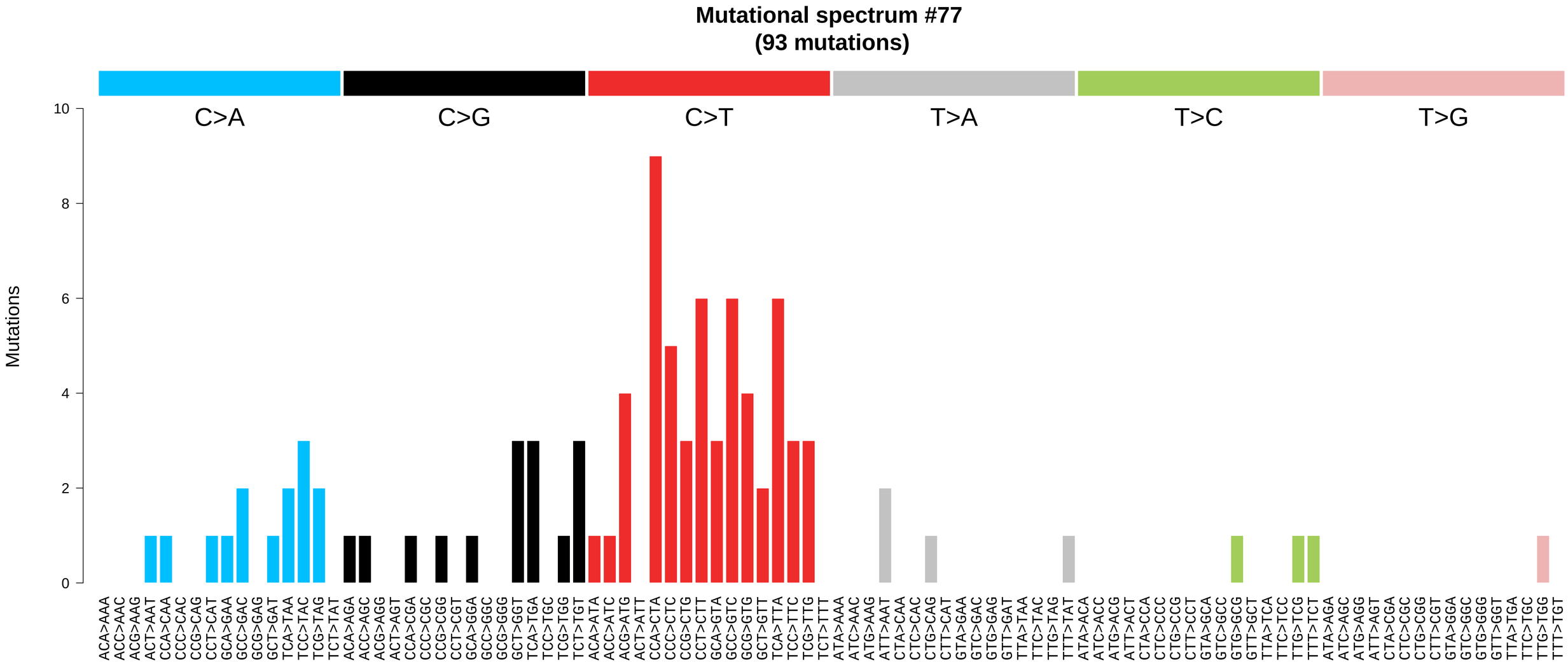

Mutational spectrum #72
(64 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

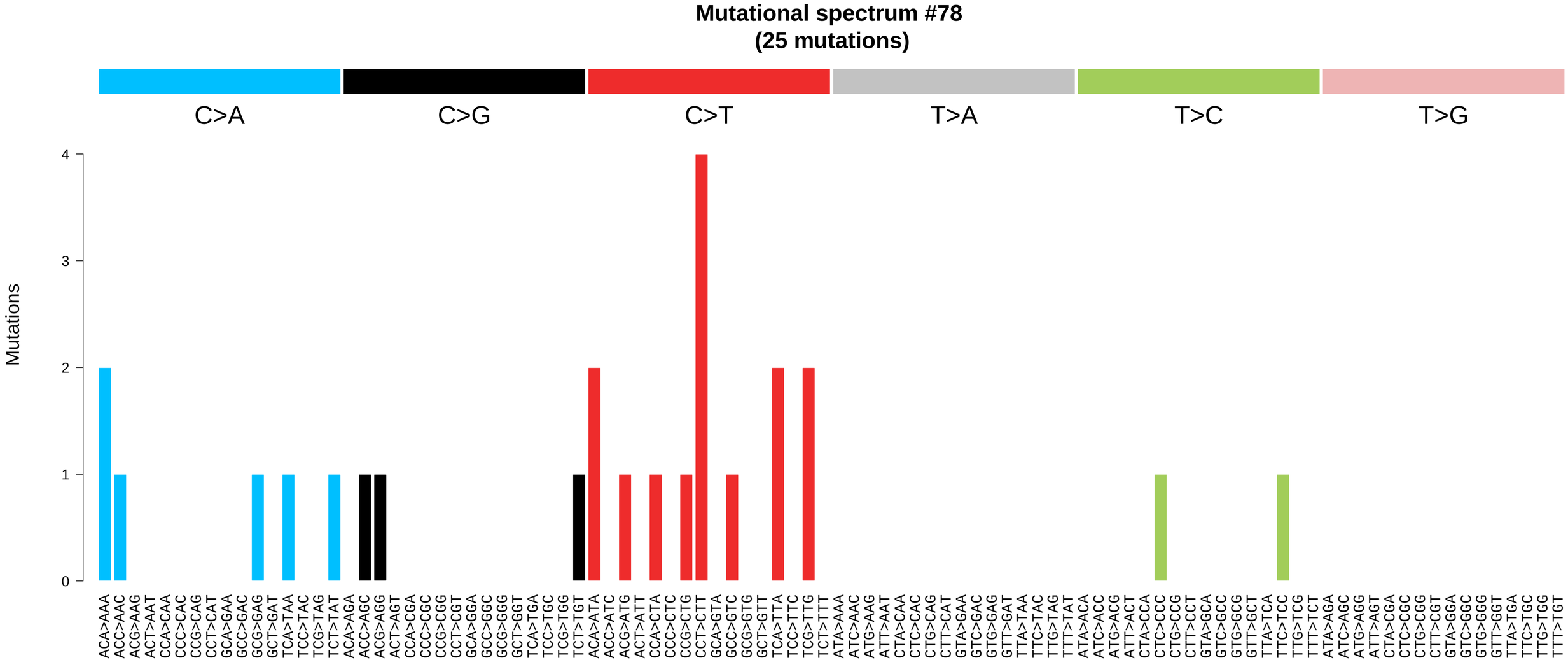

Mutational spectrum #73
(53 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

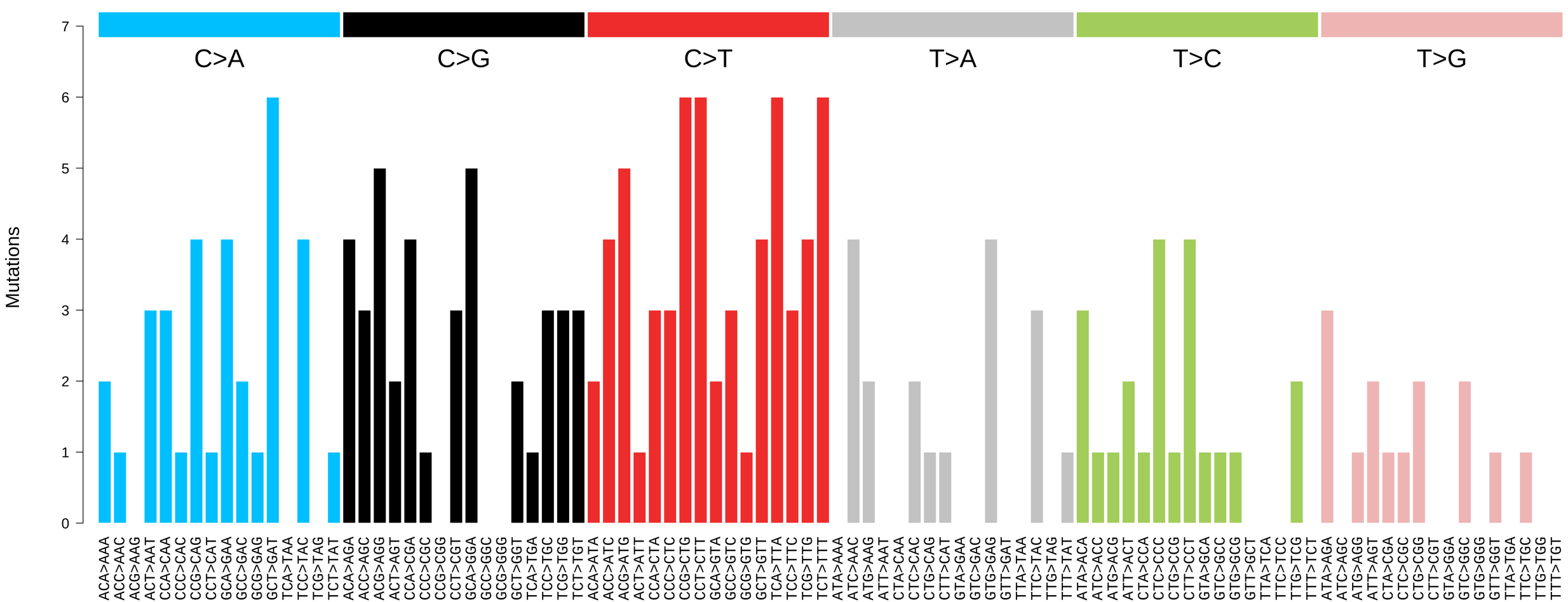

Mutational spectrum #74
(29 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

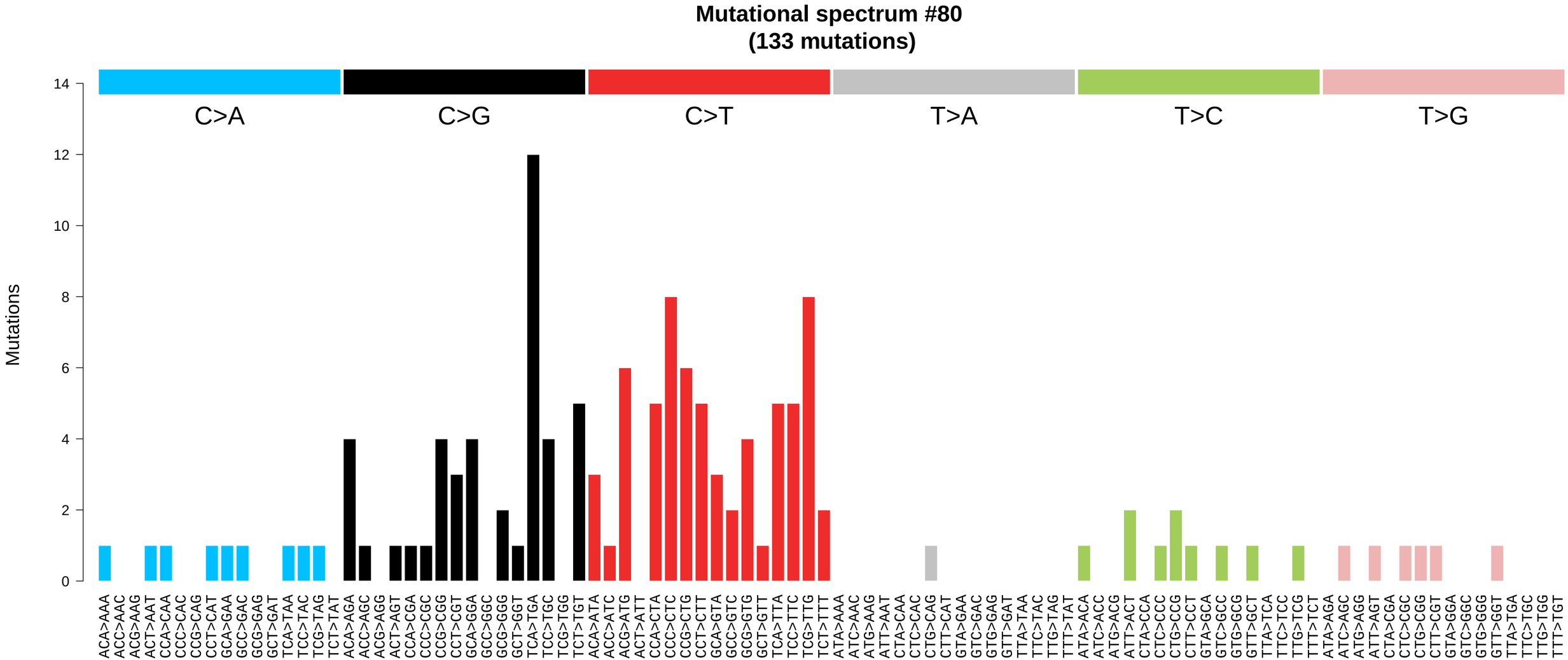

Mutational spectrum #75
(35 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

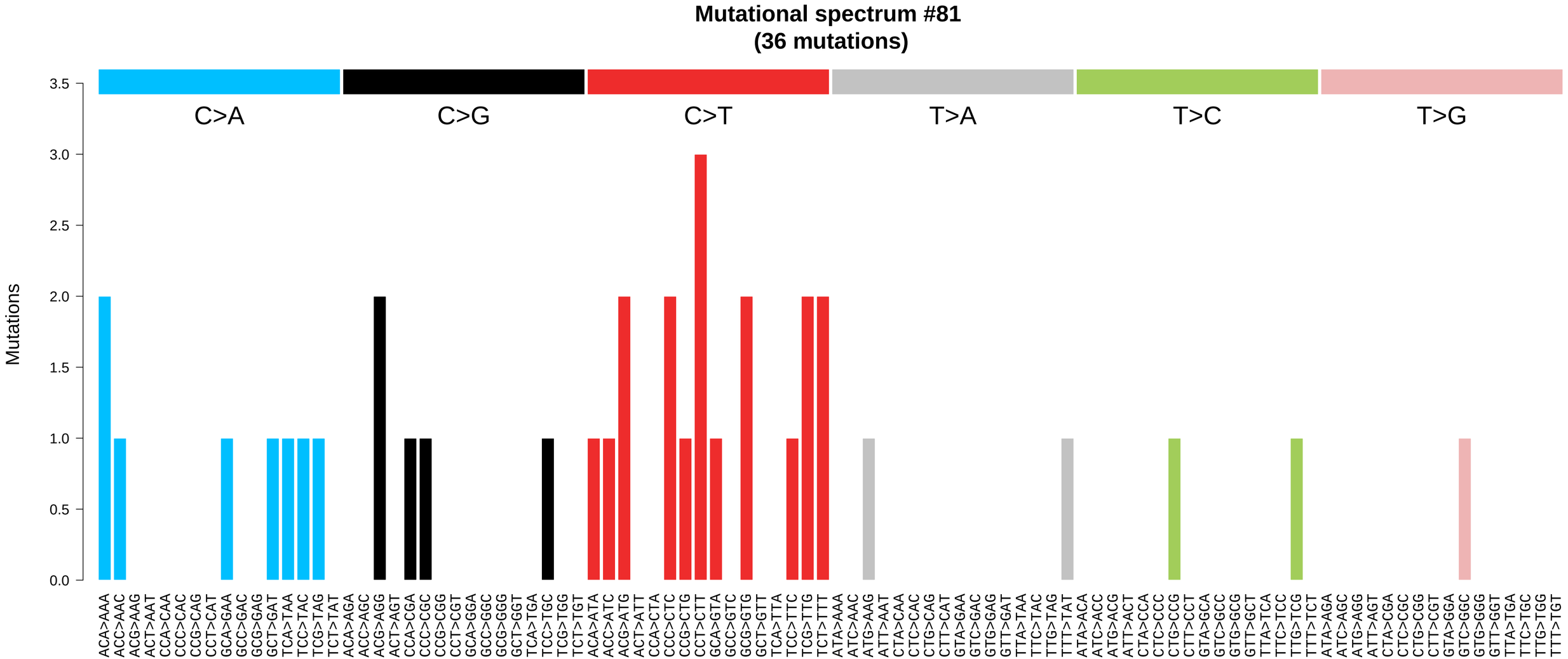

Mutational spectrum #76
(107 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

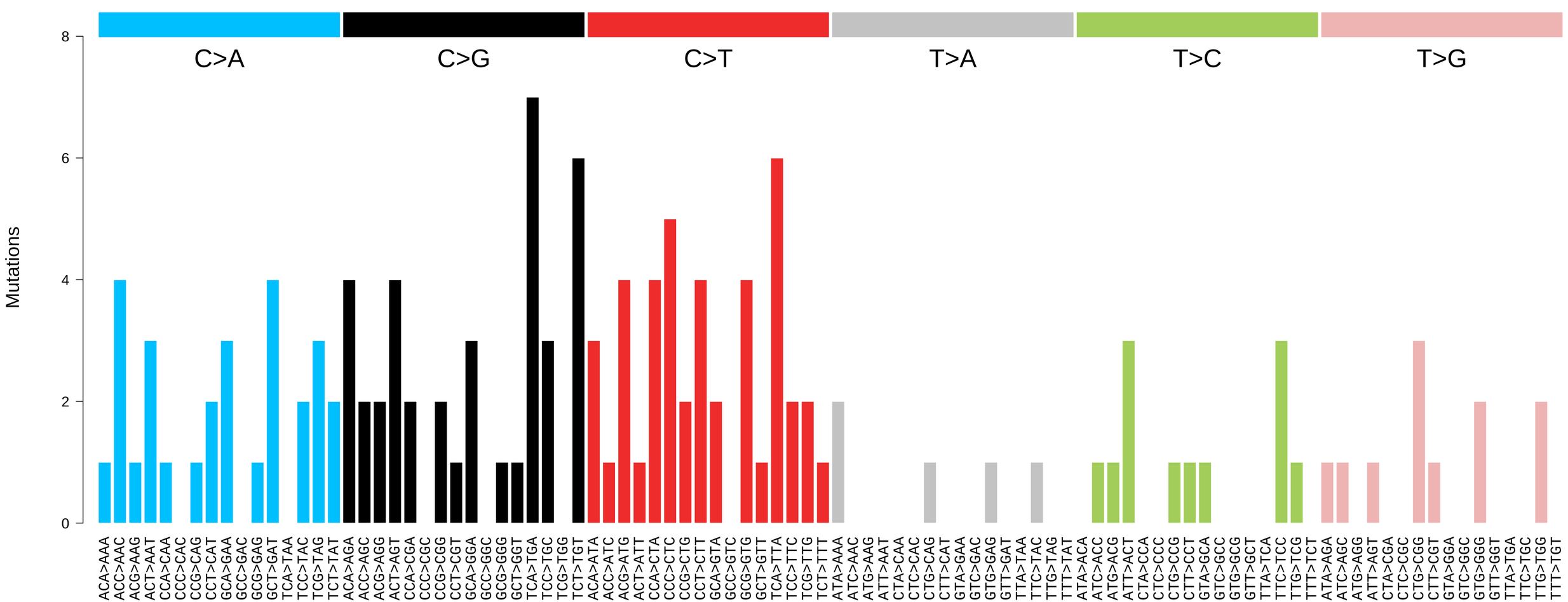

Mutational spectrum #77
(93 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

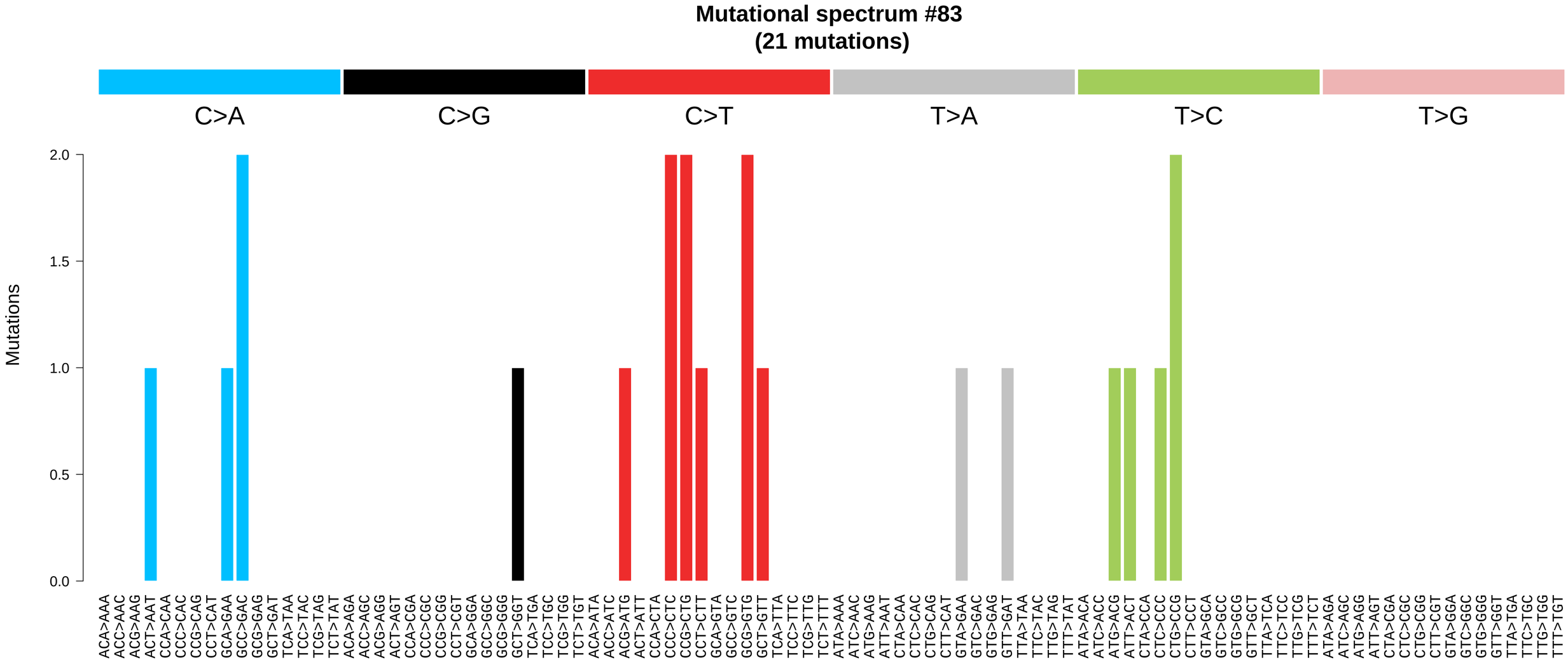

Mutational spectrum #78
(25 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

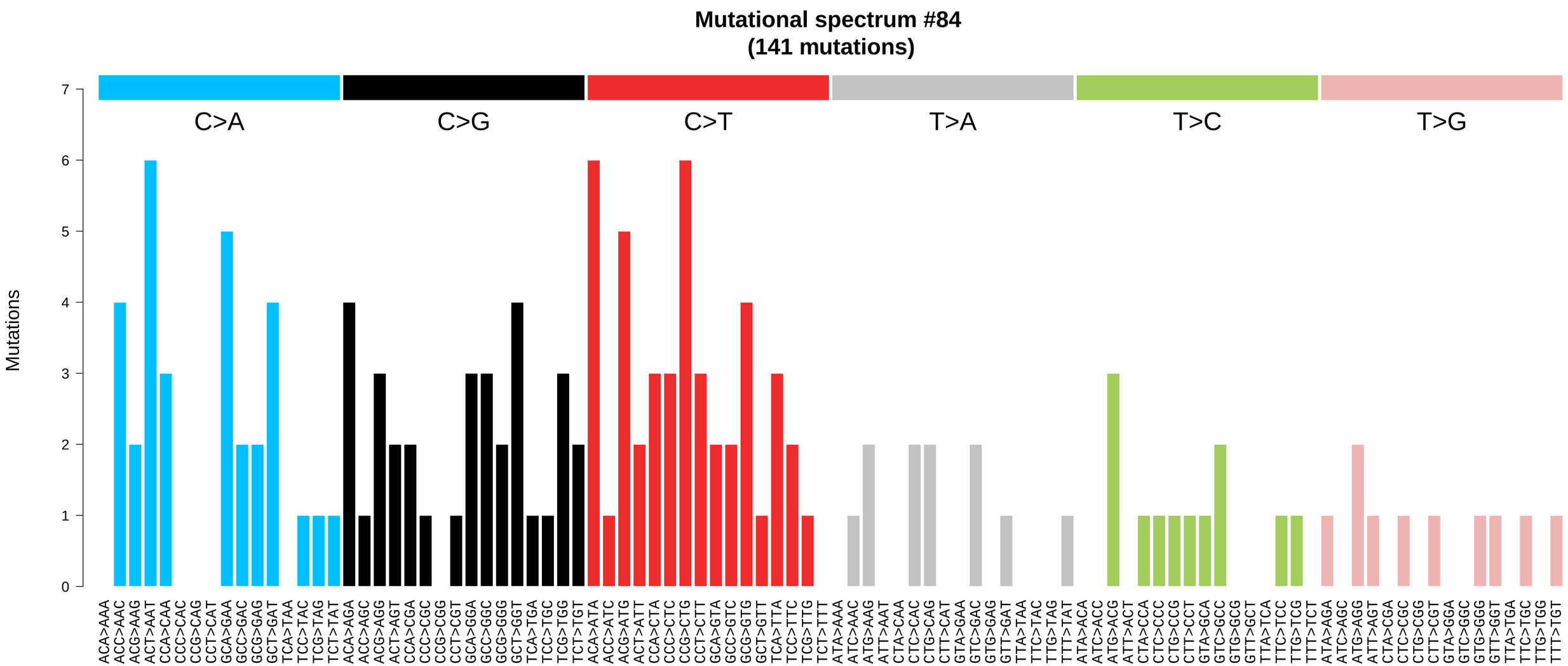

Mutational spectrum #79
(185 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

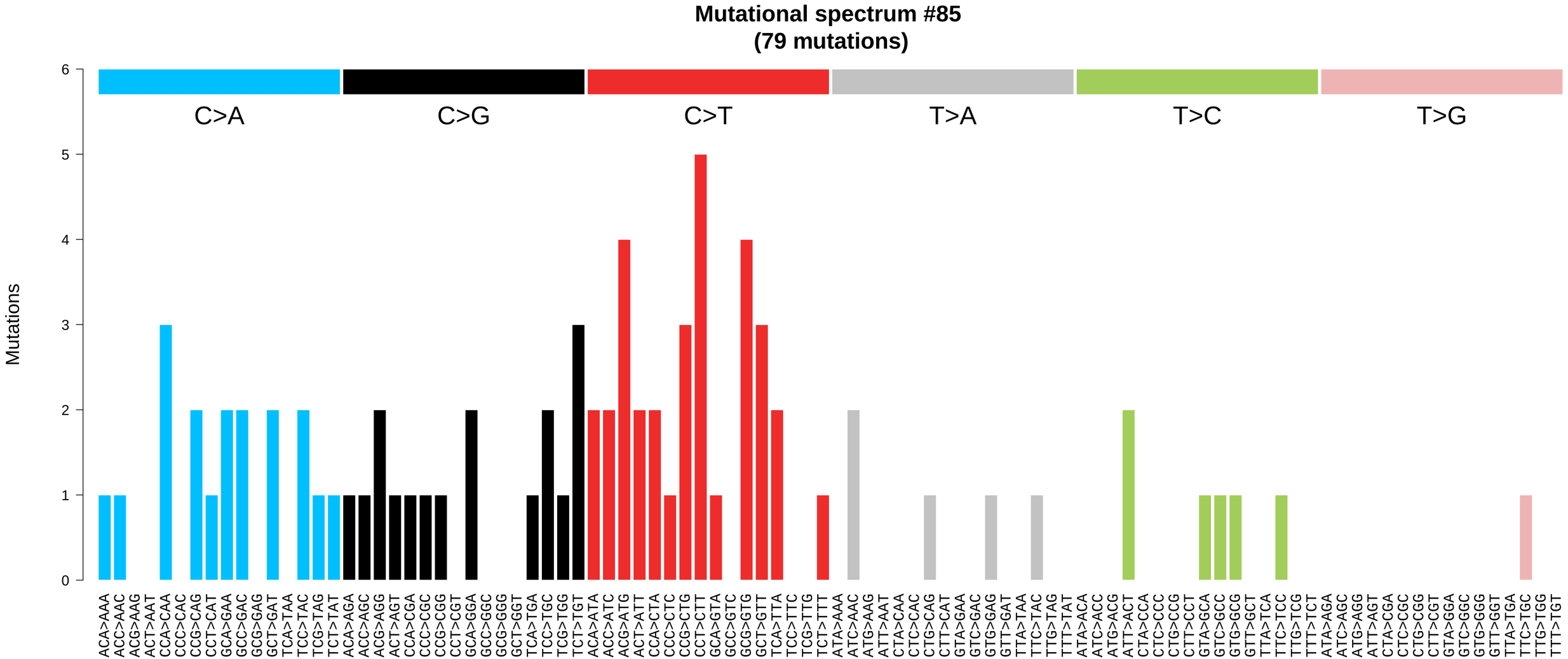

Mutational spectrum #80
(133 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
14
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

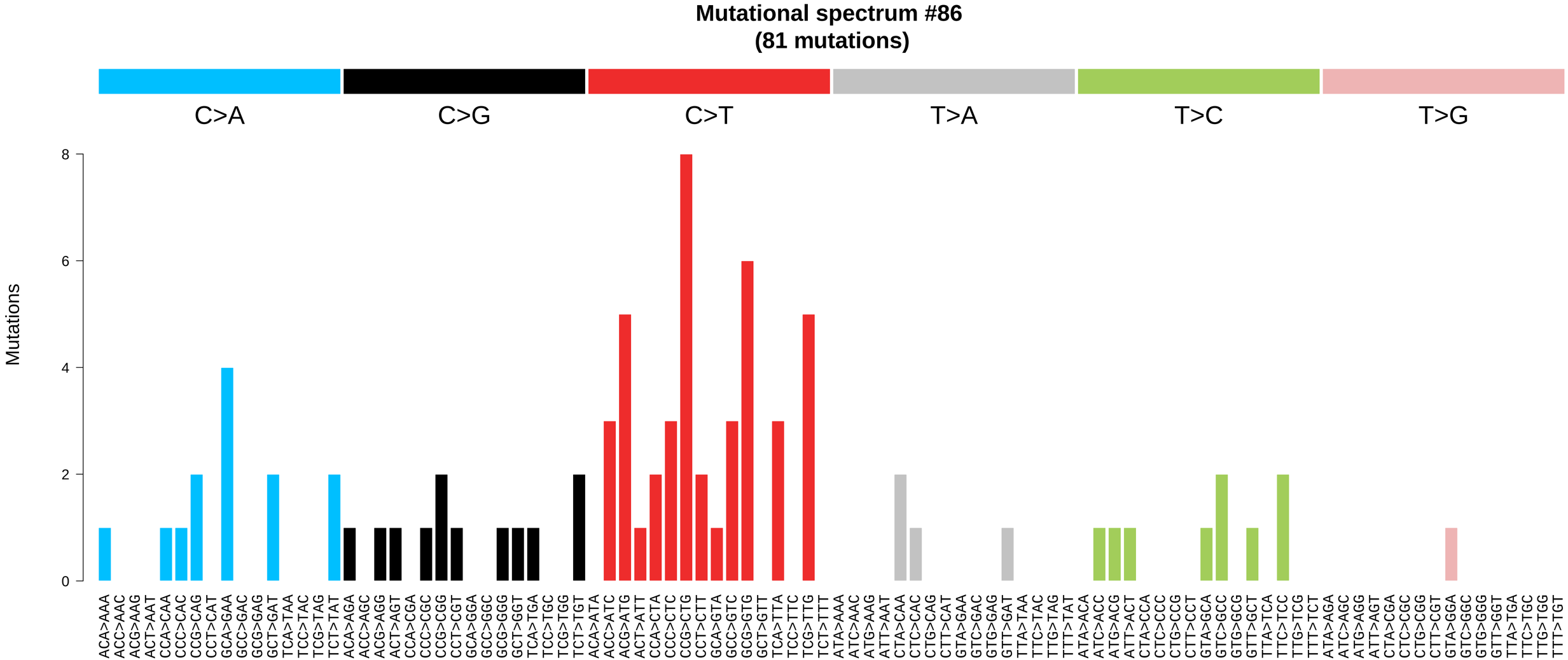

Mutational spectrum #81
(36 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

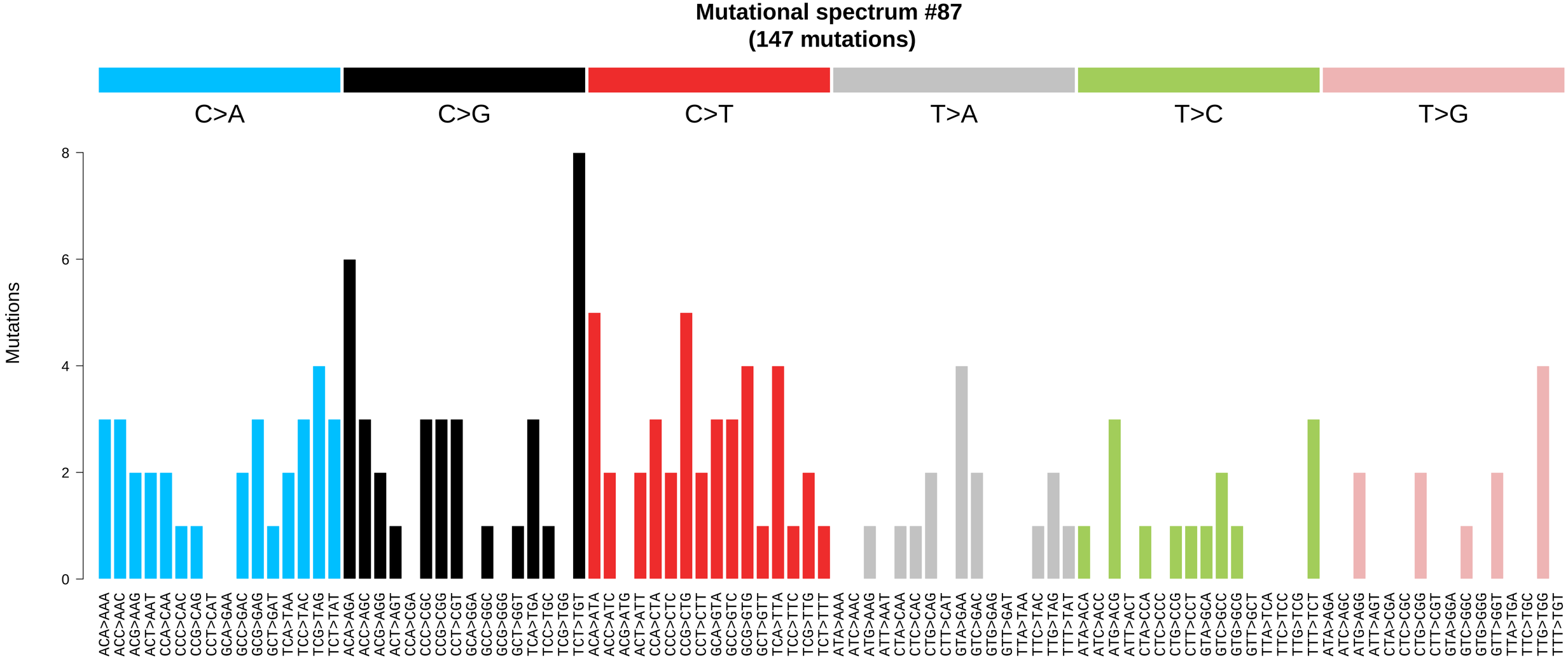

Mutational spectrum #82
(136 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

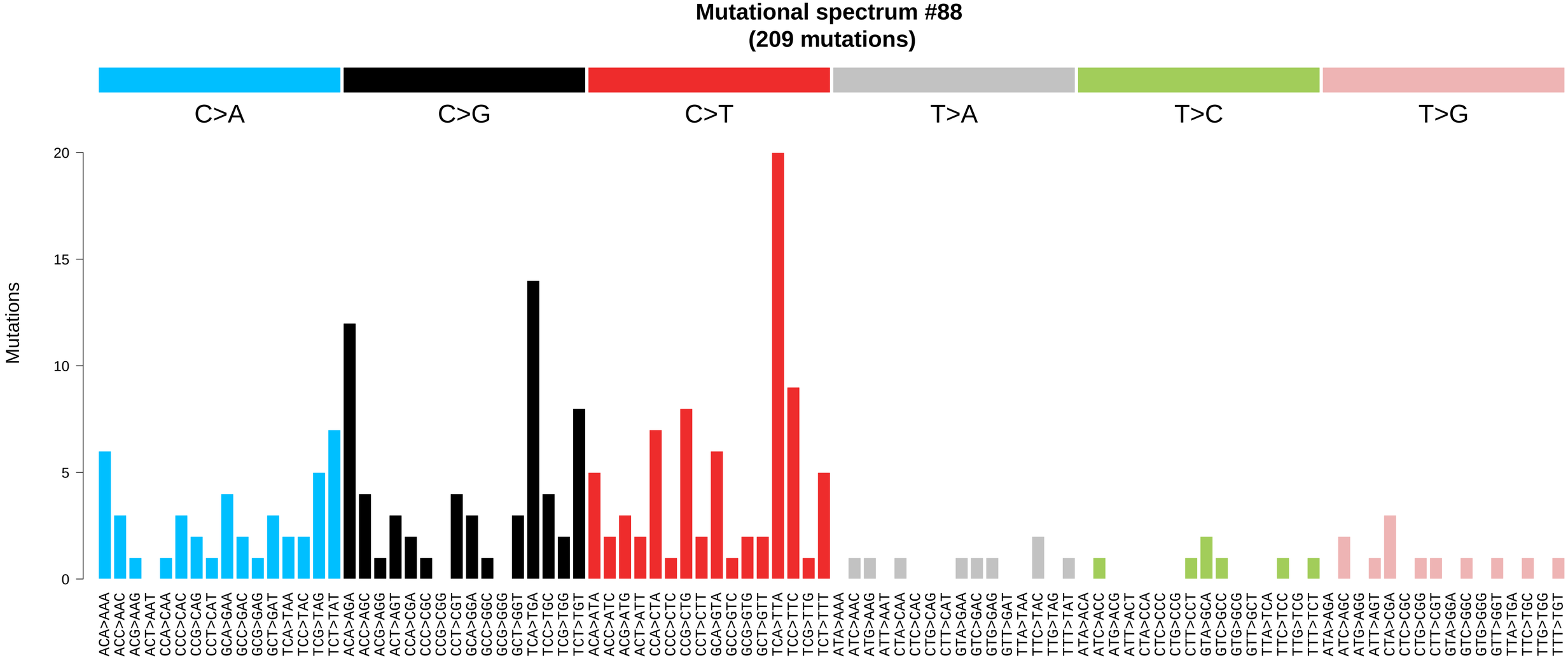

Mutational spectrum #83
(21 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

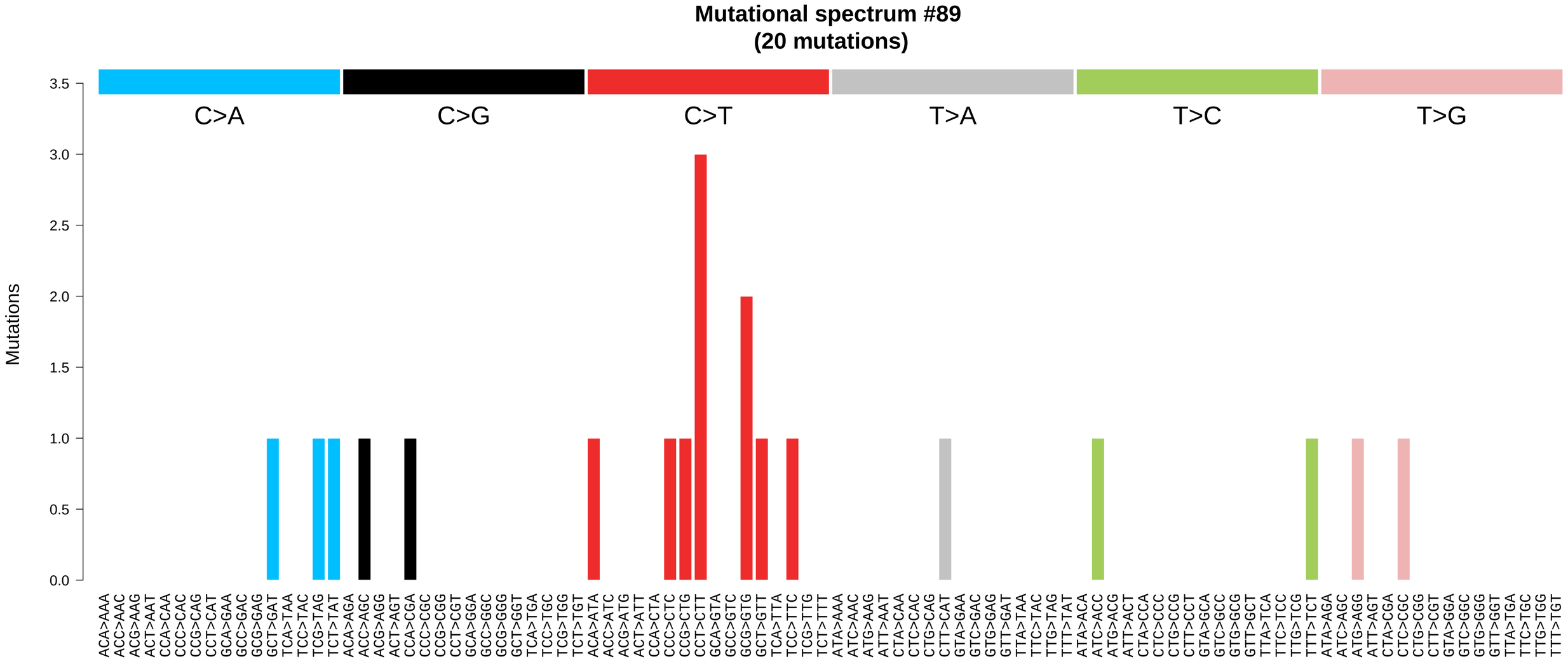

Mutational spectrum #84
(141 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

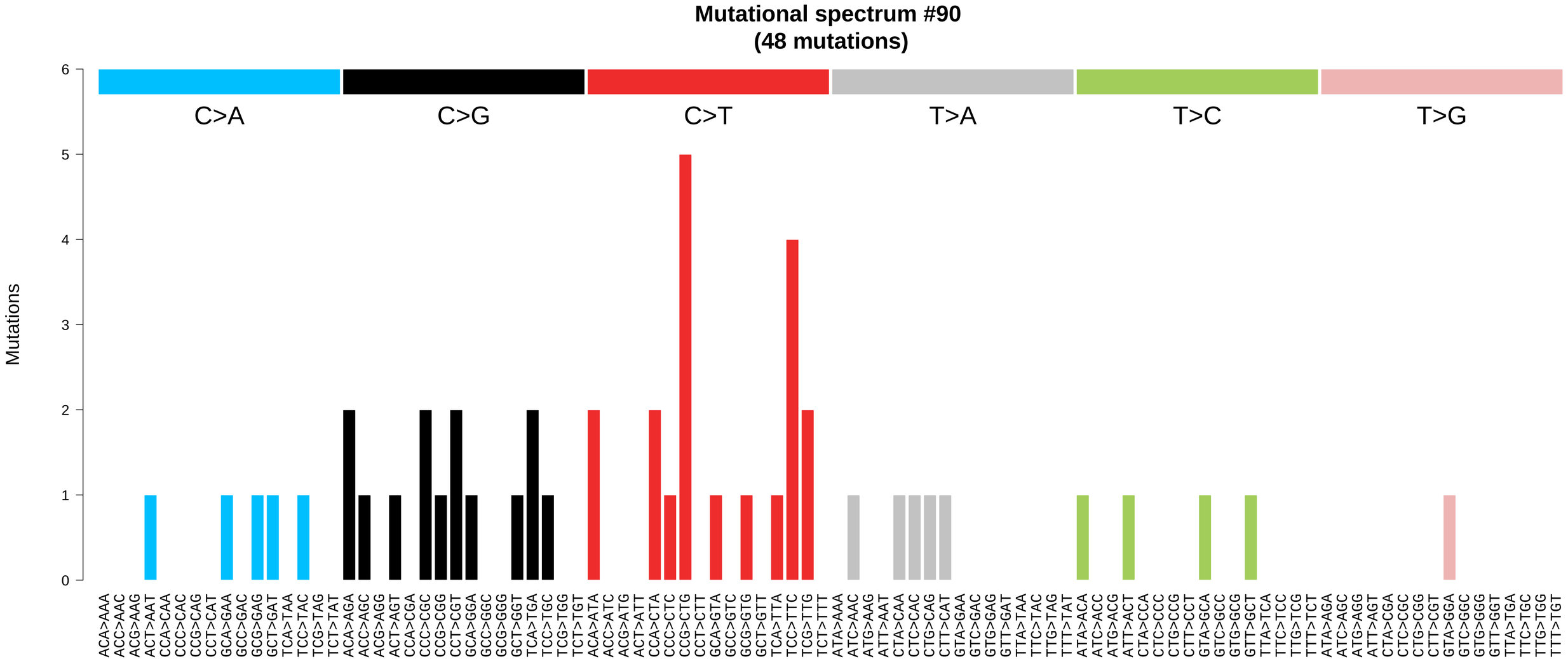

Mutational spectrum #85
(79 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

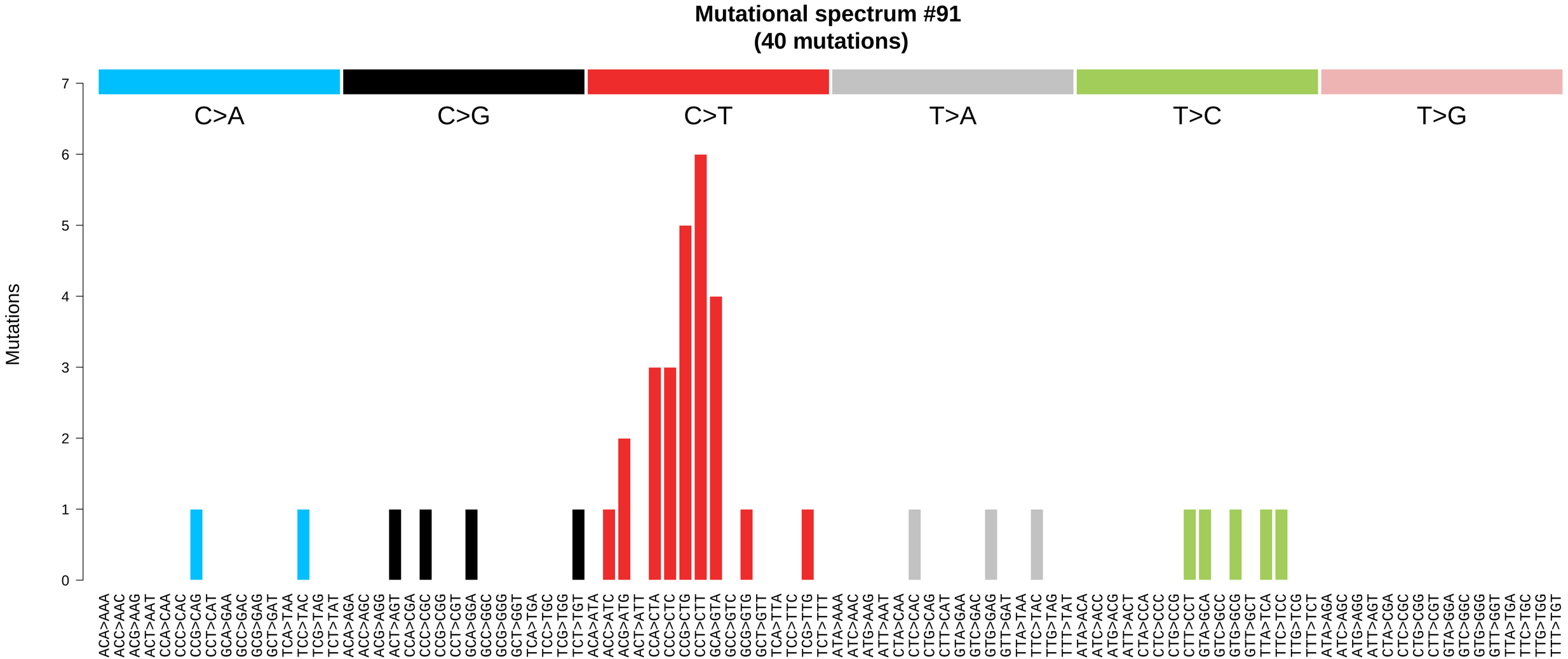

Mutational spectrum #86
(81 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

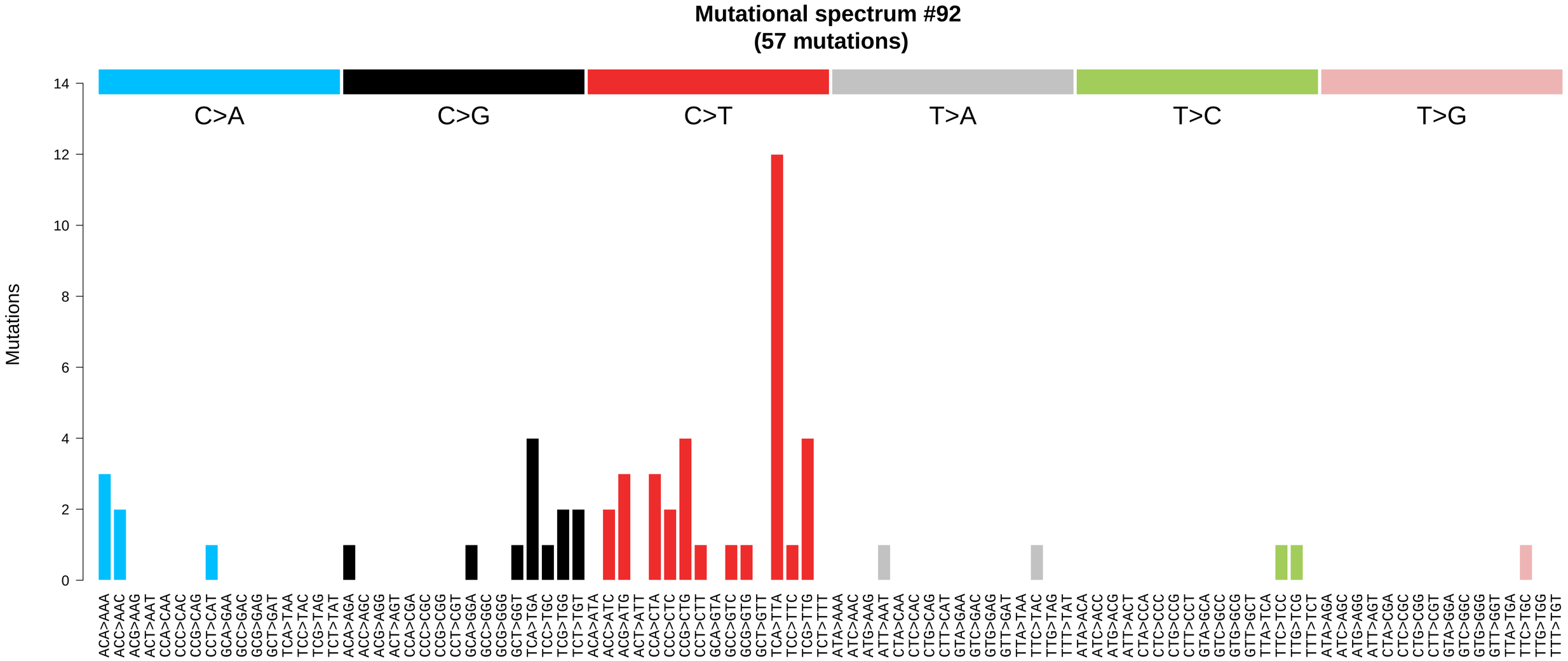

Mutational spectrum #87
(147 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

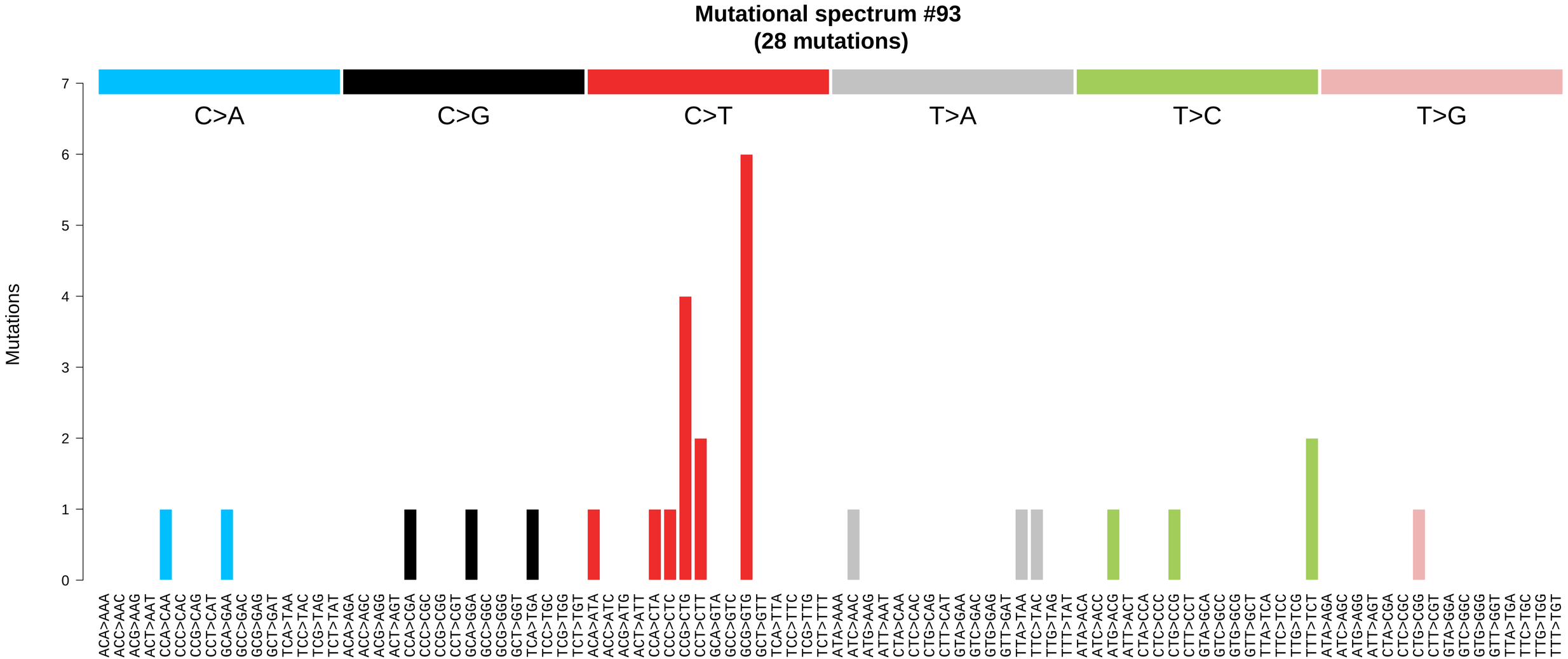

Mutational spectrum #88
(209 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

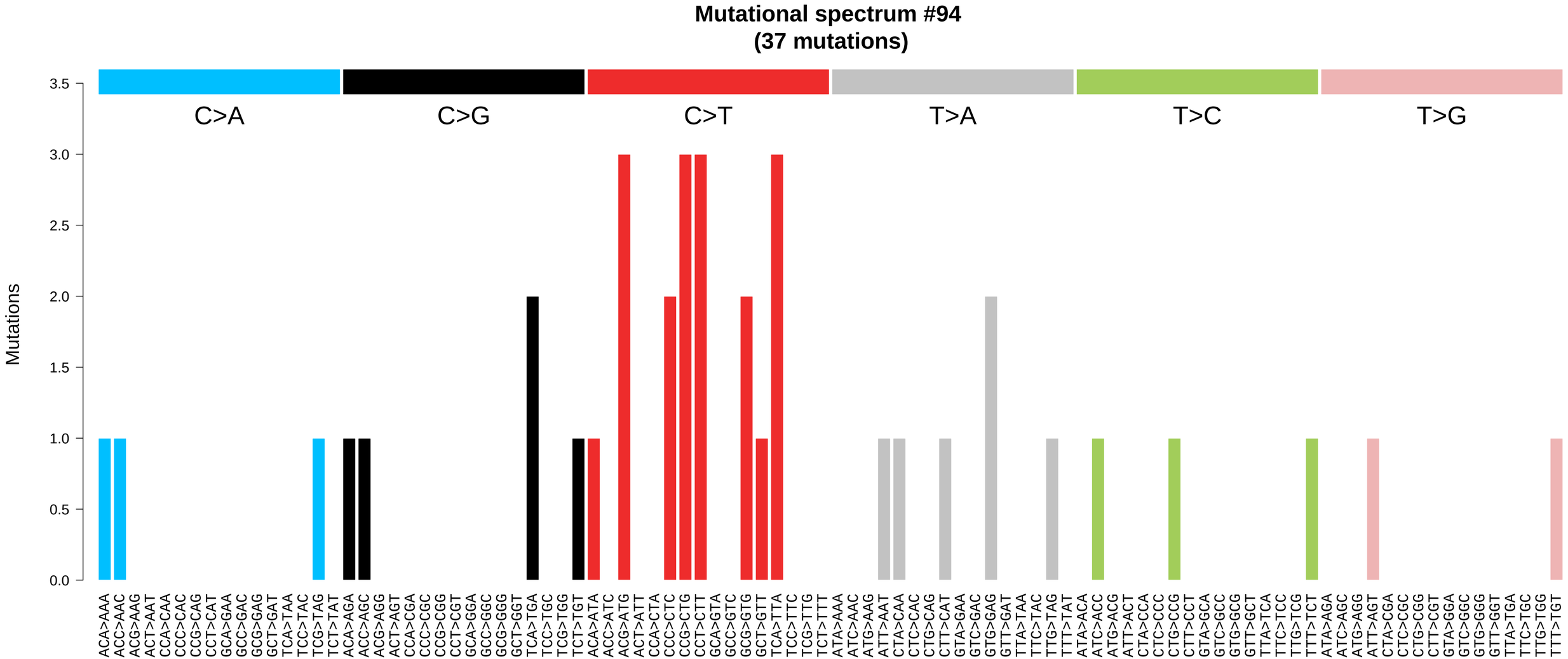

Mutational spectrum #89
(20 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

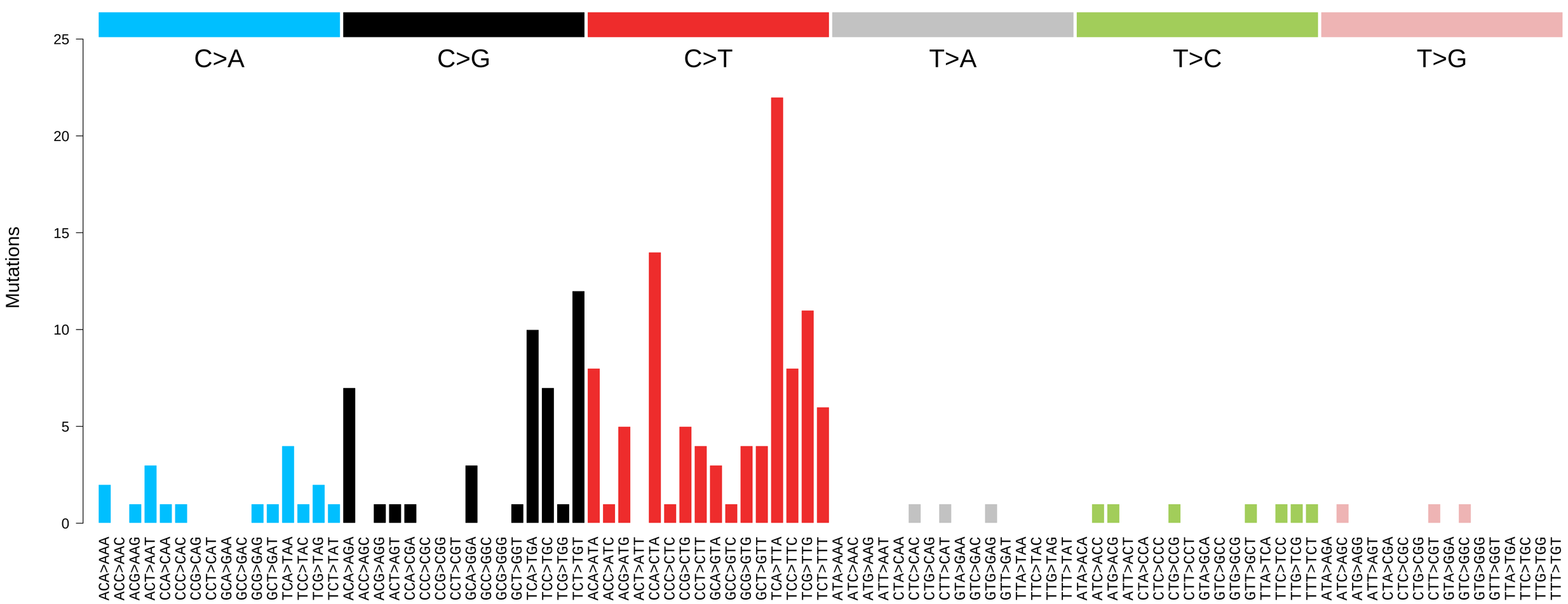

Mutational spectrum #90
(48 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

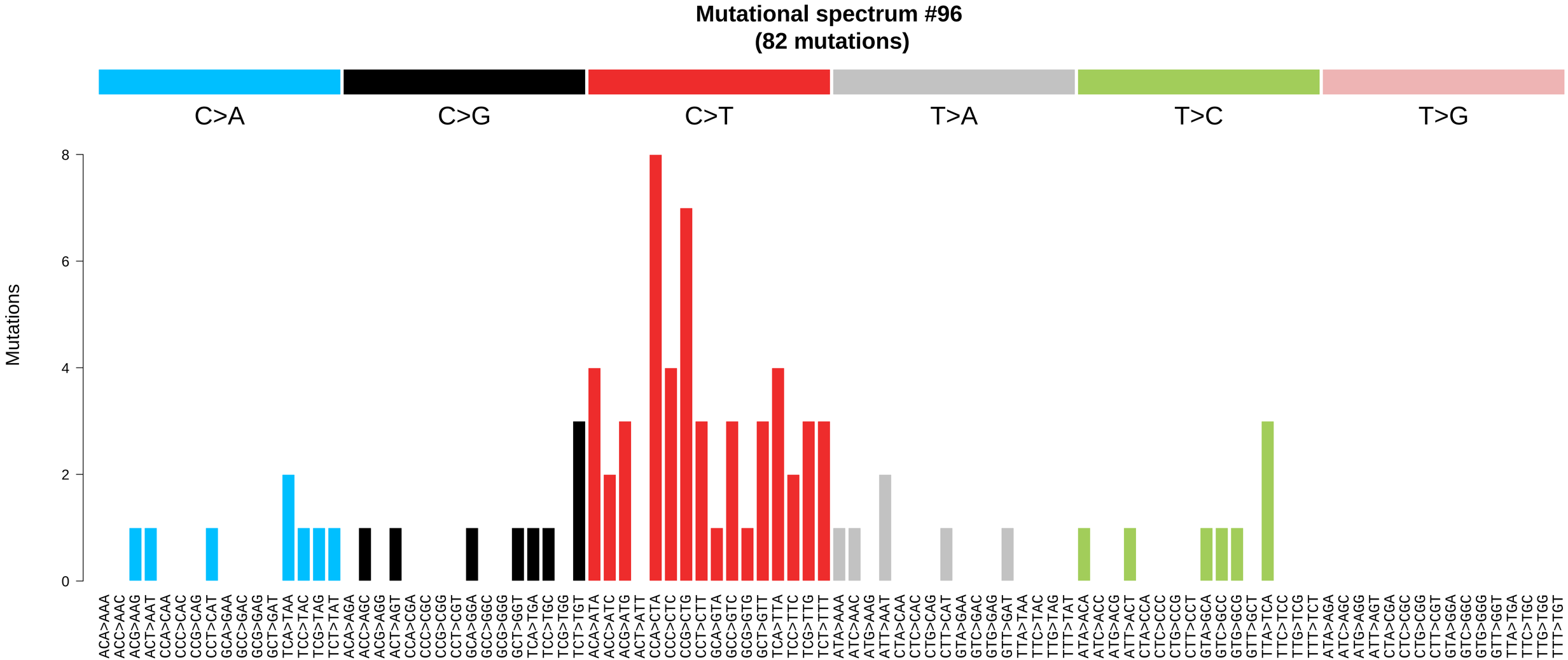

Mutational spectrum #91
(40 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

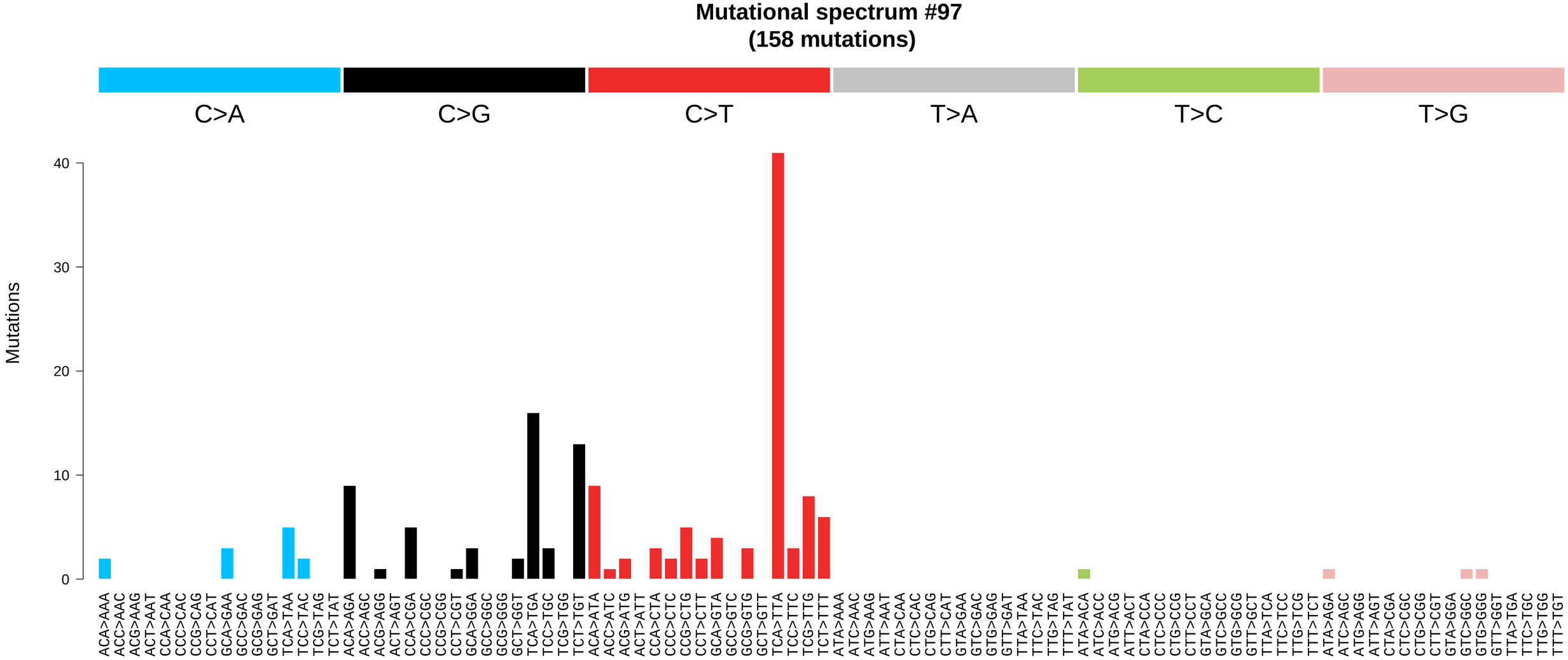

Mutational spectrum #92
(57 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
14
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

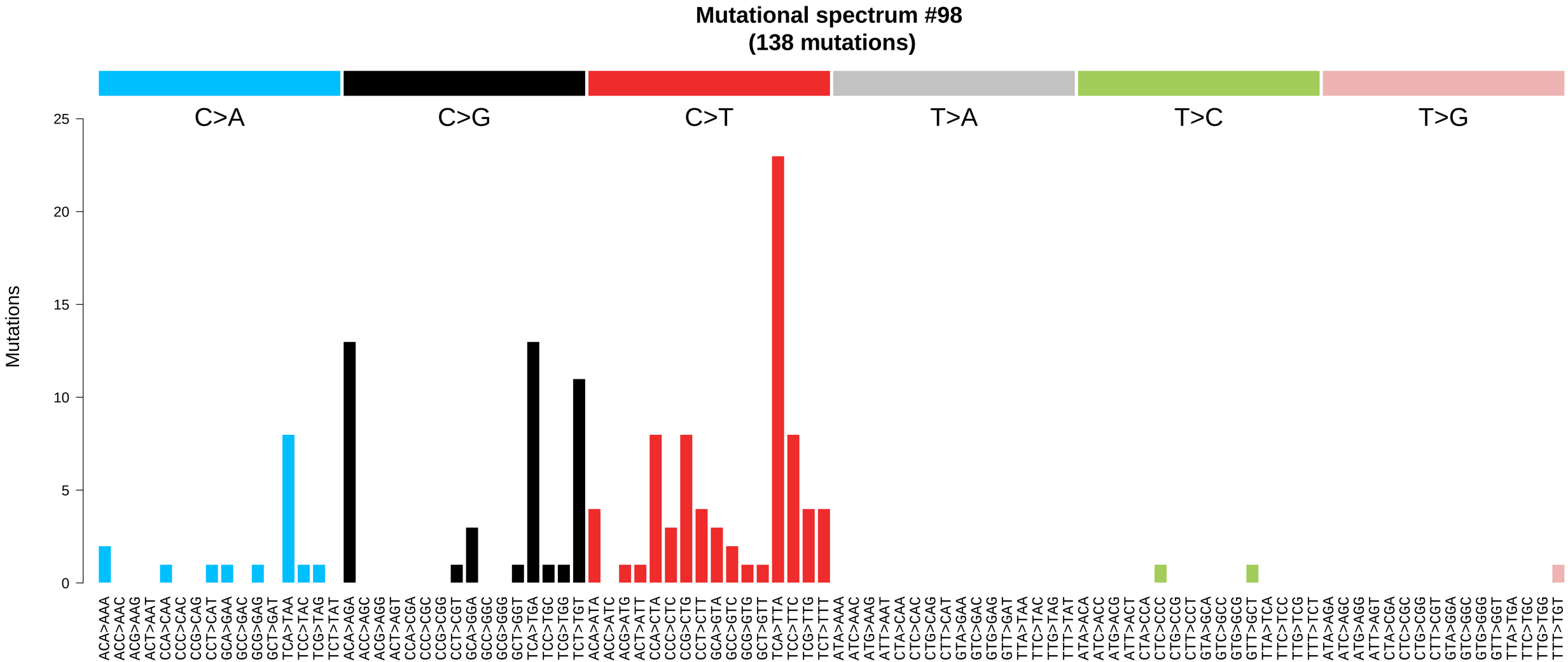

Mutational spectrum #93
(28 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

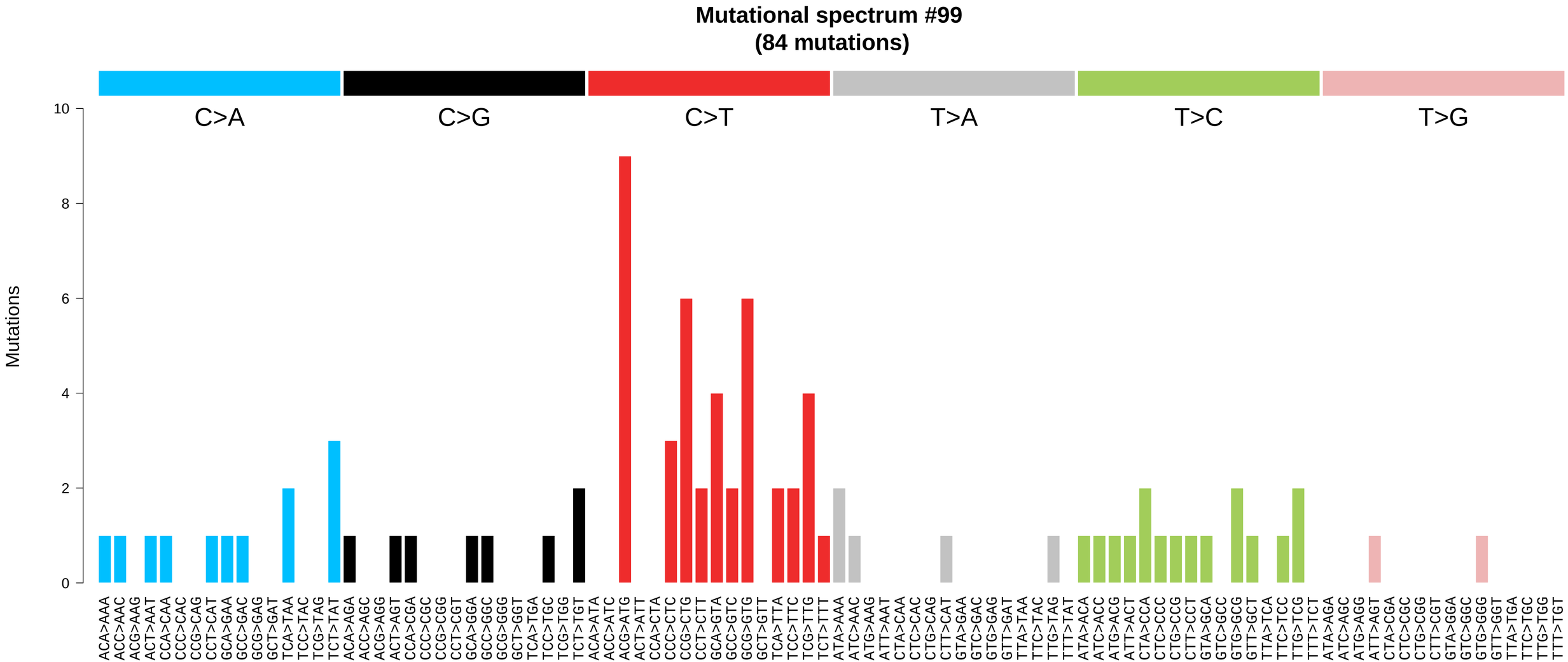

Mutational spectrum #94
(37 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

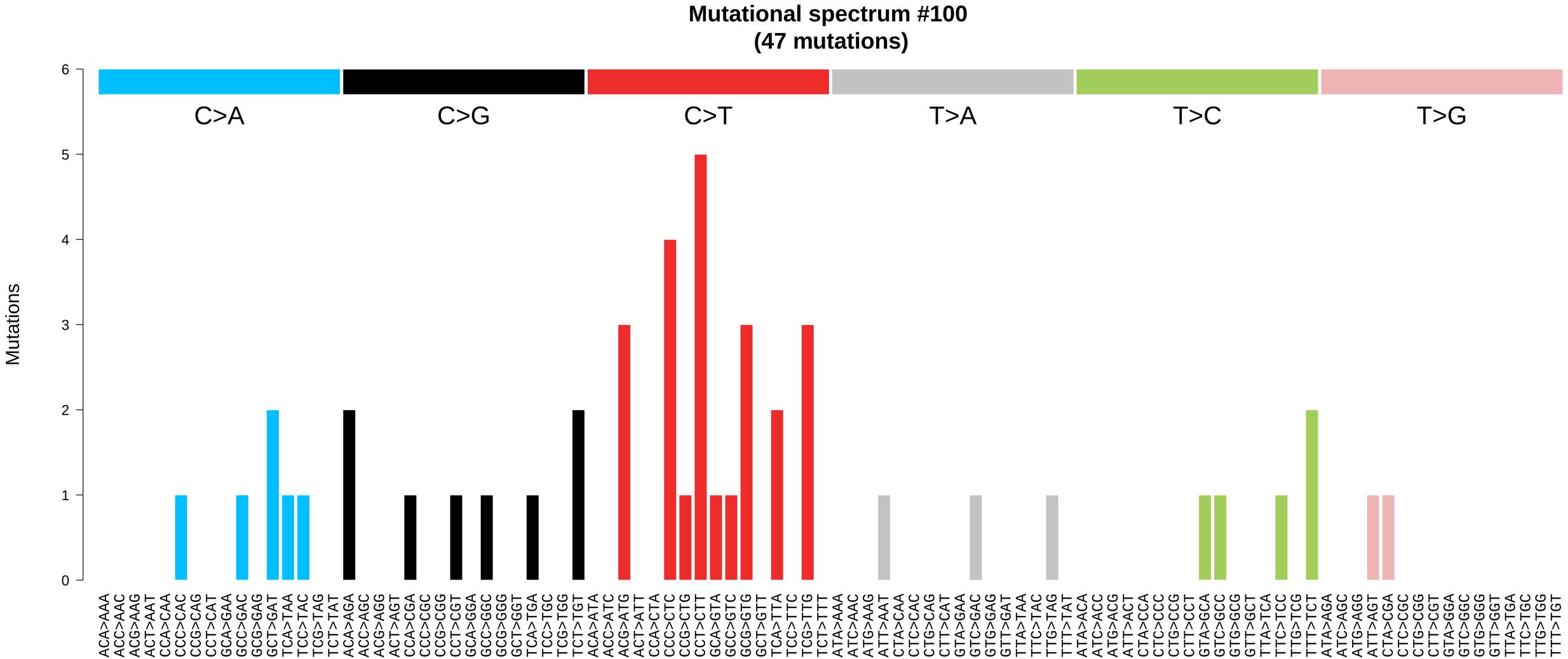

Mutational spectrum #95
(172 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
25
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

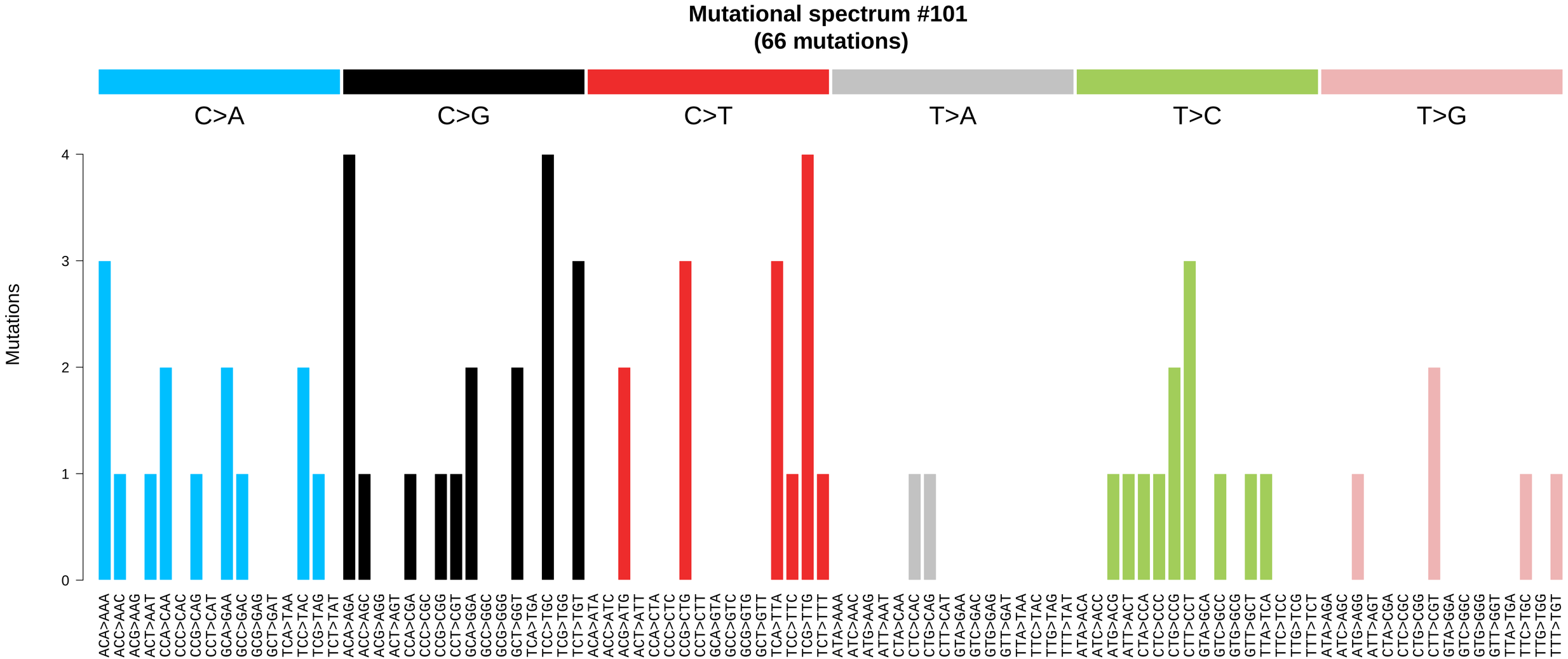

Mutational spectrum #96
(82 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

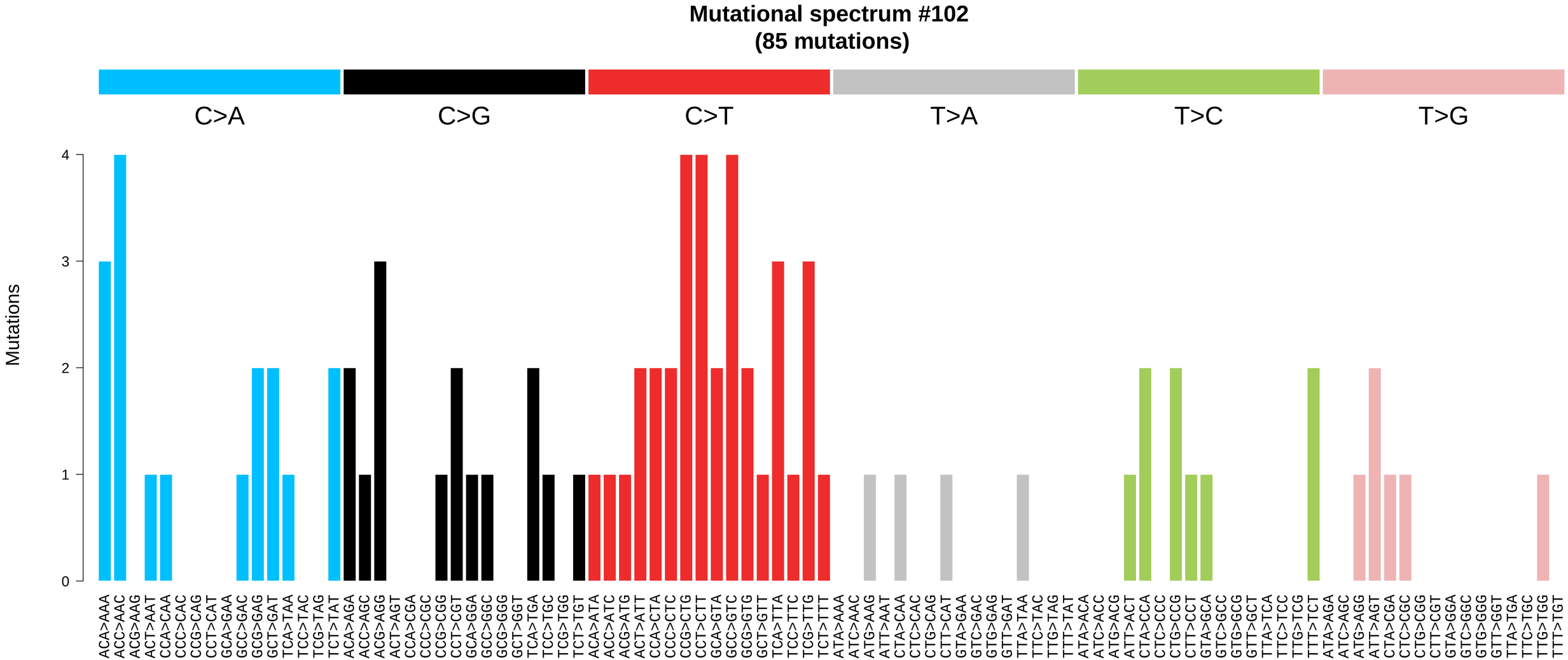

Mutational spectrum #97
(158 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
10
20
30
40
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

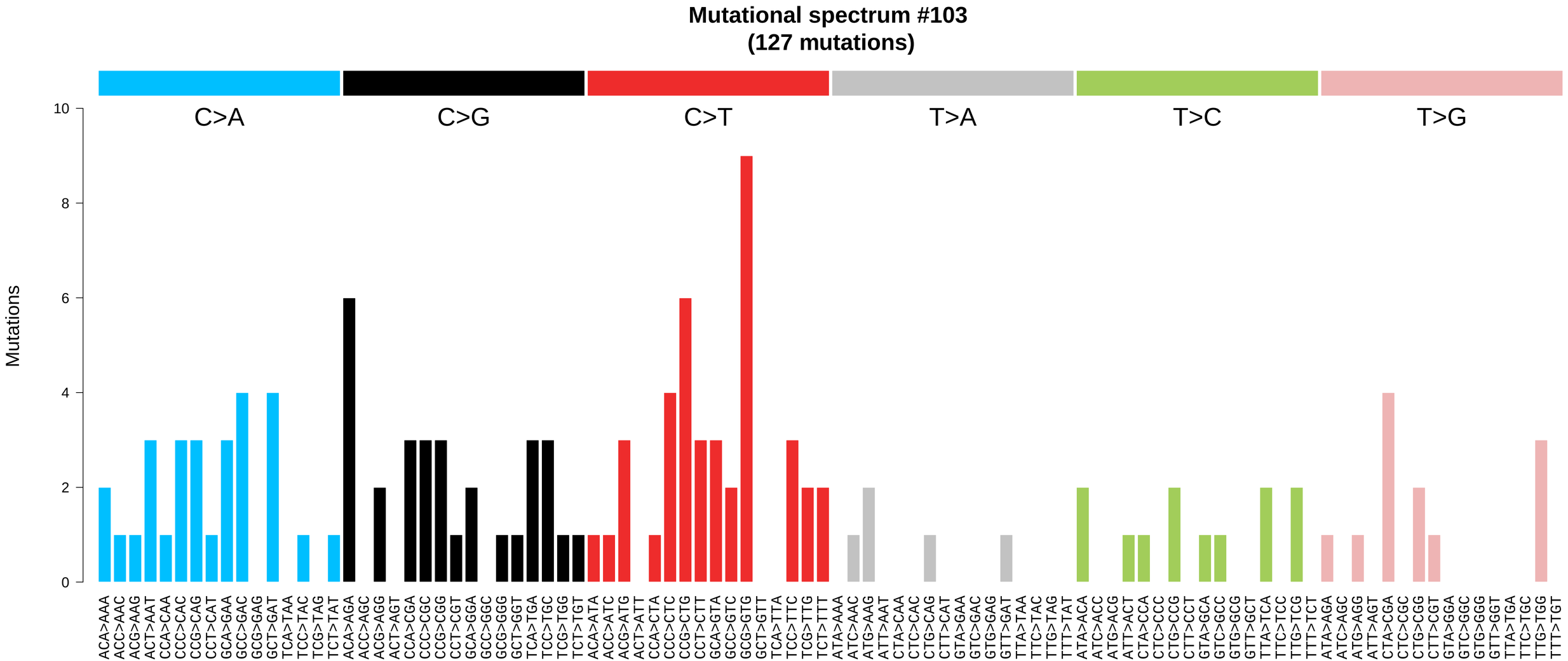

Mutational spectrum #98
(138 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
25
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

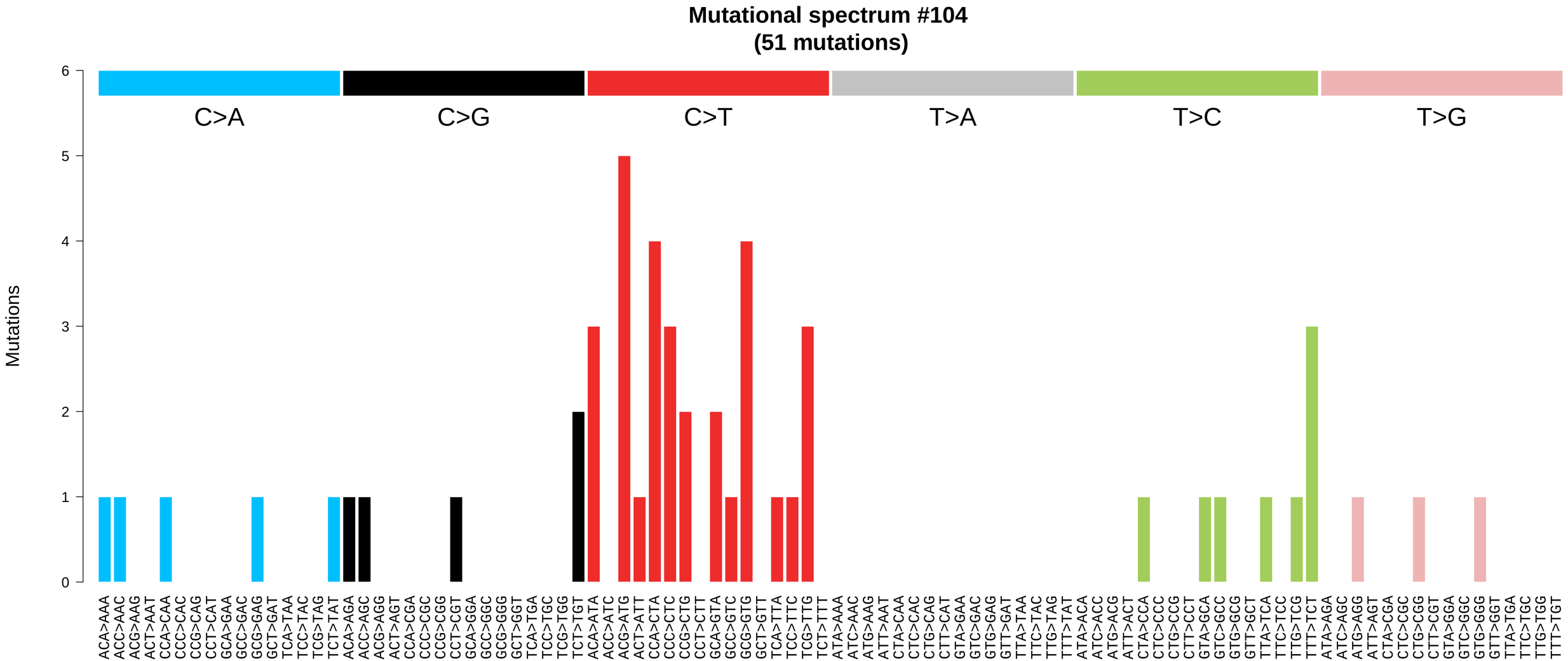

Mutational spectrum #99
(84 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

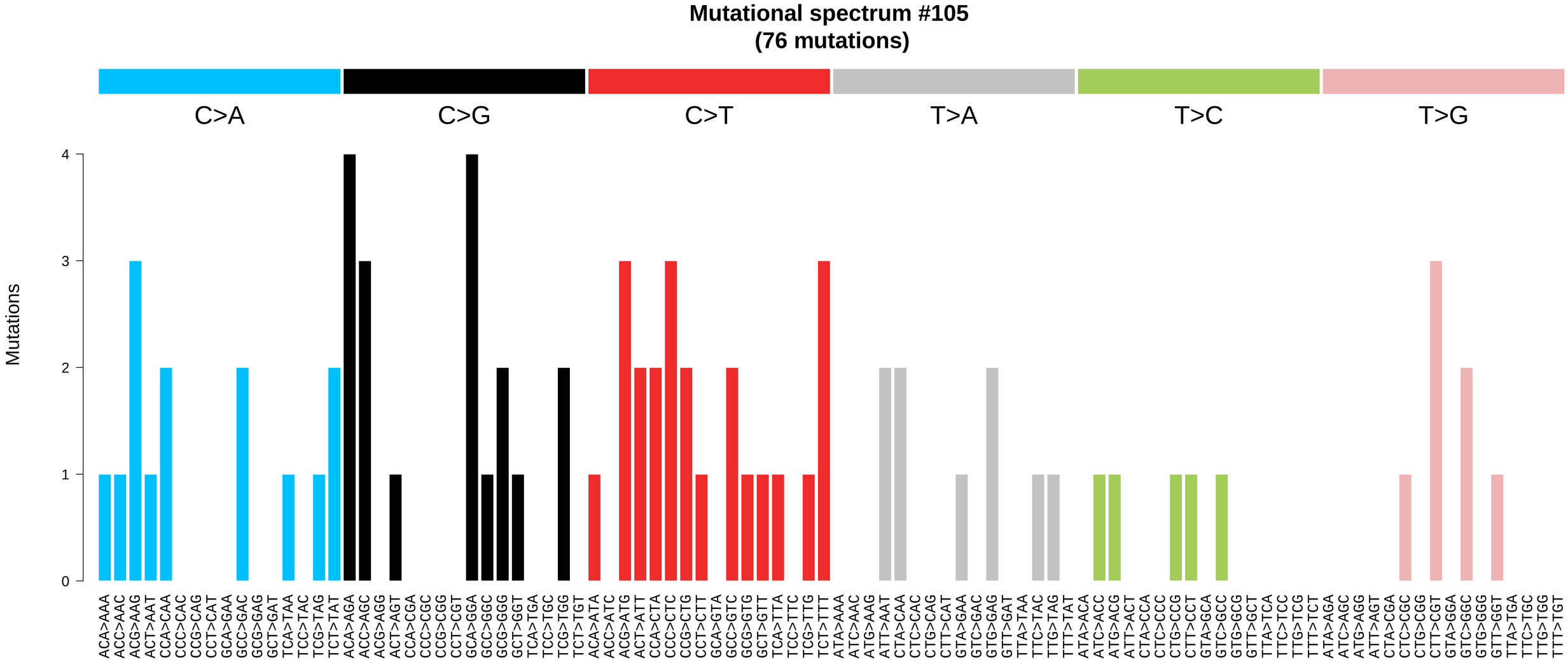

Mutational spectrum #100
(47 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

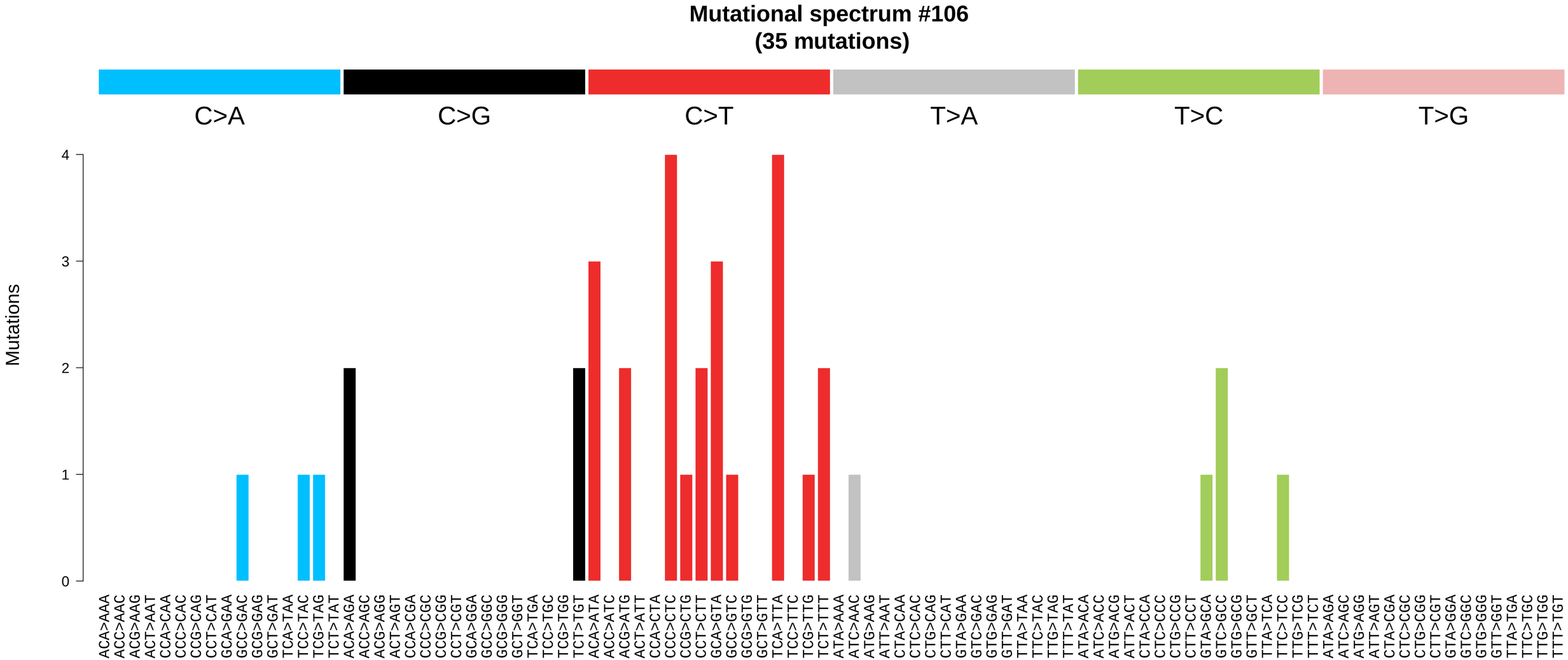

Mutational spectrum #101
(66 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

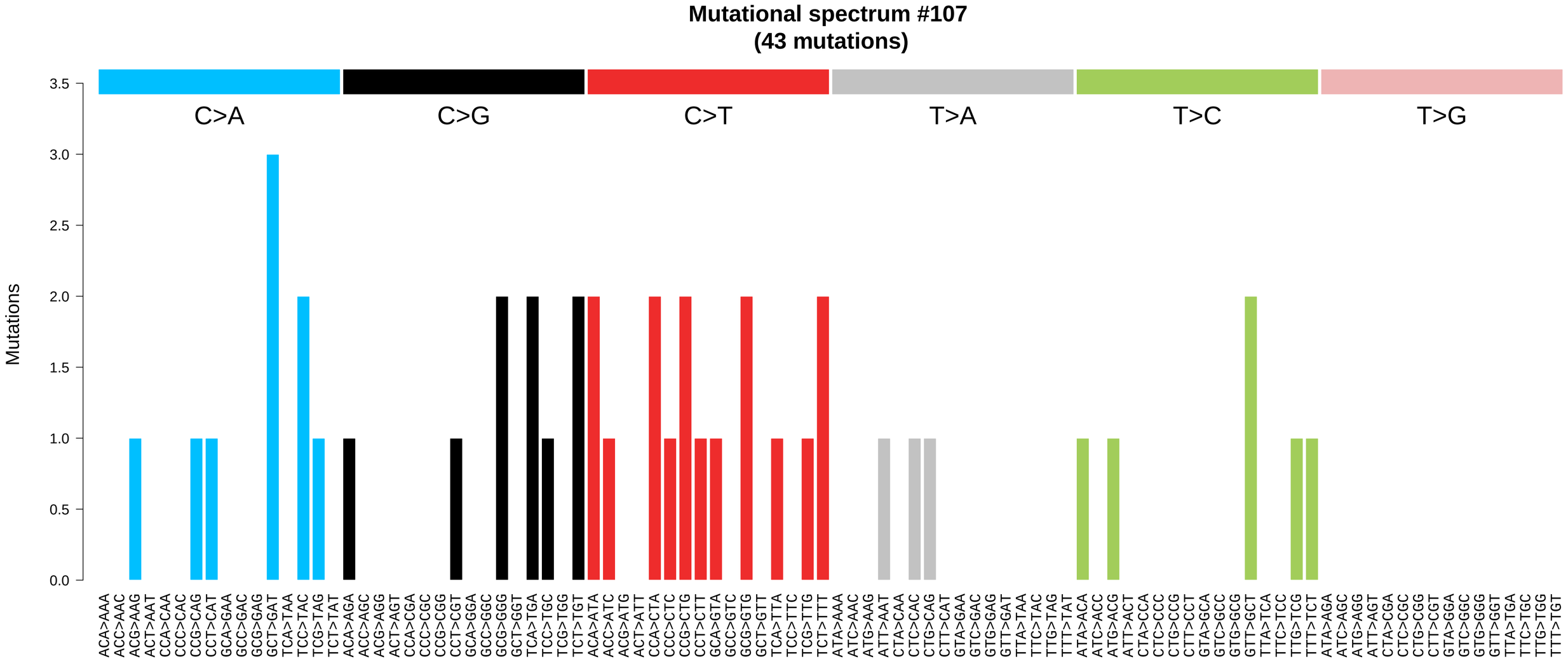

Mutational spectrum #102
(85 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

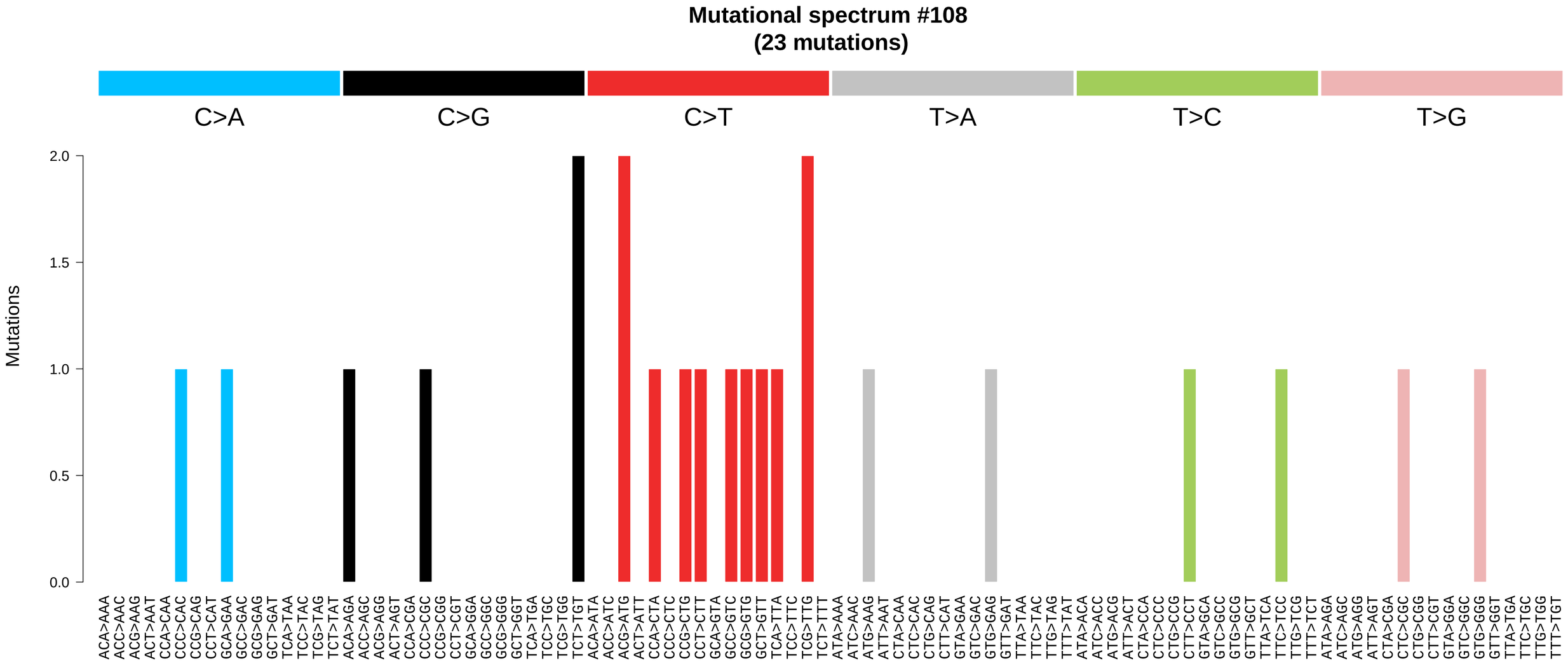

Mutational spectrum #103
(127 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

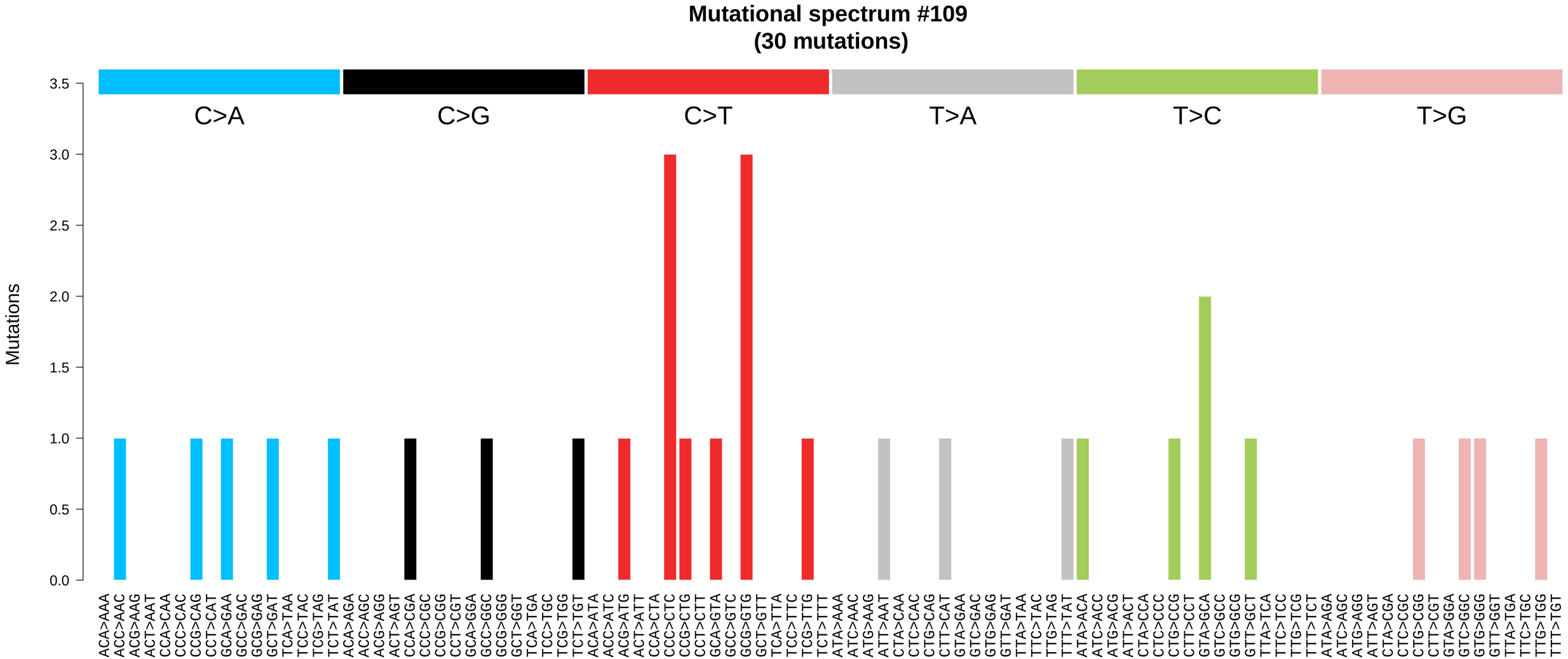

Mutational spectrum #104
(51 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

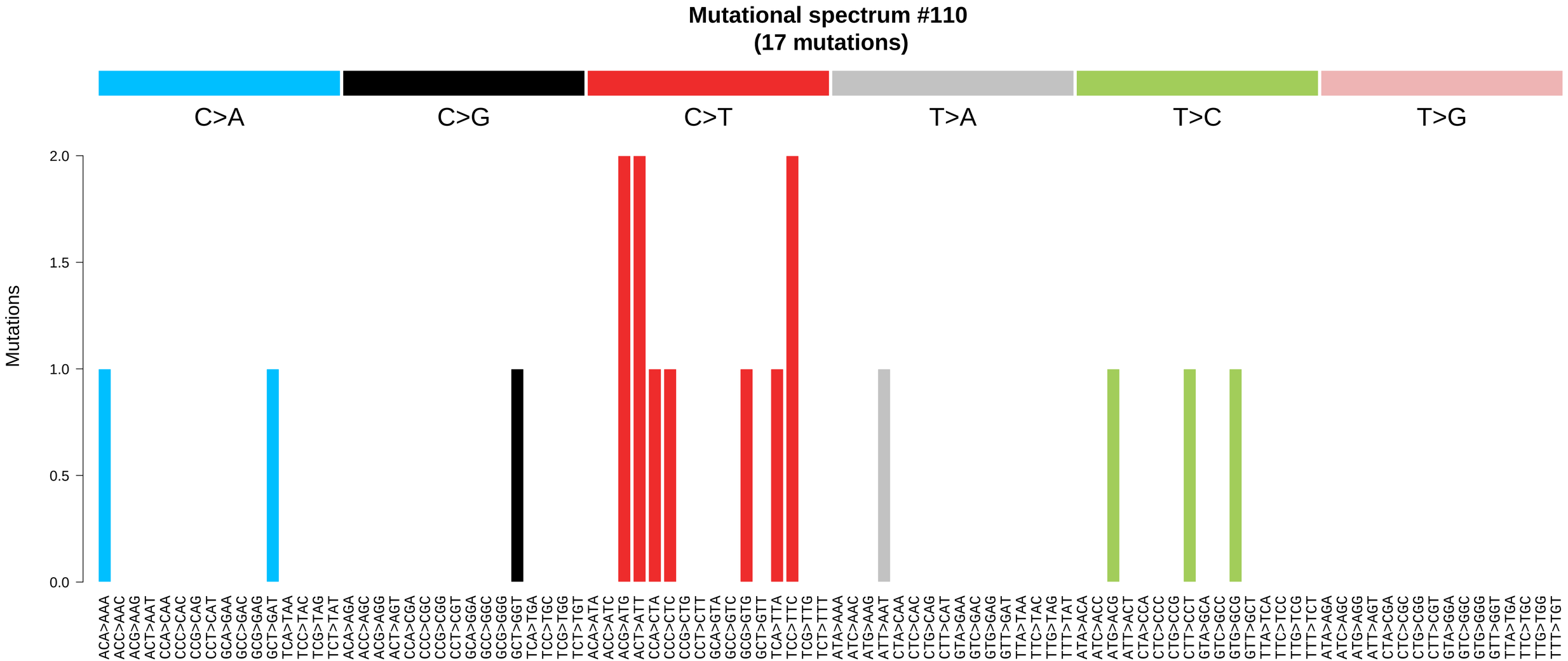

Mutational spectrum #105
(76 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

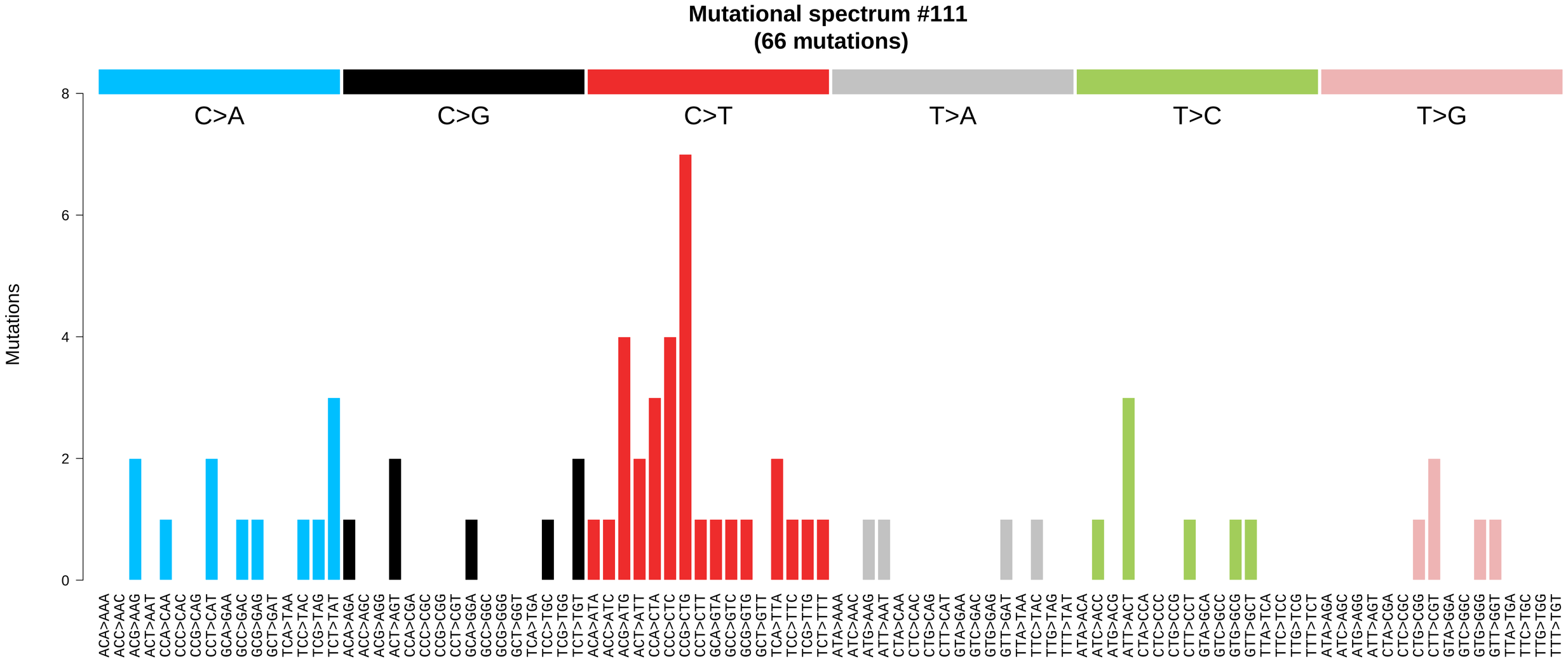

Mutational spectrum #106
(35 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

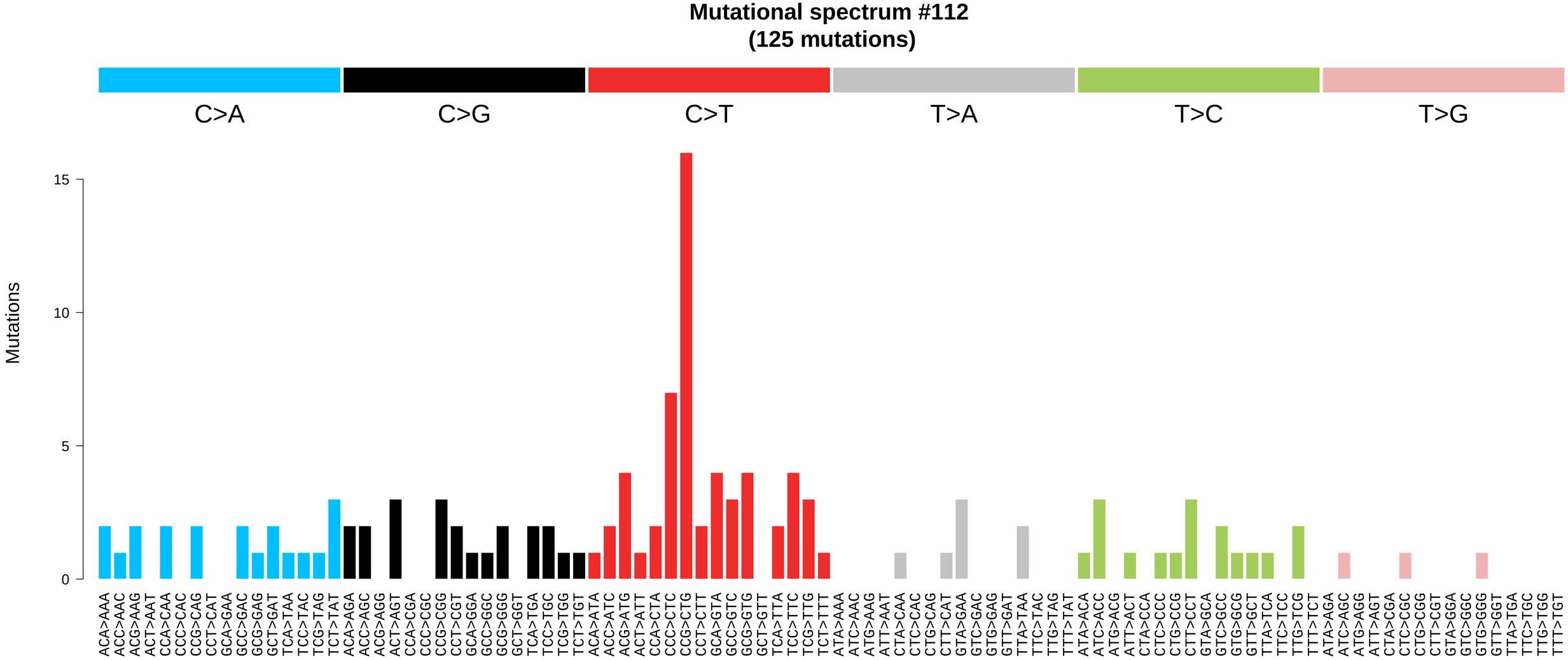

Mutational spectrum #107
(43 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

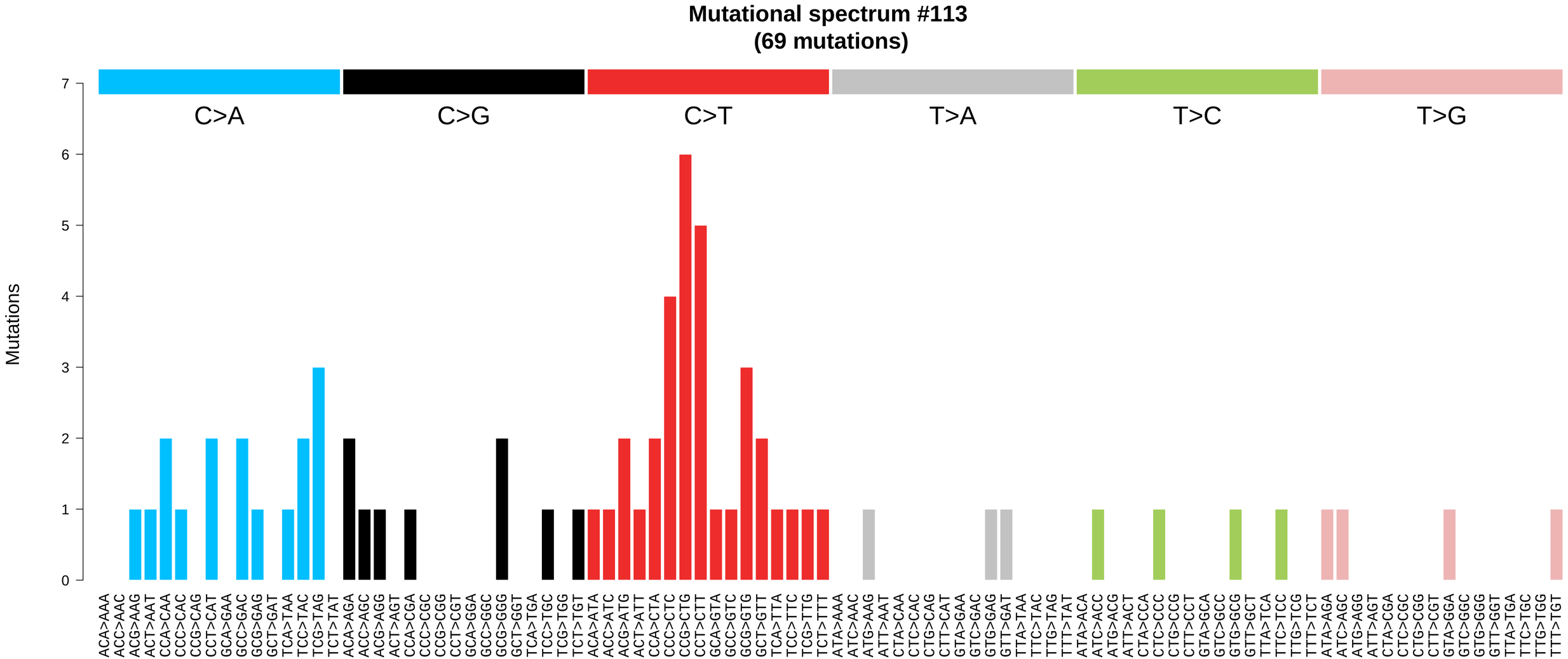

Mutational spectrum #108
(23 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

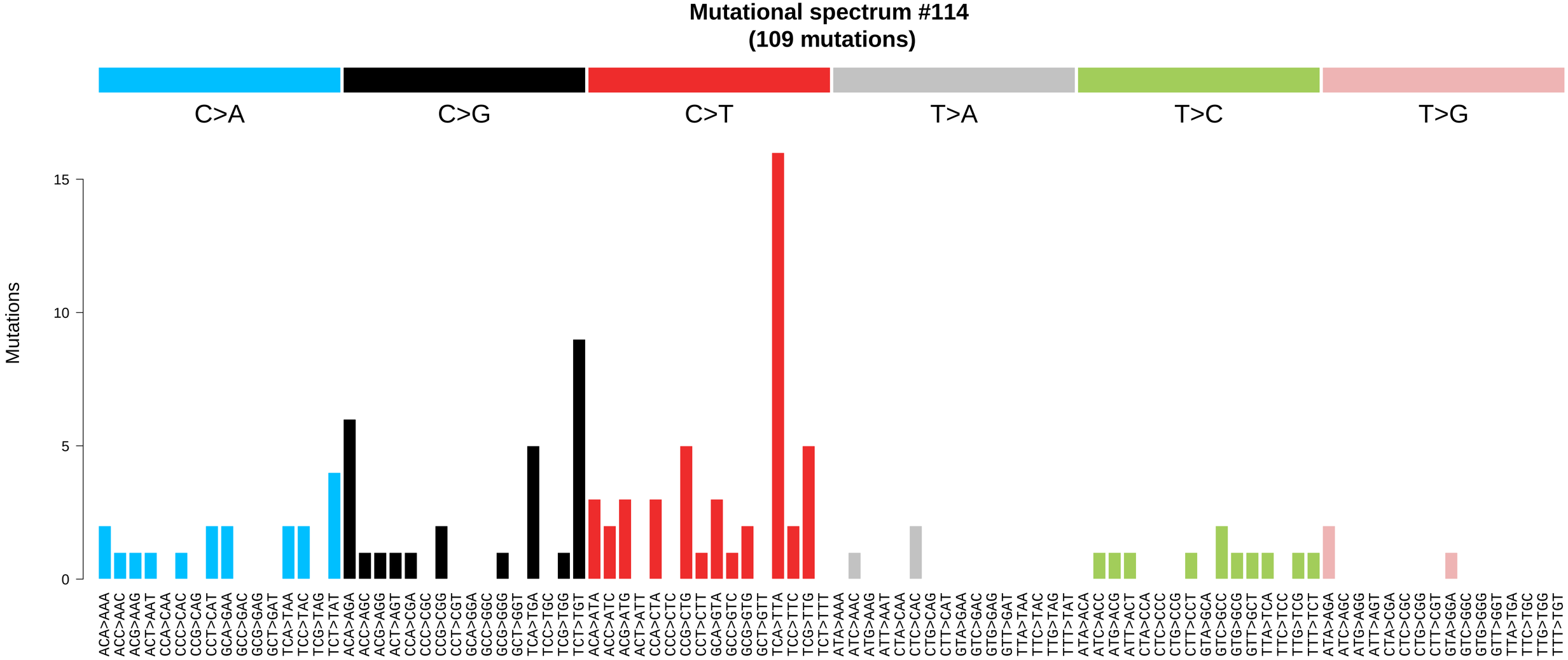

Mutational spectrum #109
(30 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

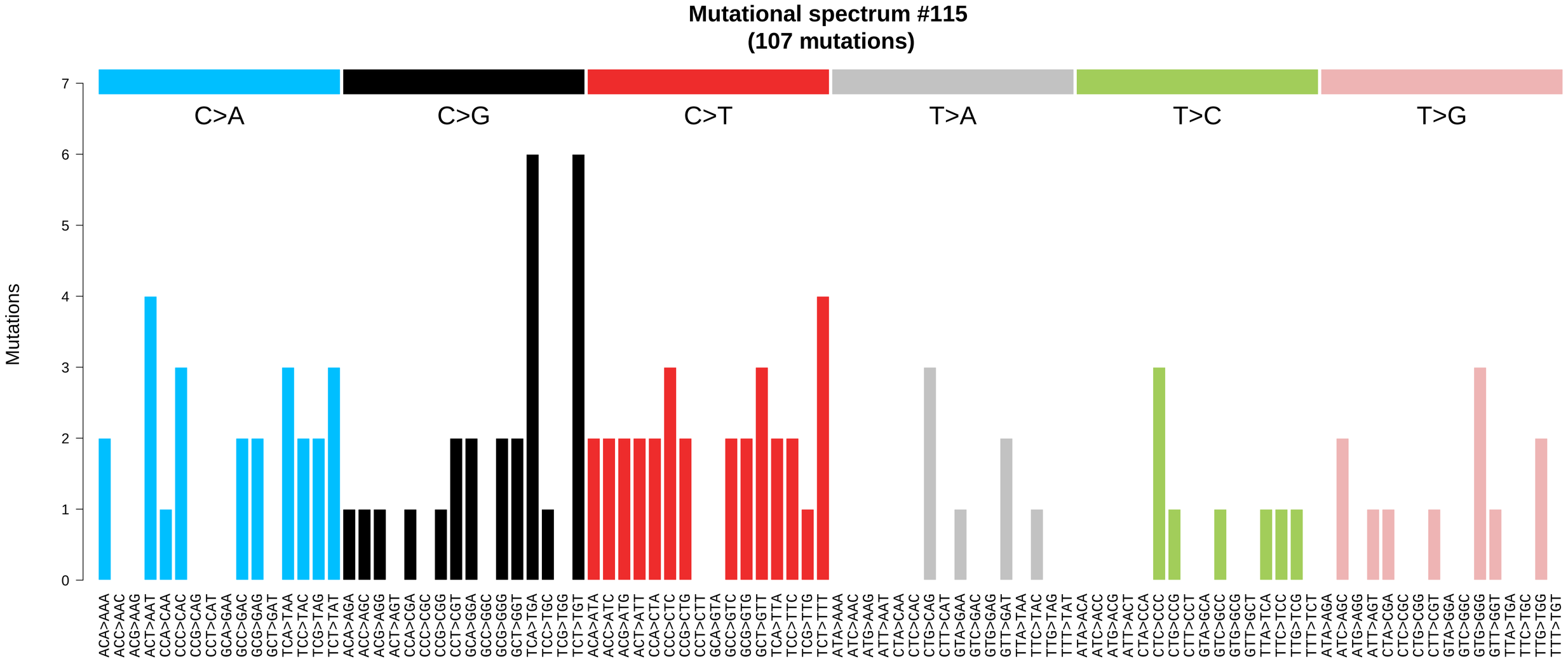

Mutational spectrum #110
(17 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

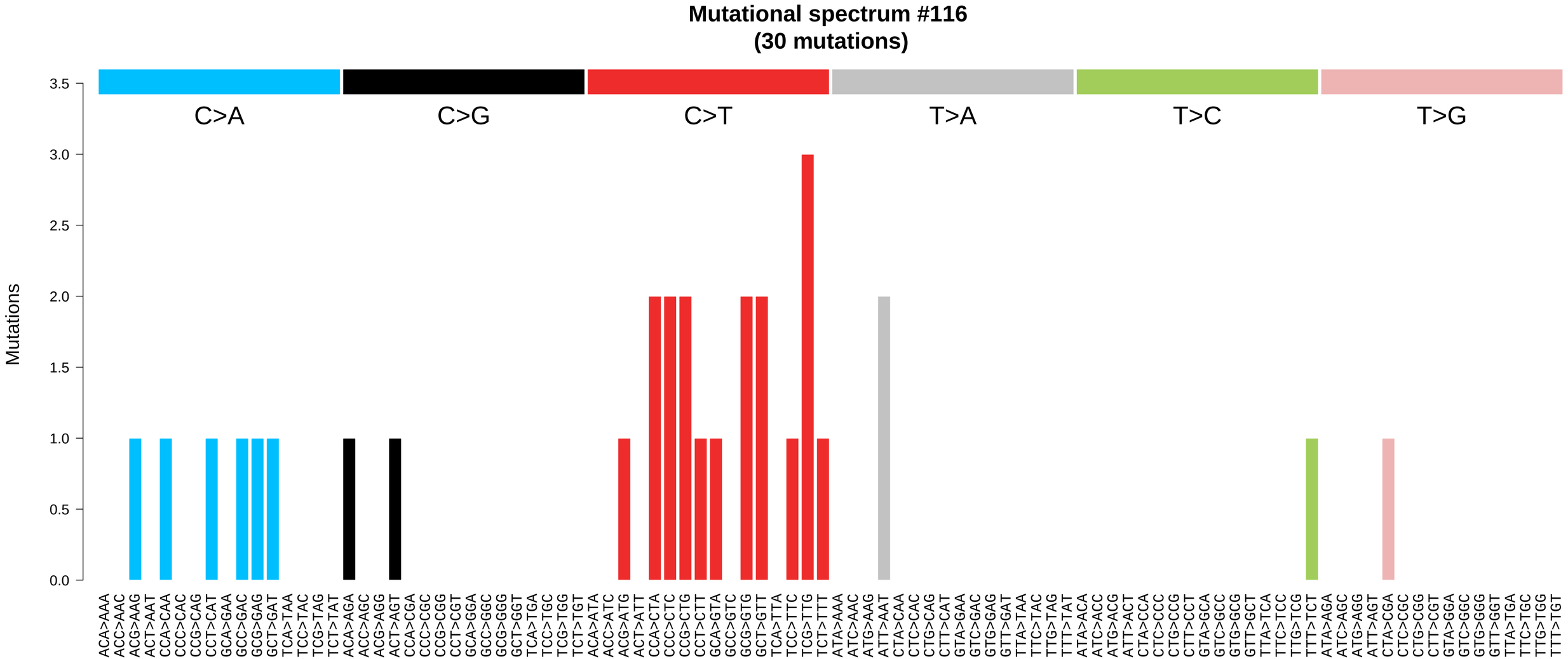

Mutational spectrum #111
(66 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

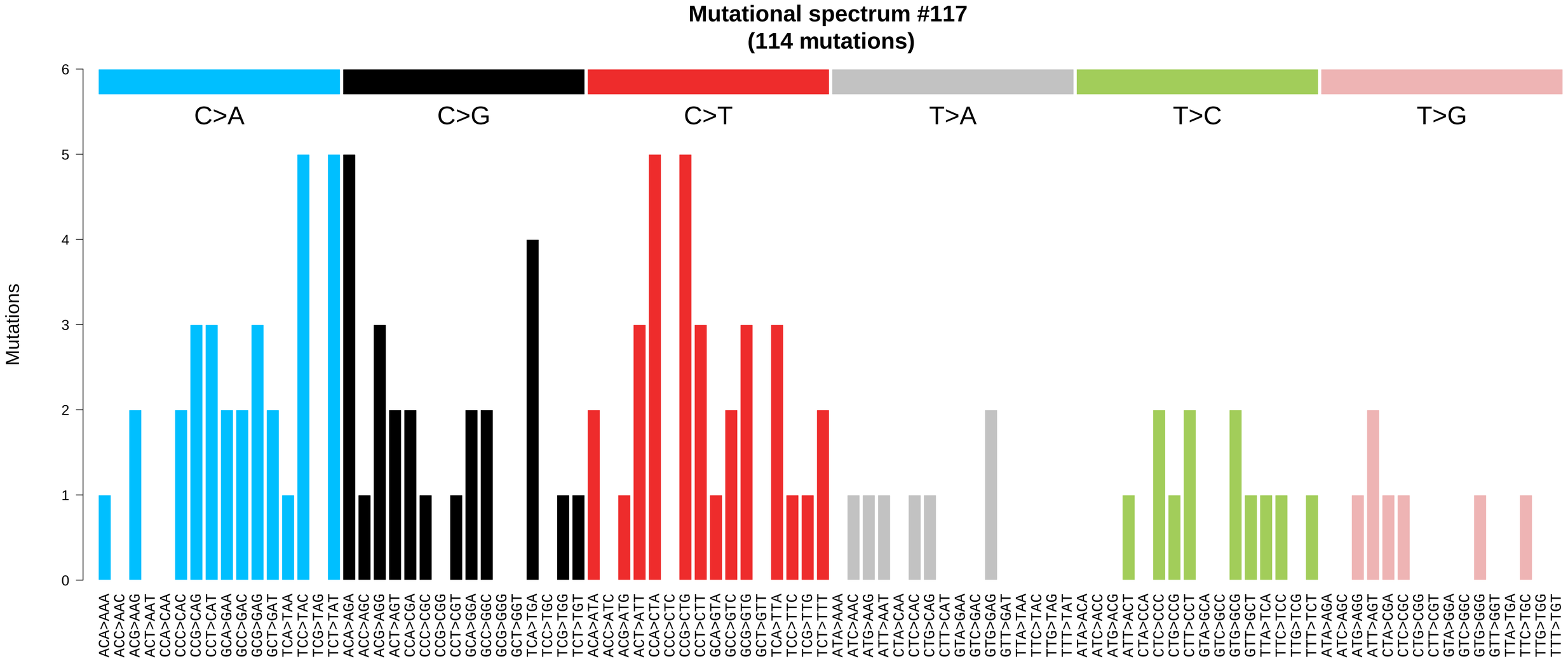

Mutational spectrum #112
(125 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
15
10
5
0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

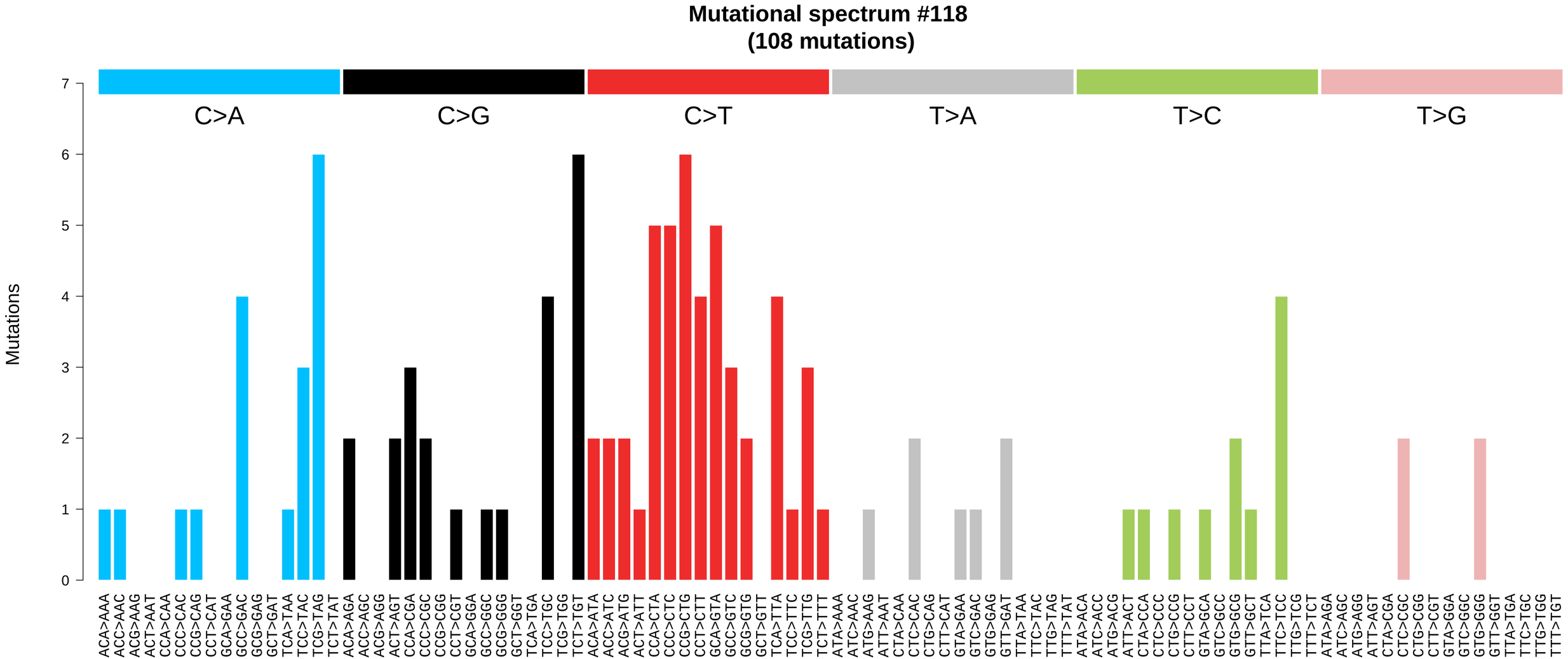

Mutational spectrum #113
(69 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

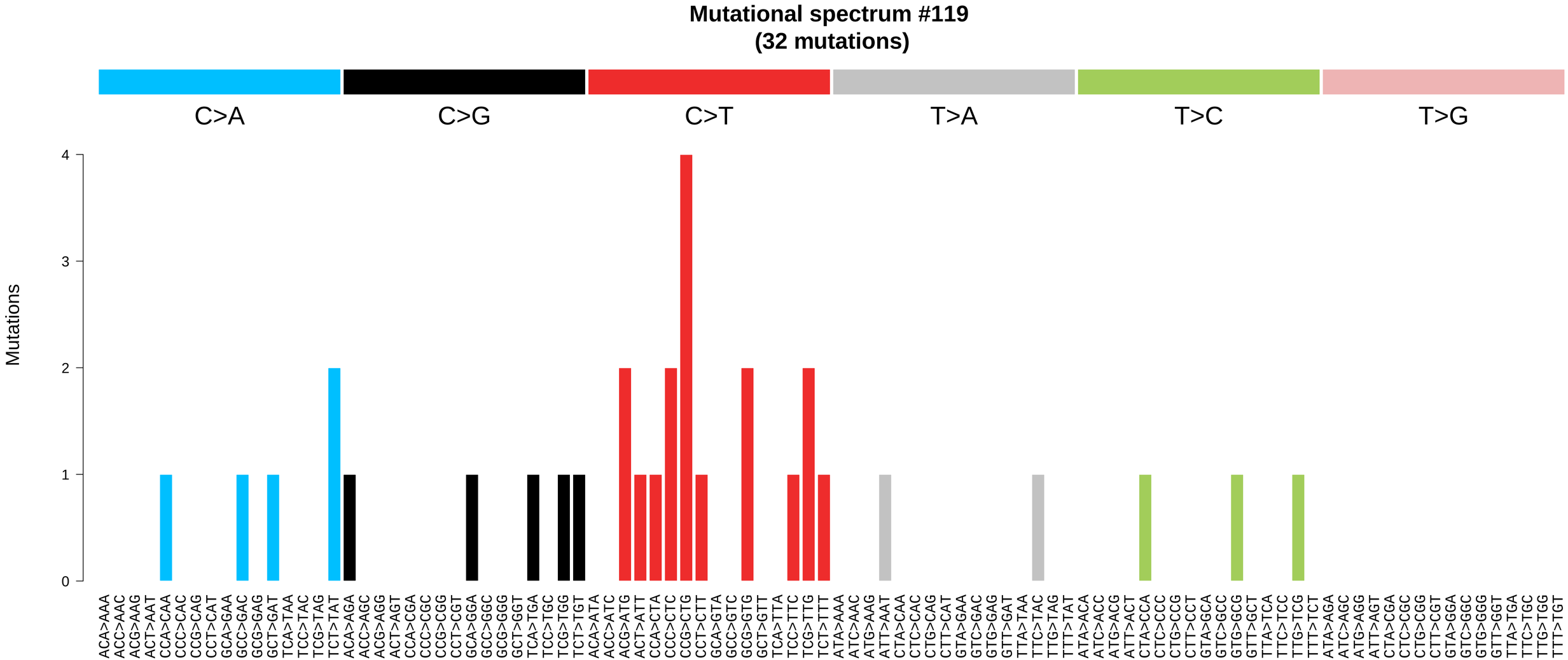

Mutational spectrum #114
(109 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
15
10
5
0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

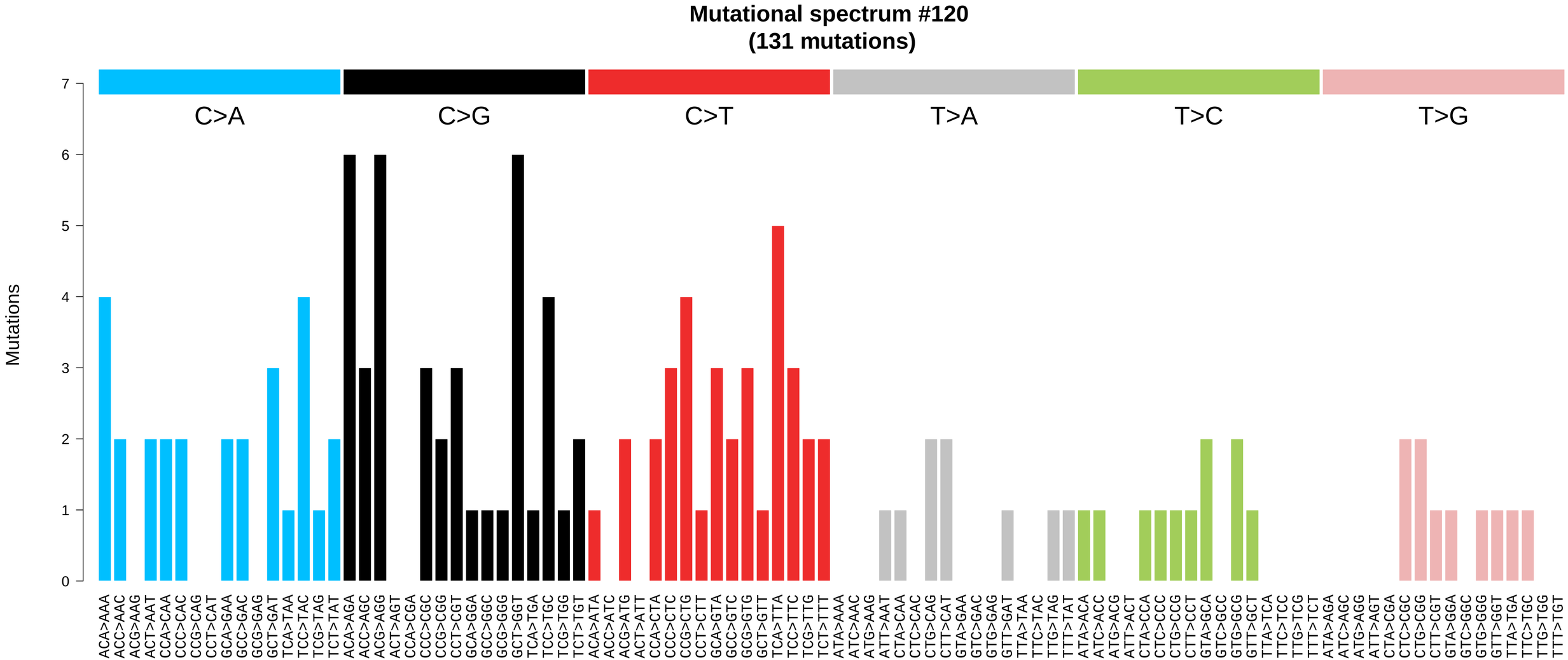

Mutational spectrum #115
(107 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

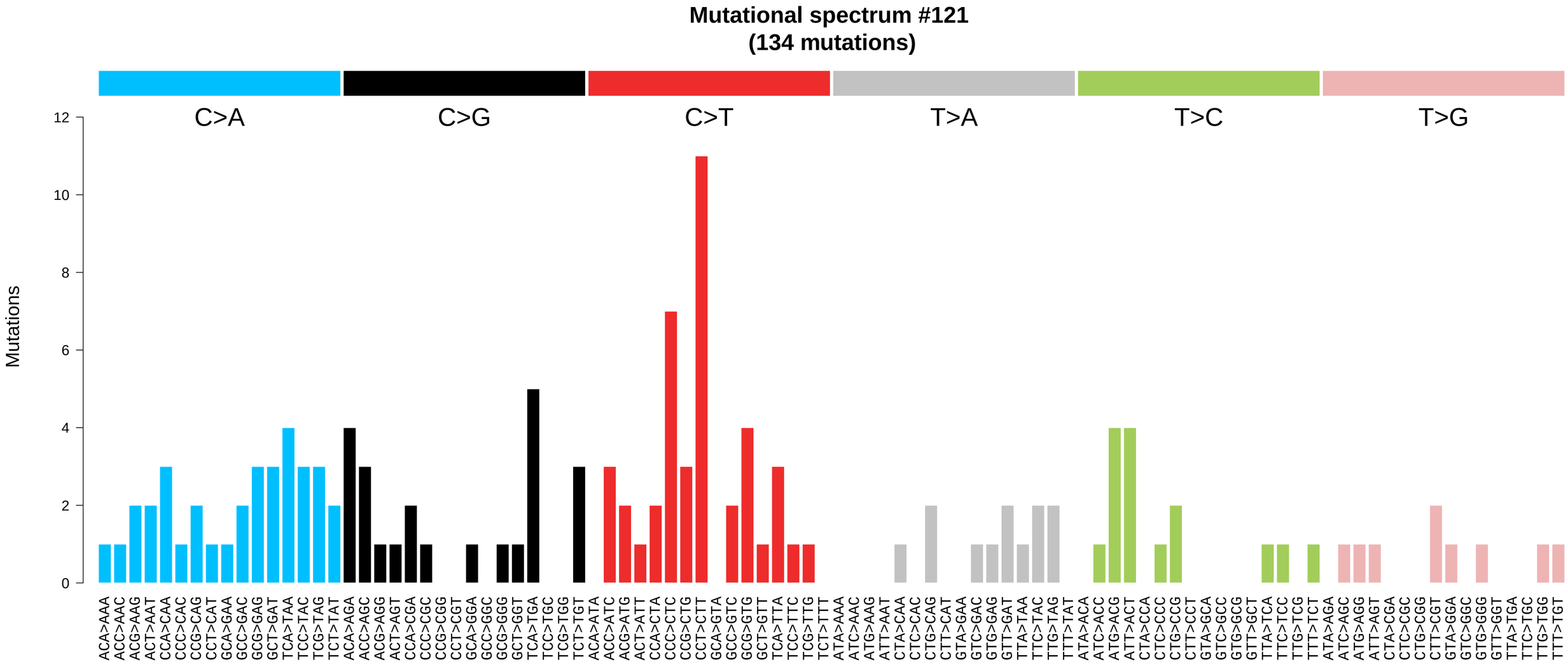

Mutational spectrum #116
(30 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

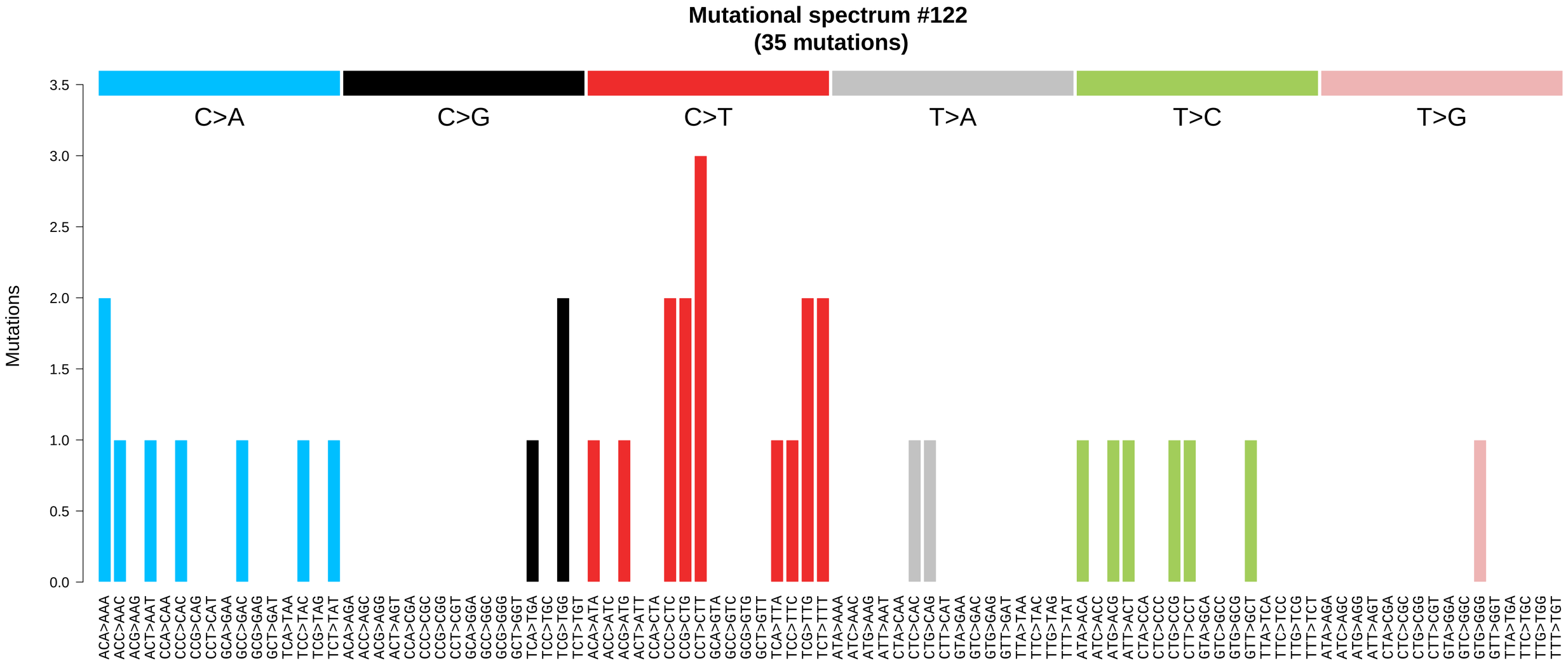

Mutational spectrum #117
(114 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

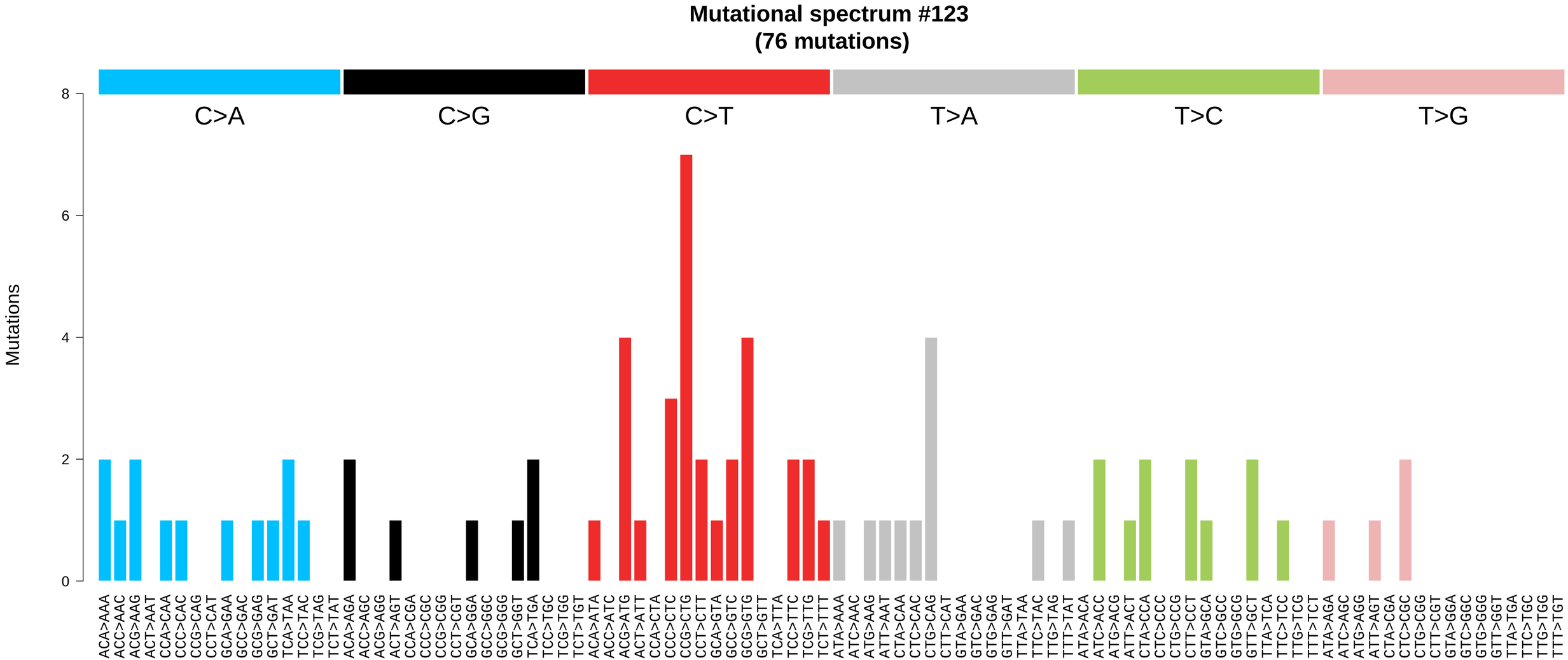

Mutational spectrum #118
(108 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

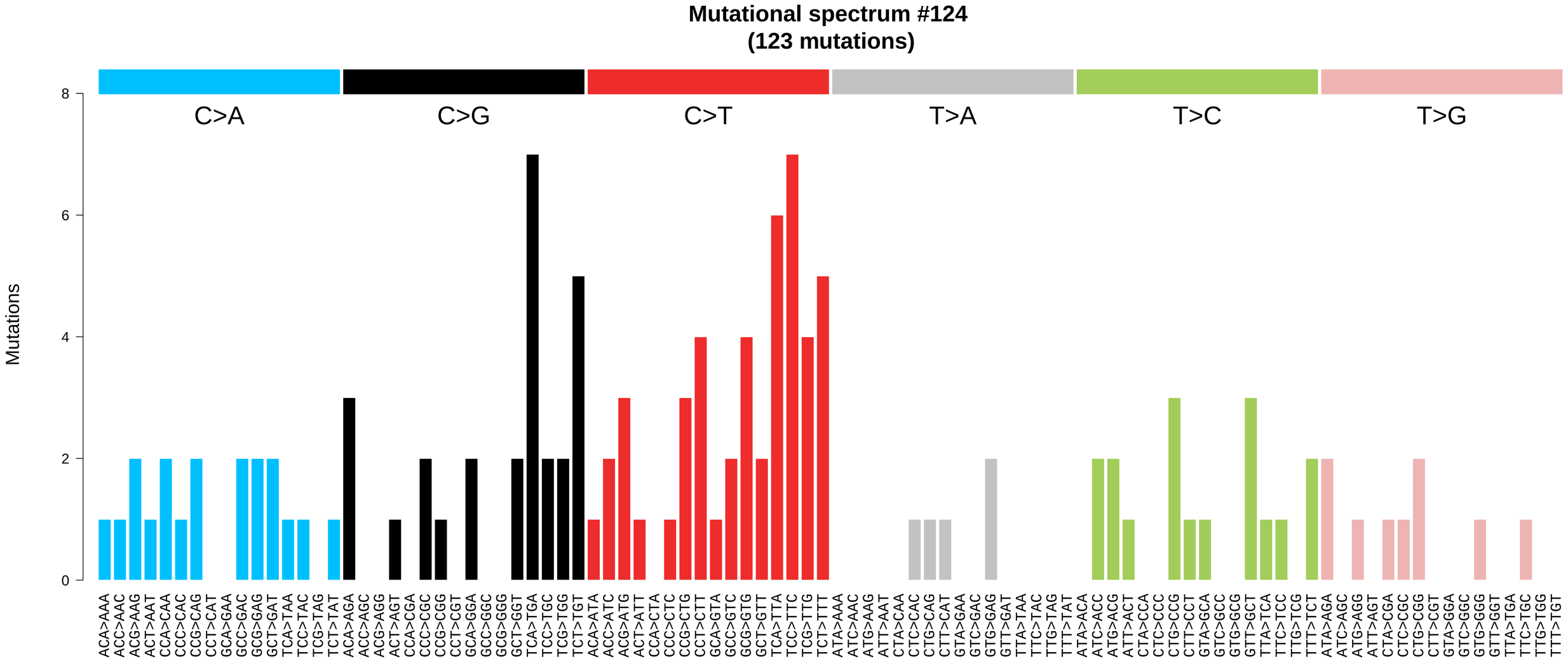

Mutational spectrum #119
(32 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

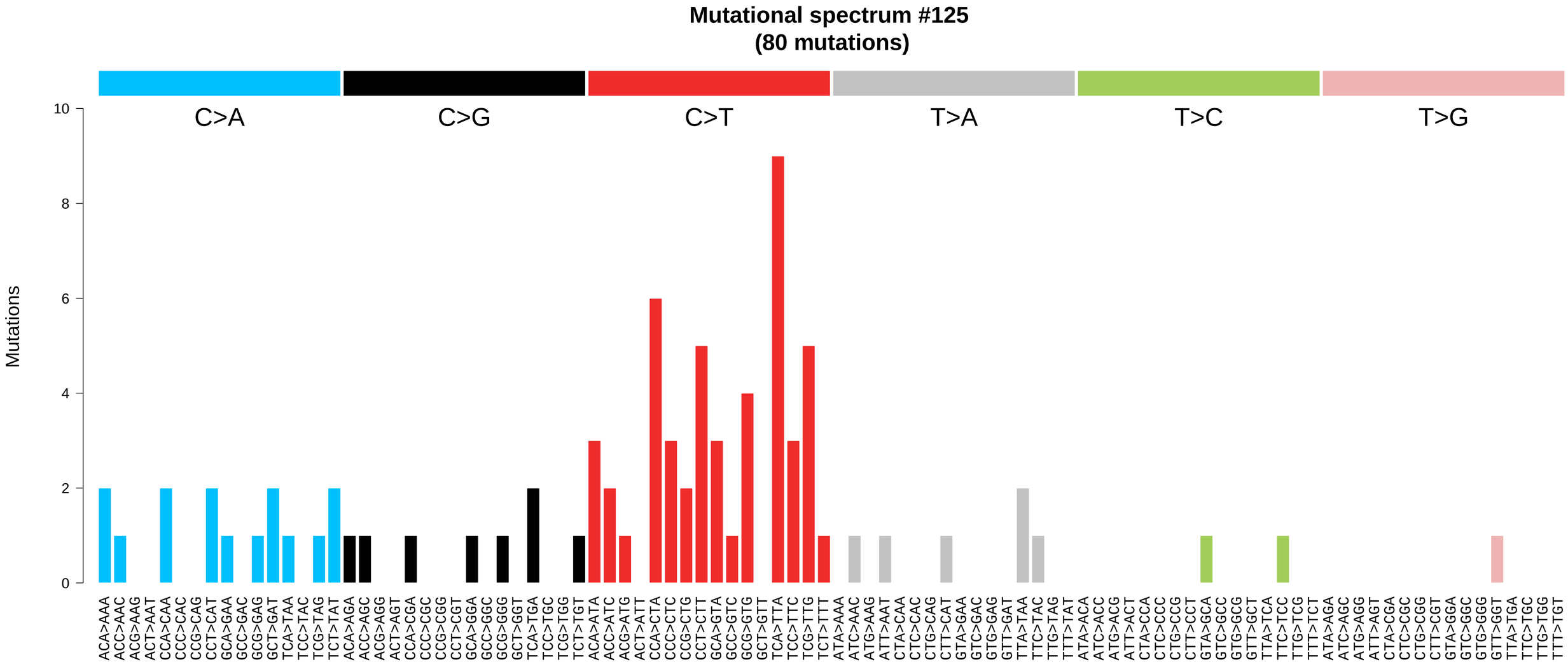

Mutational spectrum #120
(131 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

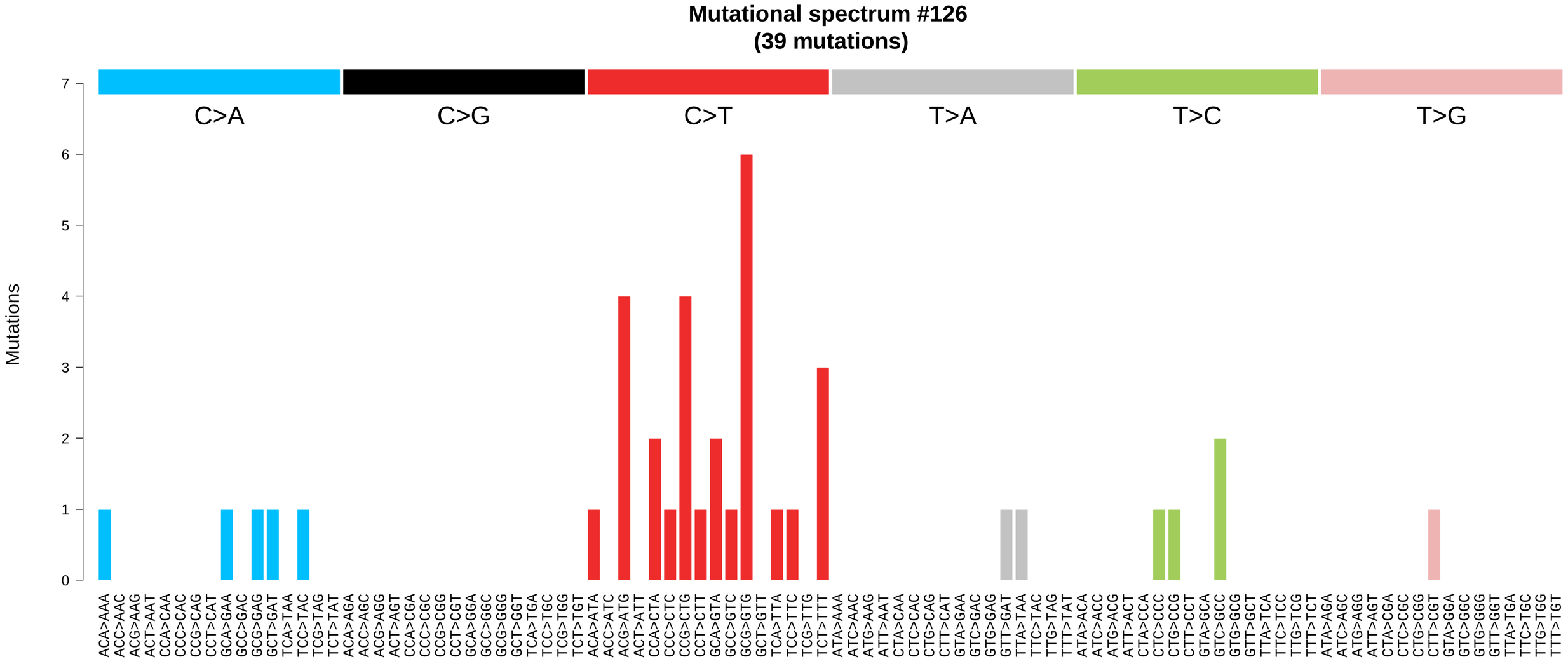

Mutational spectrum #121
(134 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

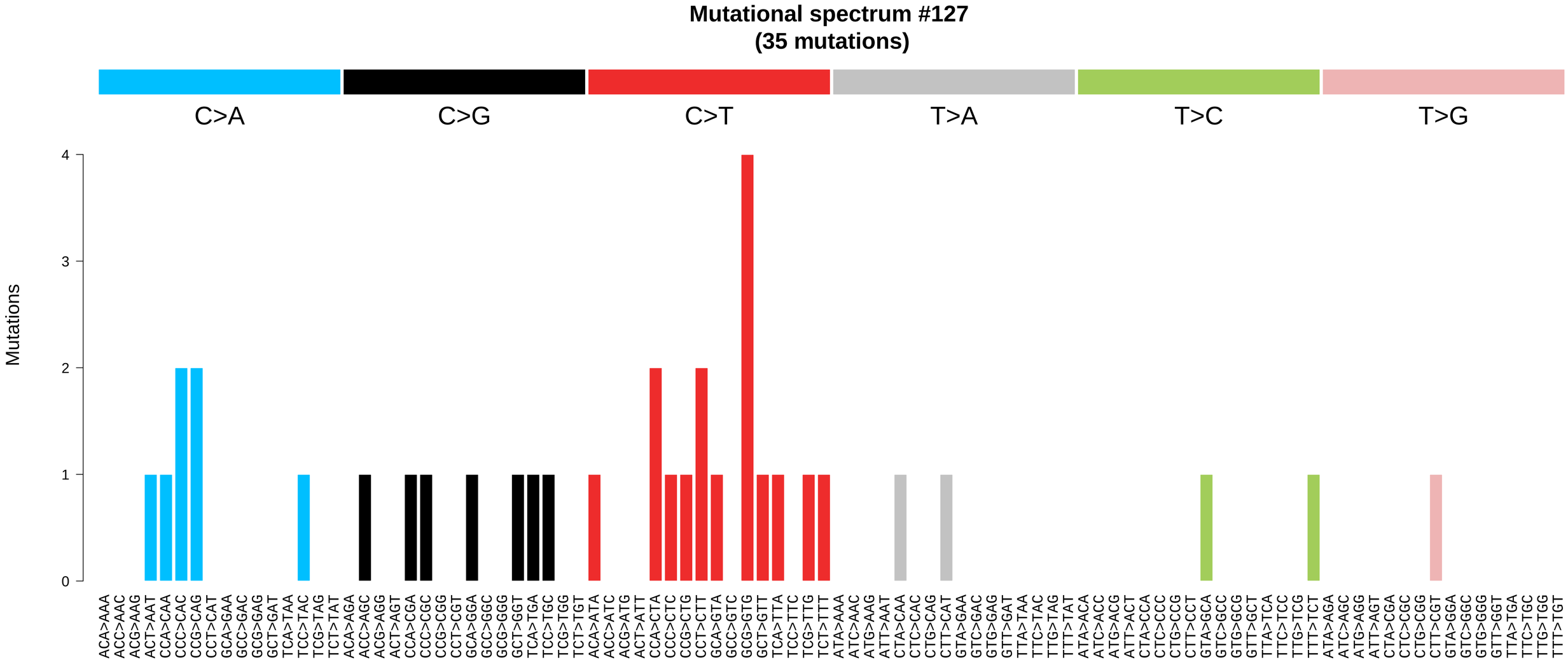

Mutational spectrum #122
(35 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

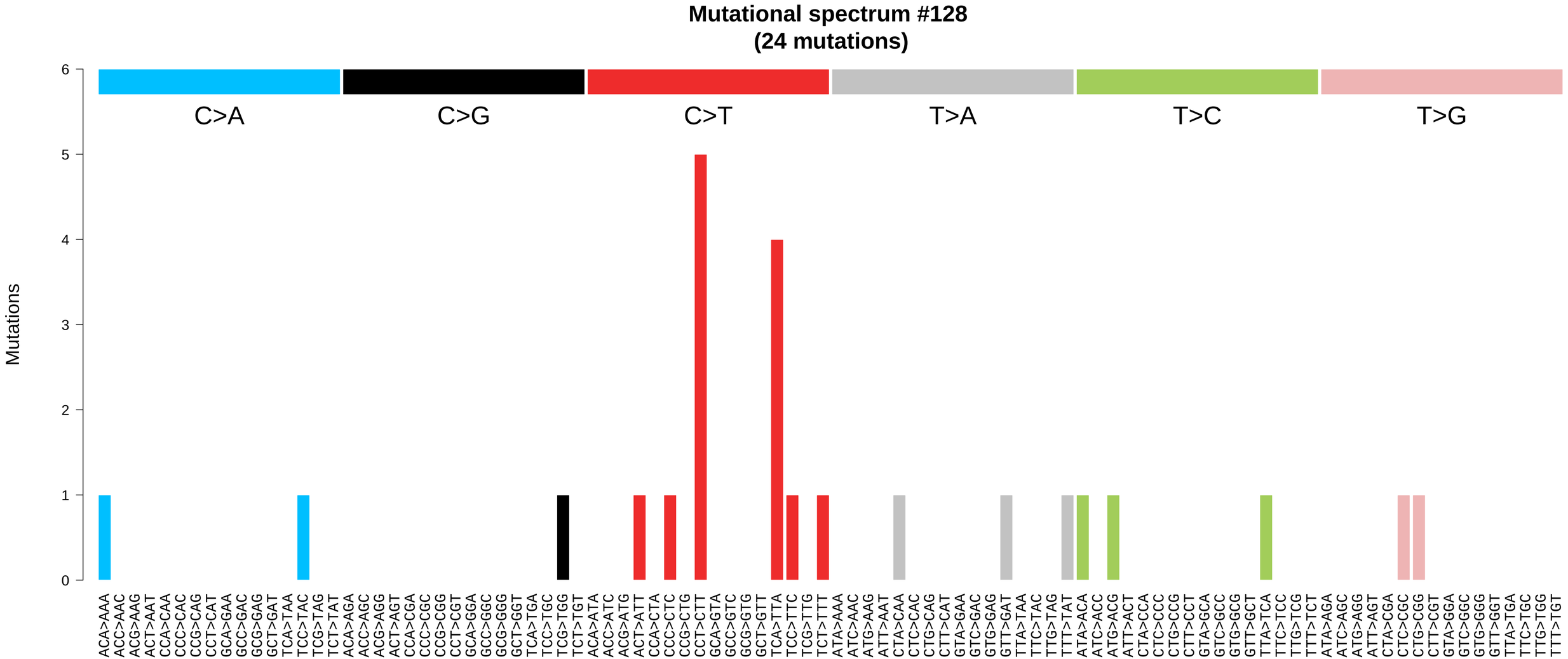

Mutational spectrum #123
(76 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

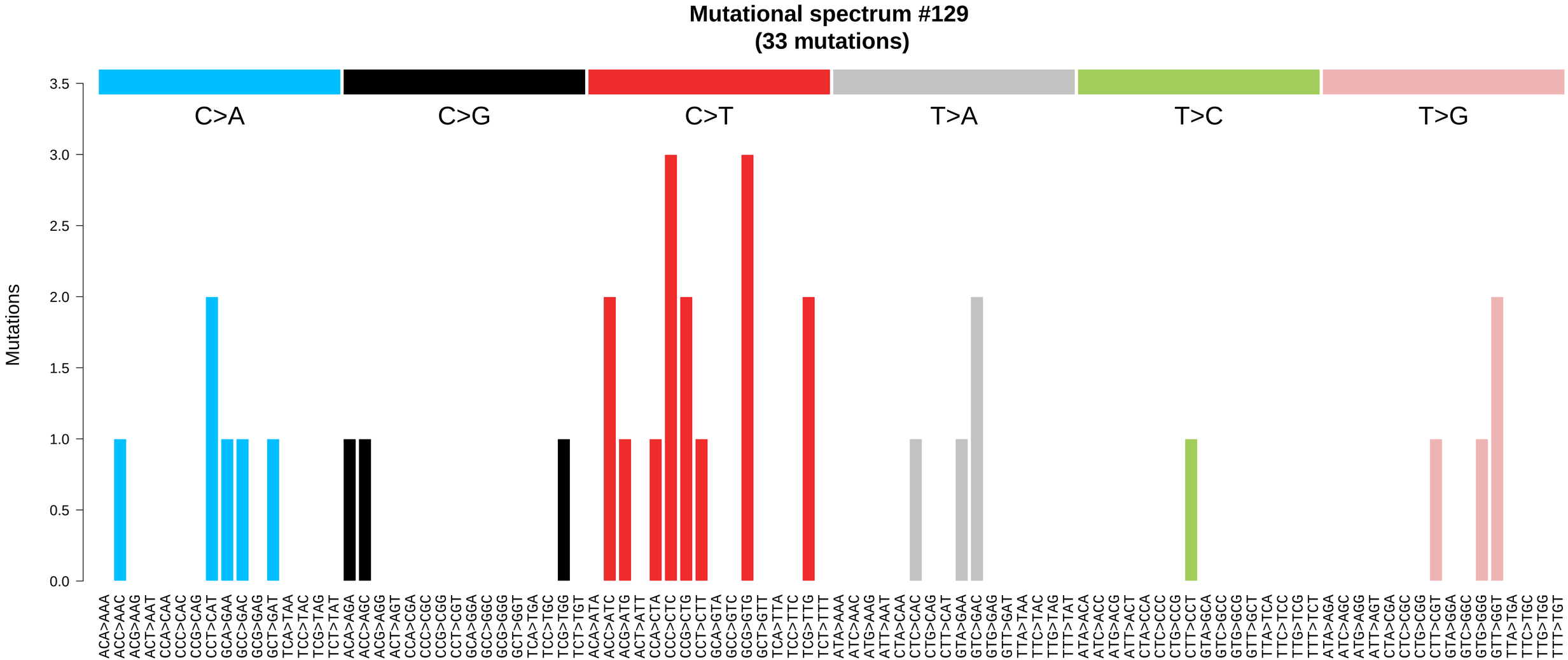

Mutational spectrum #124
(123 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

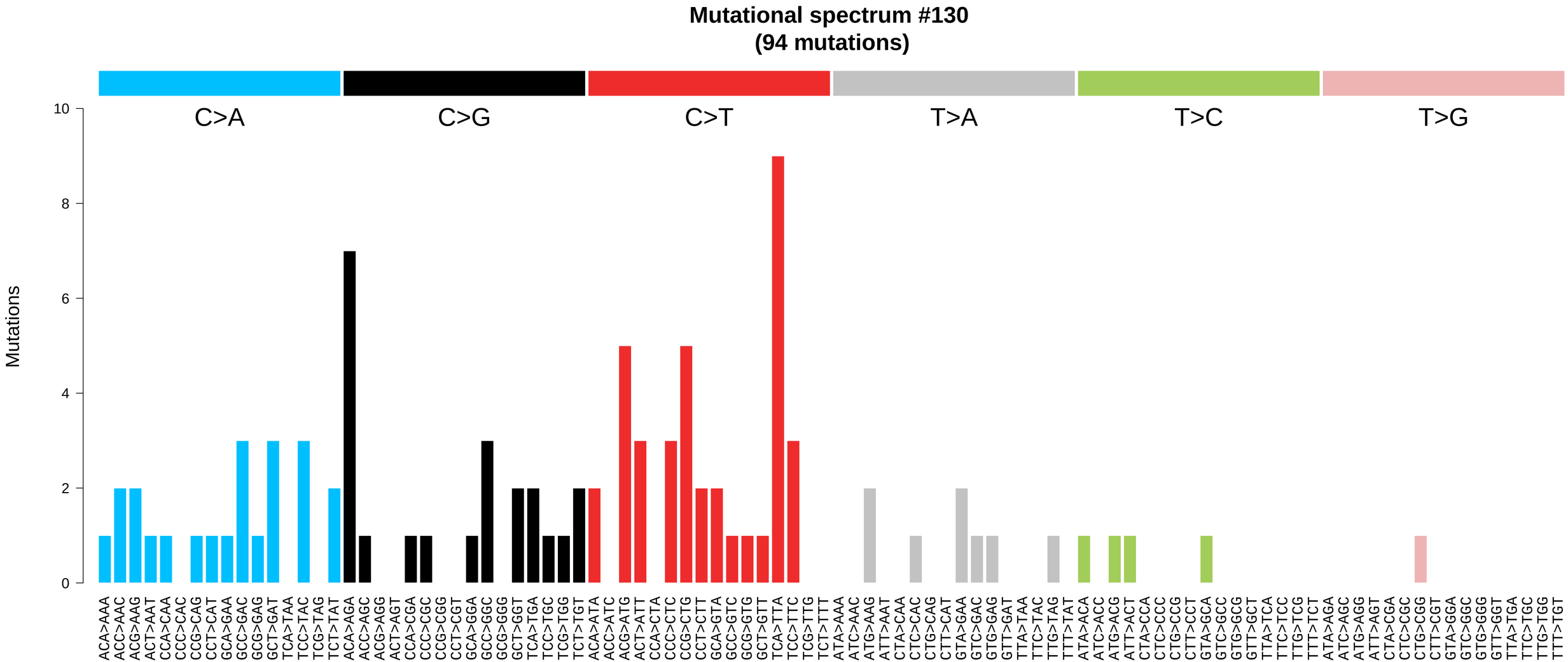

Mutational spectrum #125
(80 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

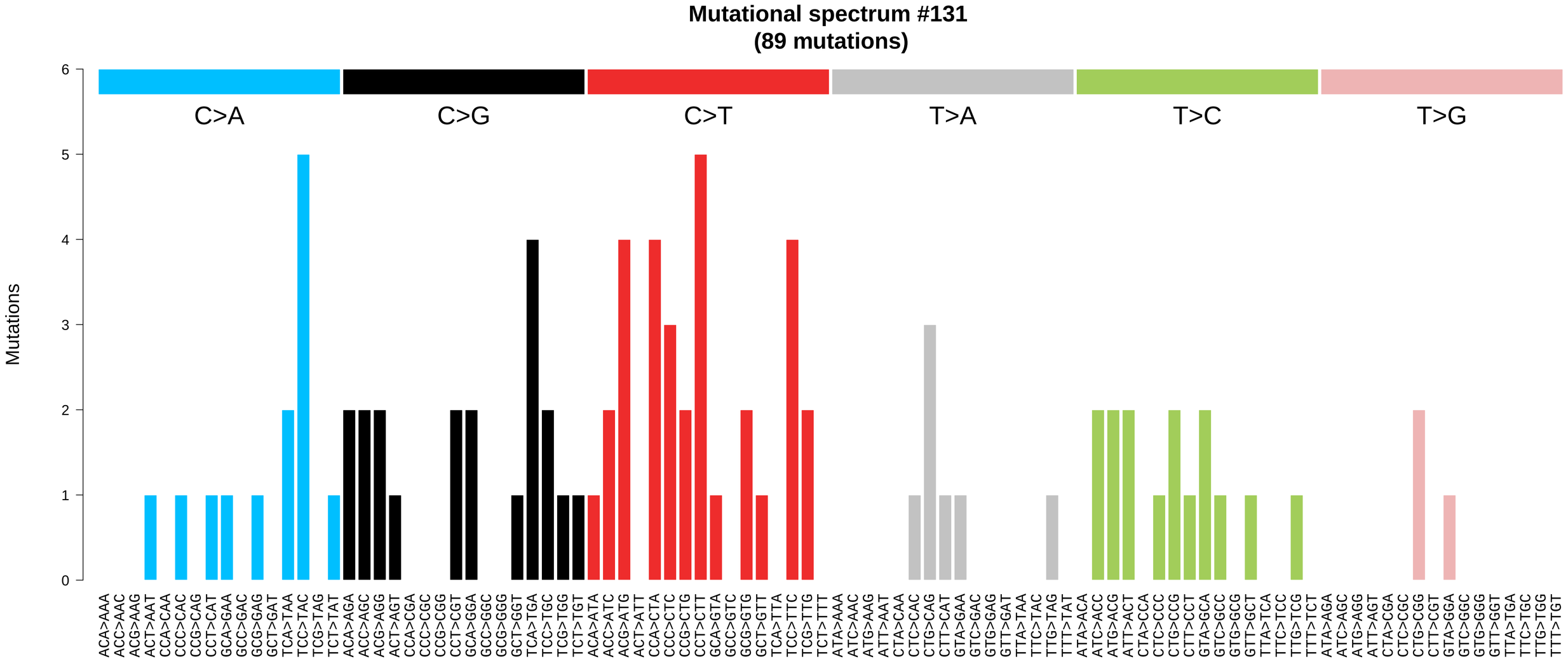

Mutational spectrum #126
(39 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

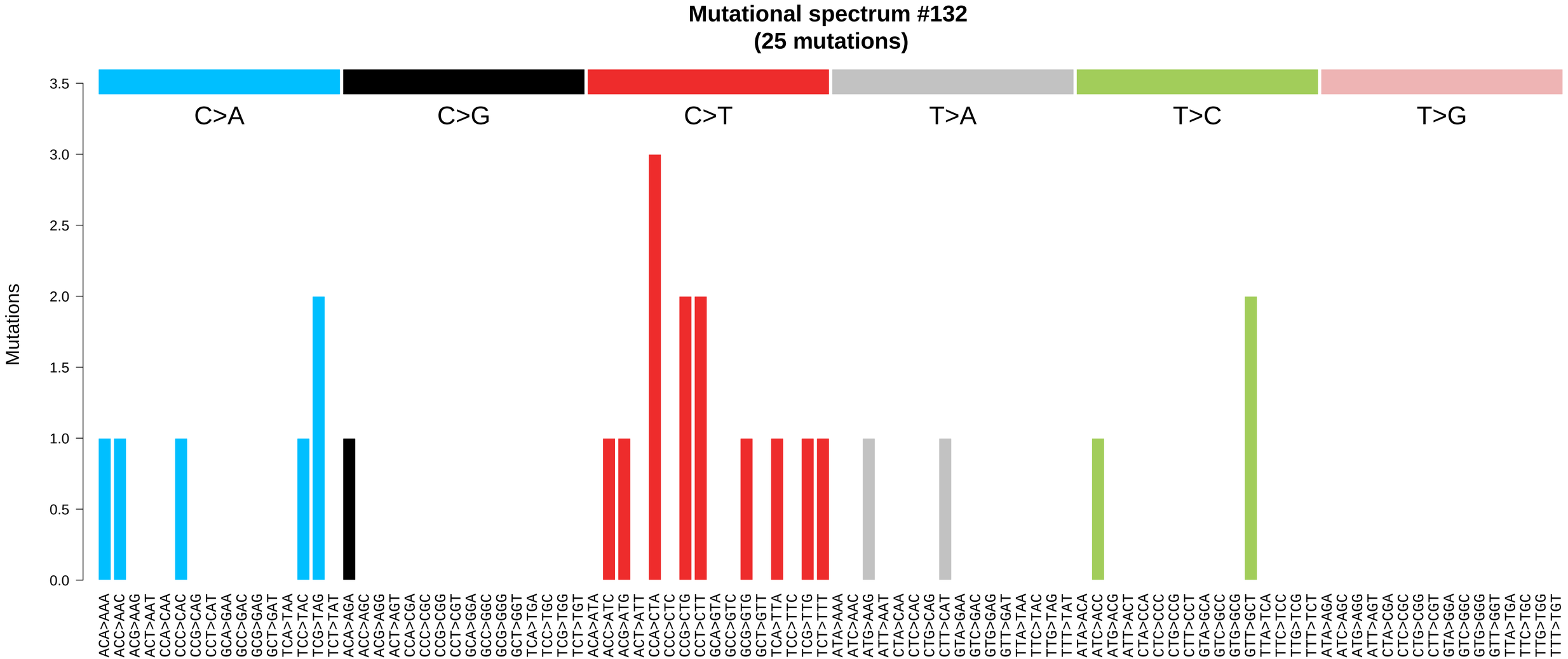

Mutational spectrum #127
(35 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

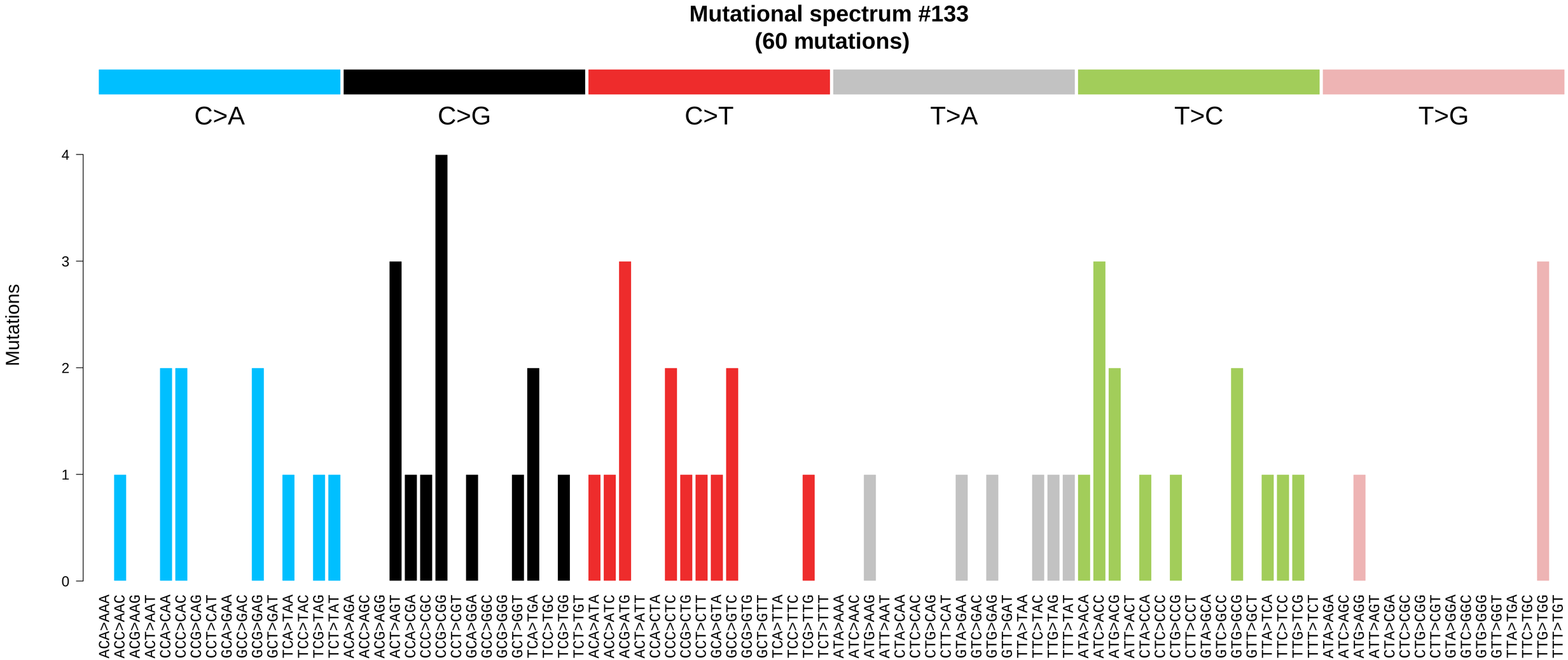

Mutational spectrum #128
(24 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

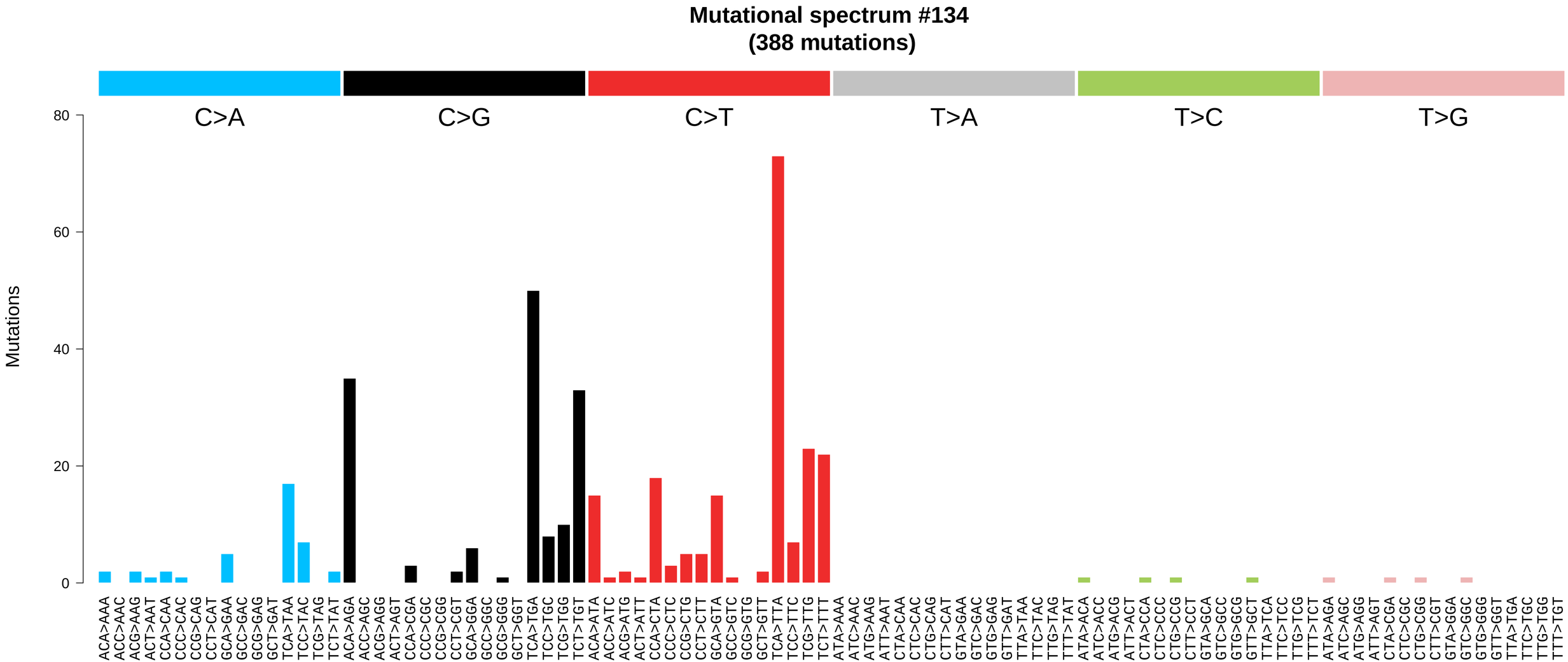

Mutational spectrum #129
(33 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

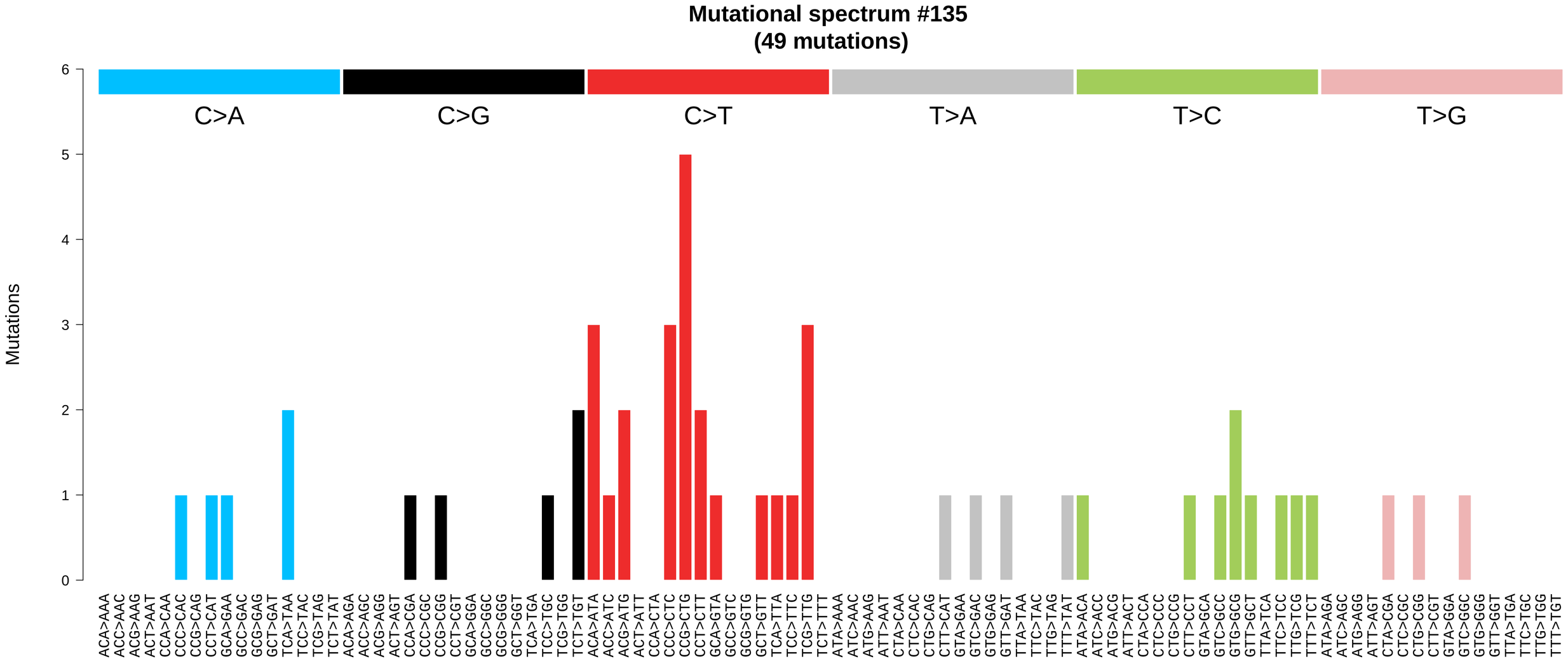

Mutational spectrum #130
(94 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

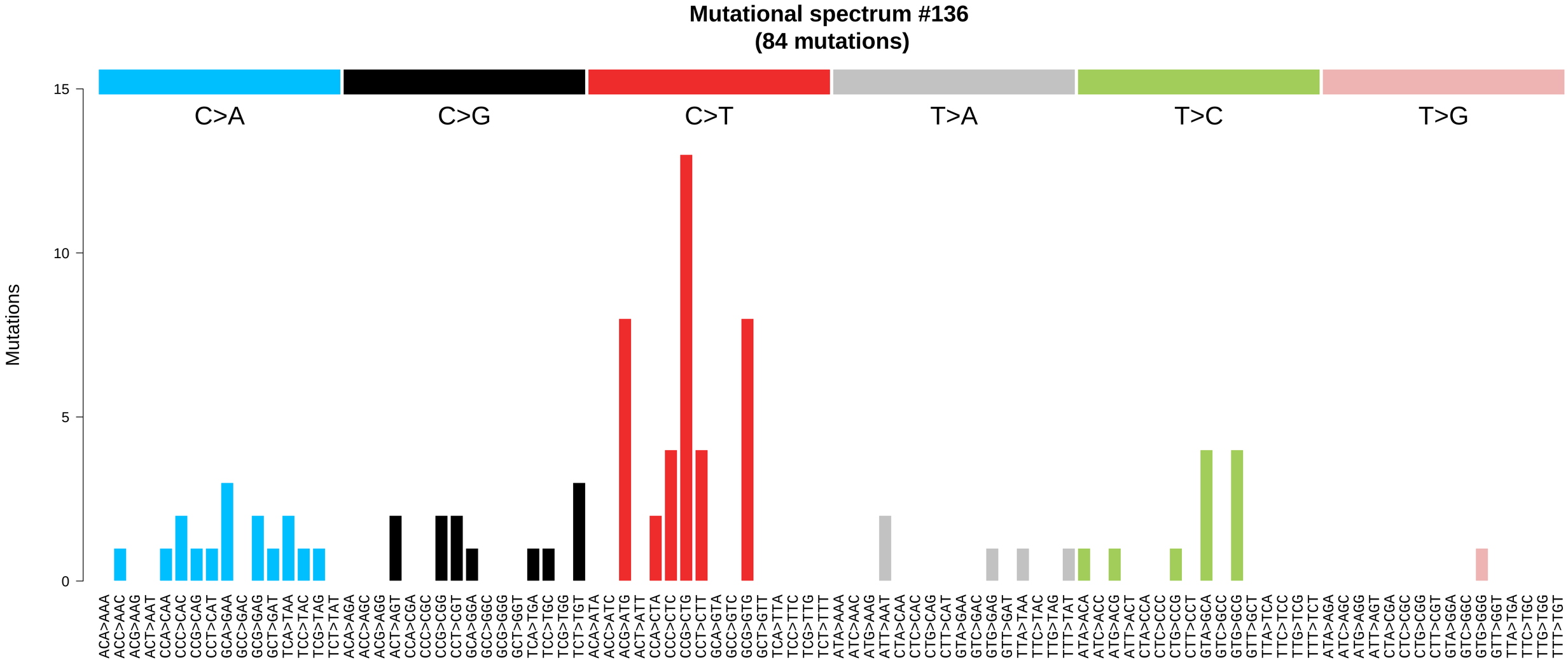

Mutational spectrum #131
(89 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

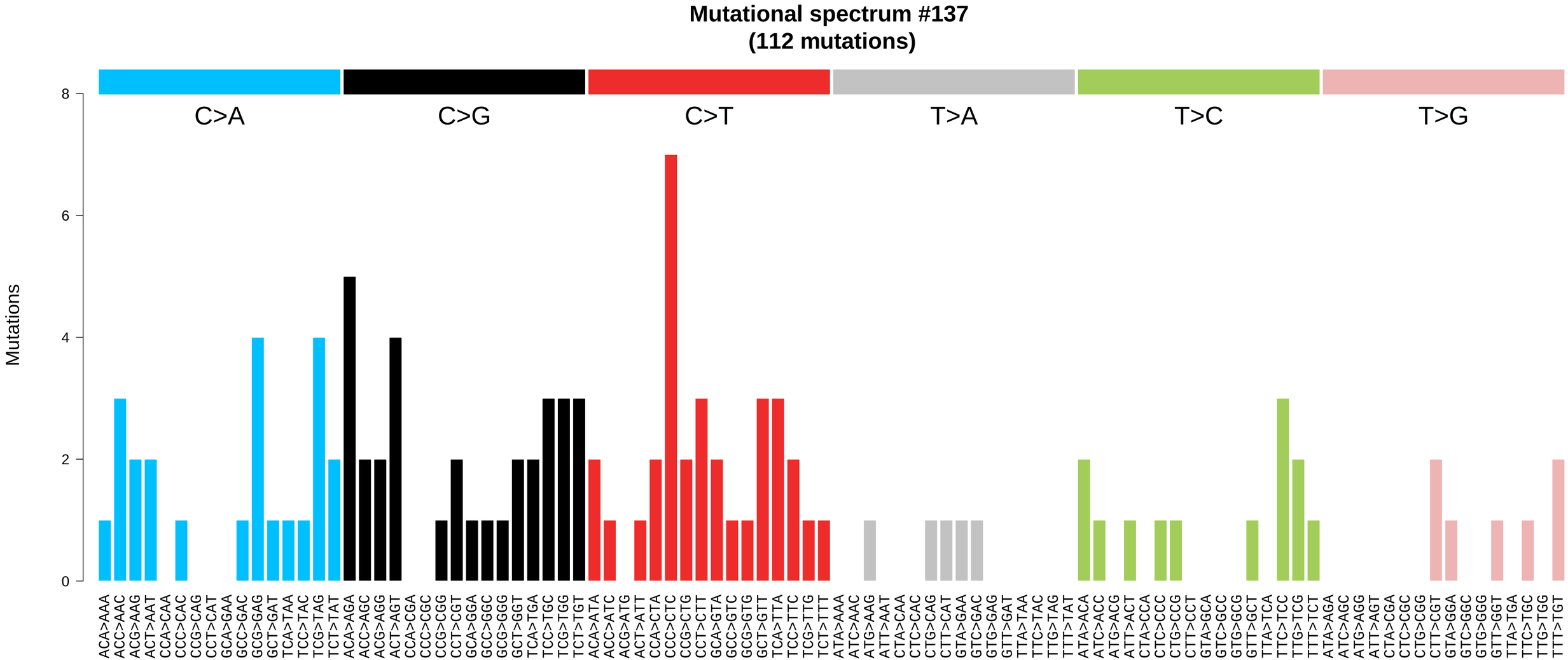

Mutational spectrum #132
(25 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

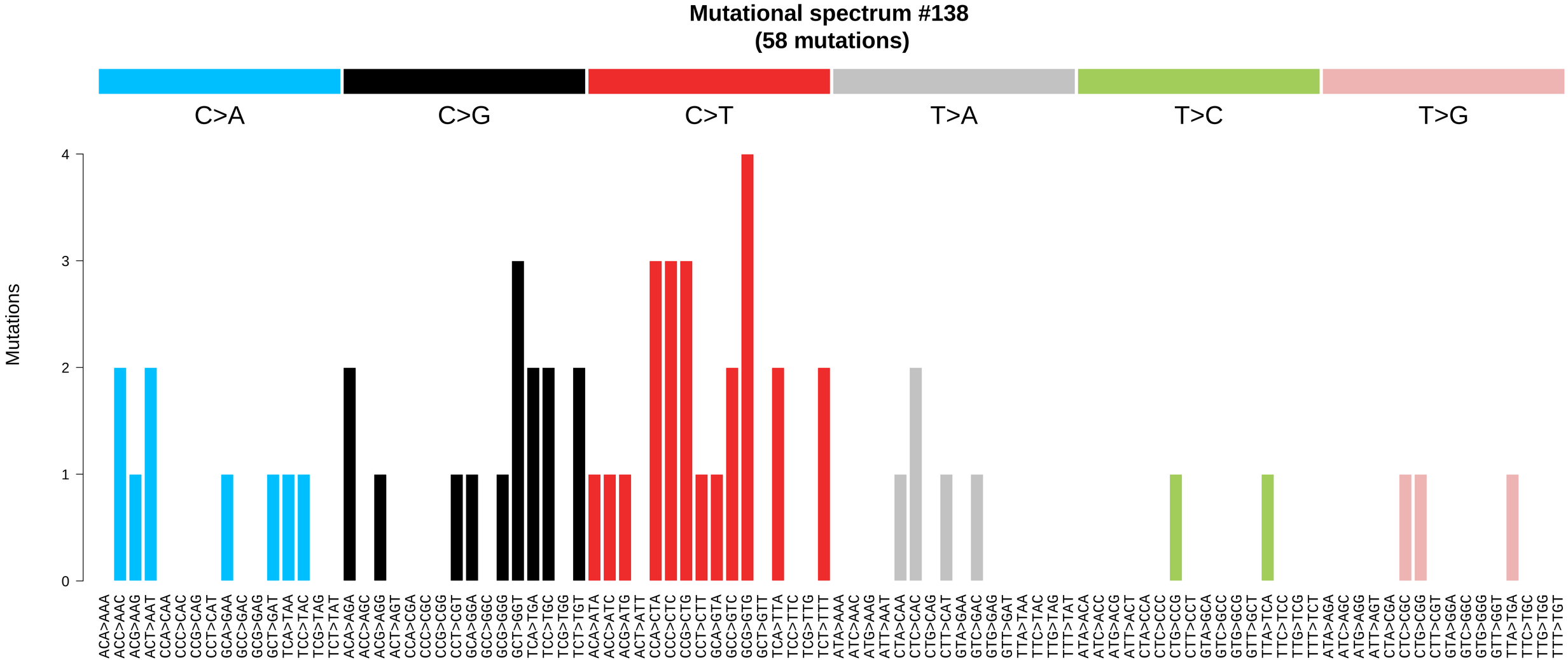

Mutational spectrum #133
(60 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

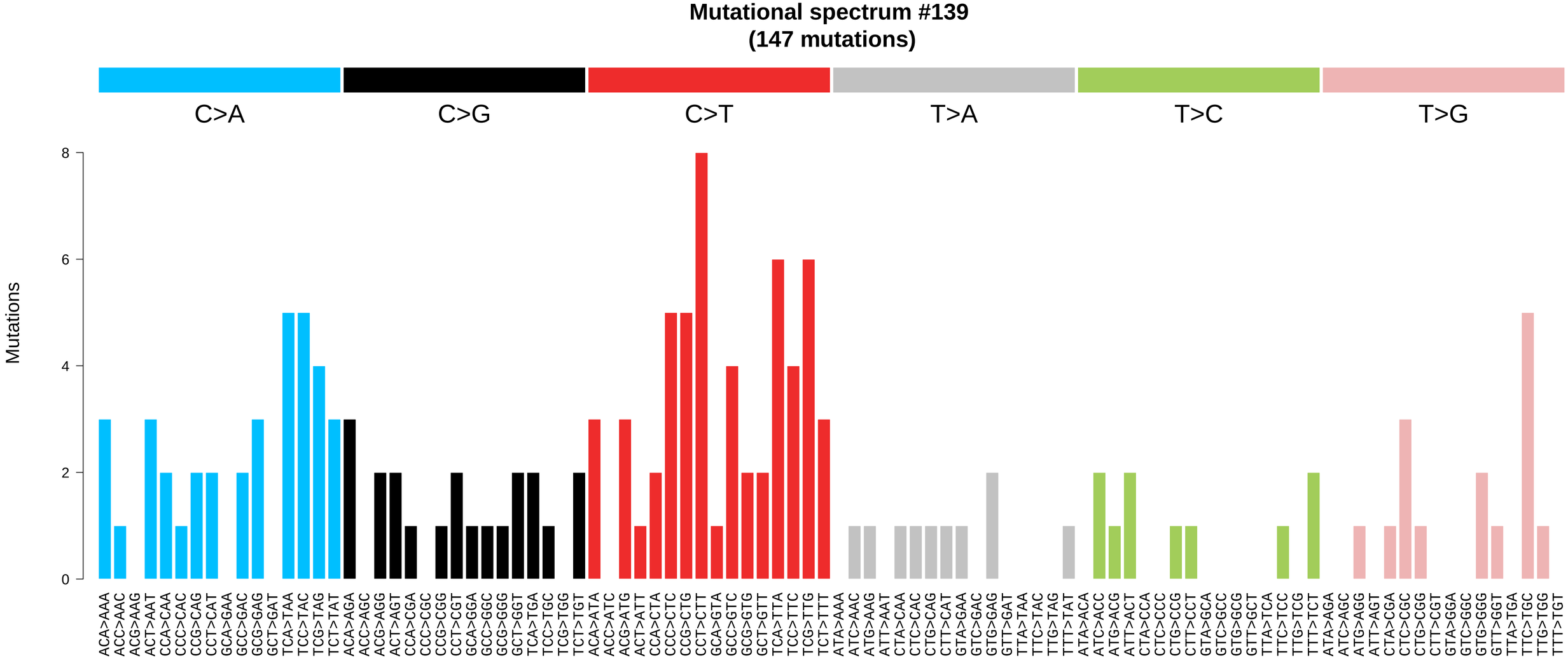

Mutational spectrum #134
(388 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
20
40
60
80
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

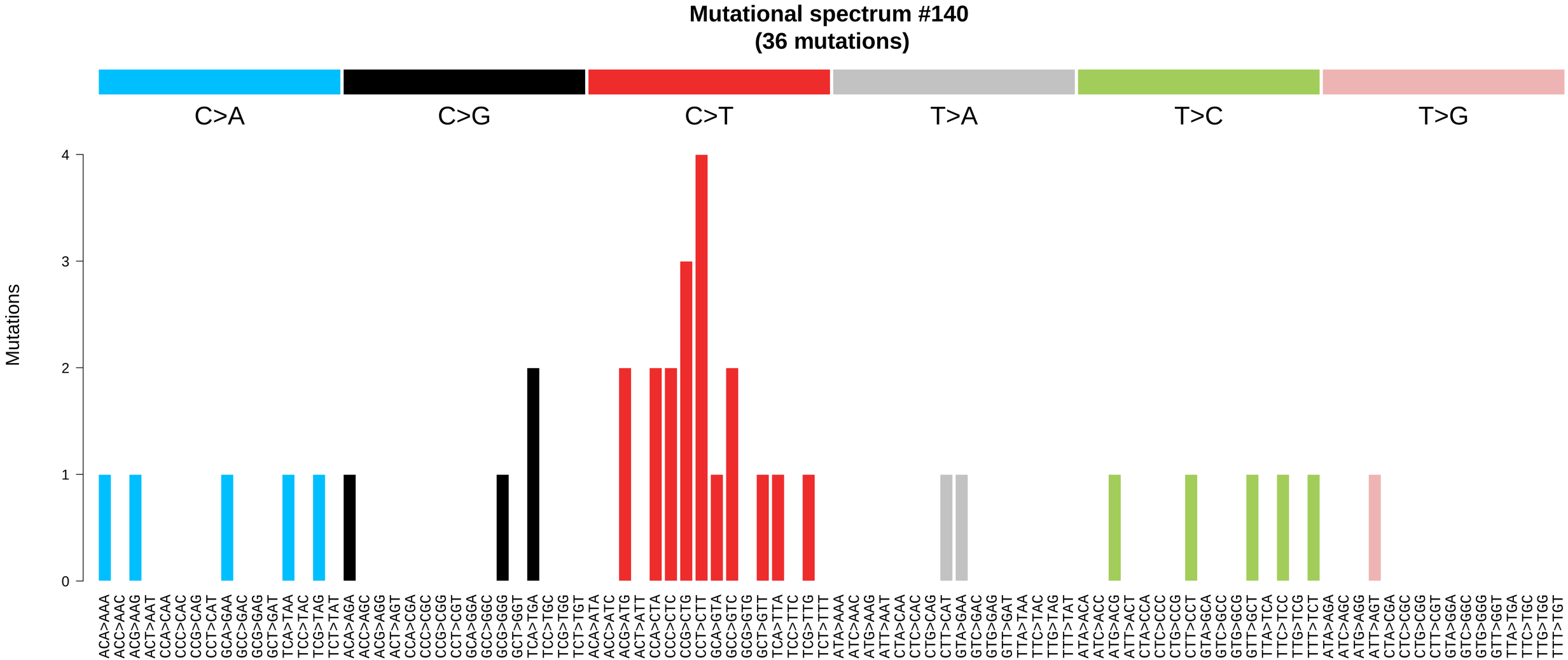

Mutational spectrum #135
(49 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

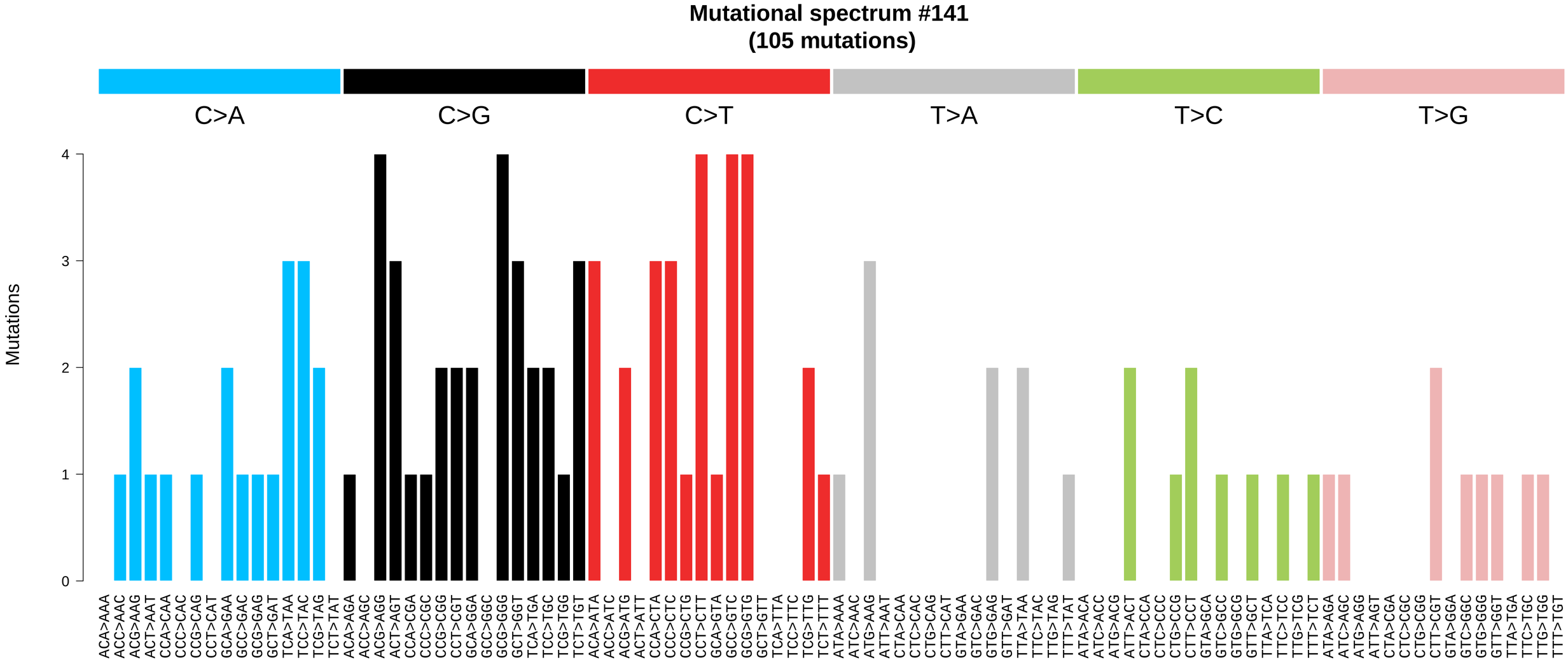

Mutational spectrum #136
(84 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
15
10
5
0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

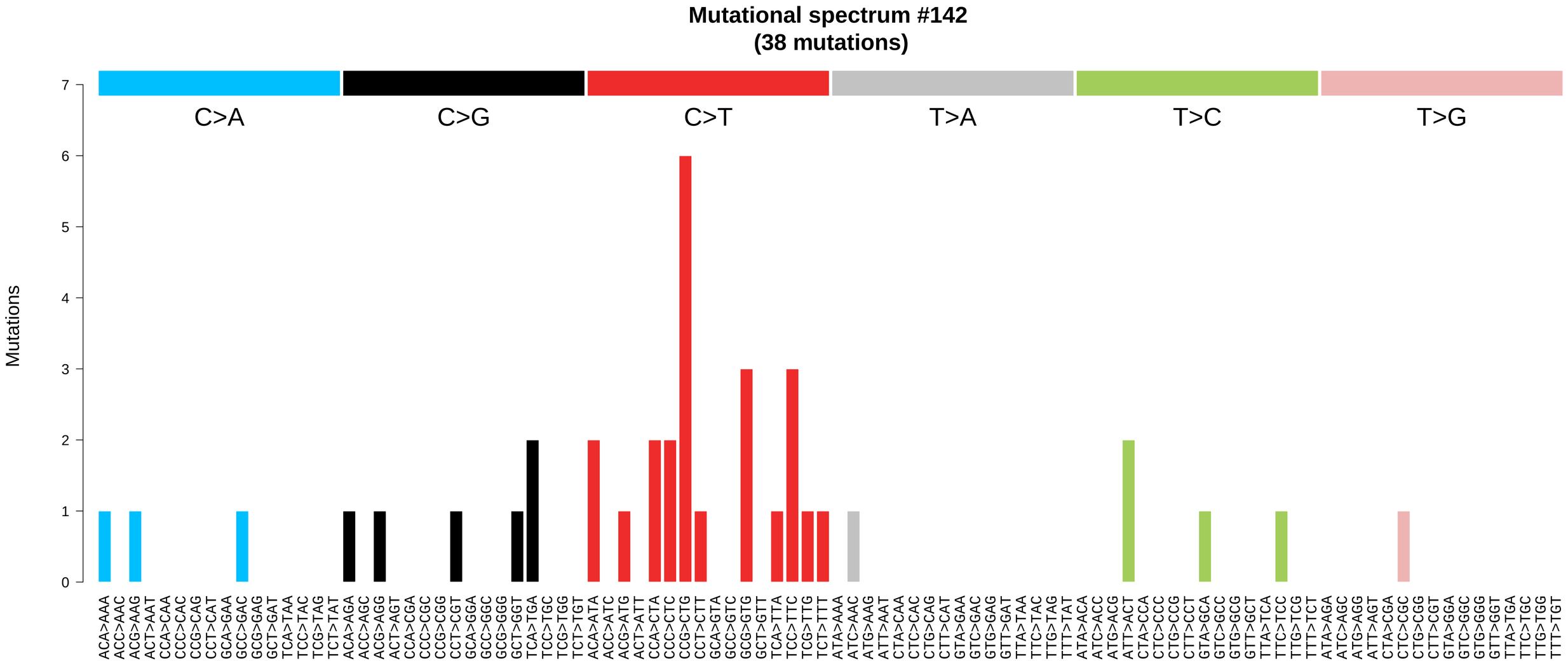

Mutational spectrum #137
(112 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

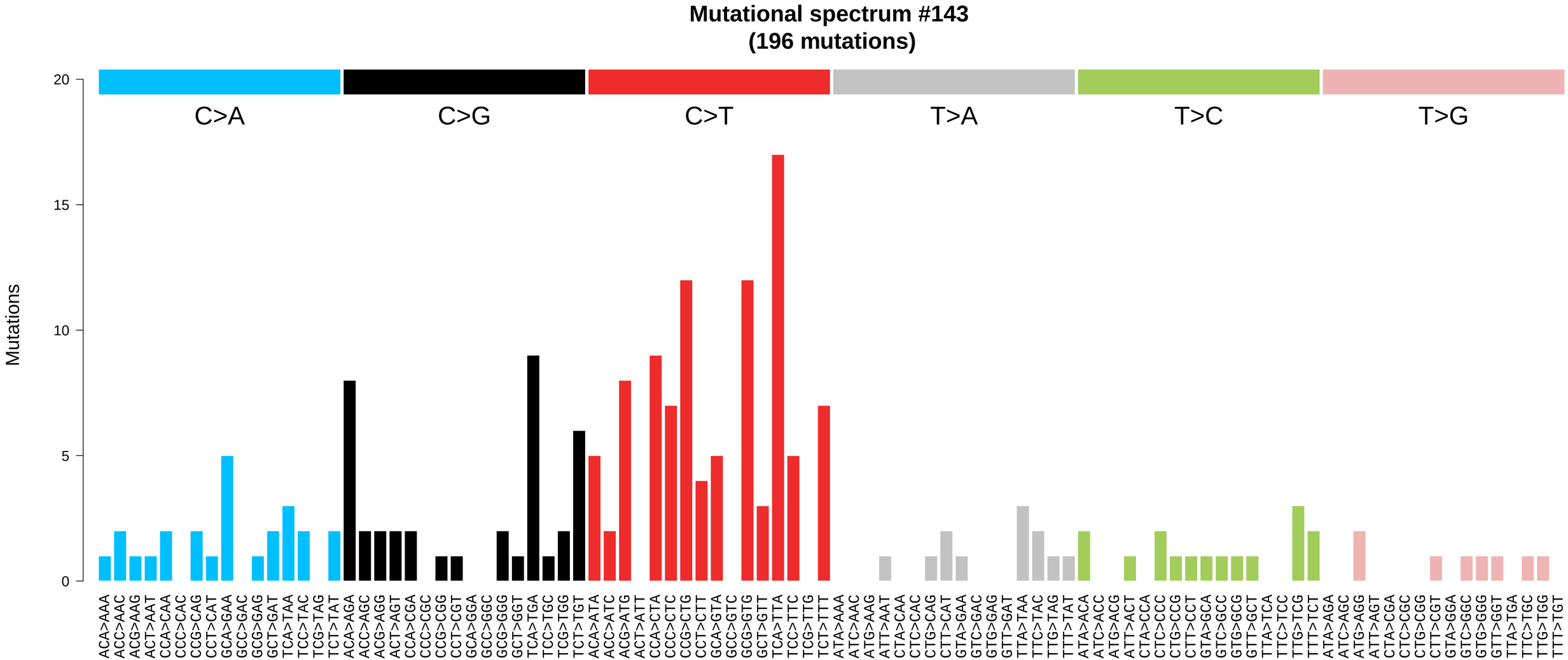

Mutational spectrum #138
(58 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

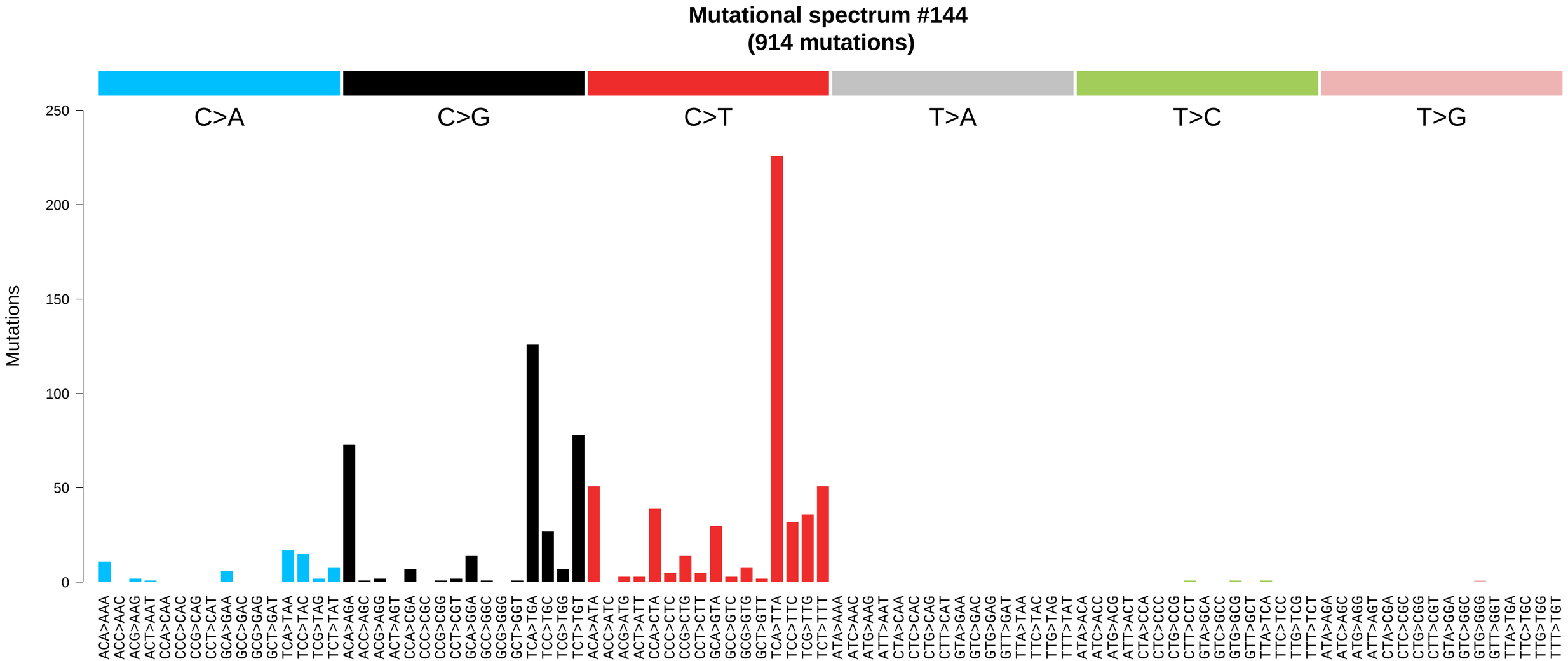

Mutational spectrum #139
(147 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

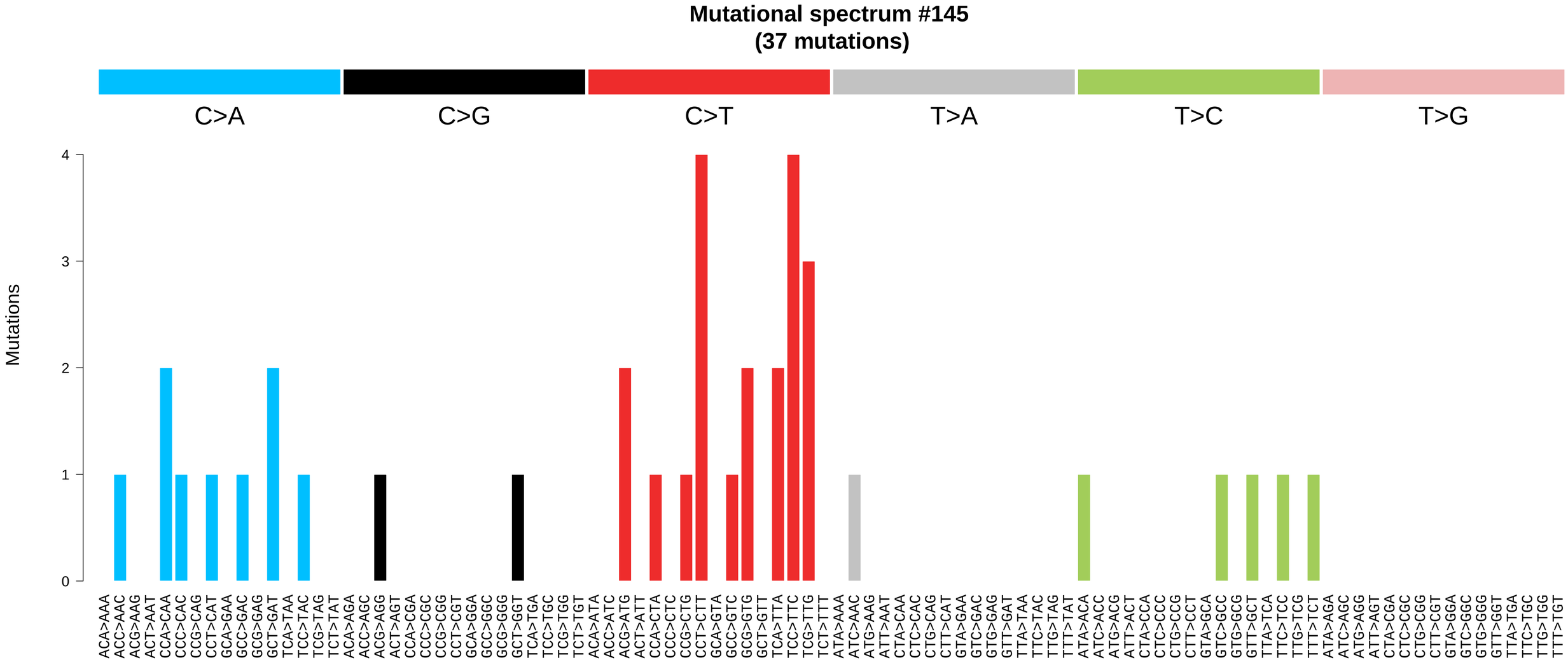

Mutational spectrum #140
(36 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

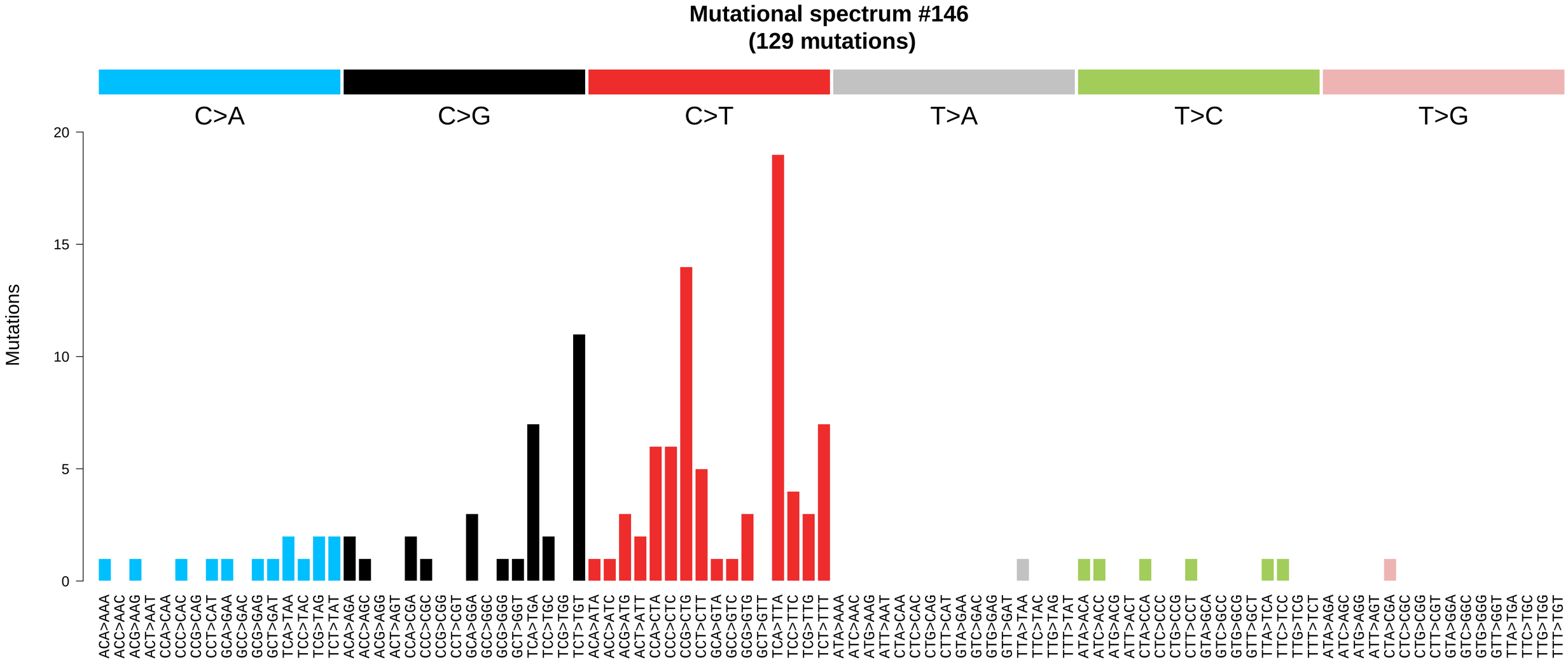

Mutational spectrum #141
(105 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

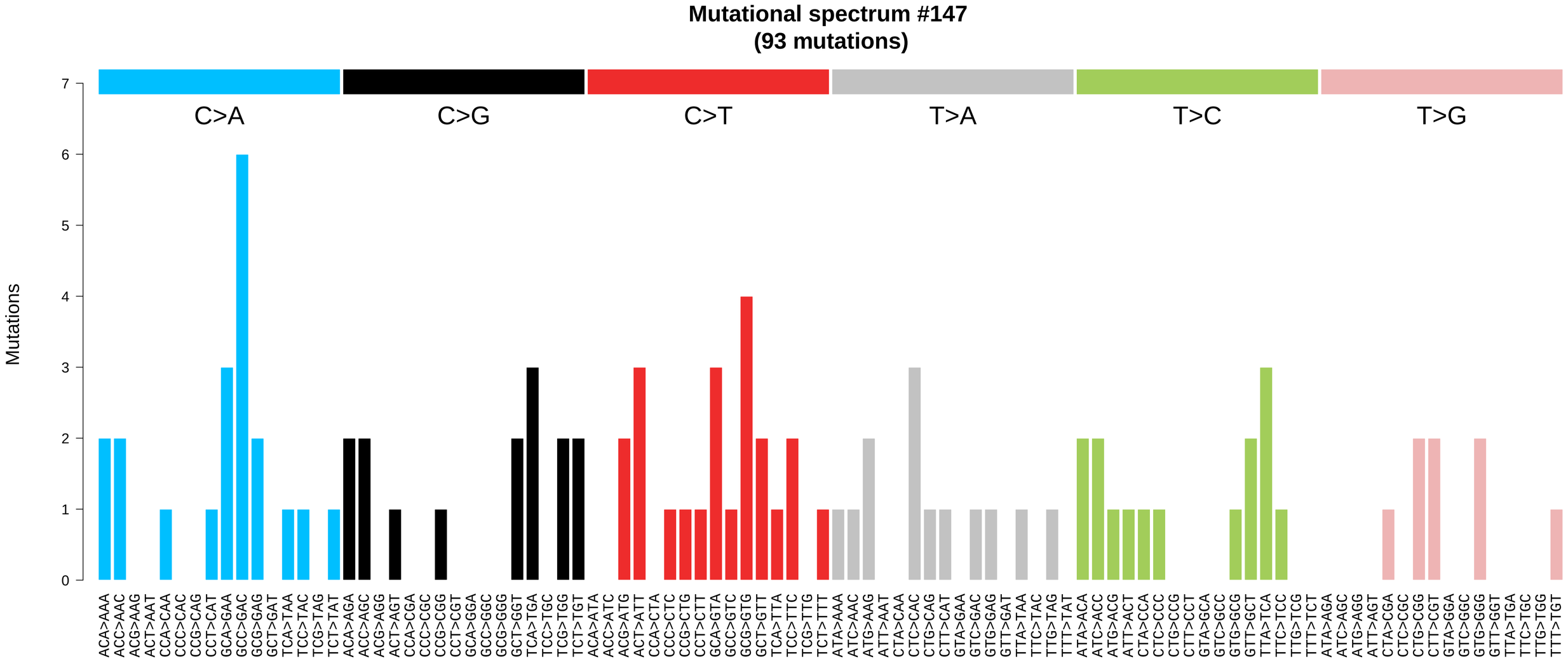

Mutational spectrum #142
(38 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

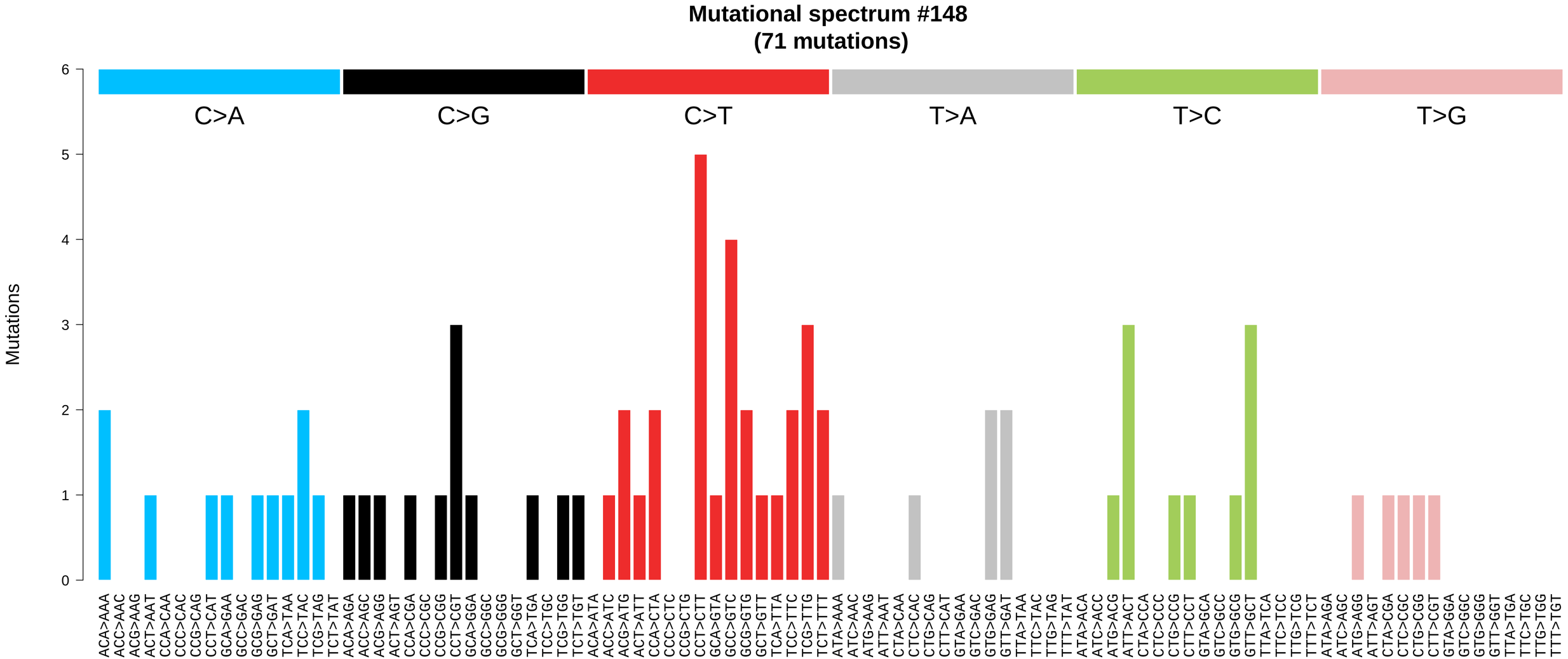

Mutational spectrum #143
(196 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

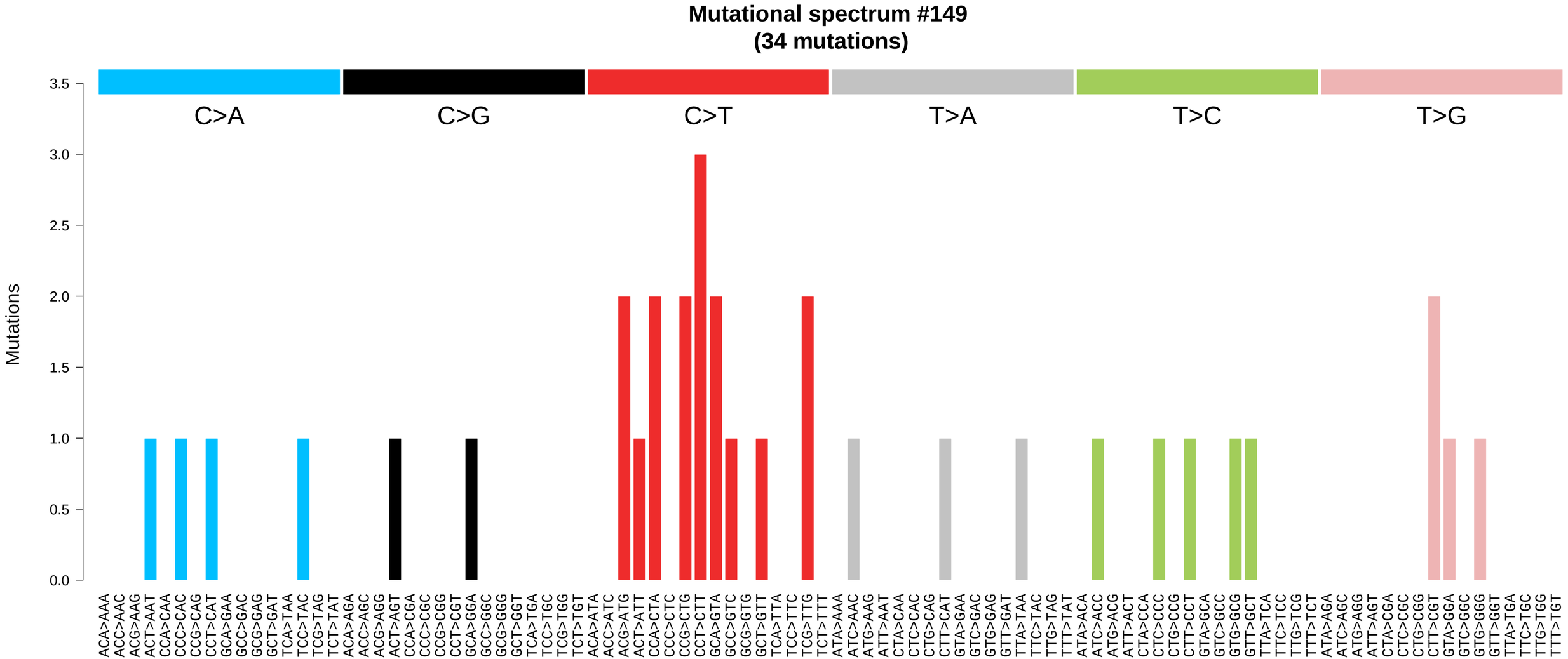

Mutational spectrum #144
(914 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
250
200
150
100
50
0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

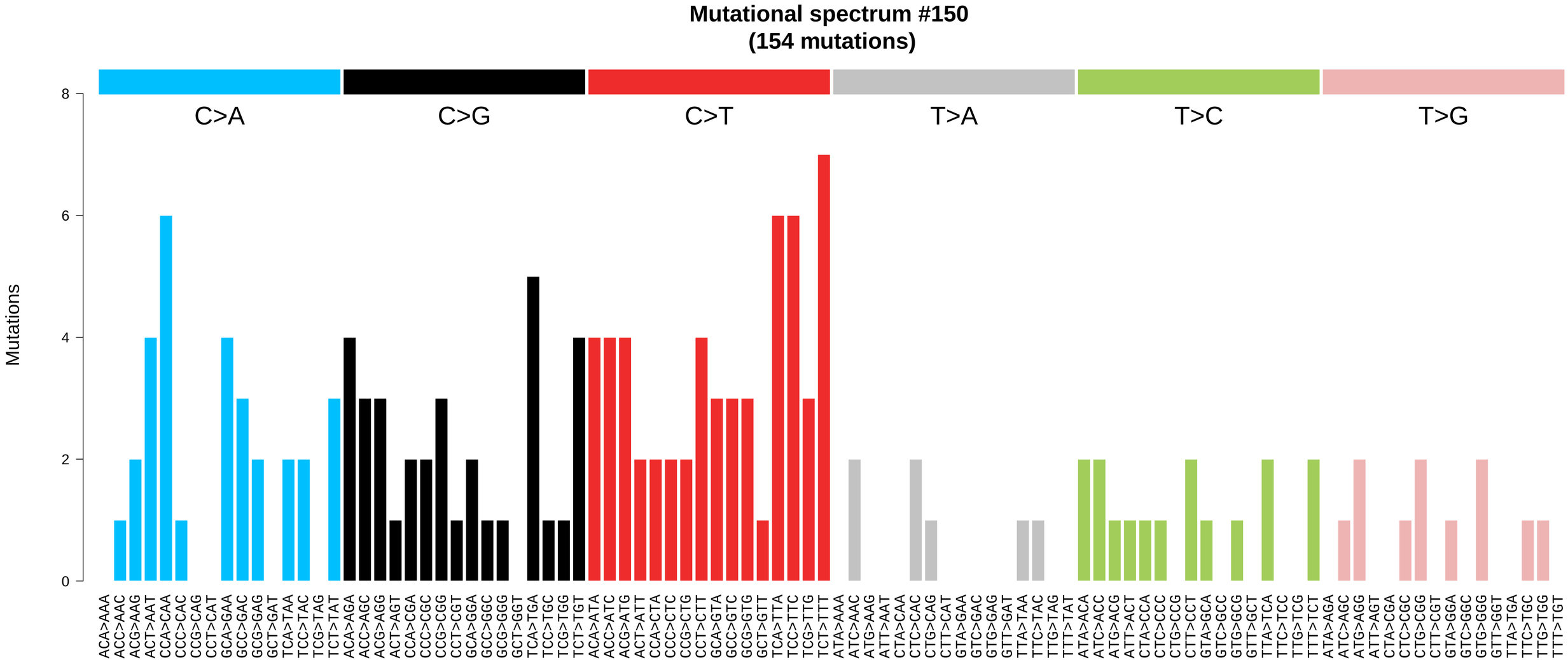

Mutational spectrum #145
(37 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

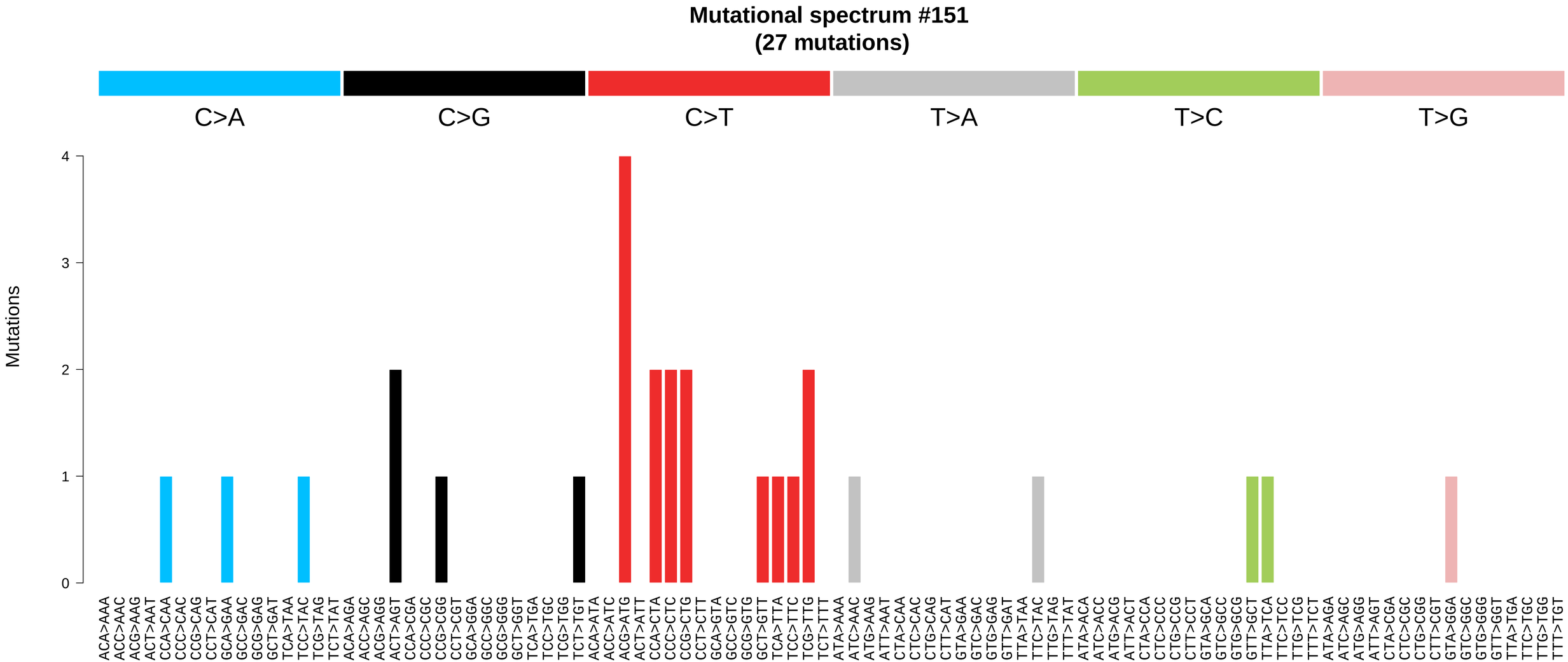

Mutational spectrum #146
(129 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

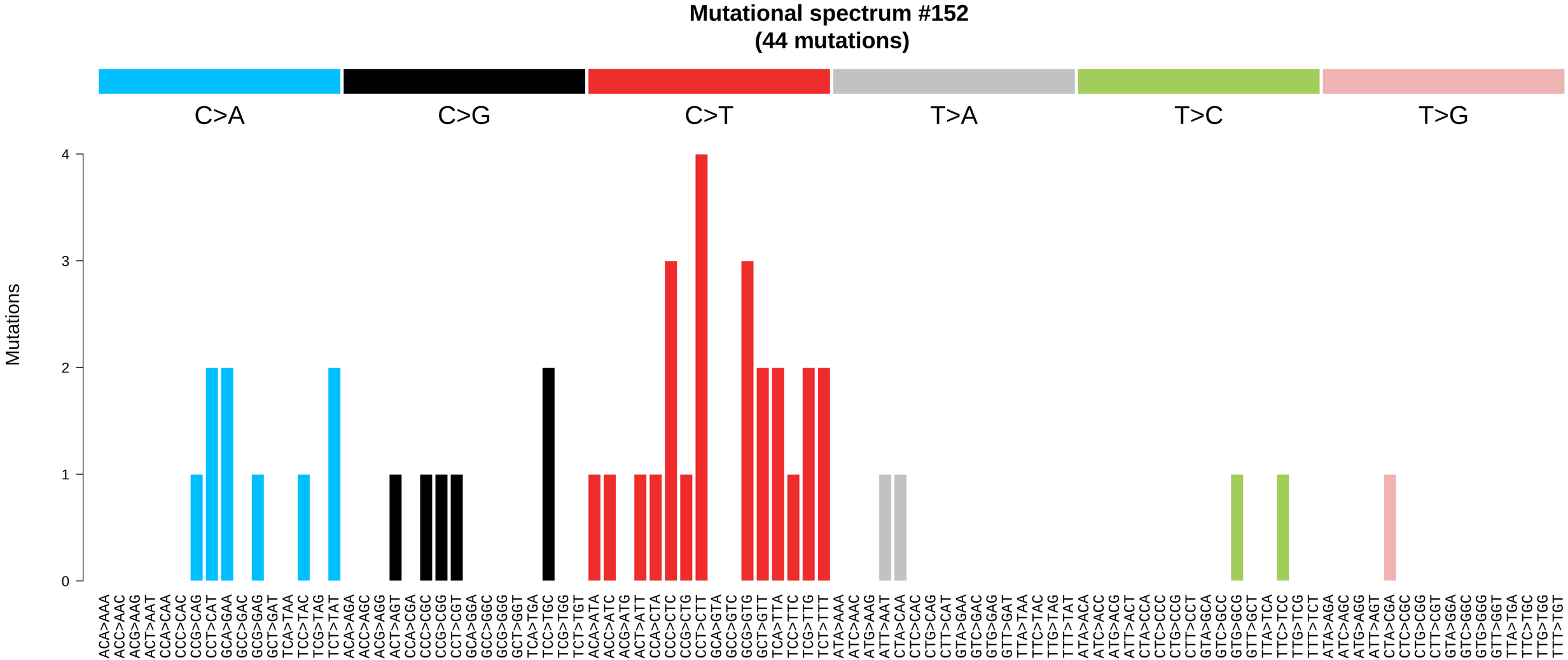

Mutational spectrum #147
(93 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

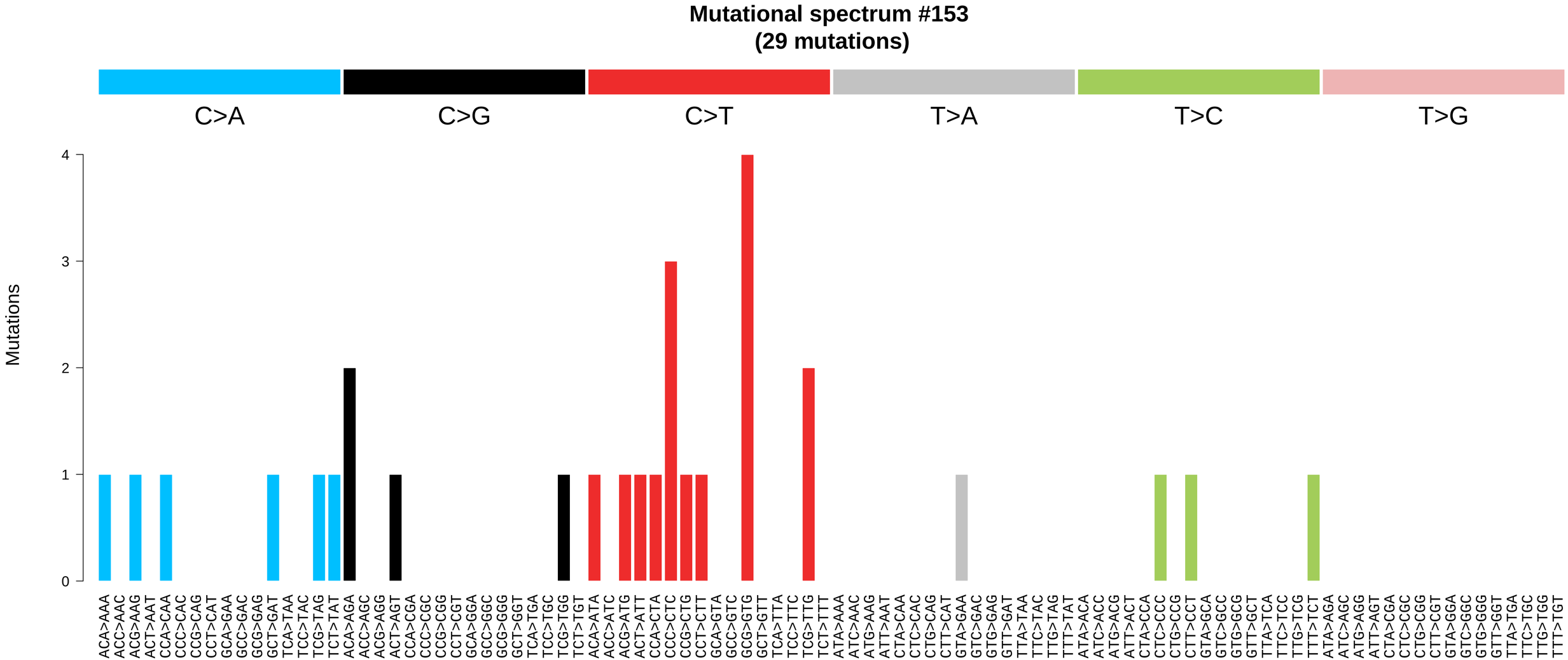

Mutational spectrum #148
(71 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

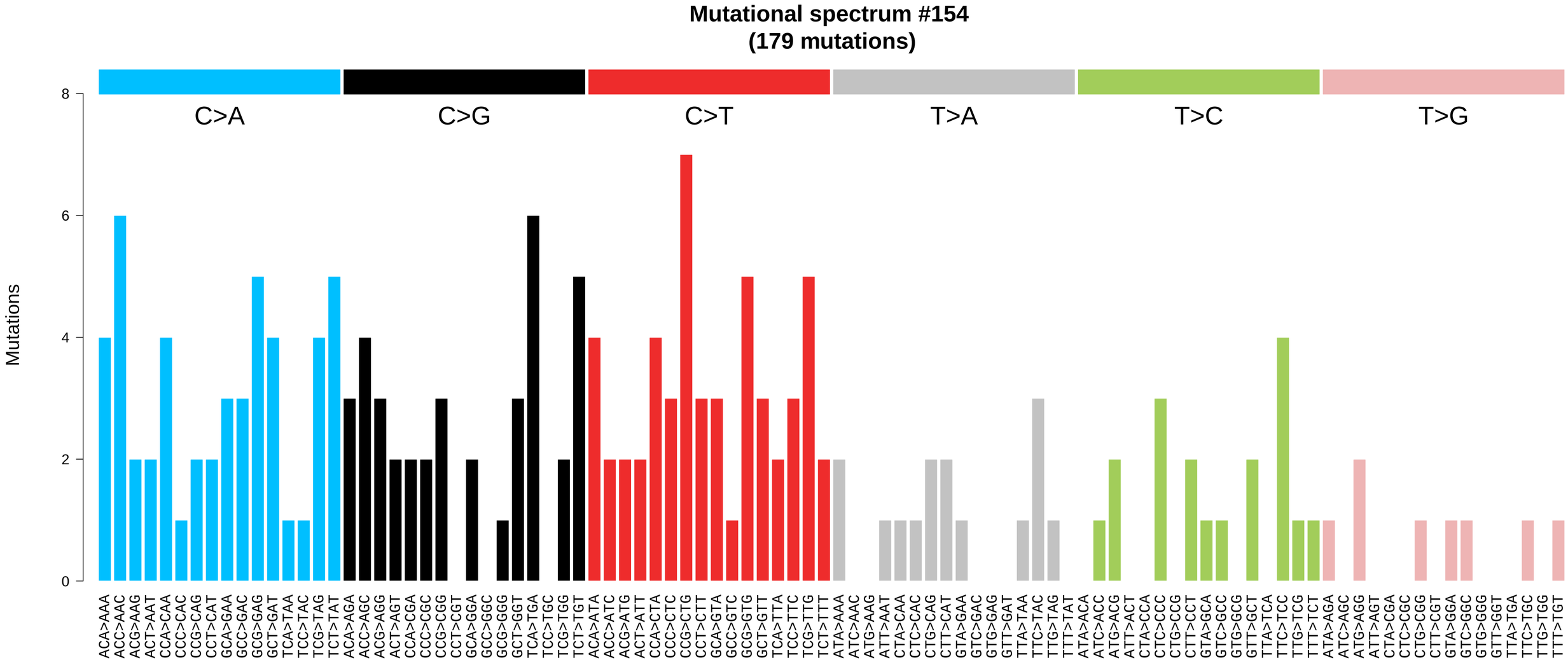

Mutational spectrum #149
(34 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

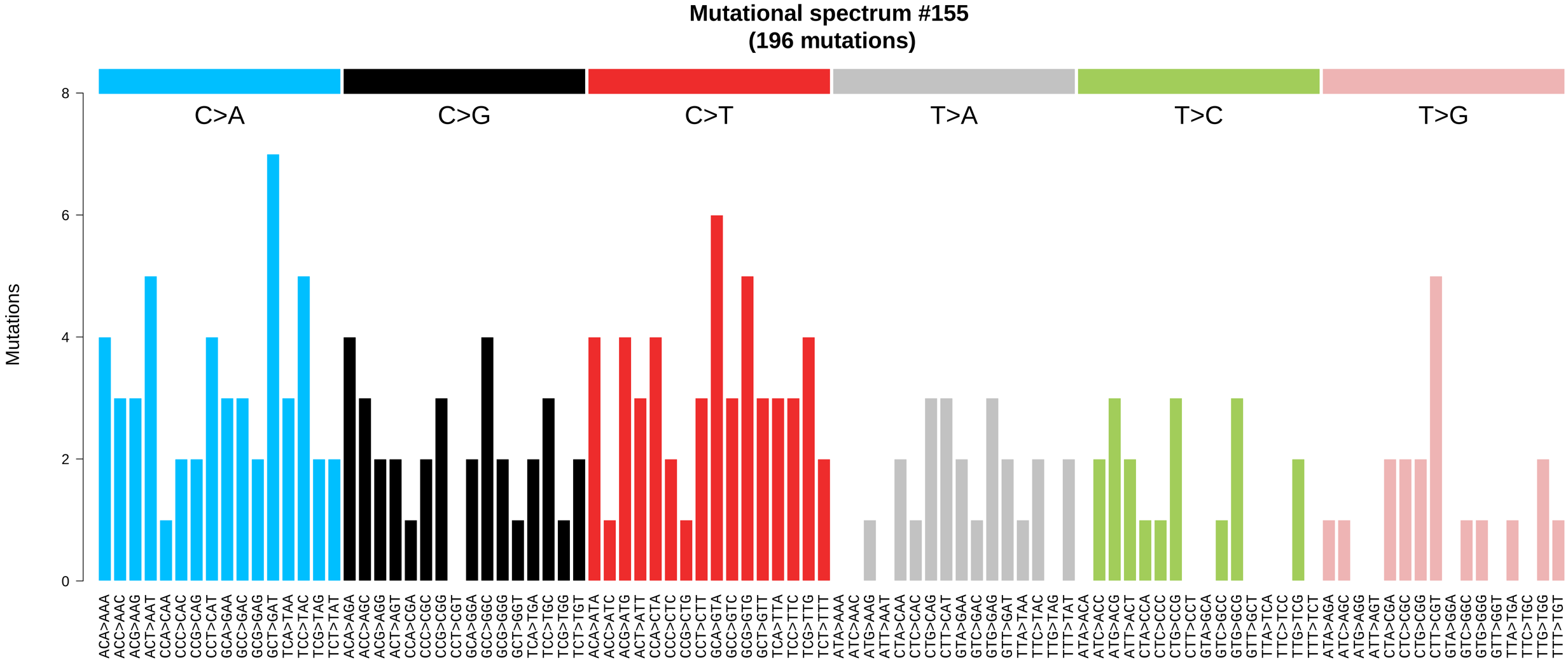

Mutational spectrum #150
(154 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

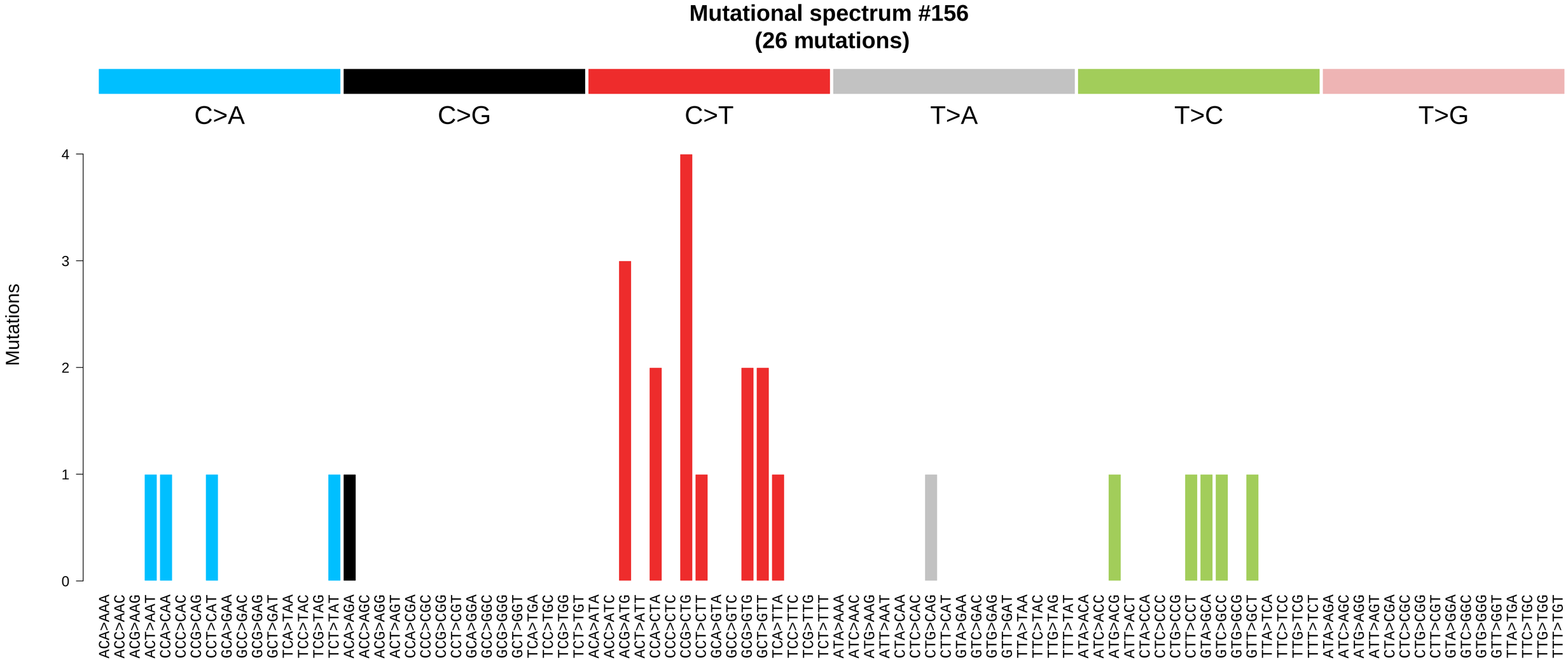

Mutational spectrum #151
(27 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

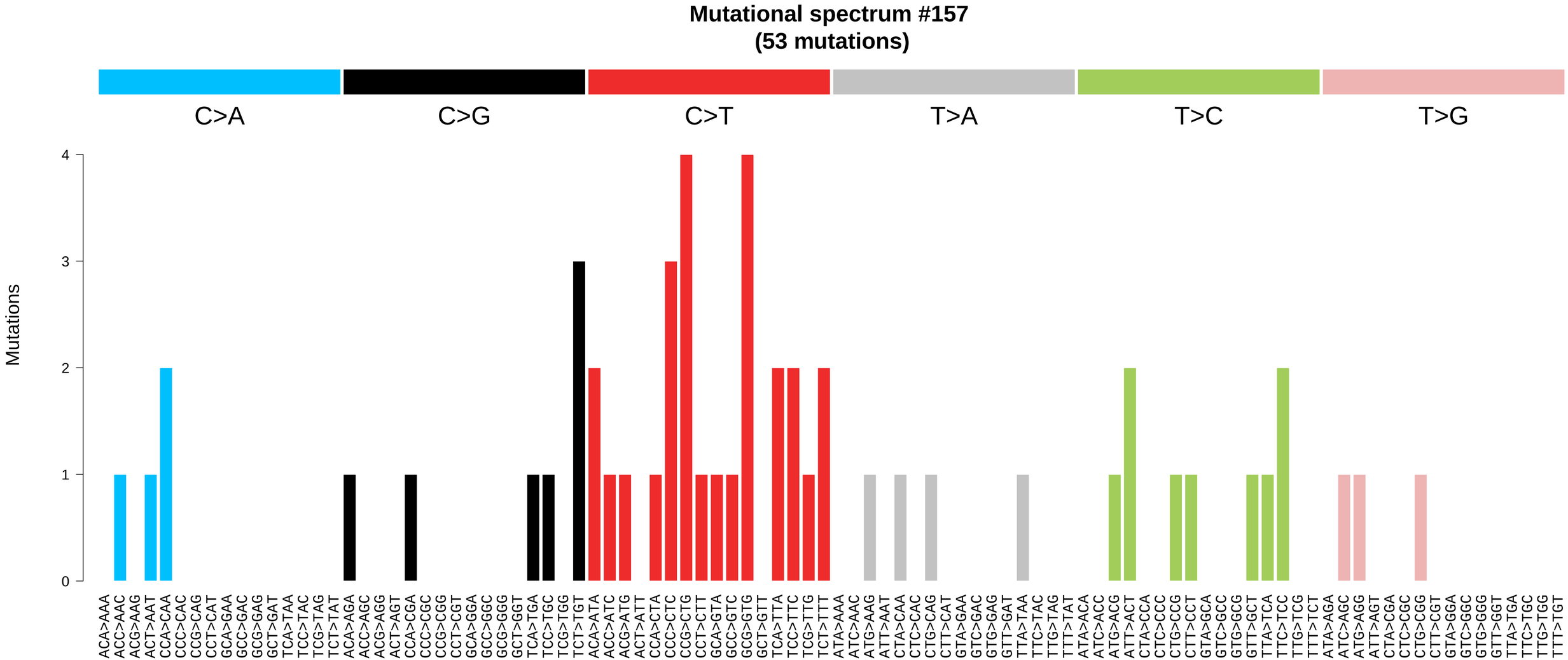

Mutational spectrum #152
(44 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

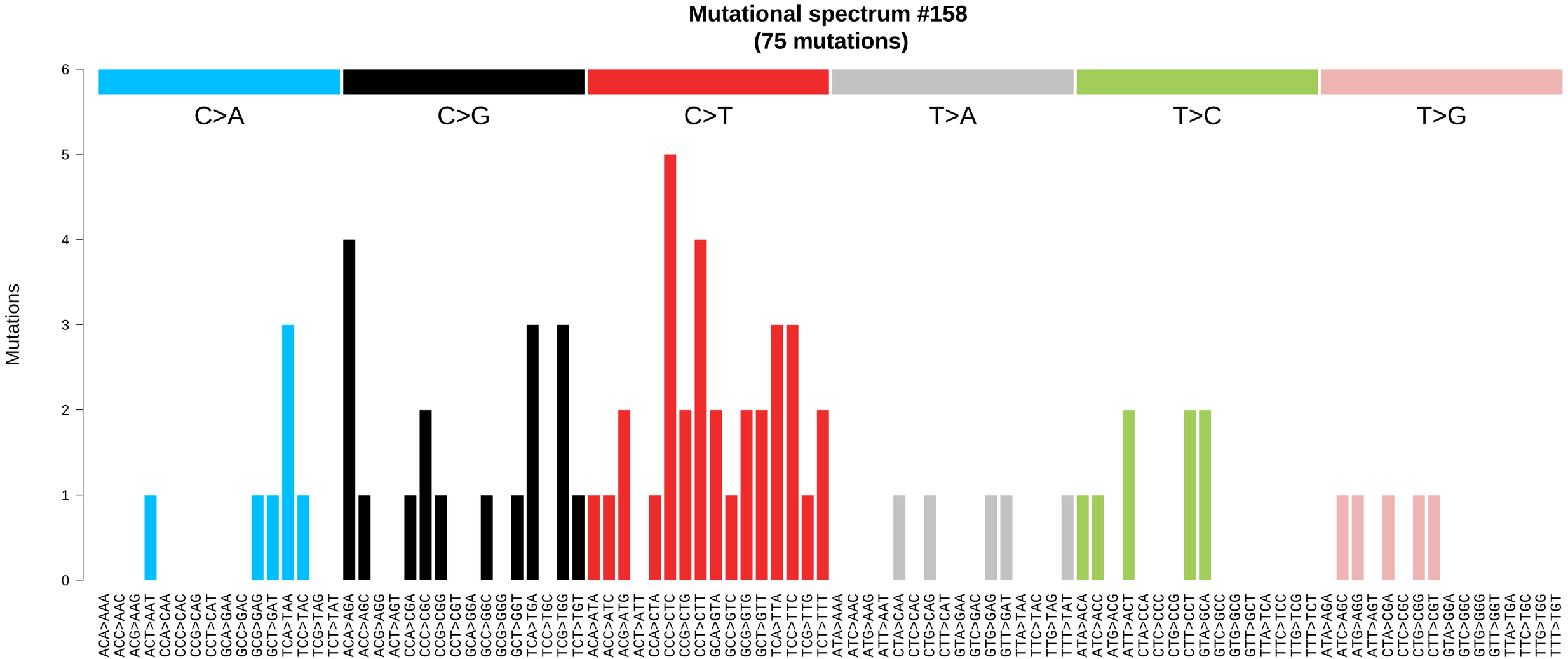

Mutational spectrum #153
(29 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

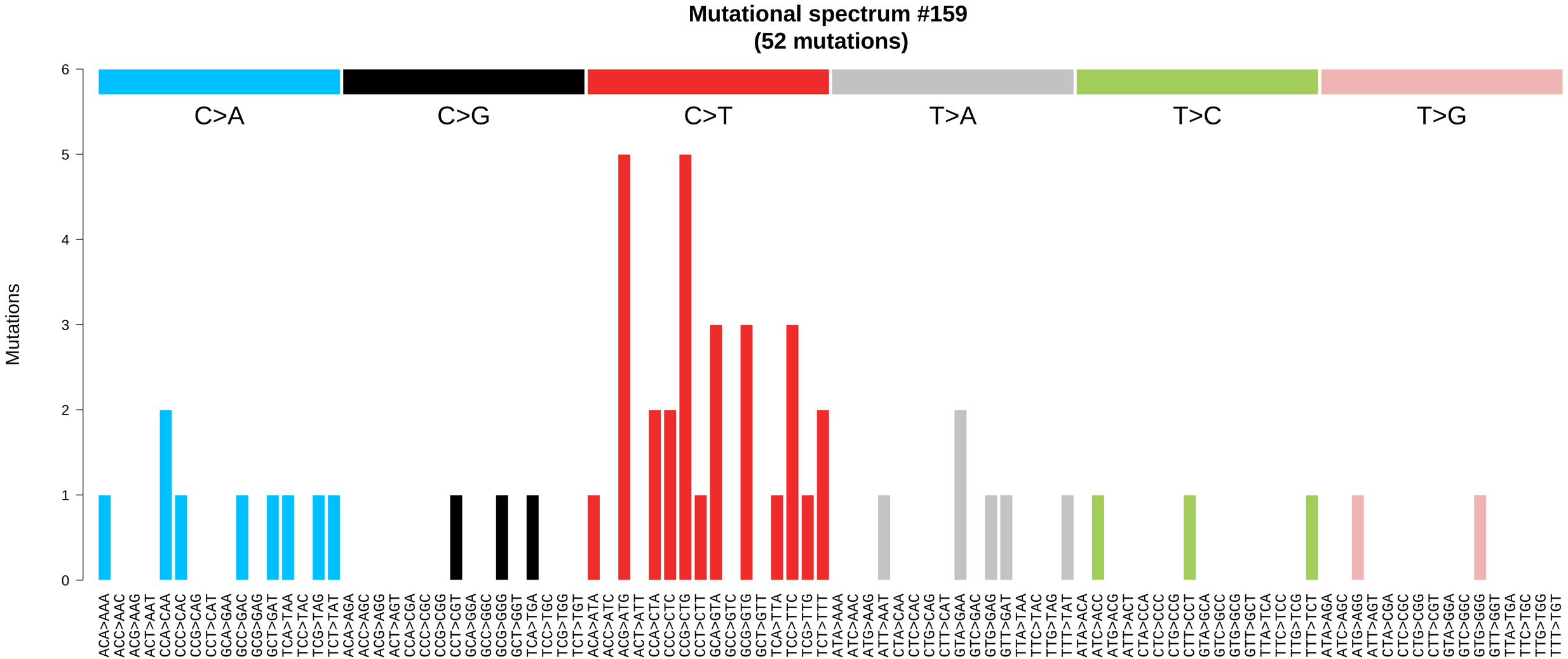

Mutational spectrum #154
(179 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

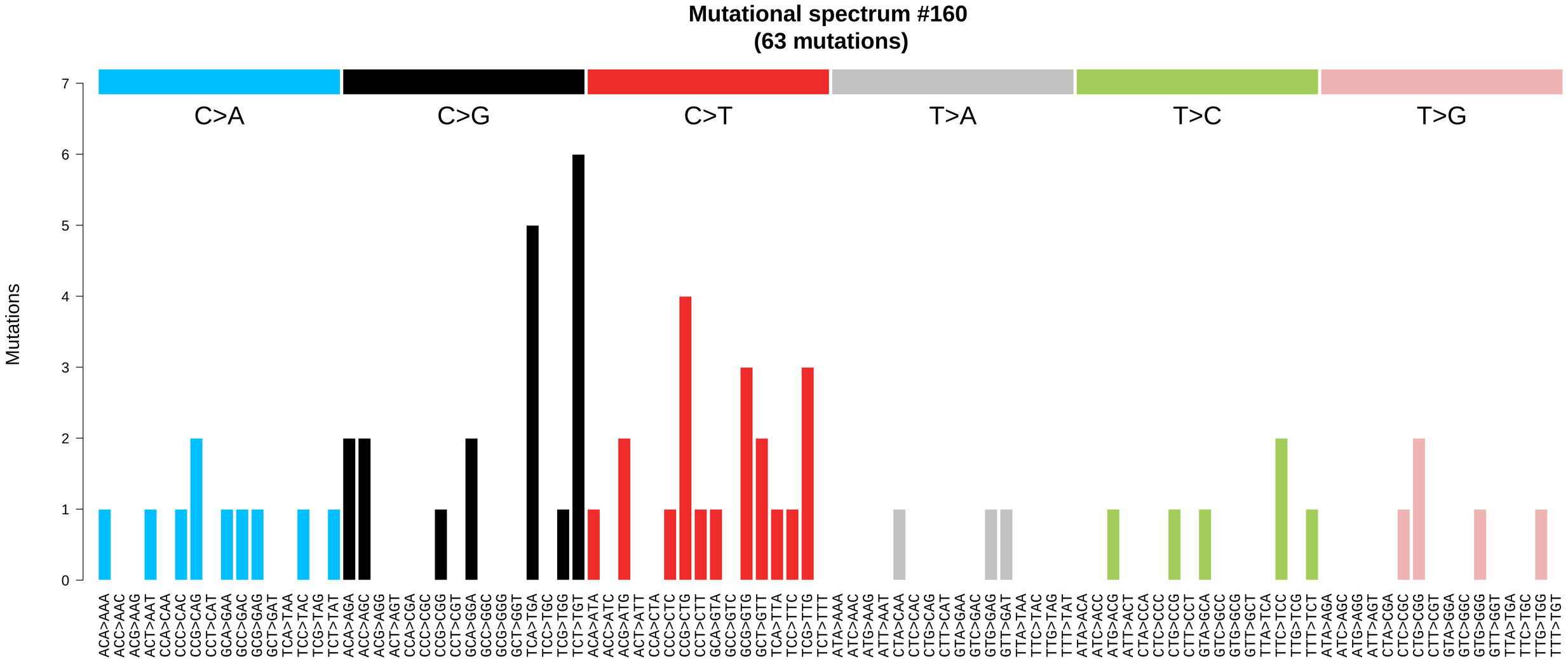

Mutational spectrum #155
(196 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

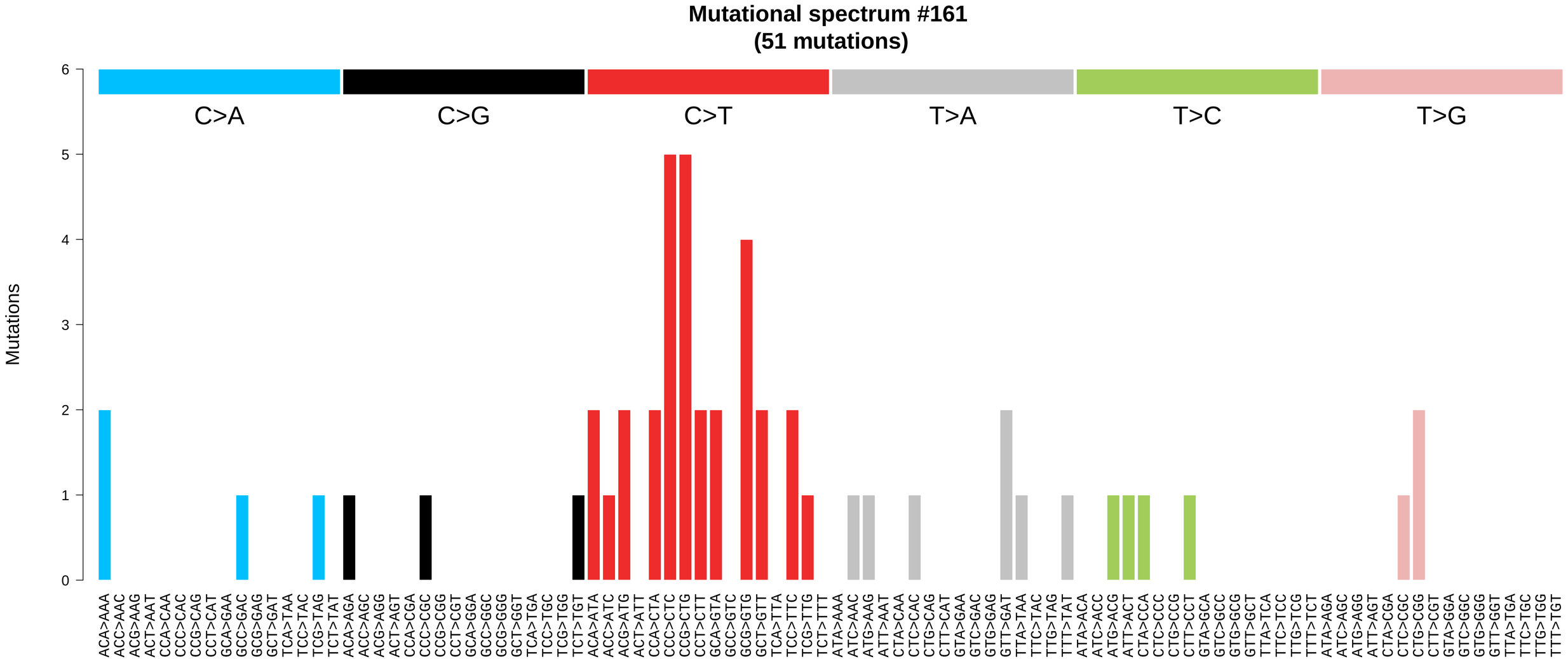

Mutational spectrum #156
(26 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

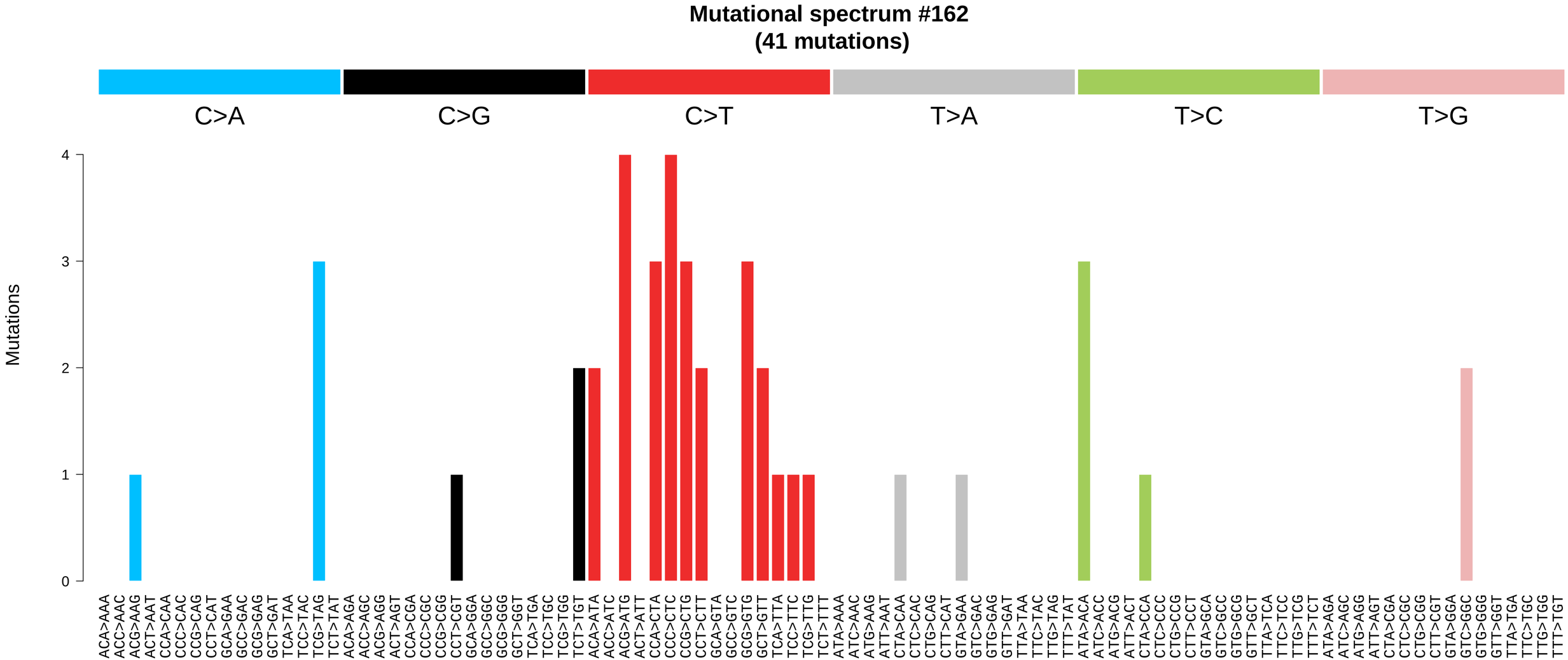

Mutational spectrum #157
(53 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

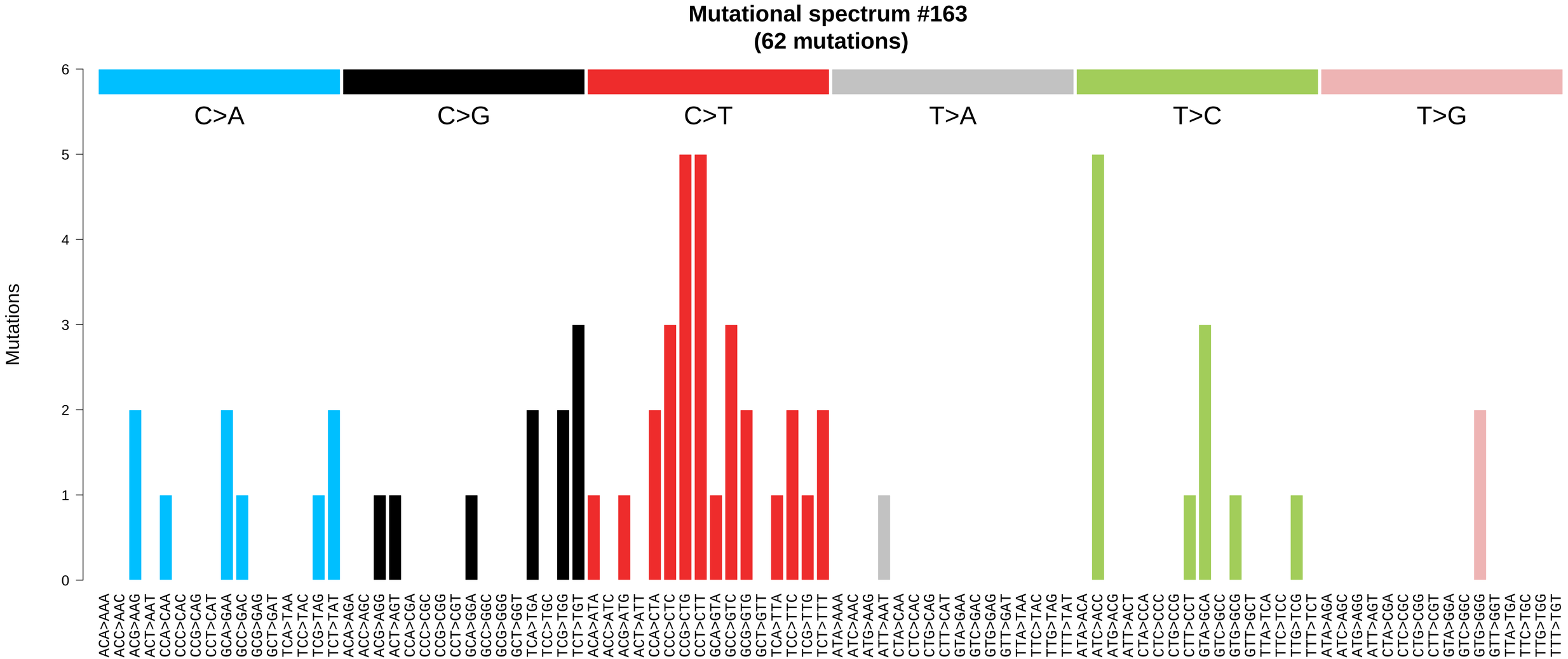

Mutational spectrum #158
(75 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

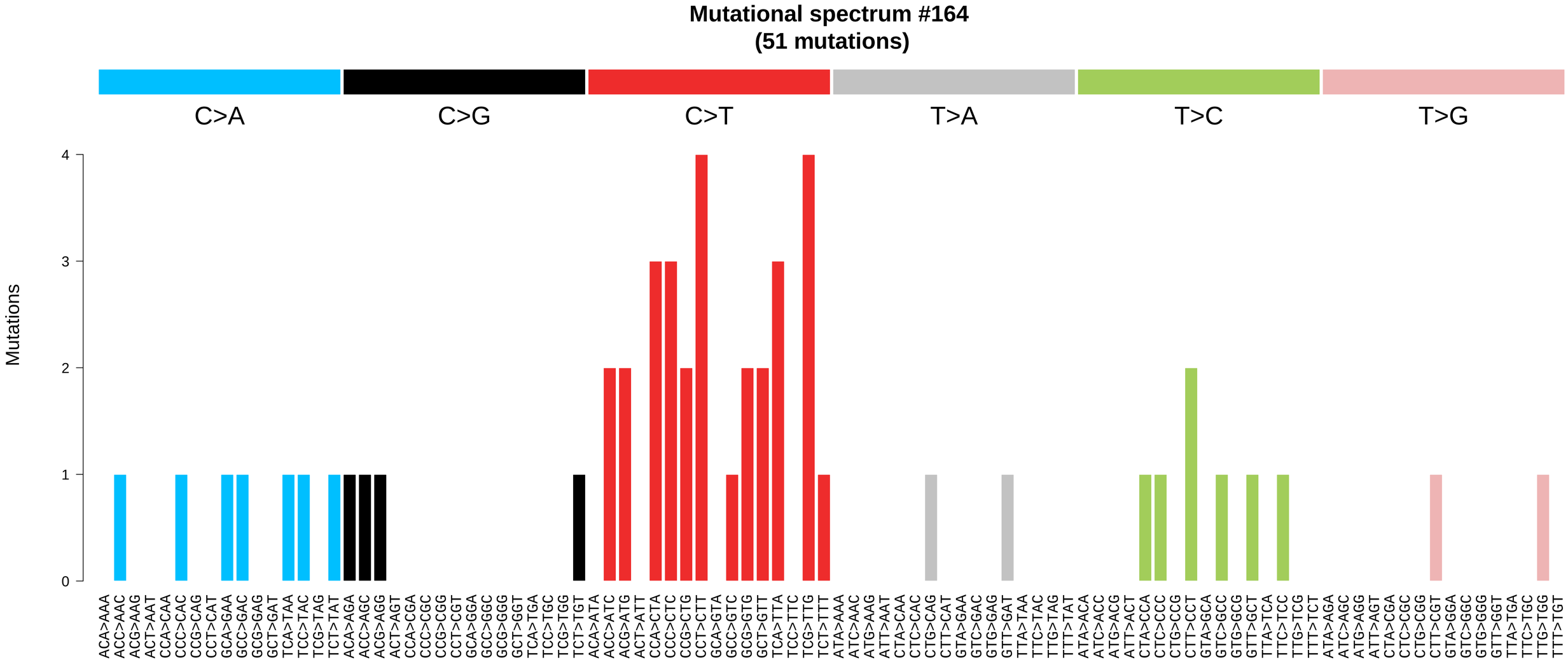

Mutational spectrum #159
(52 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

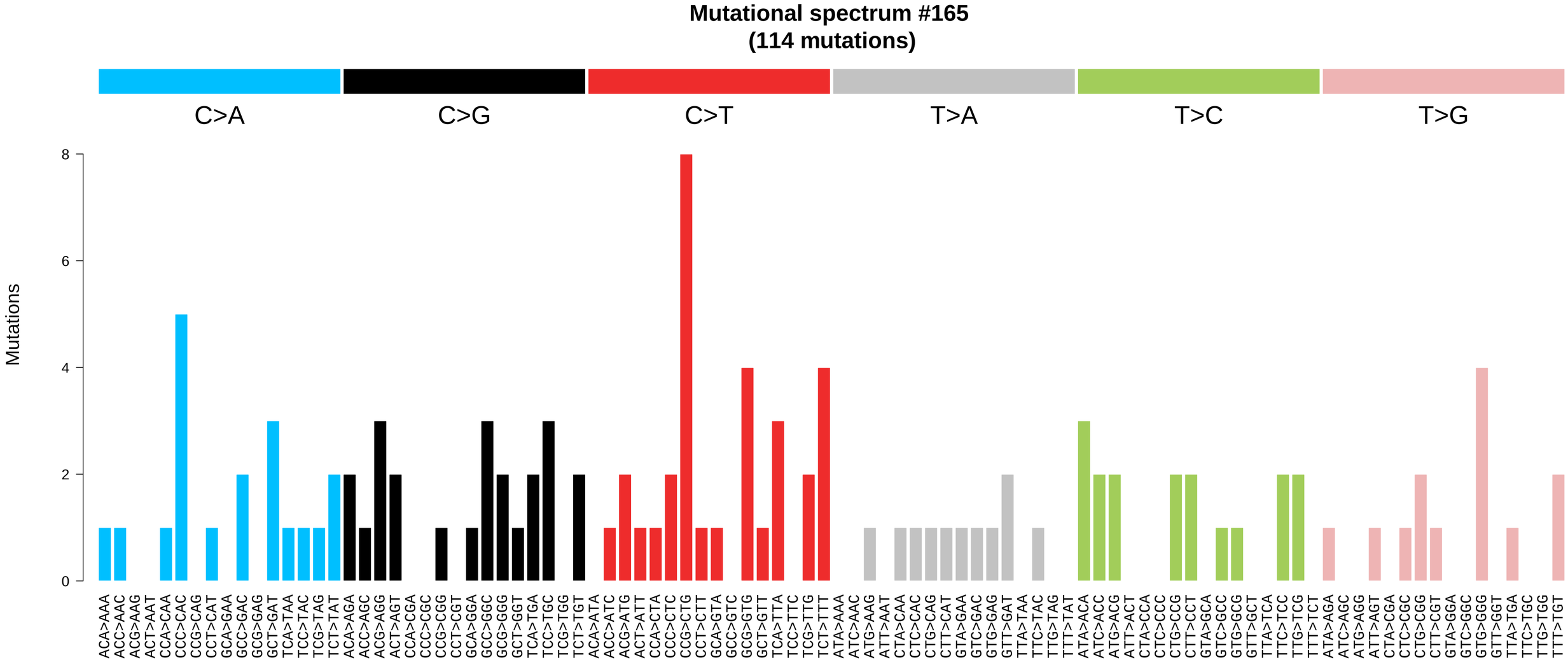

Mutational spectrum #160
(63 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

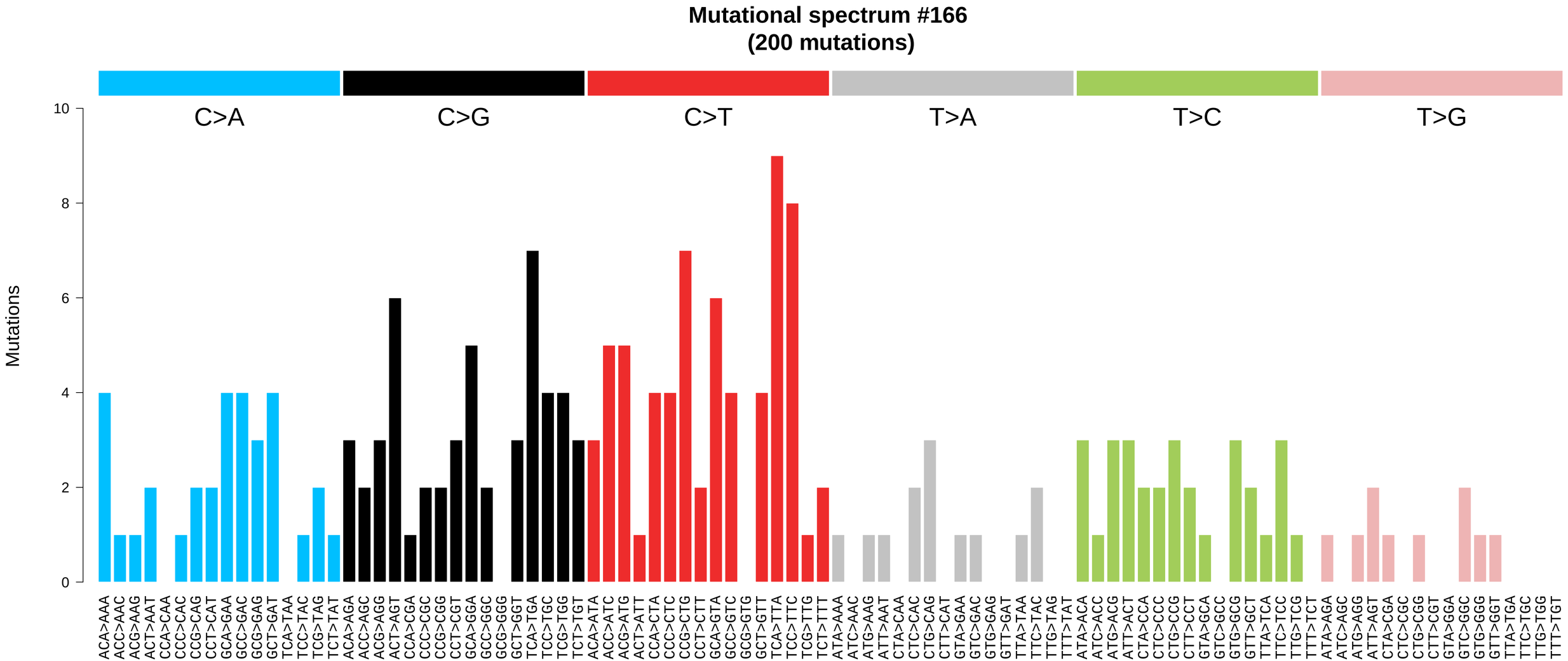

Mutational spectrum #161
(51 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

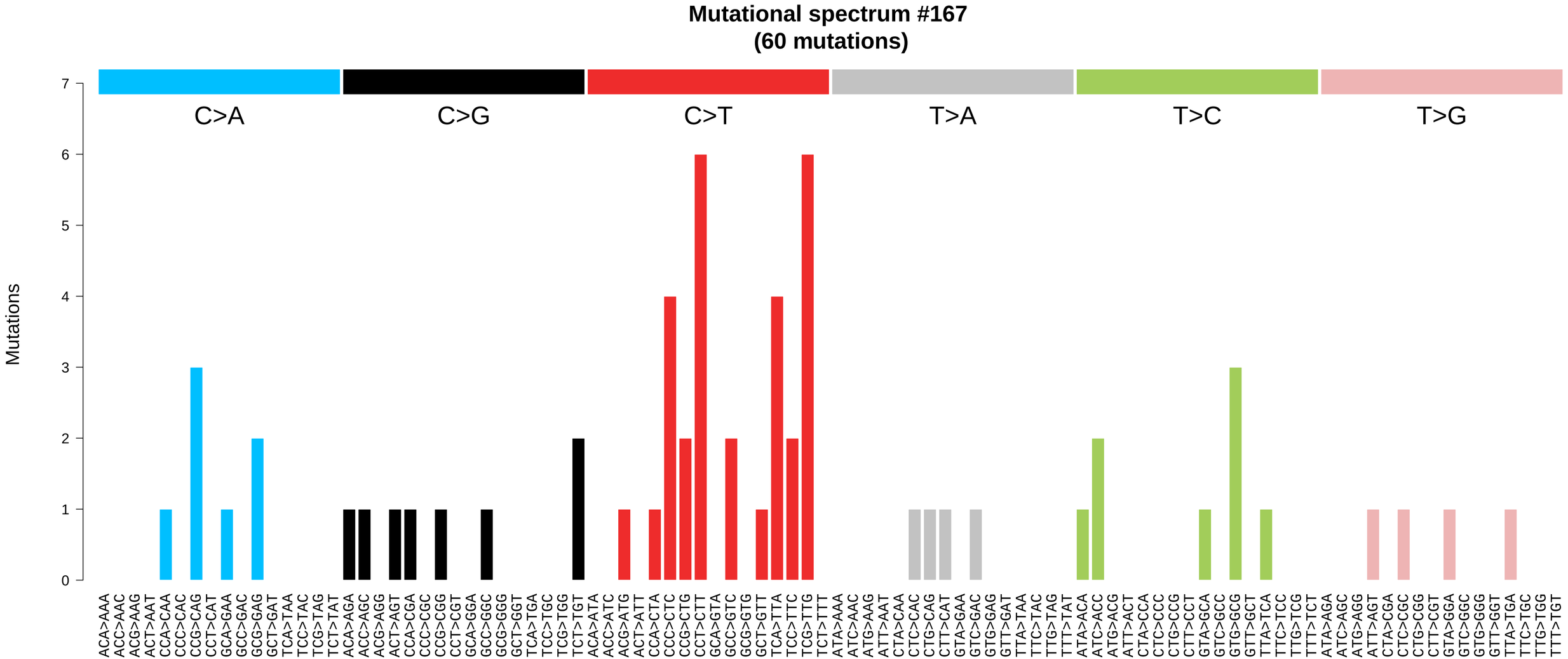

Mutational spectrum #162
(41 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

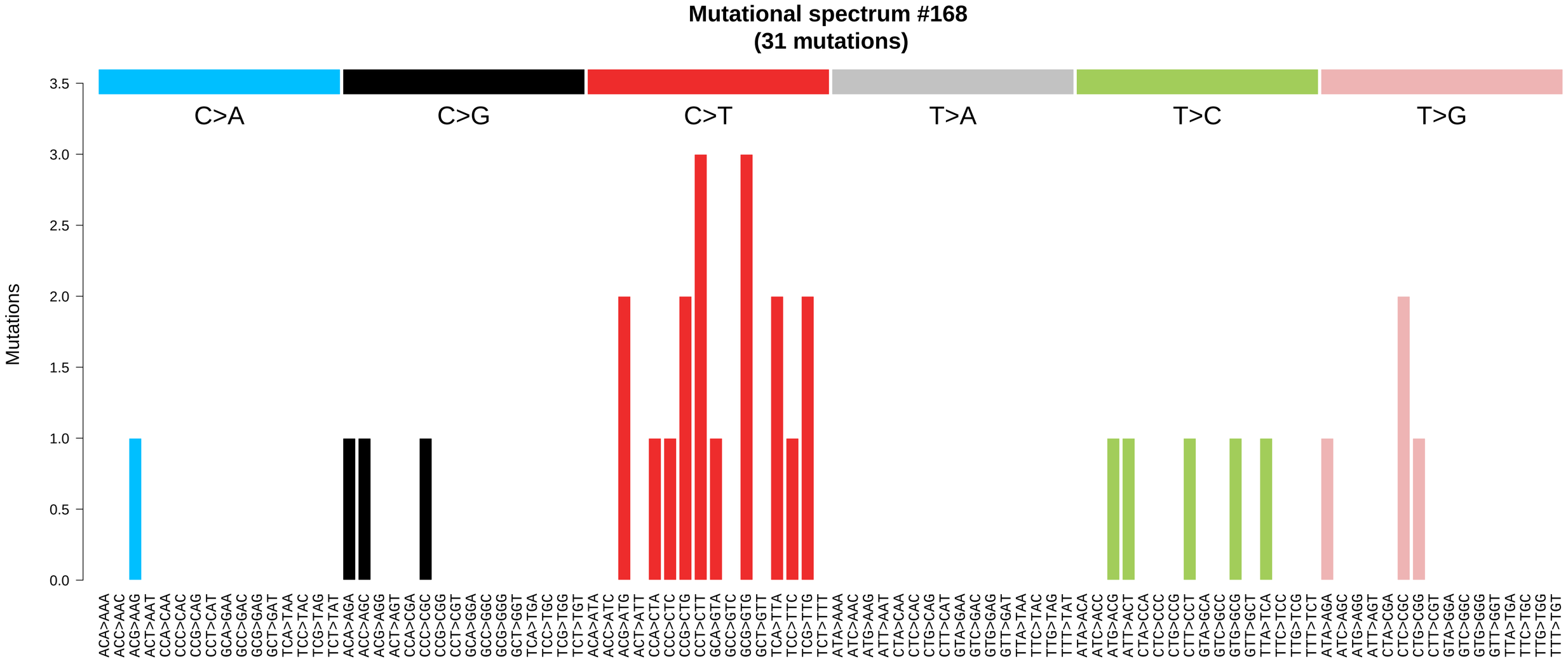

Mutational spectrum #163
(62 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

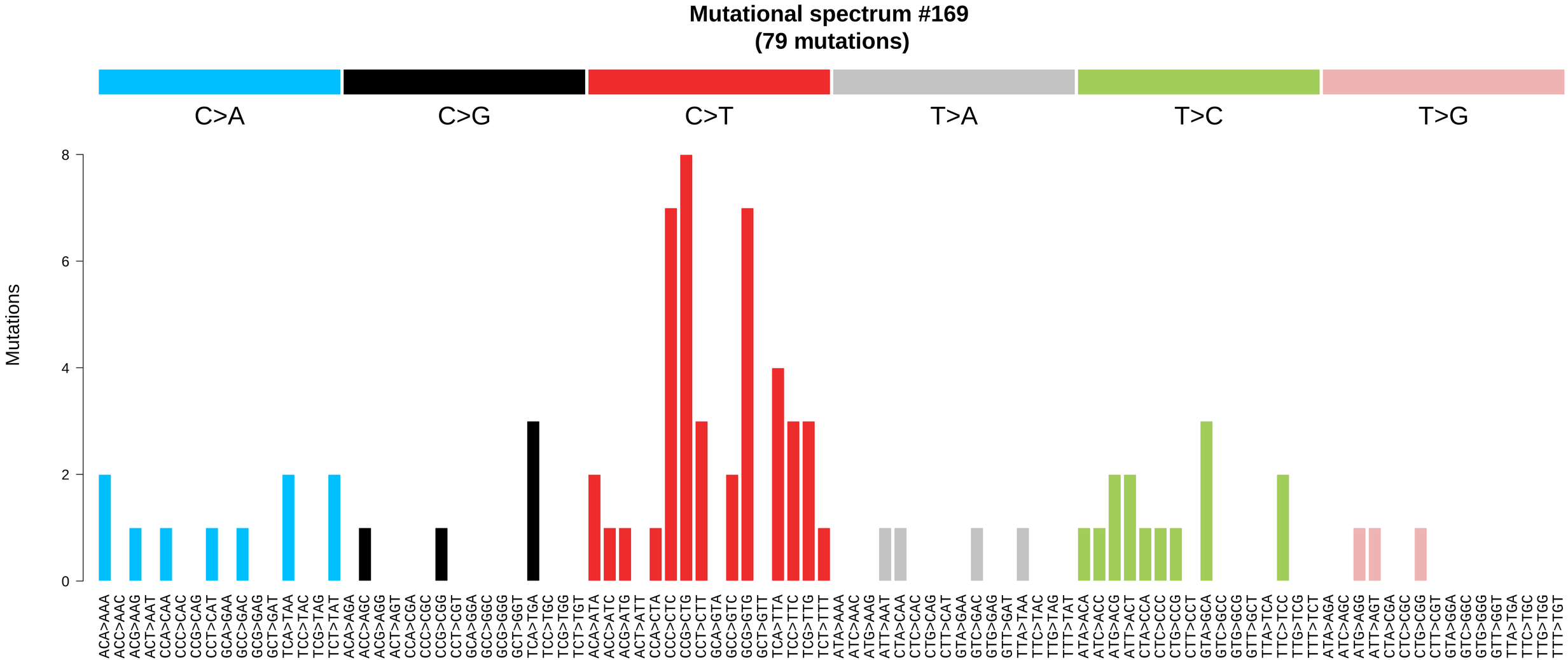

Mutational spectrum #164
(51 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

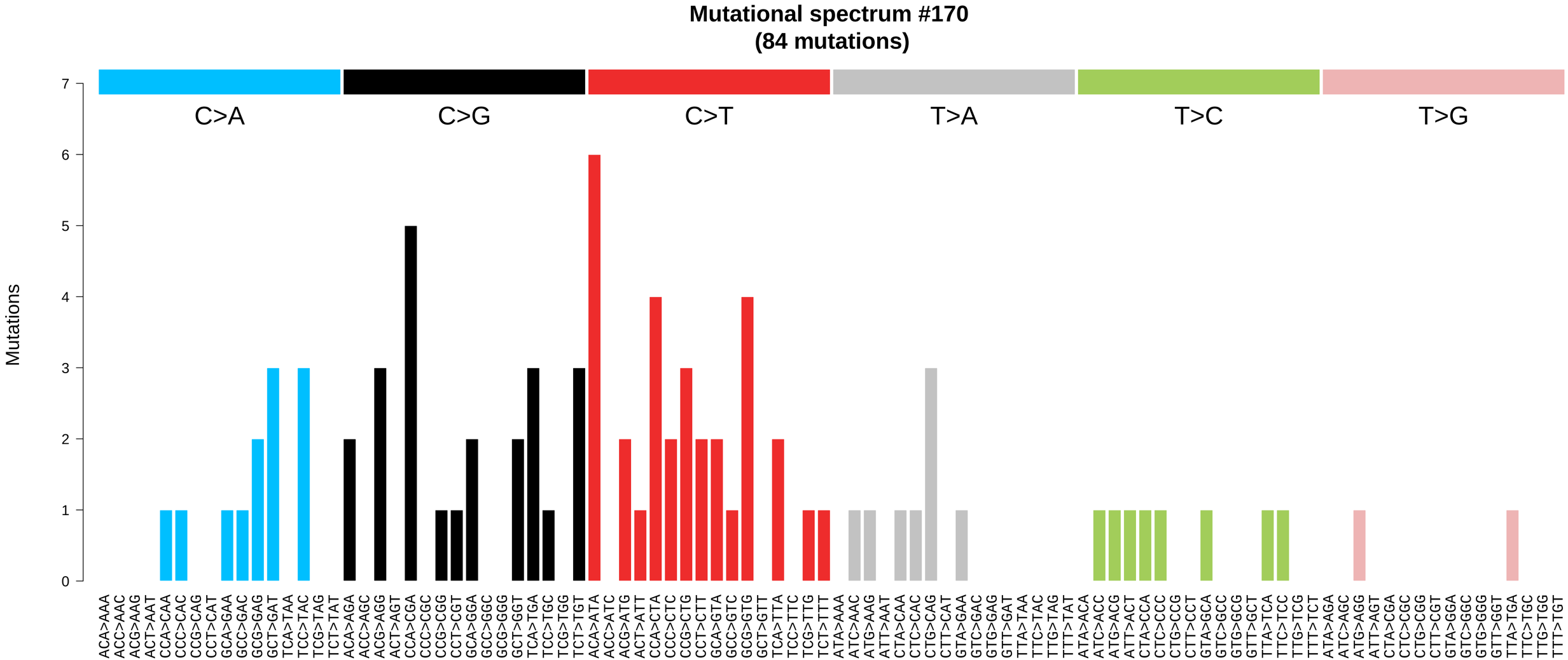

Mutational spectrum #165
(114 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

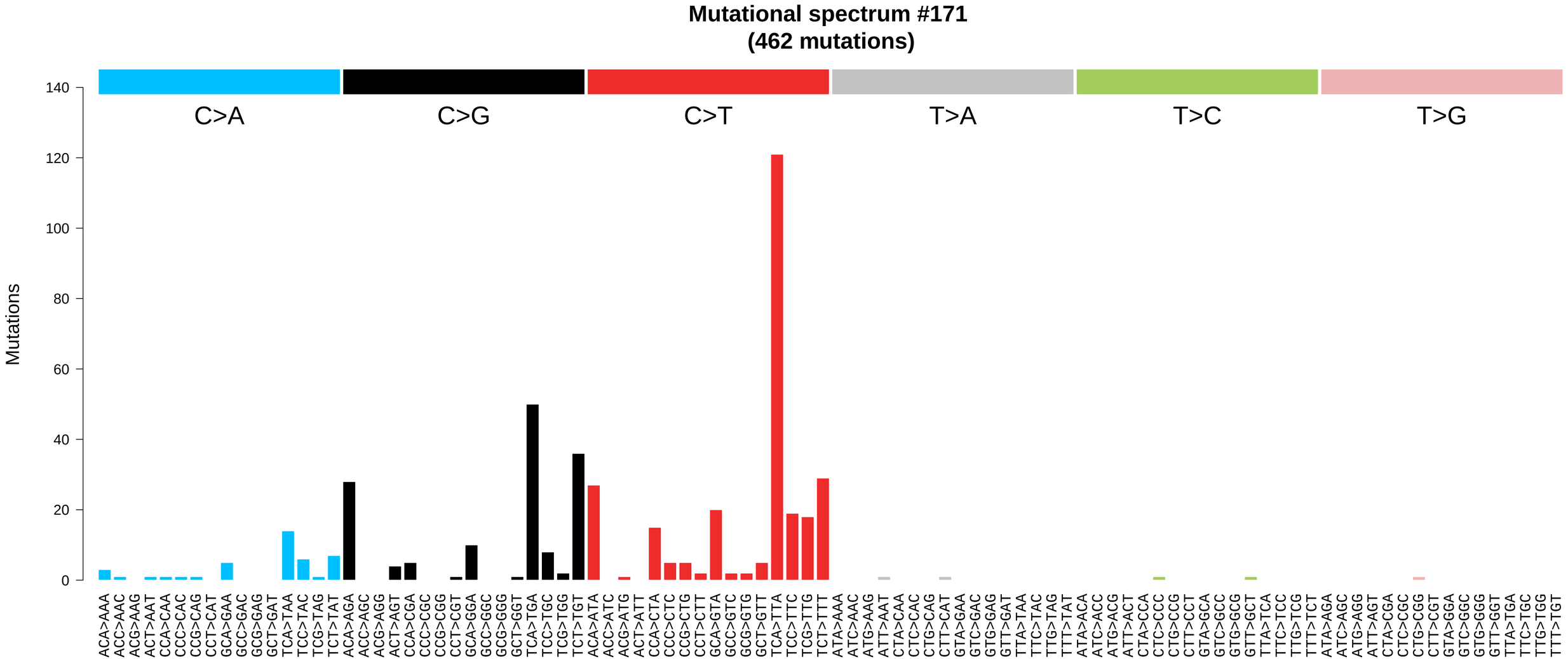

Mutational spectrum #166
(200 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

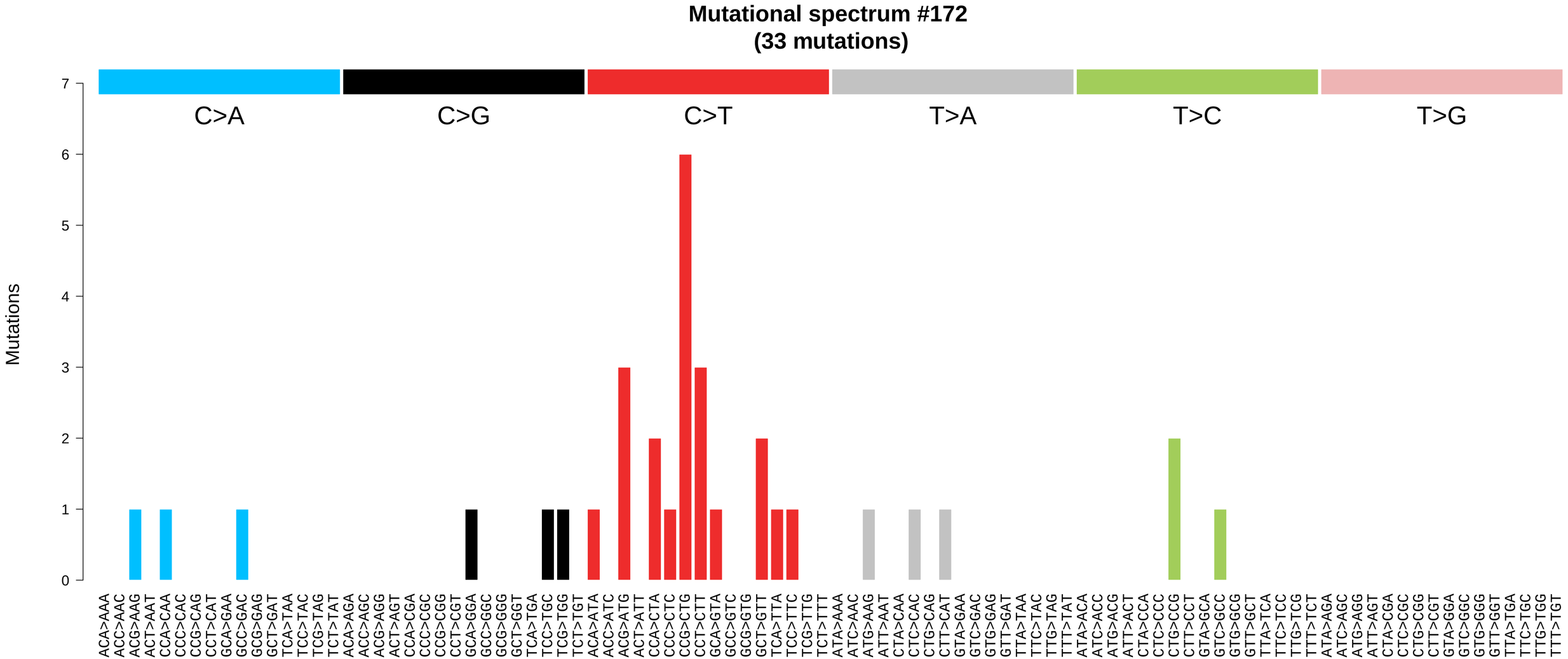

Mutational spectrum #167
(60 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

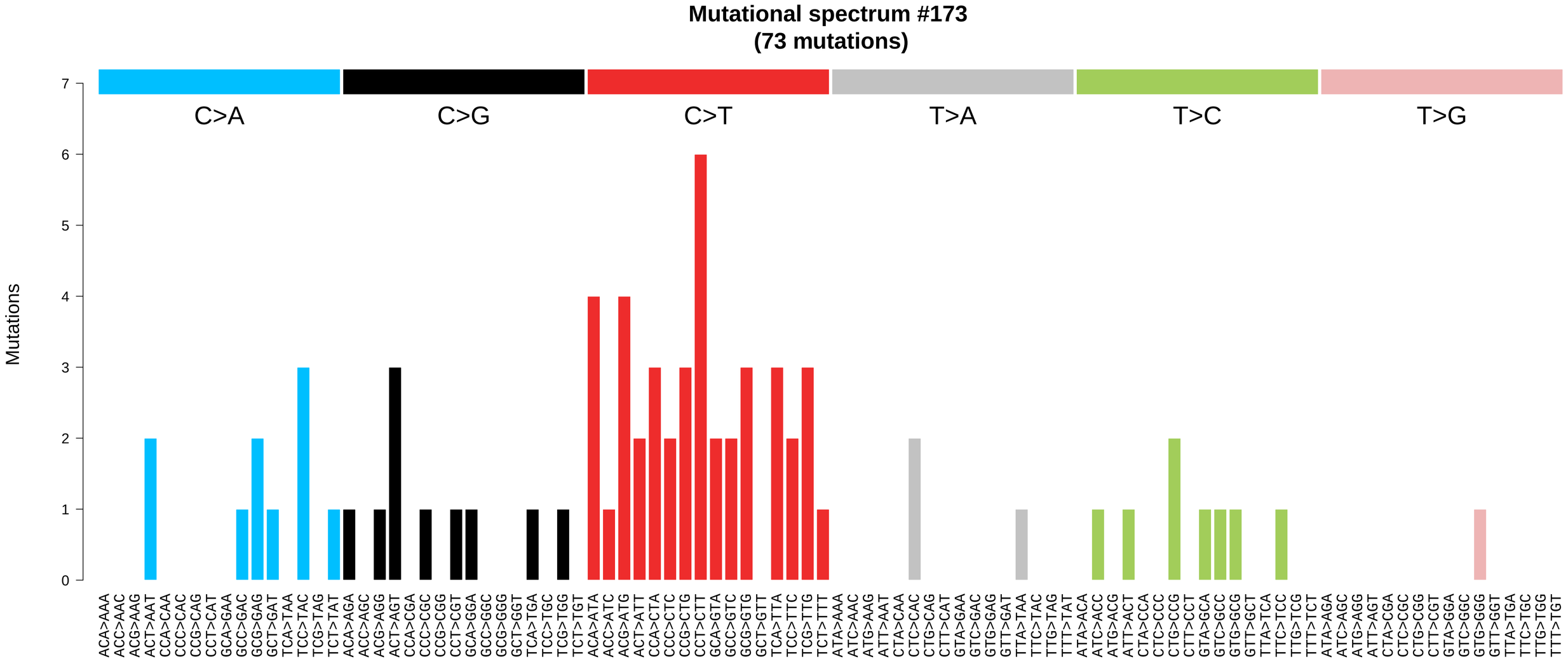

Mutational spectrum #168
(31 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

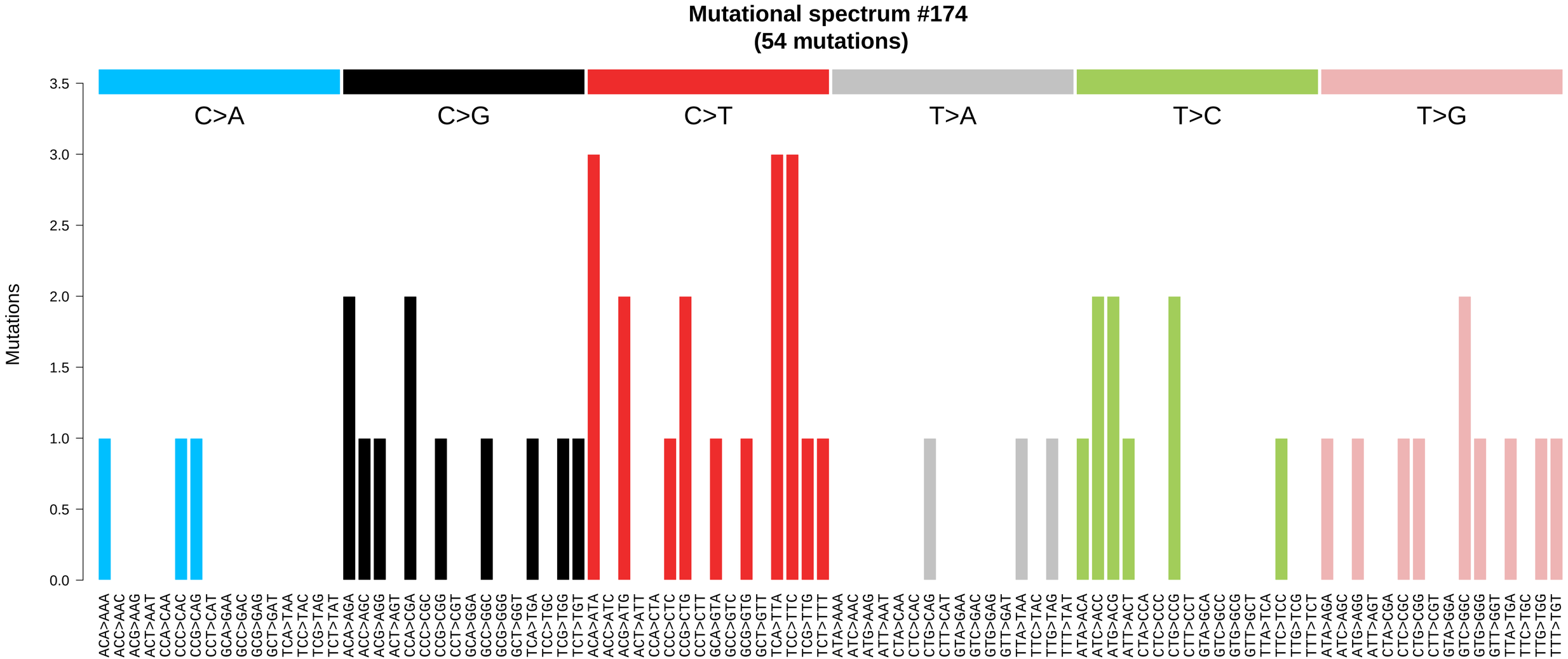

Mutational spectrum #169
(79 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

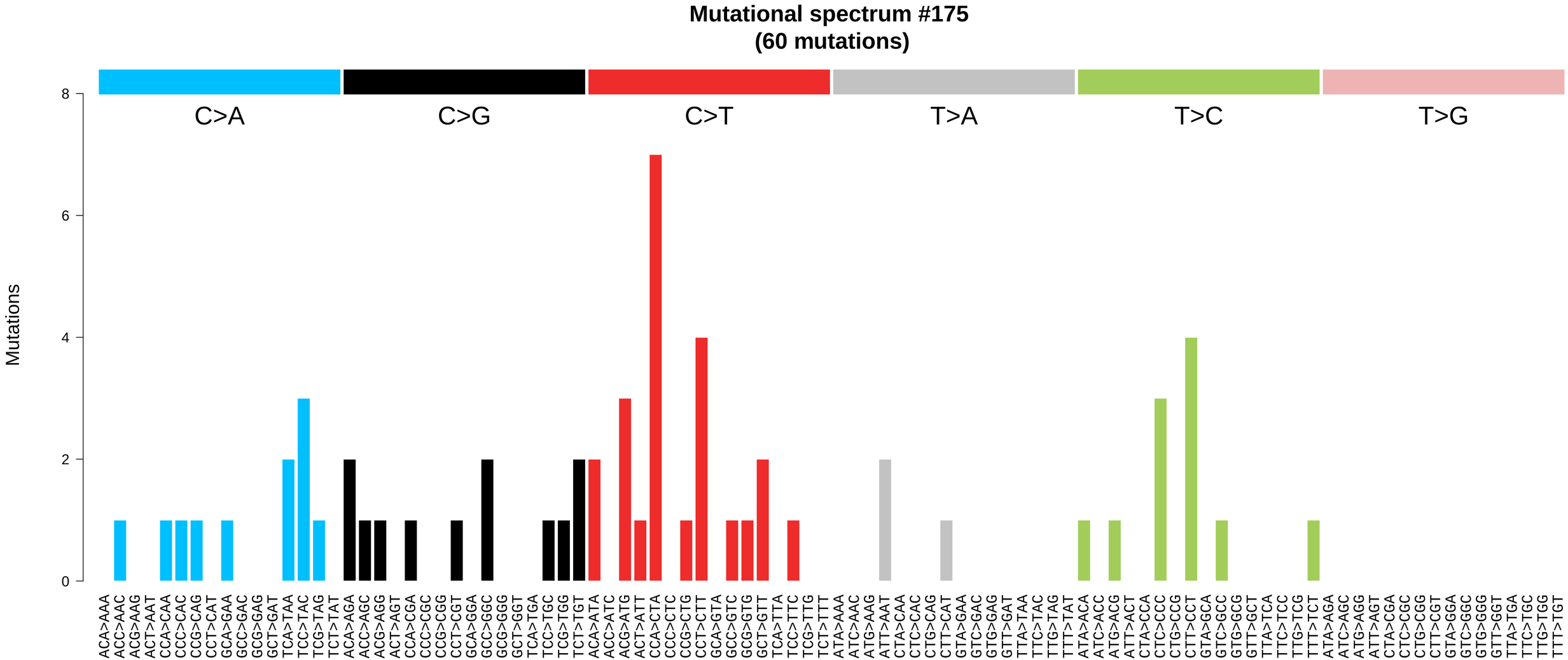

Mutational spectrum #170
(84 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

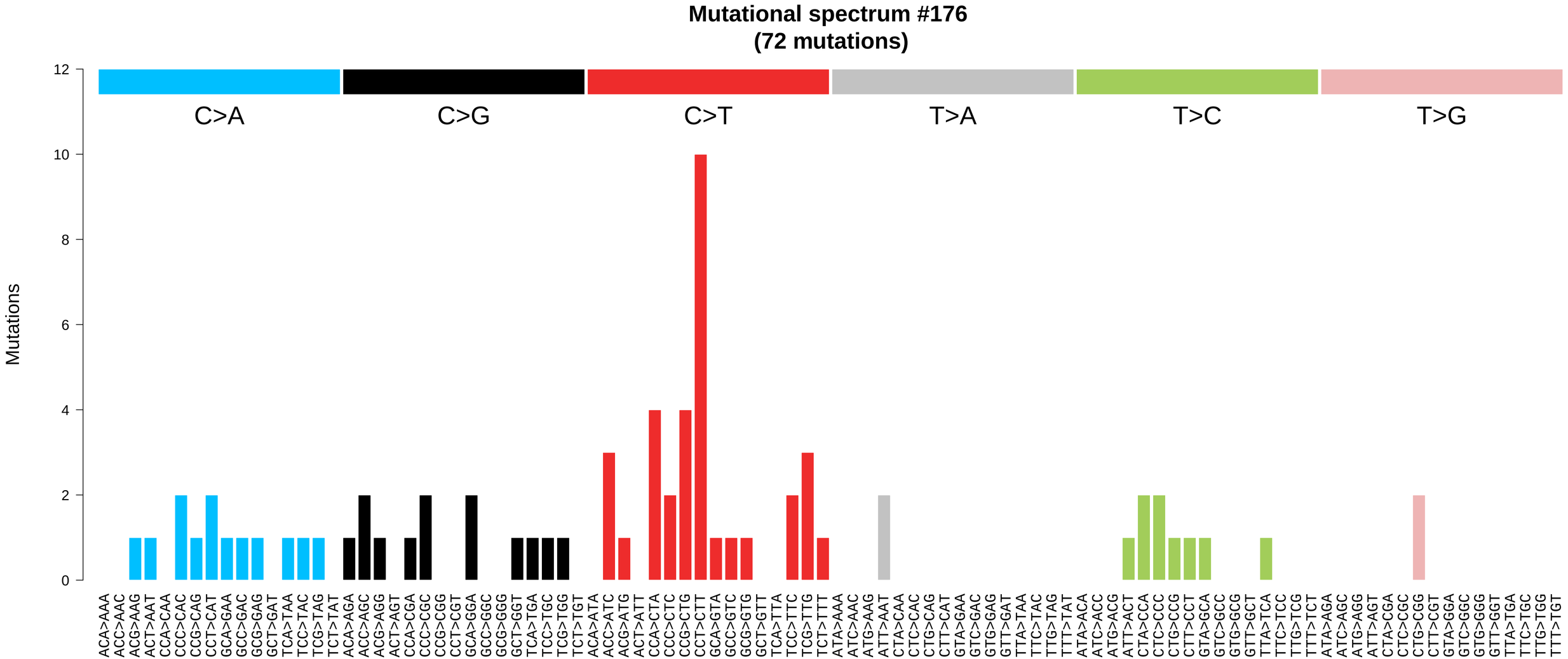

Mutational spectrum #171
(462 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
20
40
60
80
100
120
140
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

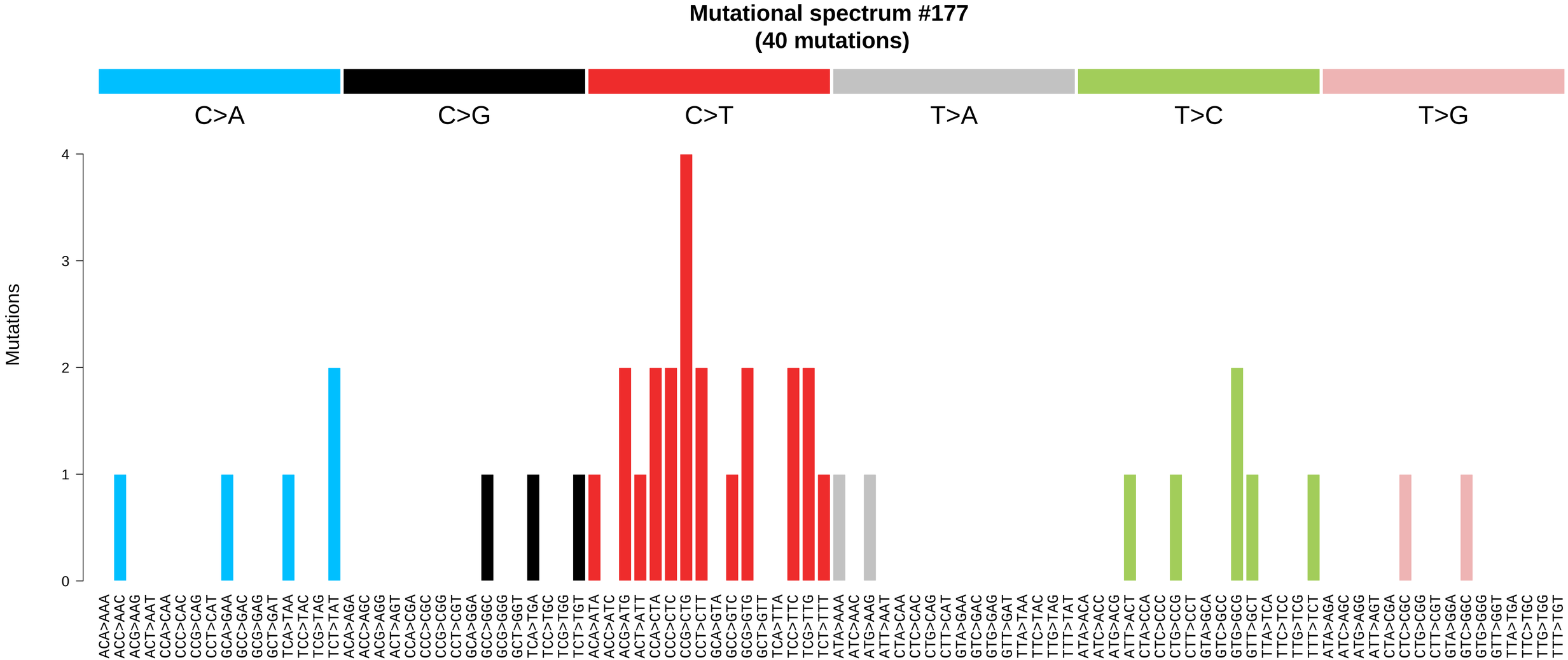

Mutational spectrum #172
(33 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

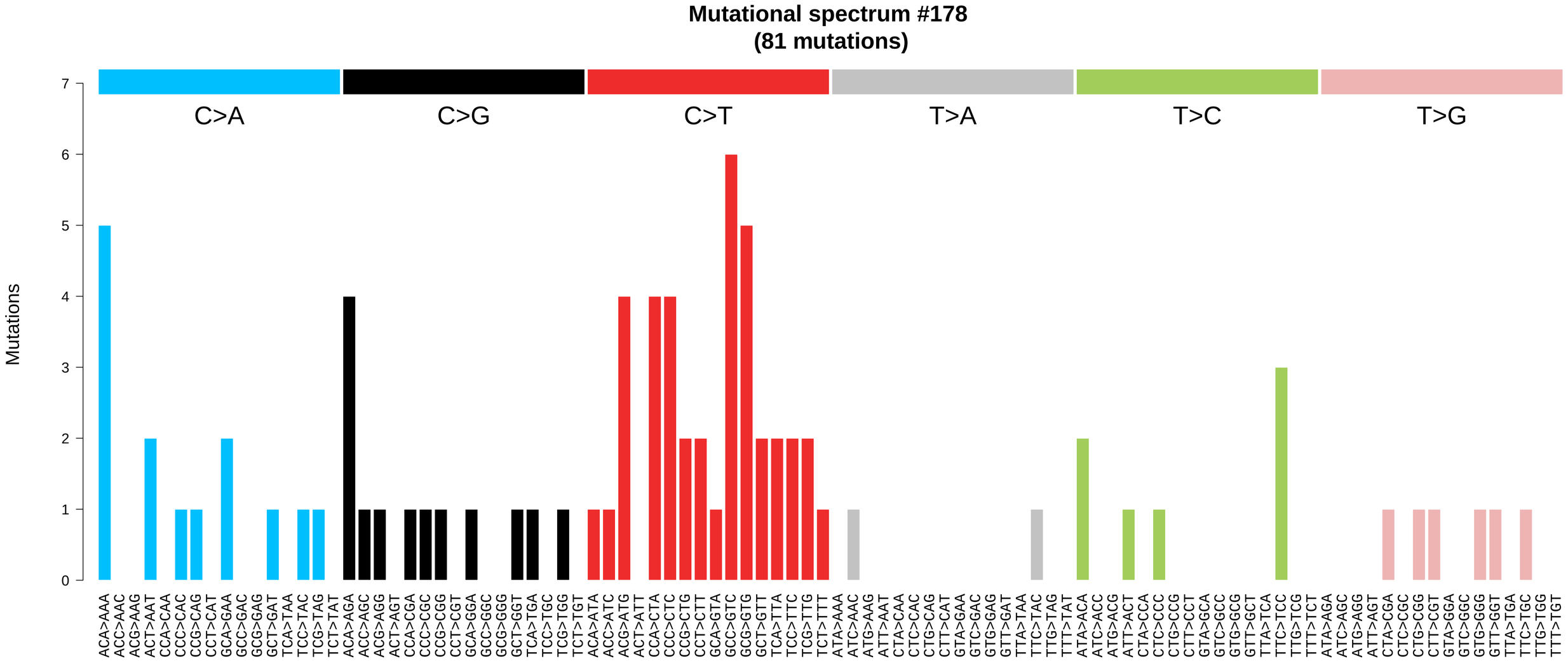

Mutational spectrum #173
(73 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

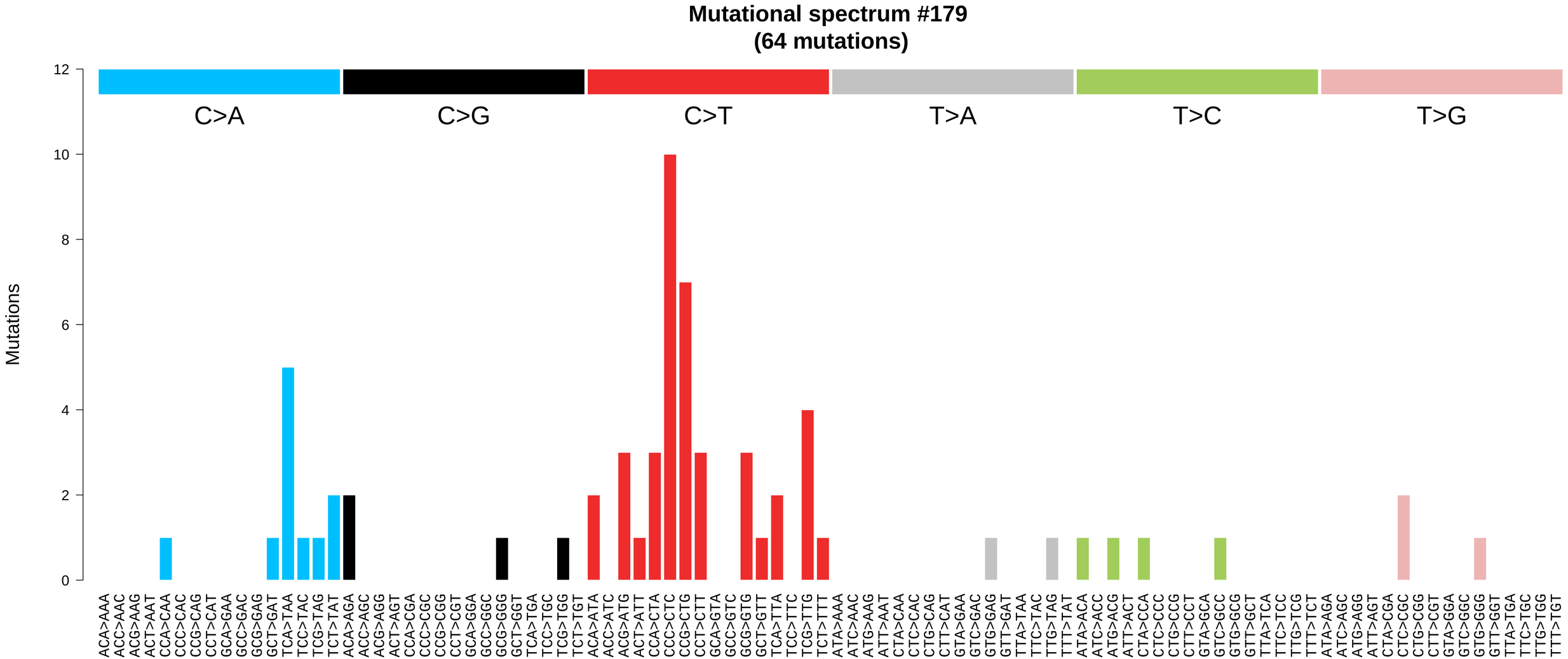

Mutational spectrum #174
(54 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

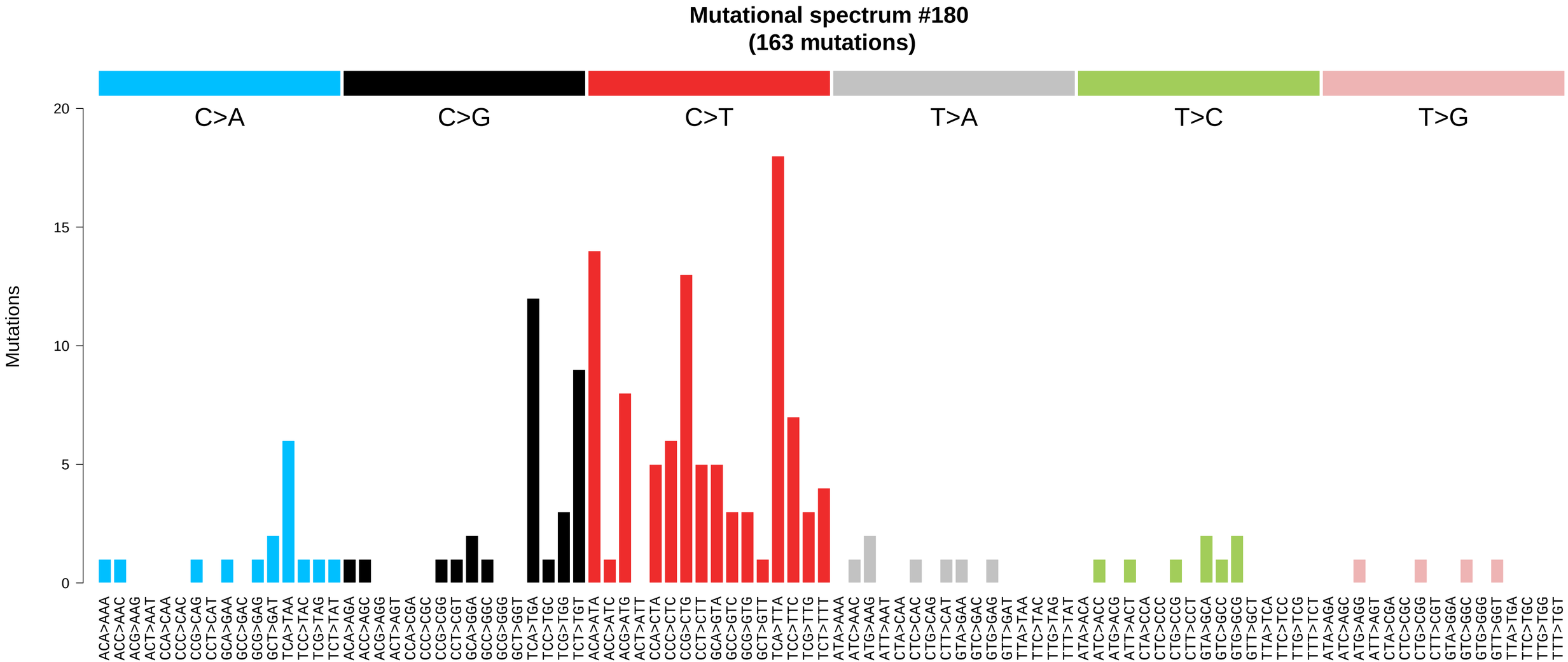

Mutational spectrum #175
(60 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

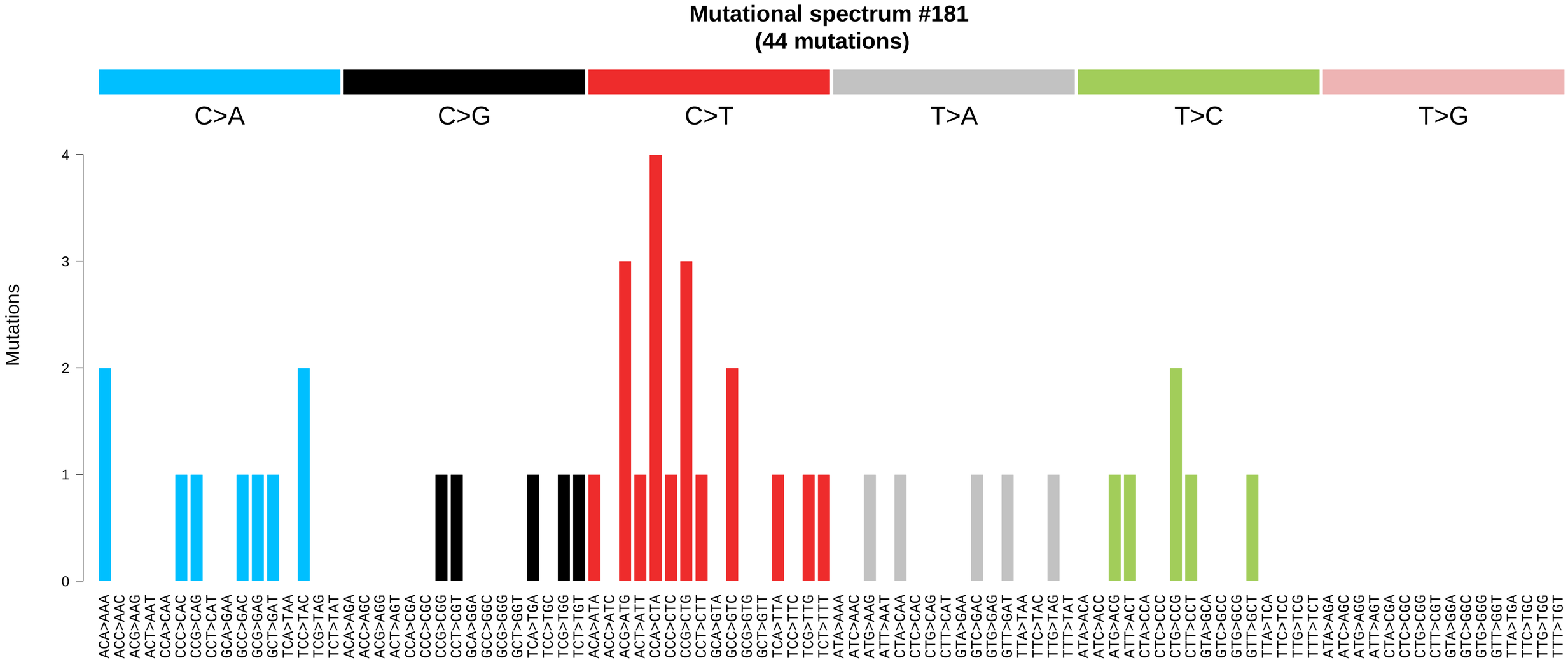

Mutational spectrum #176
(72 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

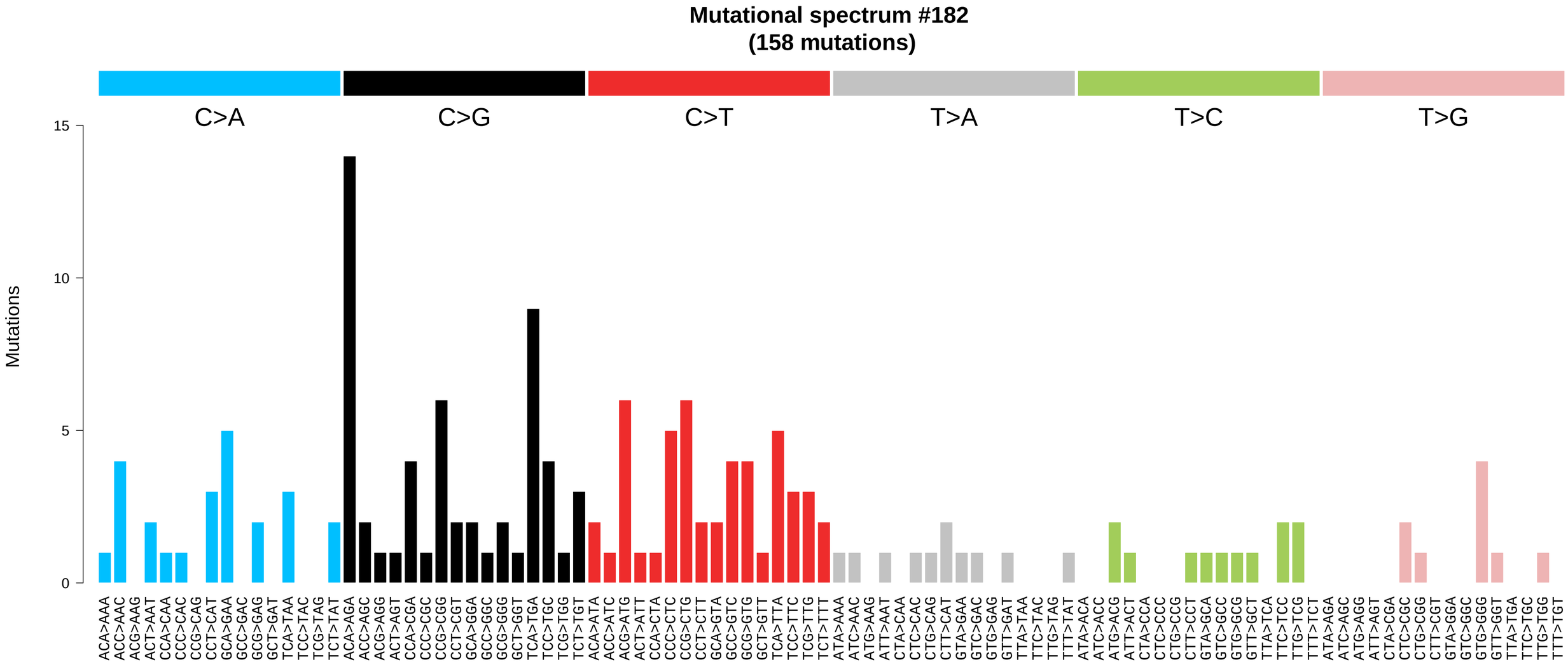

Mutational spectrum #177
(40 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

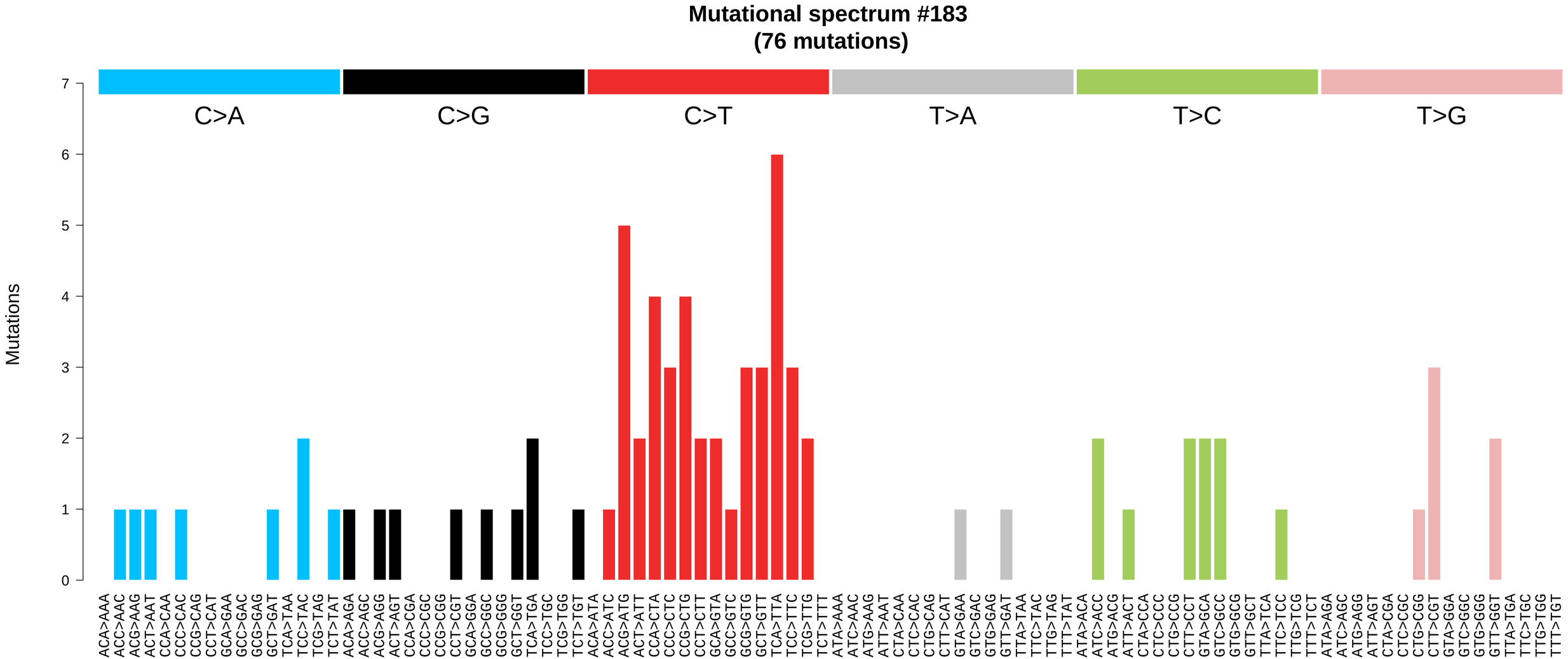

Mutational spectrum #178
(81 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

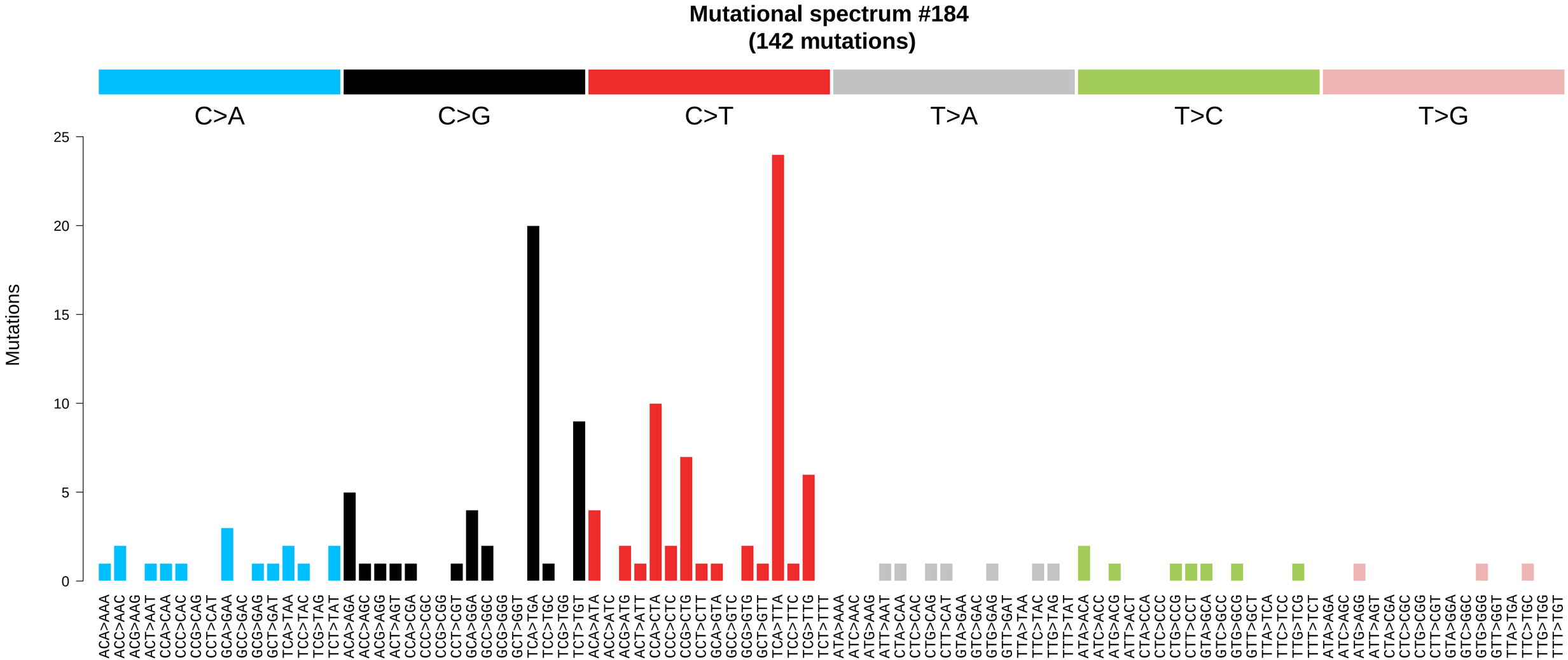

Mutational spectrum #179
(64 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
10
12
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

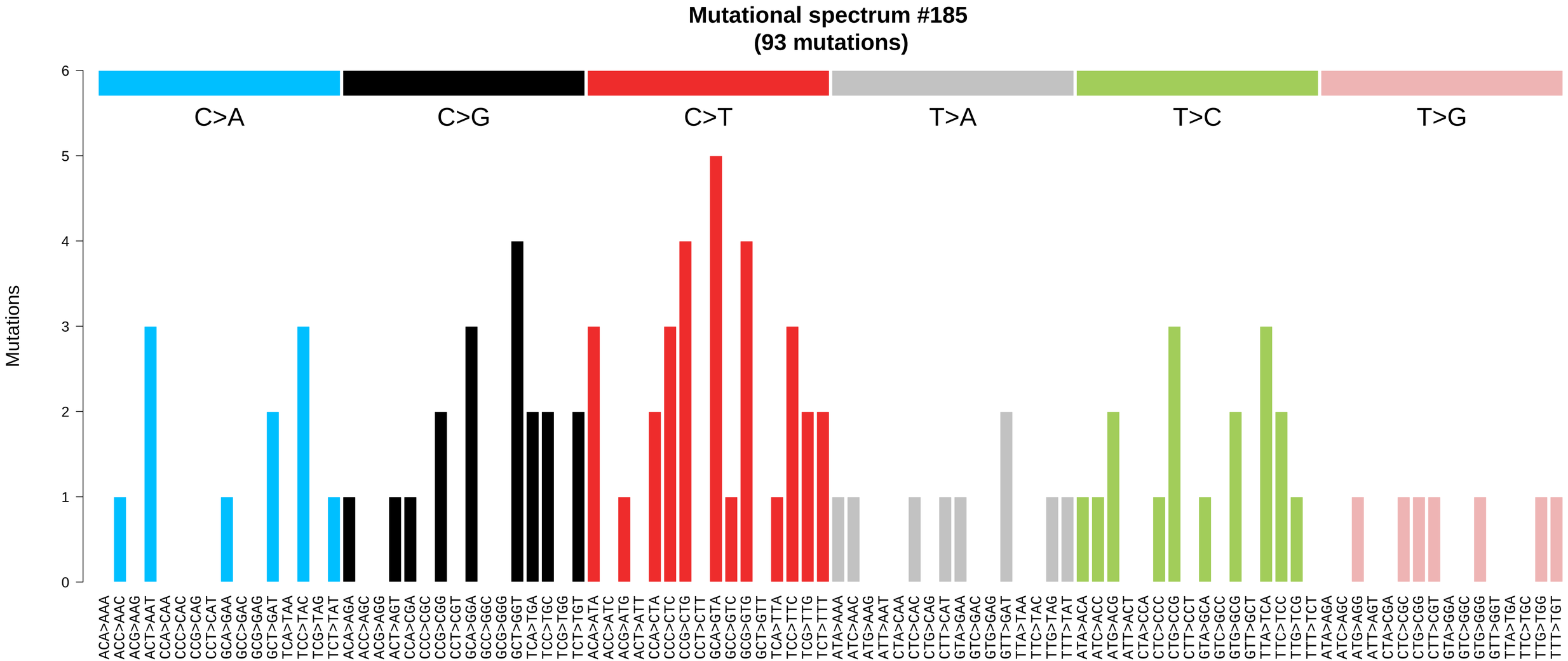

Mutational spectrum #180
(163 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

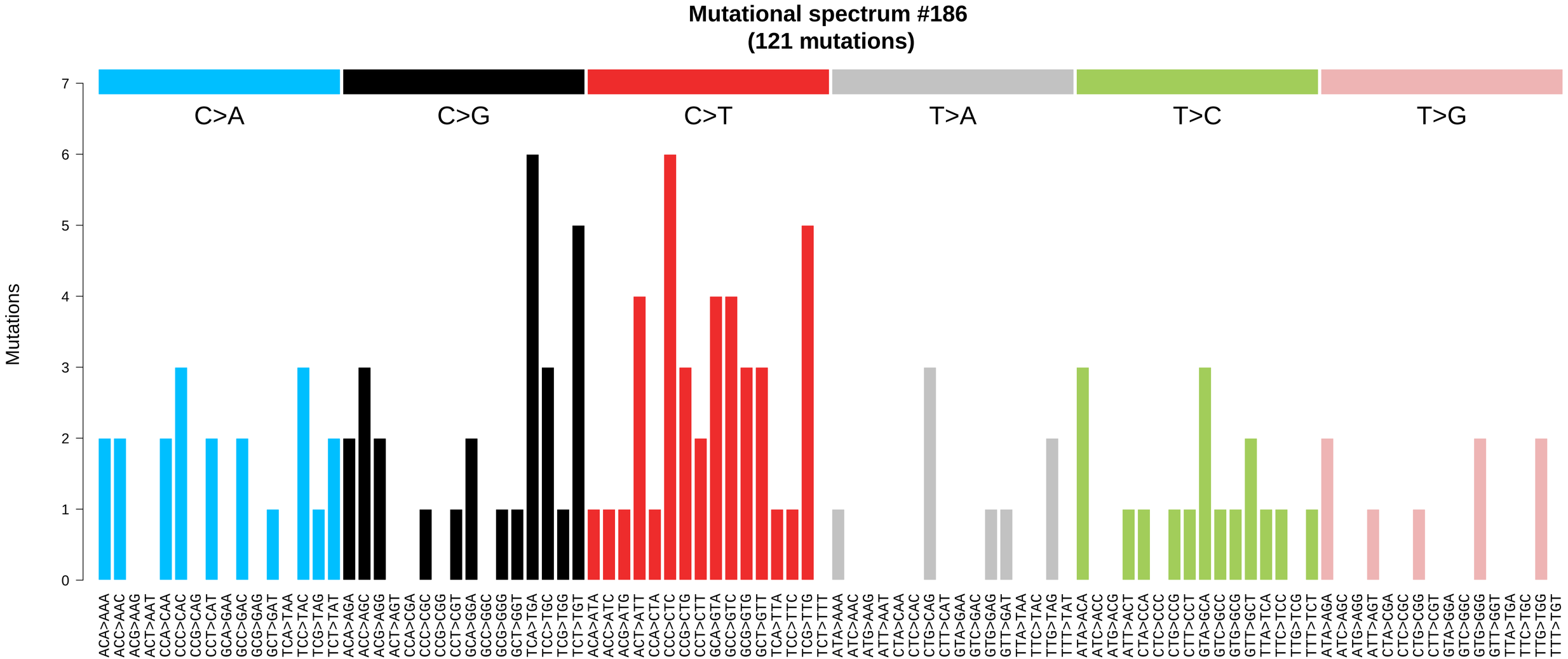

Mutational spectrum #181
(44 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

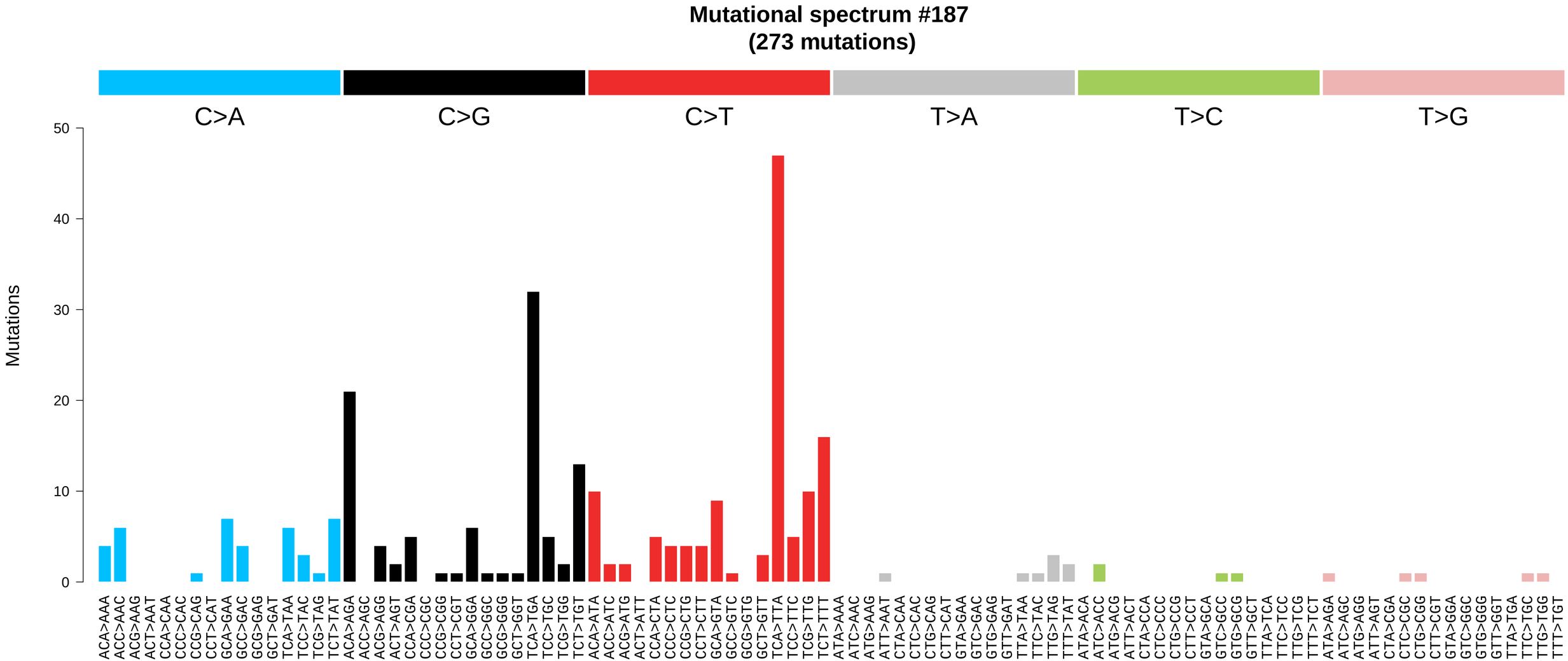

Mutational spectrum #182
(158 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

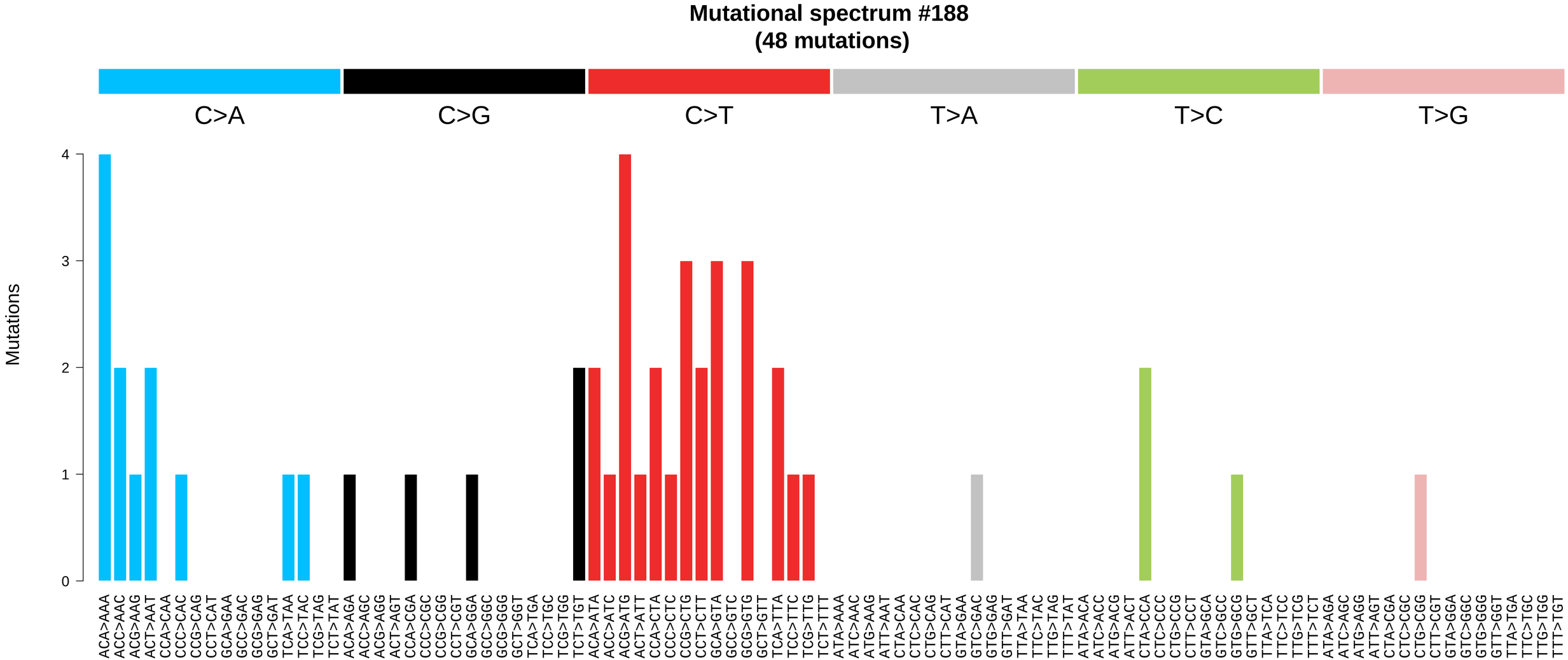

Mutational spectrum #183
(76 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

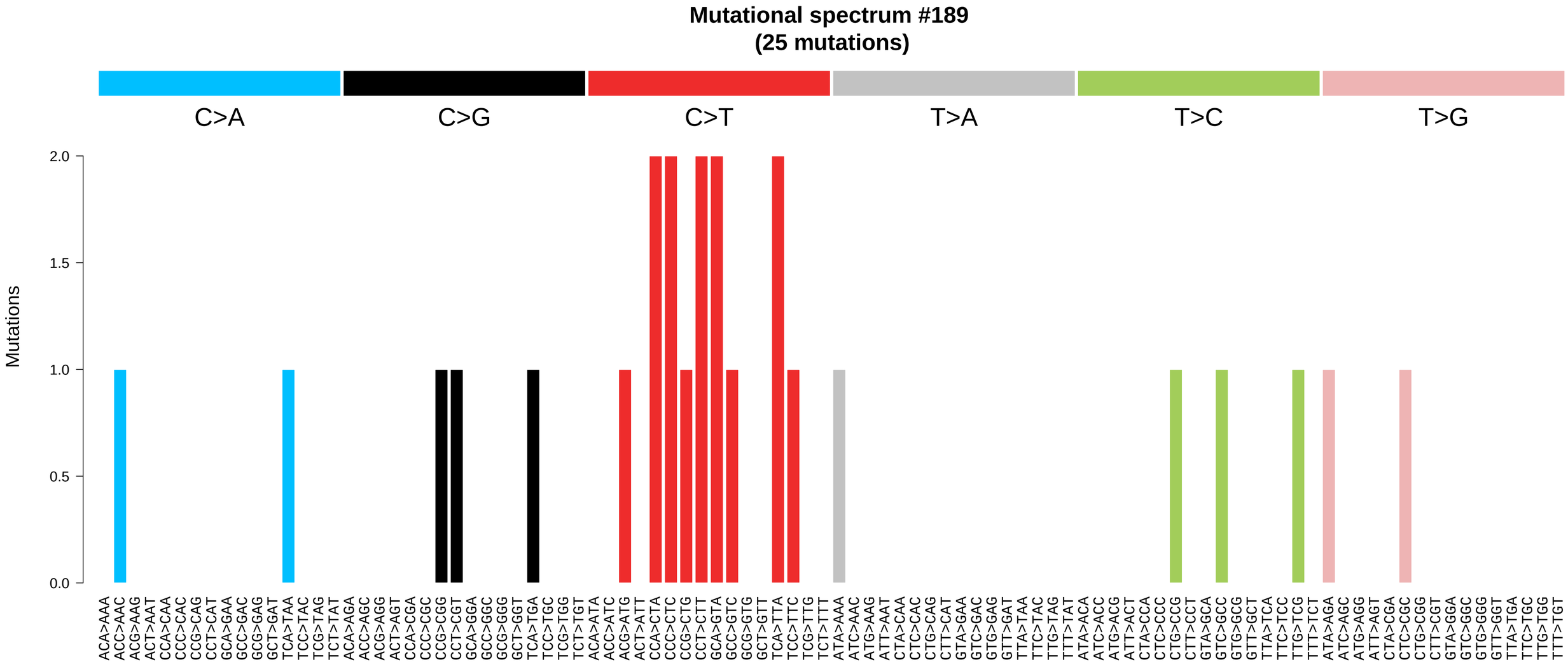

Mutational spectrum #184
(142 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
5
10
15
20
25
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

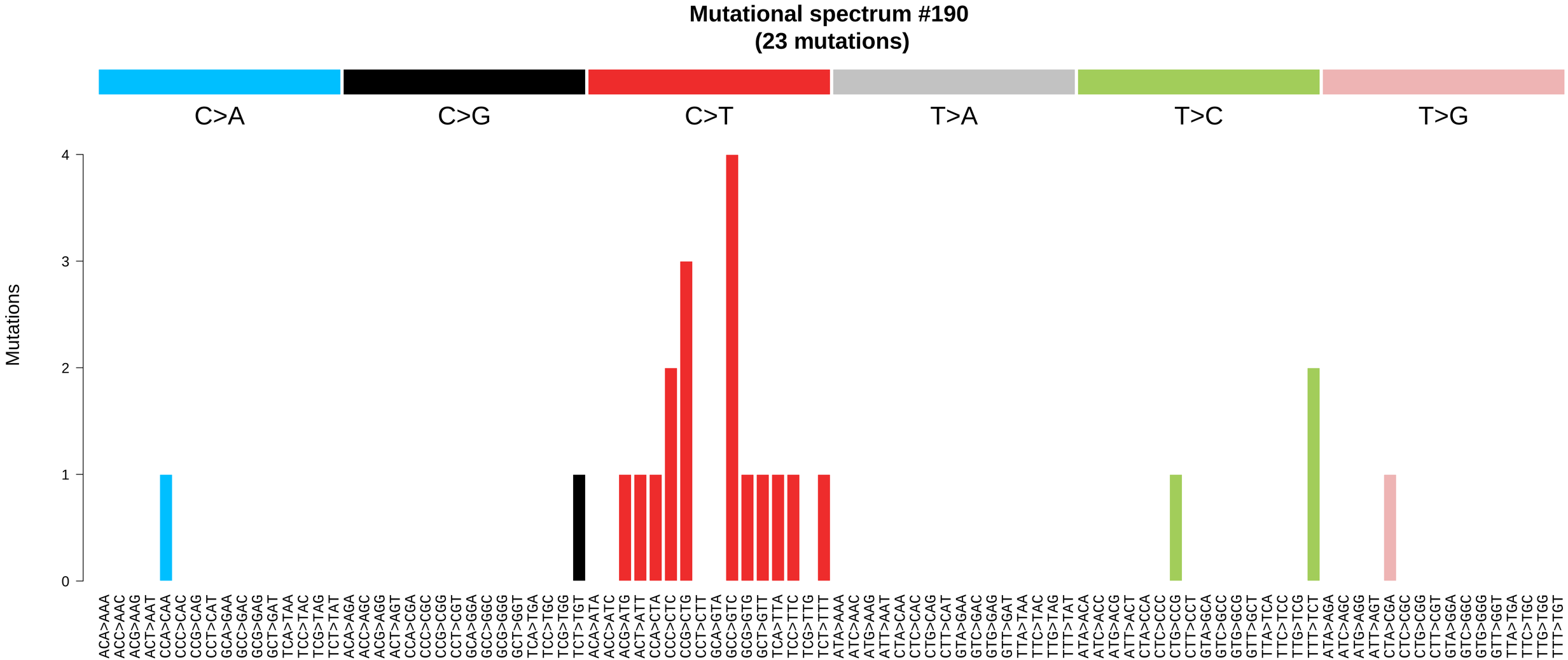

Mutational spectrum #185
(93 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

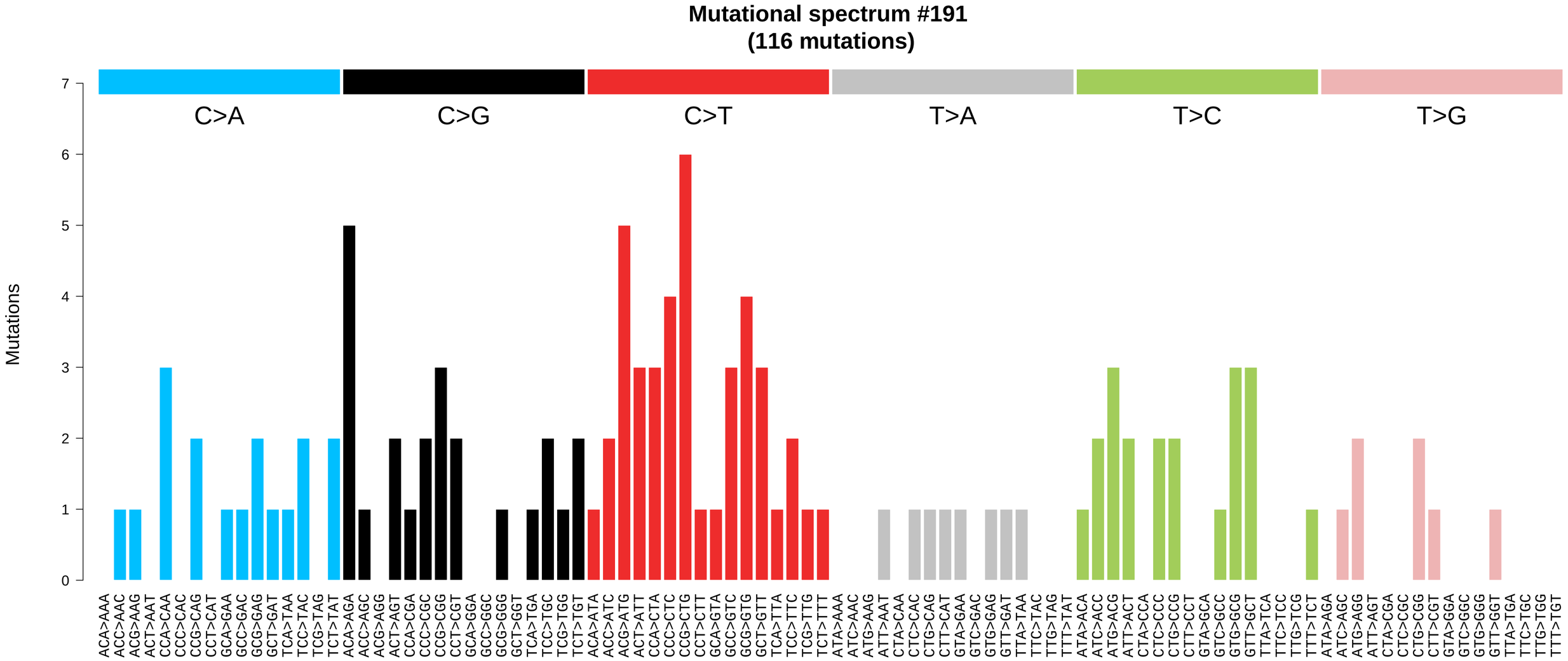

Mutational spectrum #186
(121 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

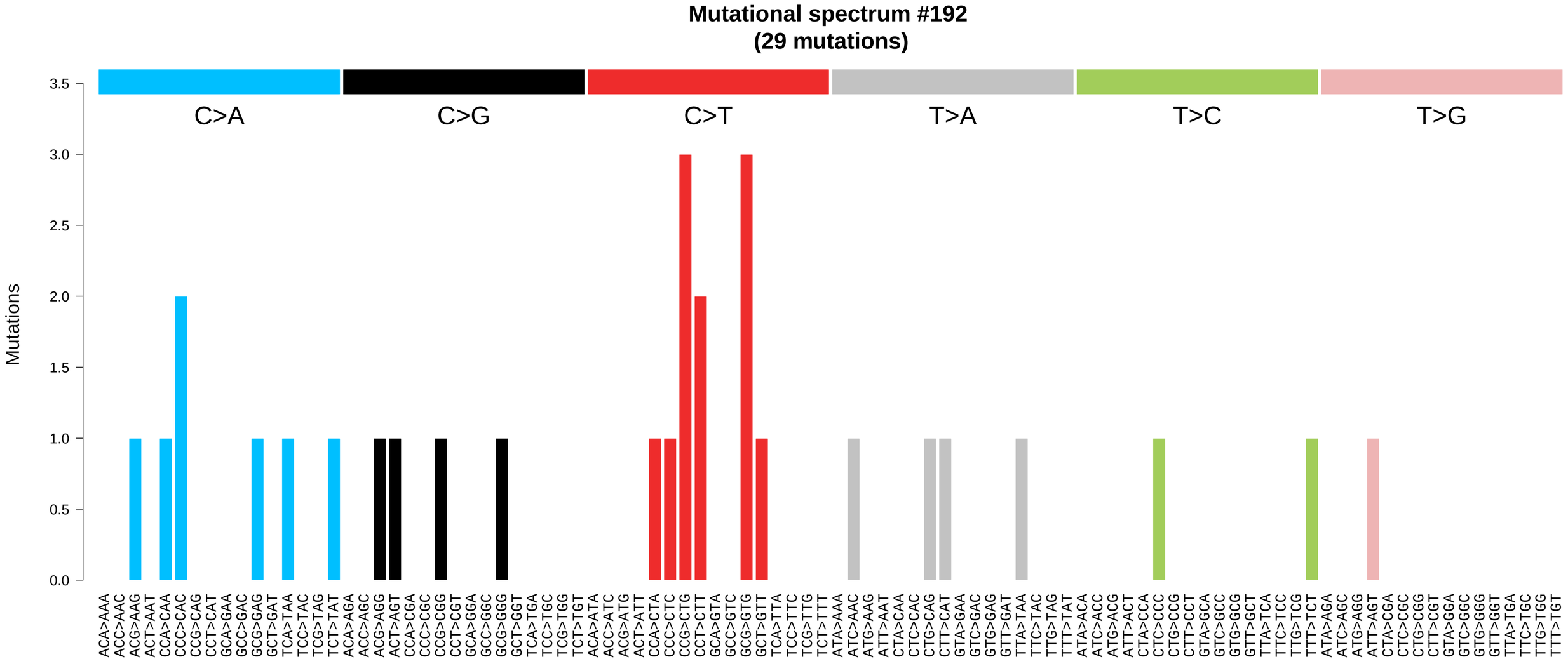

Mutational spectrum #187
(273 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
10
20
30
40
50
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

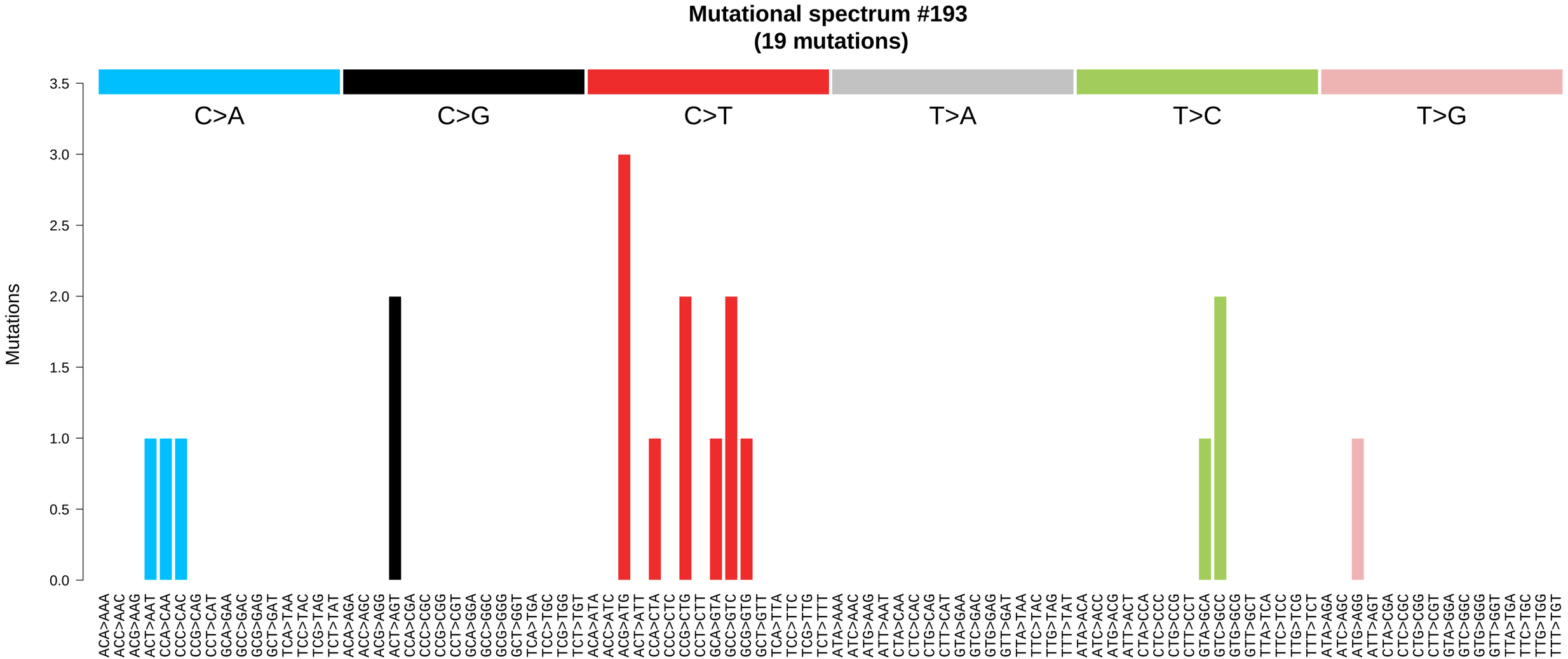

Mutational spectrum #188
(48 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

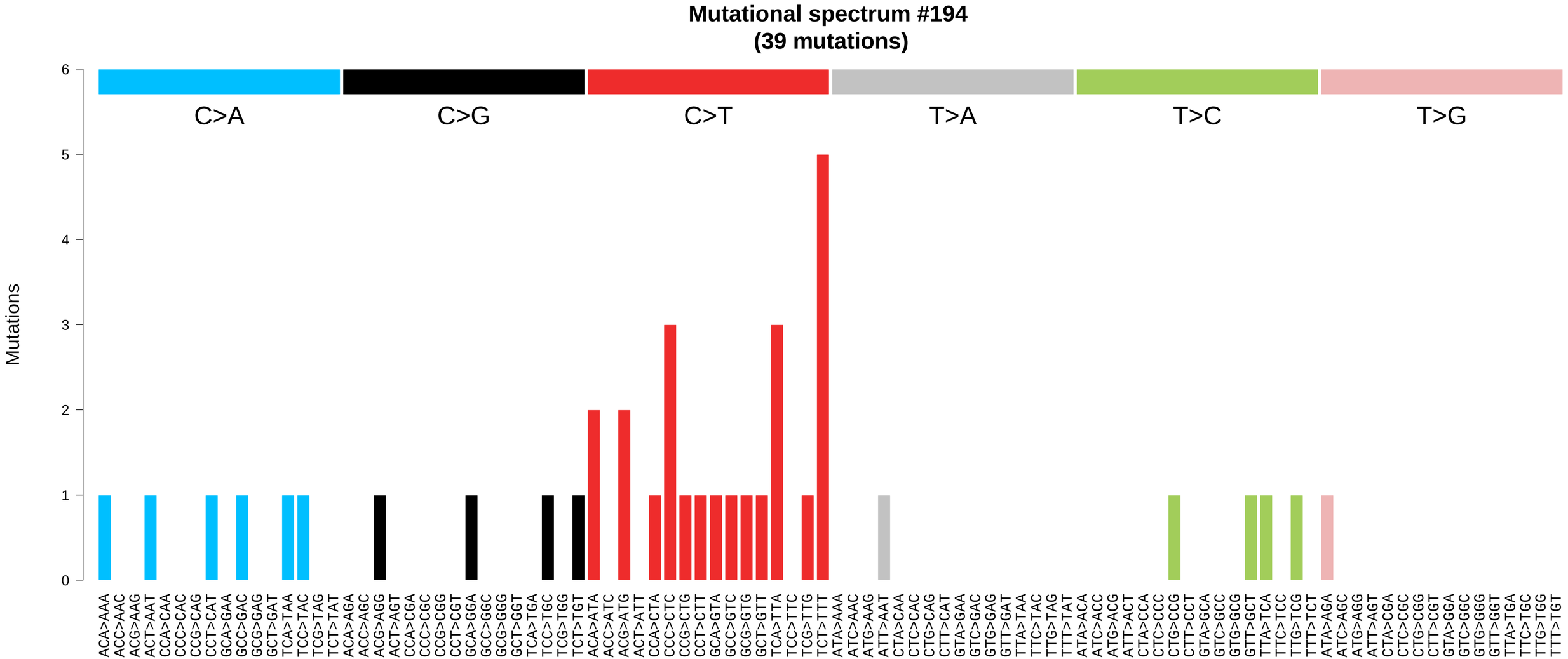

Mutational spectrum #189
(25 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT

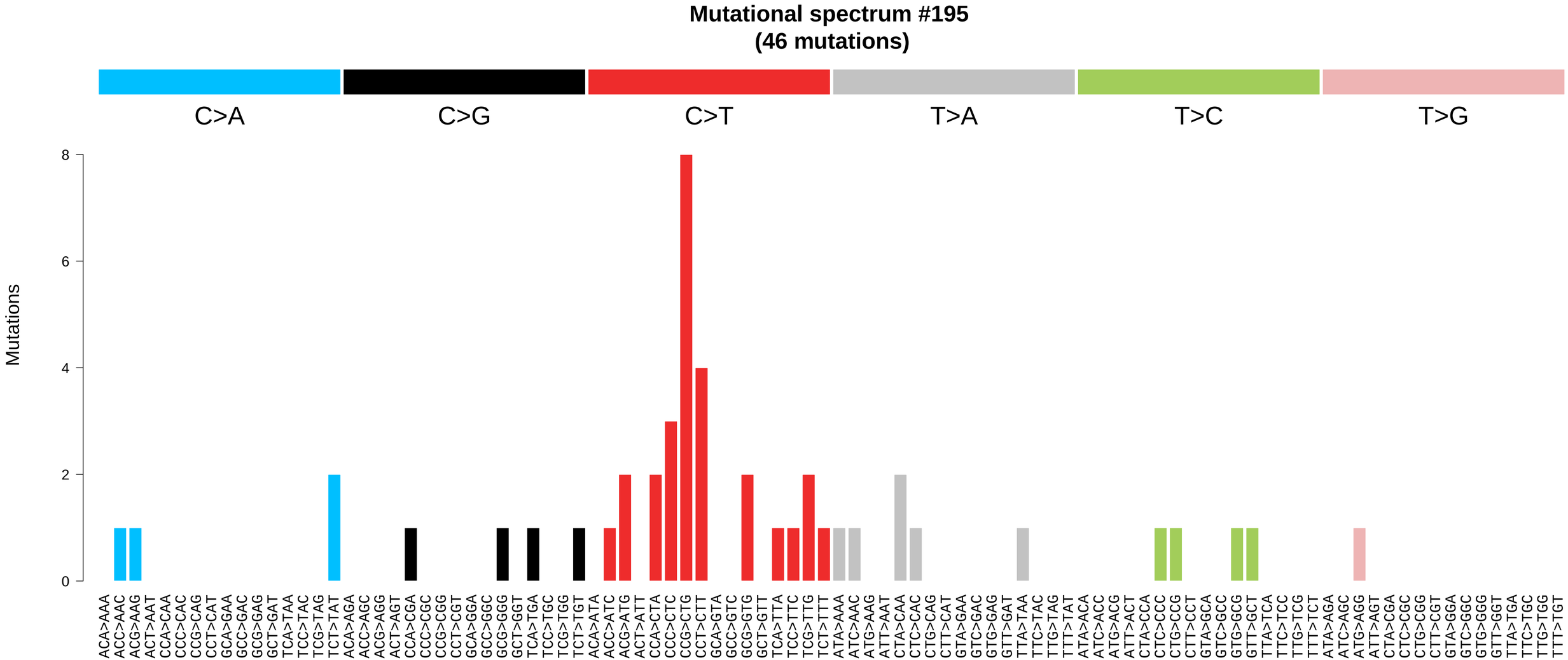

Mutational spectrum #190
(23 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT


Mutational spectrum #191
(116 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
7
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT


Mutational spectrum #192
(29 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT


Mutational spectrum #193
(19 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT


Mutational spectrum #194
(39 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
1
2
3
4
5
6
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT


Mutational spectrum #195
(46 mutations)
C>A
C>G
C>T
T>A
T>C
T>G
Mutations
0
2
4
6
8
ACA>AAA
ACC>AAC
ACG>AAG
ACT>AAT
CCA>CAA
CCC>CAC
CCG>CAG
CCT>CAT
GCA>GAA
GCC>GAC
GCG>GAG
GCT>GAT
TCA>TAA
TCC>TAC
TCG>TAG
TCT>TAT
ACA>AGA
ACC>AGC
ACG>AGG
ACT>AGT
CCA>CGA
CCC>CGC
CCG>CGG
CCT>CGT
GCA>GGA
GCC>GGC
GCG>GGG
GCT>GGT
TCA>TGA
TCC>TGC
TCG>TGG
TCT>TGT
ACA>ATA
ACC>ATC
ACG>ATG
ACT>ATT
CCA>CTA
CCC>CTC
CCG>CTG
CCT>CTT
GCA>GTA
GCC>GTC
GCG>GTG
GCT>GTT
TCA>TTA
TCC>TTC
TCG>TTG
TCT>TTT
ATA>AAA
ATC>AAC
ATG>AAG
ATT>AAT
CTA>CAA
CTC>CAC
CTG>CAG
CTT>CAT
GTA>GAA
GTC>GAC
GTG>GAG
GTT>GAT
TTA>TAA
TTC>TAC
TTG>TAG
TTT>TAT
ATA>ACA
ATC>ACC
ATG>ACG
ATT>ACT
CTA>CCA
CTC>CCC
CTG>CCG
CTT>CCT
GTA>GCA
GTC>GCC
GTG>GCG
GTT>GCT
TTA>TCA
TTC>TCC
TTG>TCG
TTT>TCT
ATA>AGA
ATC>AGC
ATG>AGG
ATT>AGT
CTA>CGA
CTC>CGC
CTG>CGG
CTT>CGT
GTA>GGA
GTC>GGC
GTG>GGG
GTT>GGT
TTA>TGA
TTC>TGC
TTG>TGG
TTT>TGT