

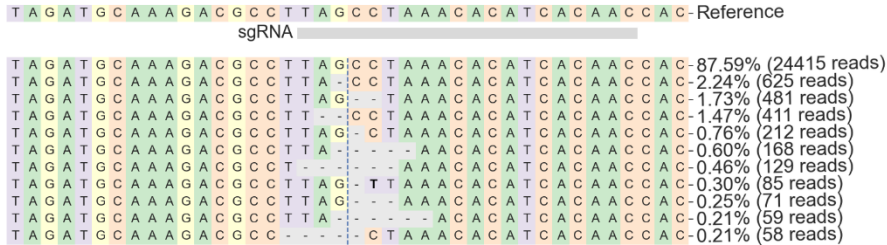
Indels% of liver gDNA from unedited hemophilia A mouse = 0.09% (background error)



Indels% of edited HA mouse liver after injection of F8 donor plasmid only = 0.10% (background error)



Indels% of edited HA mouse liver after injection with CRISPR plasmids only = 10.5%



Indels% of edited HA mouse liver after injection of CRISPR and F8 donor plasmids = 11.53%

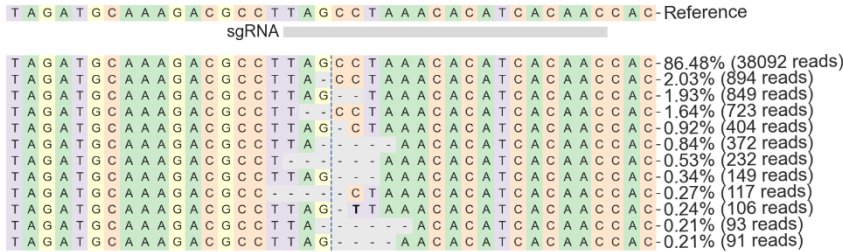


Figure S1. Frequencies of indels observed at Alb locus following in vivo editing in the liver of hemophilia A mice. One week after the injection of editing plasmids, the sequence adjacent to the editing site was amplified from the liver genomic DNA, and subsequently analyzed using next-generation sequencing (NGS) and CRISPResso2.

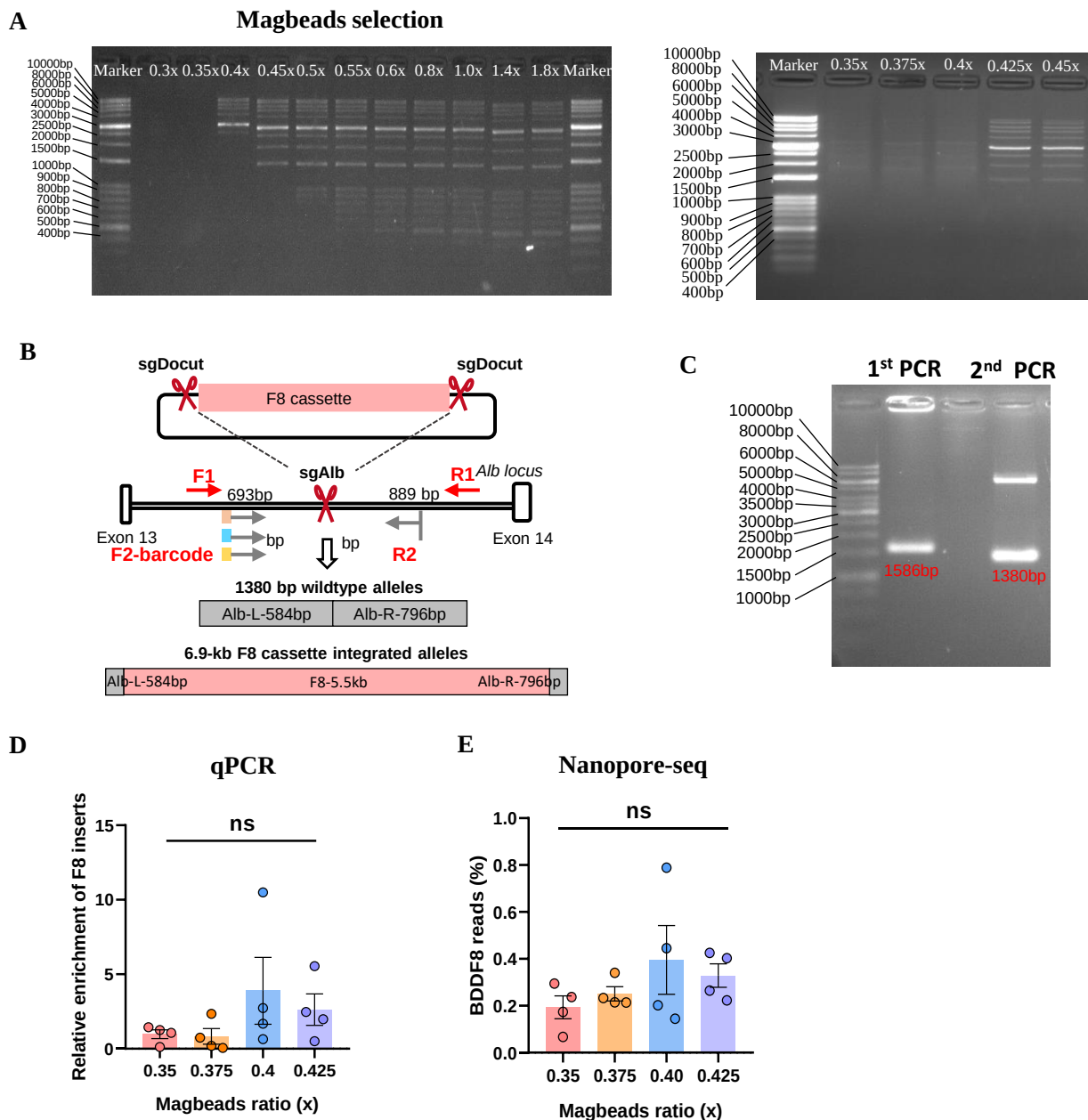
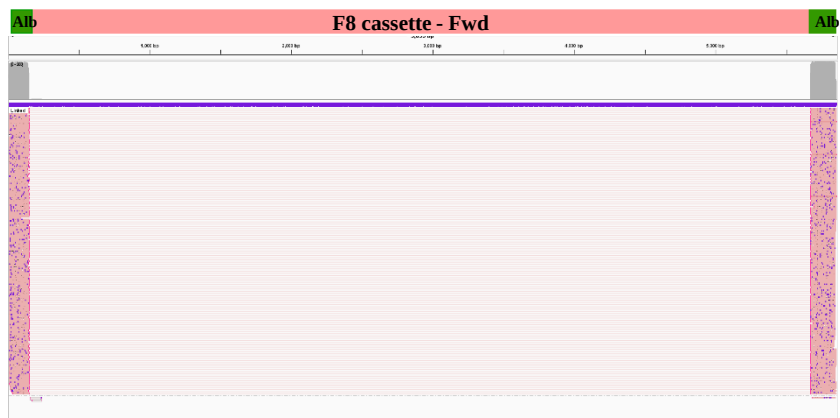
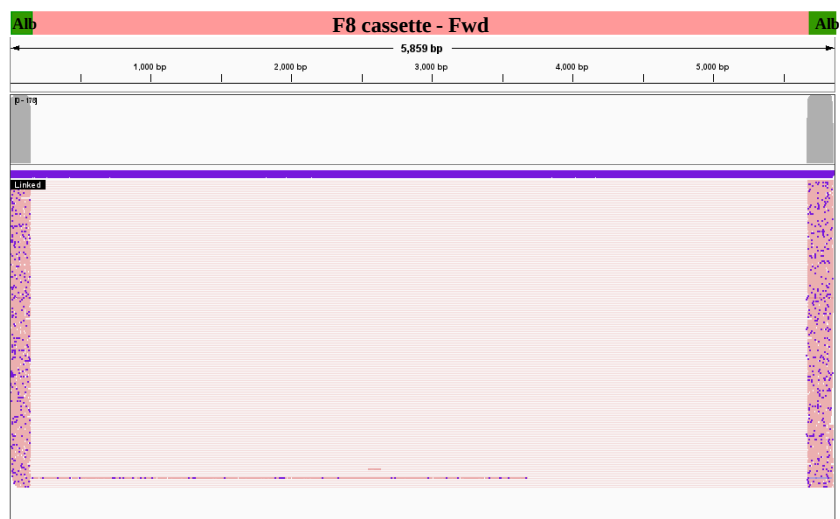


Figure S2. Enrichment of amplicons with F8 inserts by nested PCR combined with magnetic beads. (A) Assessment of the size selection efficiency at various ratios of magnetic beads (0.3x-1.8x). (B) The primer design for the nested PCR and the schematic of the expected PCR products, which included the 1380bp wildtype alleles and the approximately 6.9kb F8 cassette-integrated alleles. (C) The representative results of the gel electrophoresis of the 1st PCR products and the 2nd PCR products, which were amplified from the 1st PCR products after size selection using a beads ratio of 0.4x. The bands corresponding to alleles lacking donor insertion in the 1st and 2nd PCR products were 1586bp and 1380bp, respectively. (D) The relative enrichment of F8 inserts as determined by qPCR after size selection using magnetic beads at various ratios. The error bars represent the mean $\pm$ SEM, $n = 4$, and paired two-sided Student's t-tests were performed. (E) The determination of the percentage of F8 inserts by nanopore sequencing F8 reads (%) in the 2nd PCR products following size selection of the purified 1st PCR products using different ratios of magnetic beads. The error bars represent the mean $\pm$ SEM, $n = 4$, and paired two-sided Student's t-tests were conducted.

Size selection-None



Size selection-Once



Size selection-Twice

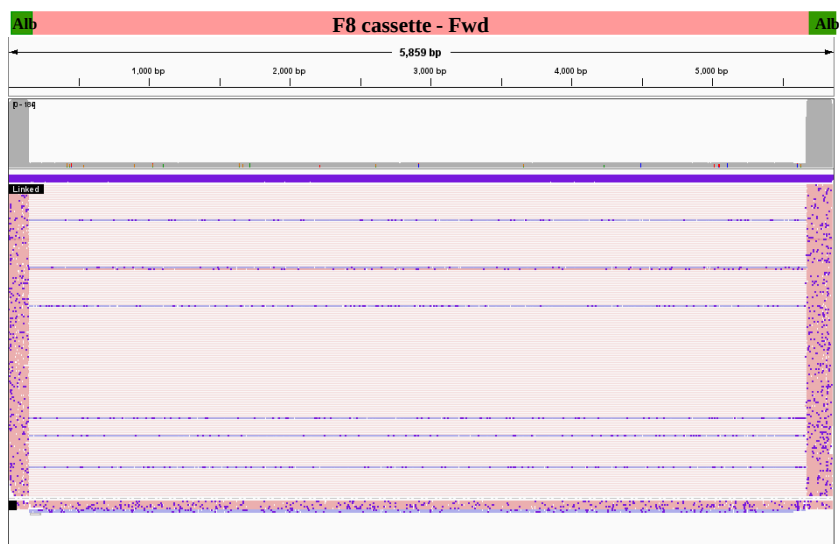
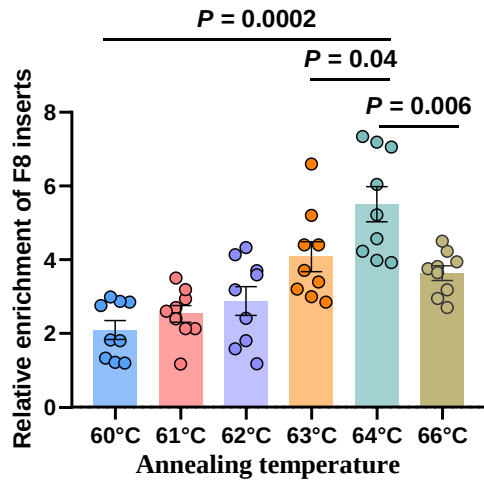


Figure S3. The 2nd PCR amplicons were sequenced and visualized after the size selection of the 1st PCR products using magnetic beads. The reference sequence of the F8 cassette was surrounded by the 332bp Alb genomic sequence.

A Optimization of annealing temperature



B 1st PCR program

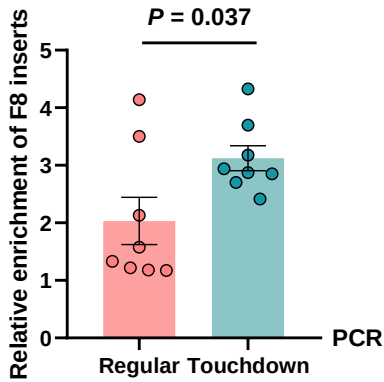
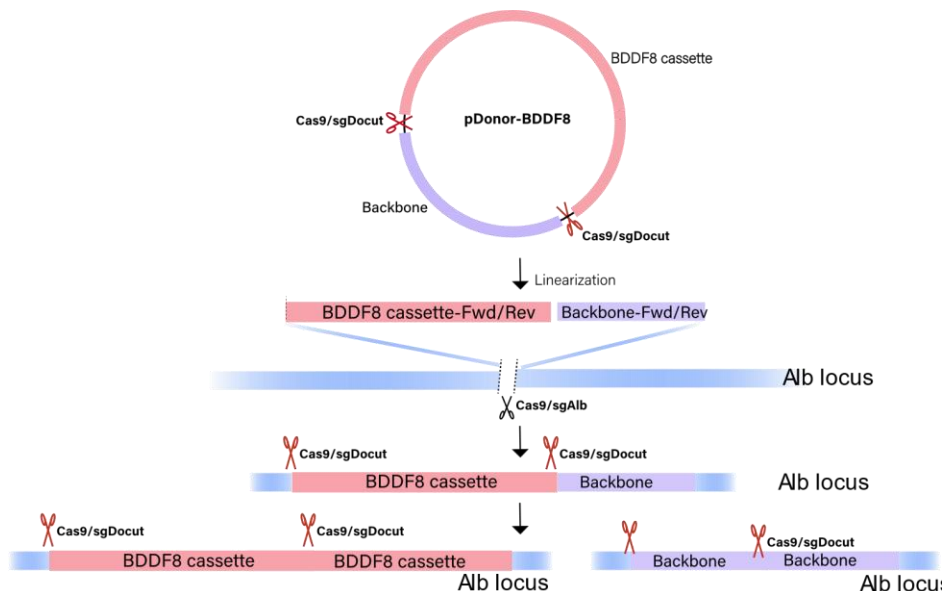


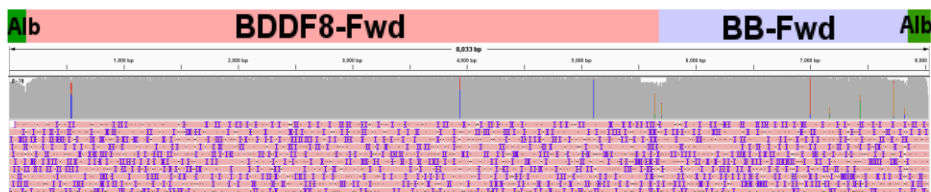
Figure S4. Optimizing the PCR conditions to enhance the amplification of F8 inserts. (A) The optimization of the annealing temperature in the 1st PCR to improve the amplification of F8 inserts. The relative enrichment of amplicons with F8 inserts was determined using qPCR. The error bars represent the mean $\pm$ SEM, $n = 9$, and paired two-sided Student's t -tests were conducted. (B) The touchdown program employed in the 1st PCR increases the amplification of F8 inserts. The touchdown program used in this study was 6 cycles of [98°C for 10s, 68°C (-1°C/cycle) for 15s, 68°C for 6.5min]; 25 cycles of [98°C for 10s, 62°C for 15s, 68°C for 6.5min]. The error bars indicate the mean $\pm$ SEM, $n = 8$, and paired two-sided Student's t -tests were conducted.

A Schematic of insertions of multiple double-cut donor fragments

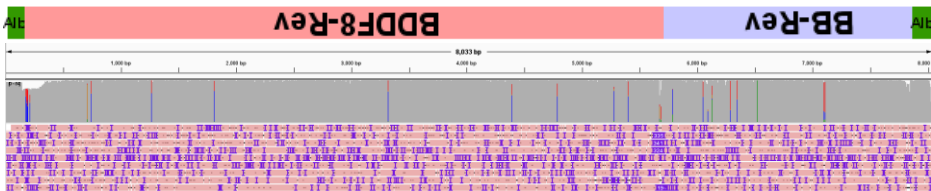


B Additional two-fragment integrations

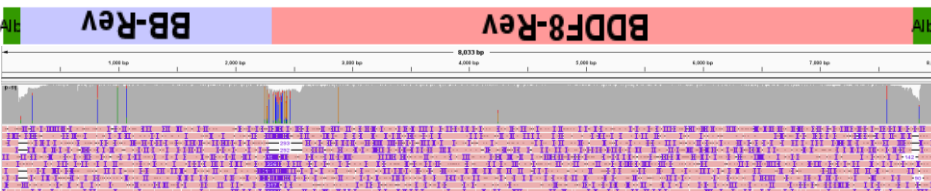
F8fBBf inserts = 0.35%. Shows 10 out of 79 reads.



F8rBBr inserts = 0.24%. Shows 10 out of 54 reads.



BBrF8r inserts = 0.22%. Shows 10 out of 51 reads.



BBfF8f inserts = 0.09%. Shows 10 out of 22 reads.

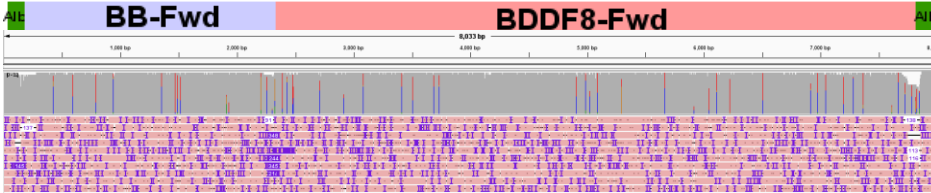
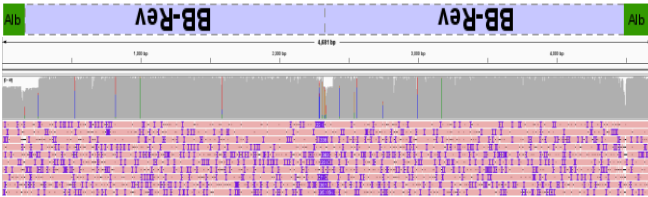
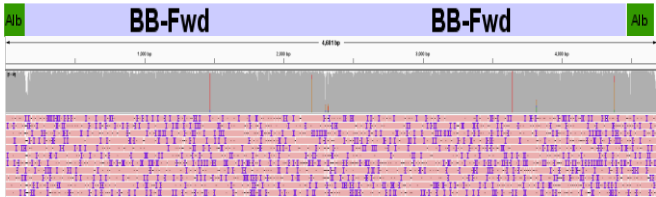


Figure S5. Identification of the two-fragment and three-fragment insertions of the double-cut donor plasmid occurred following in vivo linearization by Cas9-sgRNA. (A) illustrates the schematic of the insertions of multiple fragments of the linearized double-cut donor. (B) shows the visualization of additional two-fragment integrations not presented in Figure 5.

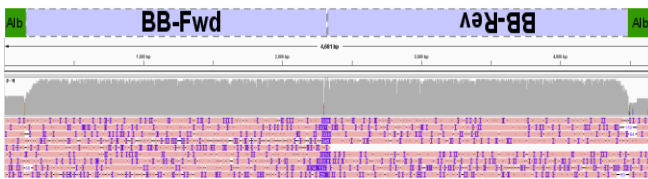
BBrBBR inserts = 0.22%. Shows 10 out of 49 reads.



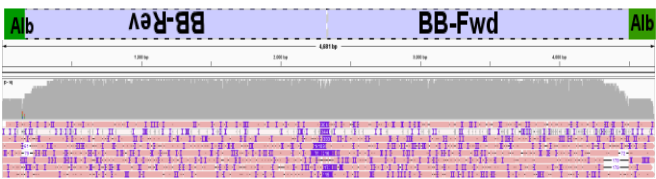
BBfBBf inserts = 0.20%. Shows 10 out of 46 reads.



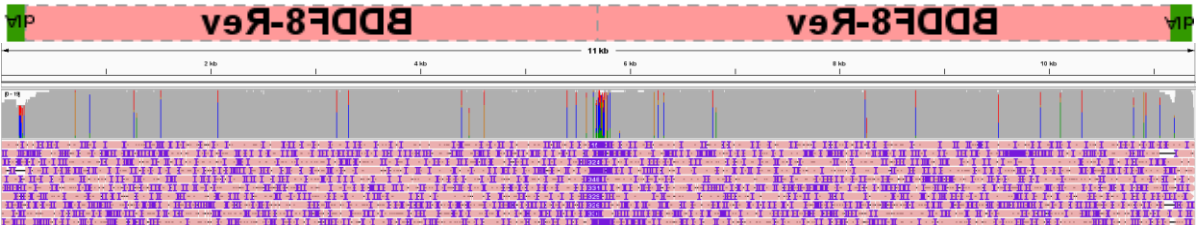
BBfBBR inserts = 0.04%. Shows 9 out of 9 reads.



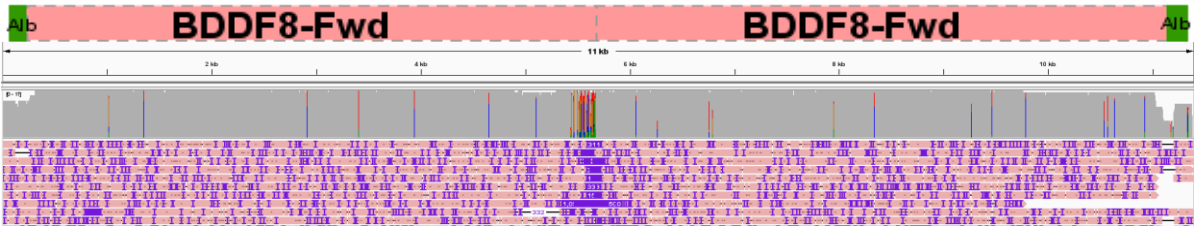
BBrBBf inserts = 0.04%. Shows 8 out of 8 reads.



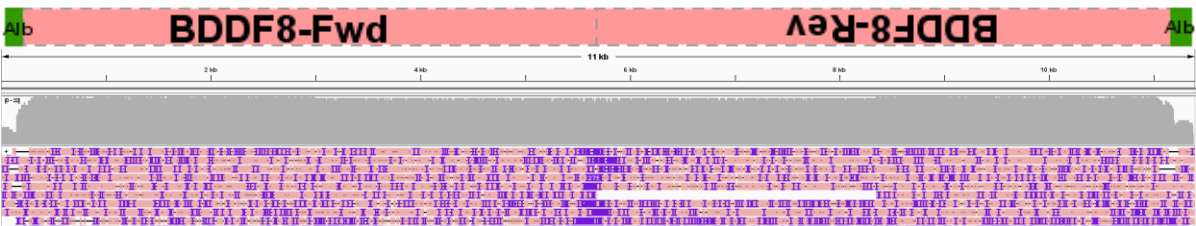
F8rF8r inserts = 0.08%. Shows 10 out of 19 reads.



F8fF8f inserts = 0.08%. Shows 10 out of 17 reads.



F8fF8r inserts = 0.05%. Shows 10 out of 11 reads.



F8fF8r inserts = 0.03%. Shows 8 out of 8 reads.

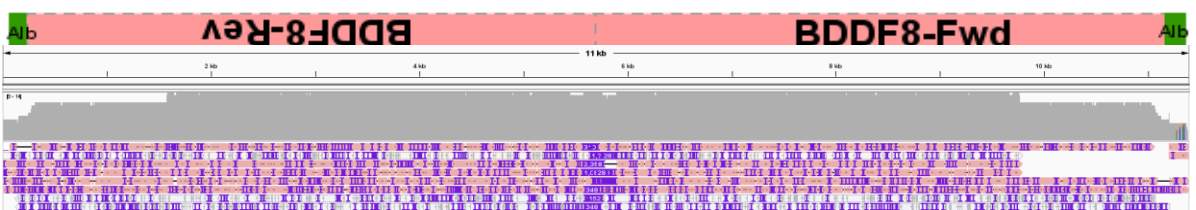


Figure S5B. The visualization of additional two-fragment integrations (Continued).

C Three-fragment insertions: BB+BB+F8

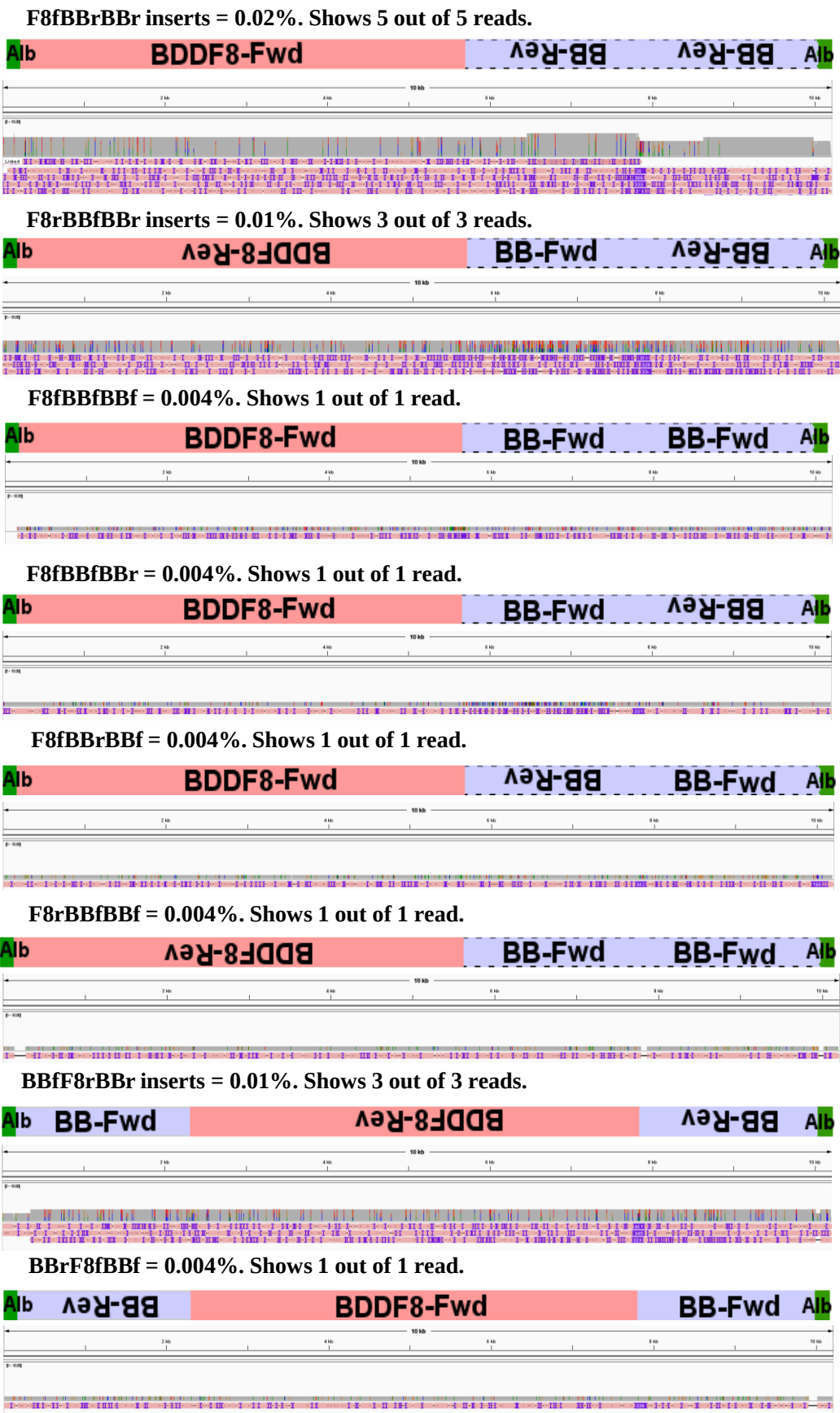
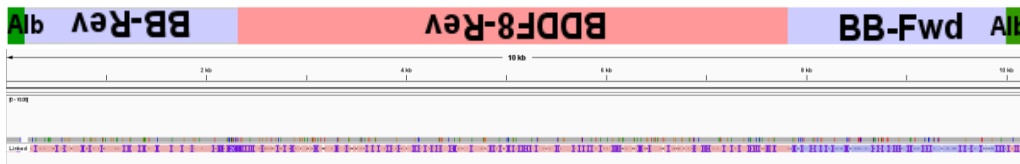
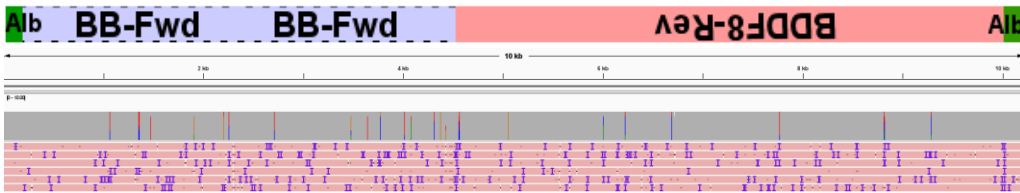


Figure S5C. The visualization of three-fragment insertions, specifically the insertion of two plasmid backbone fragments and one F8 piece.

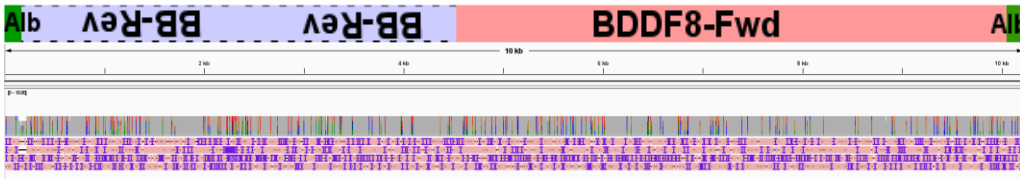
BBrF8rBBf = 0.004%. Shows 1 out of 1 reads.



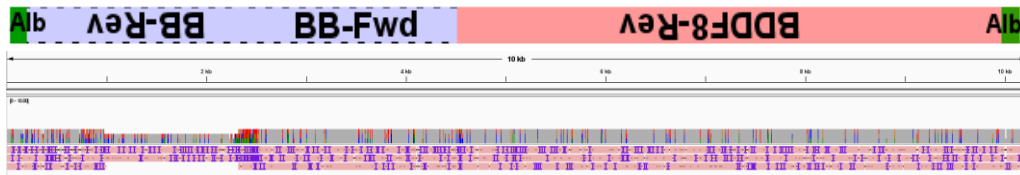
BBfBBfF8r inserts = 0.03%. Shows 6 out of 6 reads.



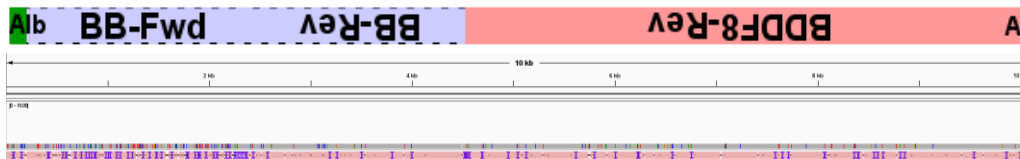
BBrBBrF8f inserts = 0.02%. Shows 4 out of 4 reads.



BBrBBfF8r inserts = 0.01%. Shows 3 out of 3 reads.



BBfBBrF8r inserts = 0.004%. Shows 1 out of 1 reads.



BBfBBBrF8f inserts = 0.004%. Shows 1 out of 1 reads.

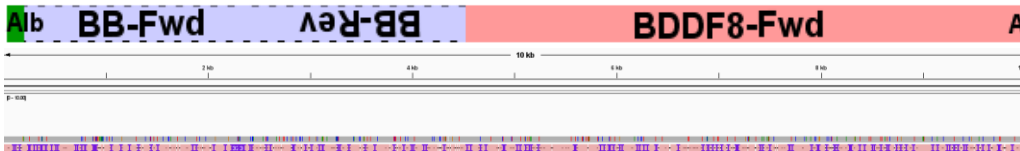
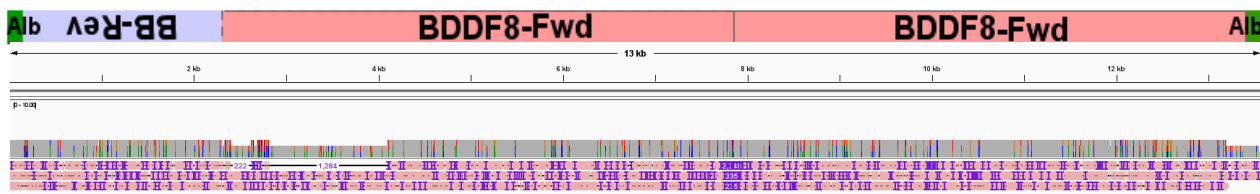


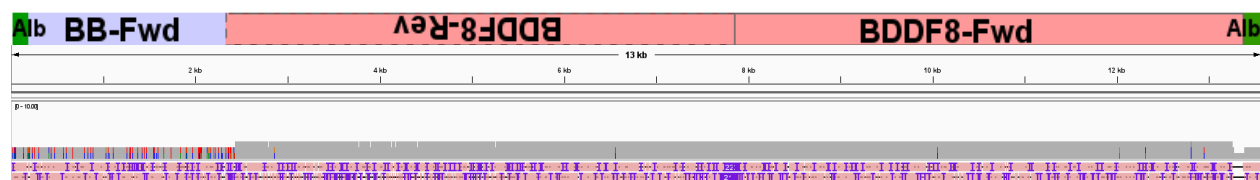
Figure S5C. The visualization of three-fragment insertions, specifically the insertion of two plasmid backbone fragments and one F8 piece (continued).

D Three-fragment insertions: BB+F8+F8

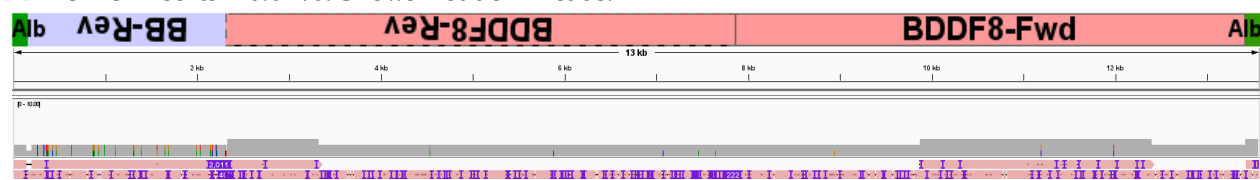
BBrF8fF8f inserts = 0.01%. Shows 3 out of 3 reads.



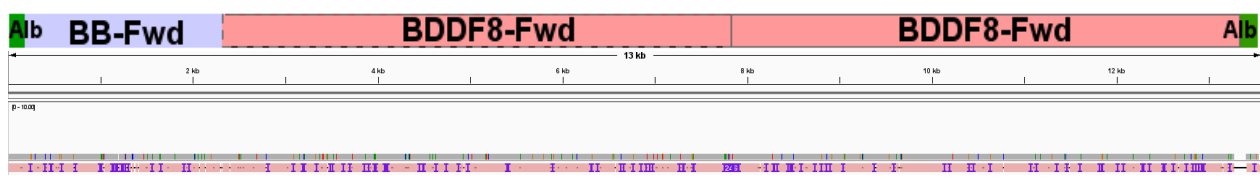
BBfF8rF8f inserts = 0.01%. Shows 2 out of 2 reads.



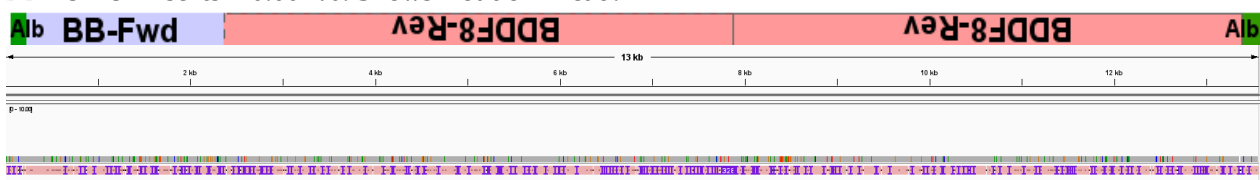
BBrF8rF8f inserts = 0.01%. Shows 2 out of 2 reads.



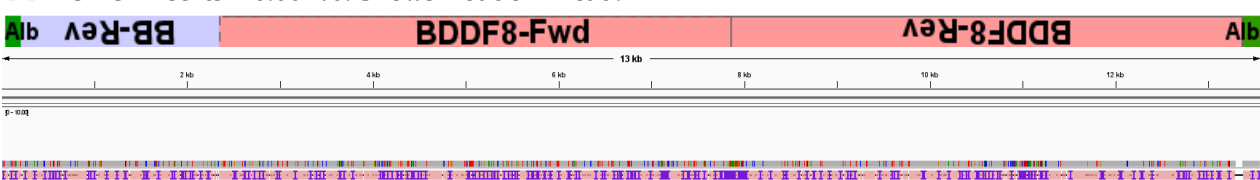
BBfF8fF8f inserts = 0.004%. Shows 1 out of 1 reads.



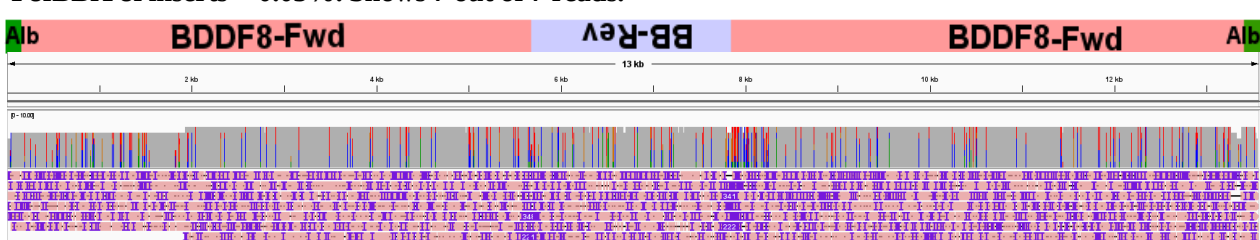
BBfF8rF8r inserts = 0.004%. Shows 1 out of 1 read.



BBrF8fF8r inserts = 0.004%. Shows 1 out of 1 read.



F8fBBBrF8f inserts = 0.03%. Shows 7 out of 7 reads.



F8fBBBrF8r inserts = 0.03%. Shows 6 out of 6 reads.

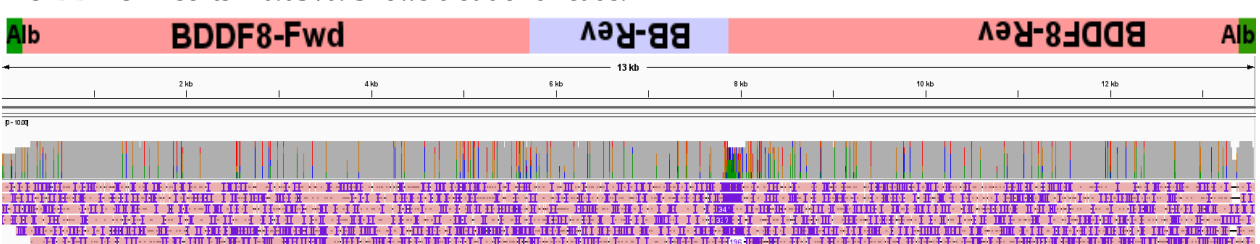
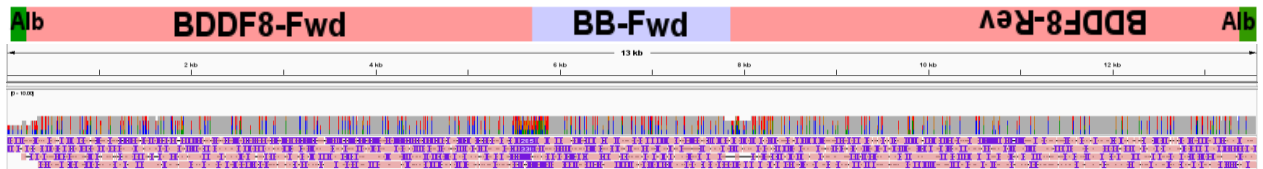
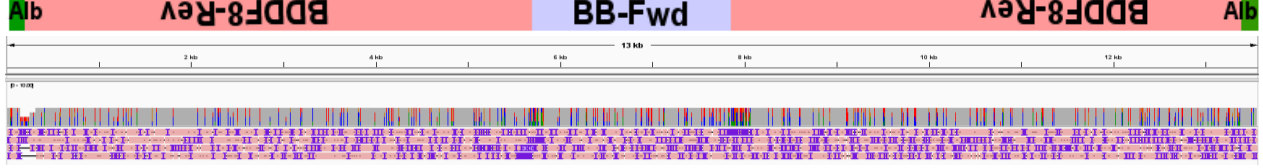


Figure S5D. The visualization of three-fragment insertions, specifically the insertion of one plasmid backbone fragment and two F8 pieces.

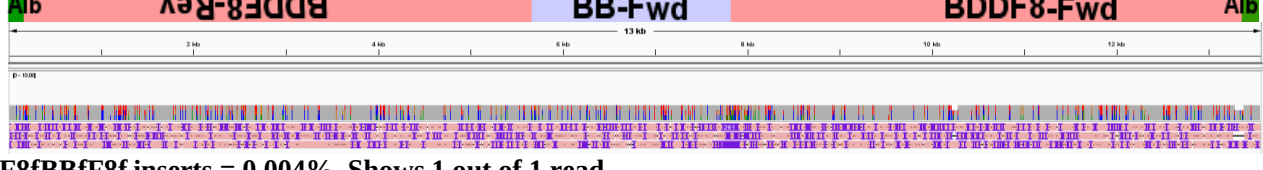
F8fBBfF8r inserts = 0.02%. Shows 4 out of 4 reads.



F8rBBfF8r inserts = 0.02%. Shows 4 out of 4 reads.



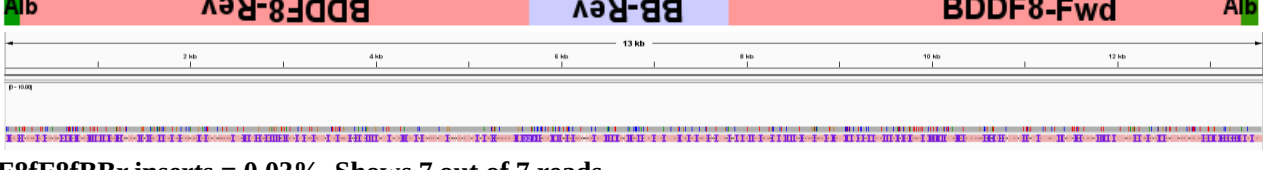
F8rBBfF8f inserts = 0.01%. Shows 3 out of 3 reads.



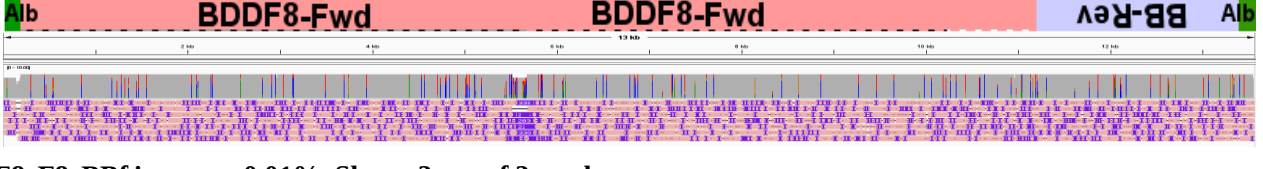
F8fBBfF8f inserts = 0.004%. Shows 1 out of 1 read.



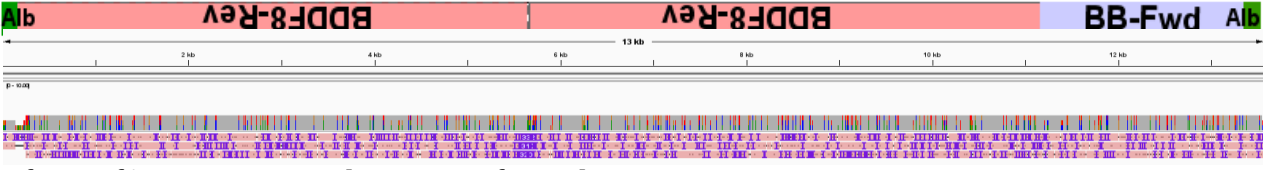
F8rBBrF8f inserts = 0.004%. Shows 1 out of 1 read.



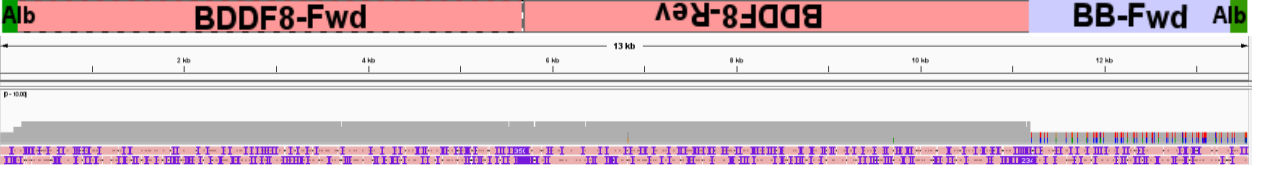
F8fF8fBBr inserts = 0.03%. Shows 7 out of 7 reads.



F8rF8rBBf inserts = 0.01%. Shows 3 out of 3 reads.



F8fF8rBBf inserts = 0.01%. Shows 2 out of 2 reads.



F8rF8fBBr inserts = 0.004%. Shows 1 out of 1 read.

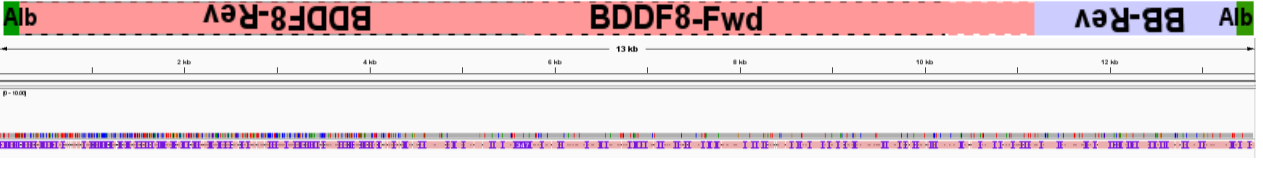
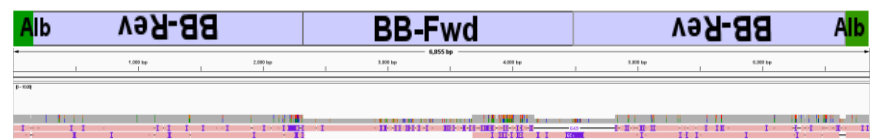


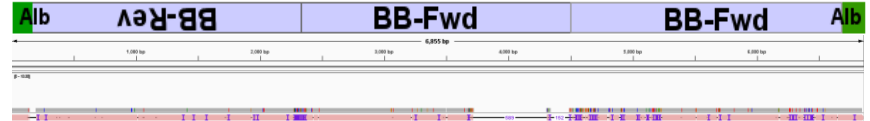
Figure S5D. The visualization of three-fragment insertions, specifically the insertion of one plasmid backbone fragment and two F8 pieces (continued).

E Three-fragment insertions: BB+BB+BB

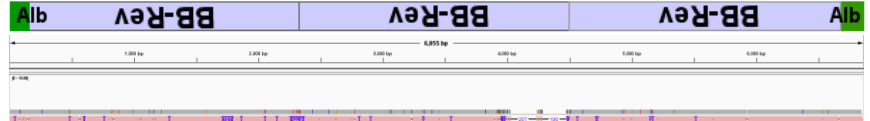
BBrBBfBBr inserts = 0.01%. Shows 2 out of 2 reads.



BBrBBfBBf inserts = 0.004%. Shows 1 out of 1 read.



BBrBBrBBr inserts = 0.004%. Shows 1 out of 1 read.



BfBBfBBf inserts = 0.004%. Shows 1 out of 1 read.



BBfBBfBBr inserts = 0.004%. Shows 1 out of 1 reads.



F Three-fragment insertions: F8+F8+F8

F8rF8rF8r inserts = 0.004%. Shows 1 out of 1 read.

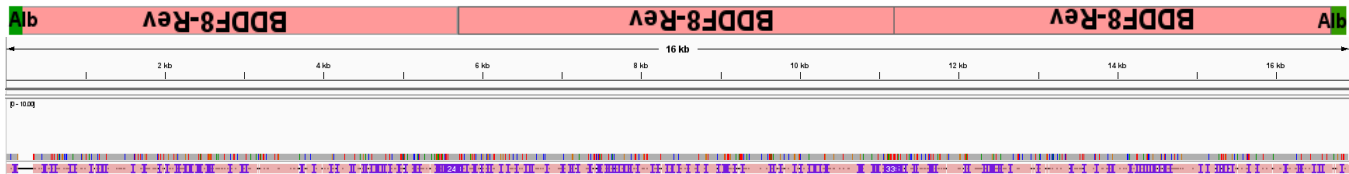
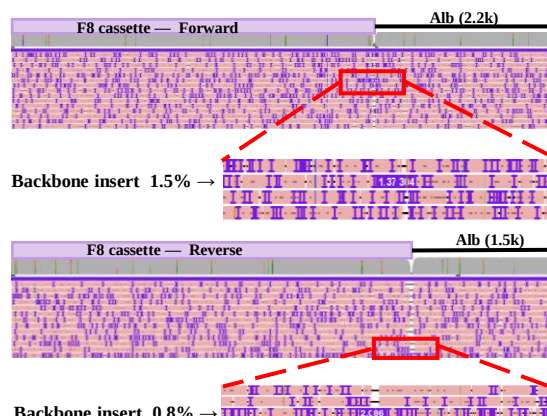
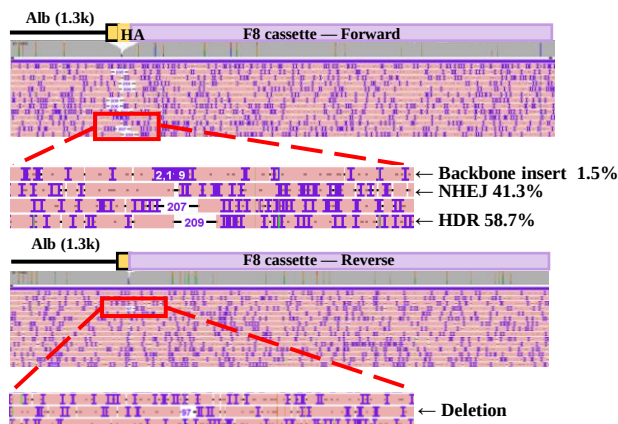
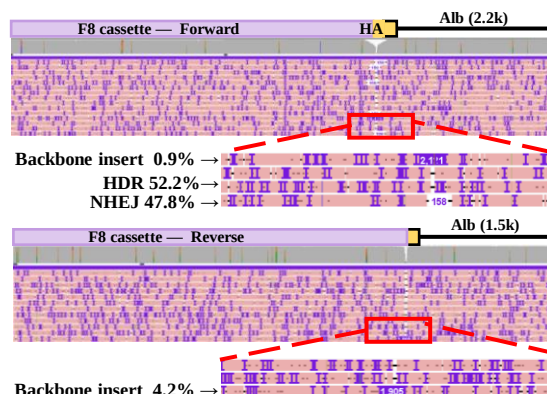
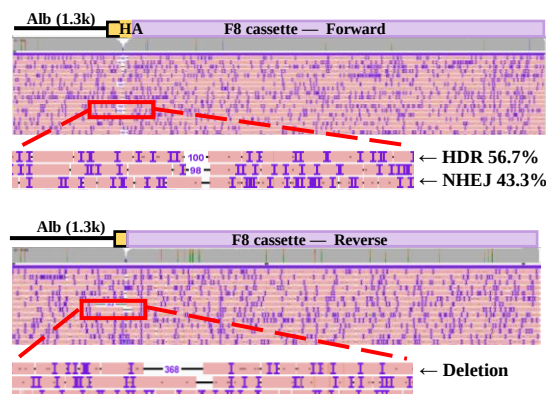


Figure S5. The visualization of three-fragment insertions, specifically the insertion of three plasmid backbone fragments (E), and three F8 pieces (F).

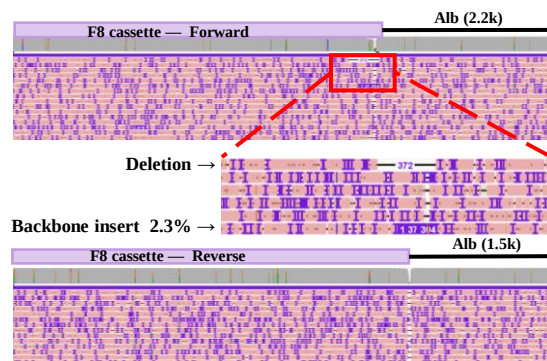
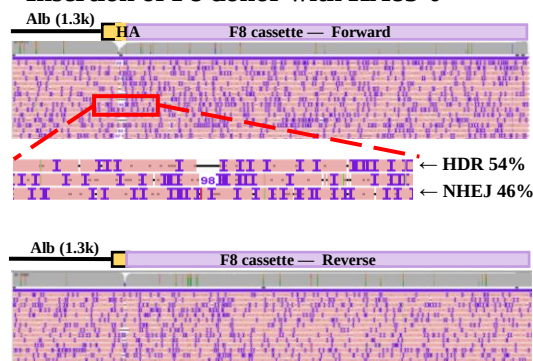
Insertion of F8 donor with HA190-0



Insertion of F8 donor with HA85-130



Insertion of F8 donor with HA85-0



Insertion of F8 donor with HA600-600

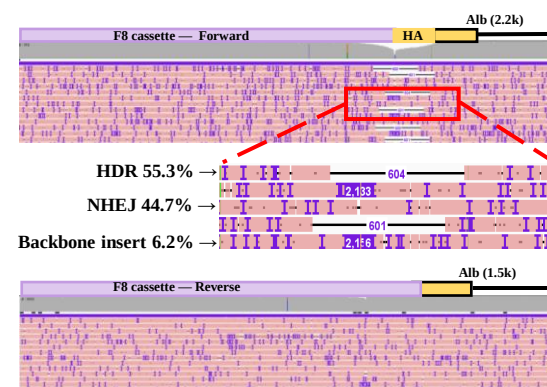
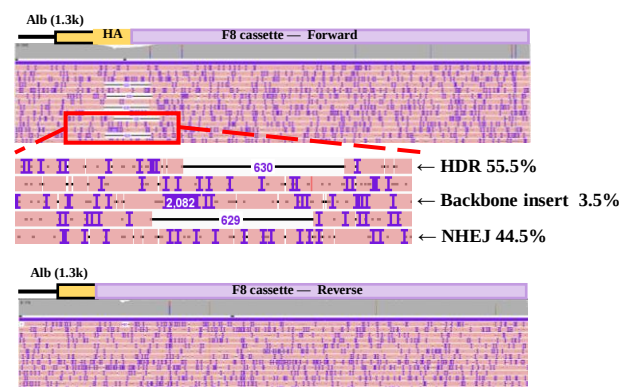
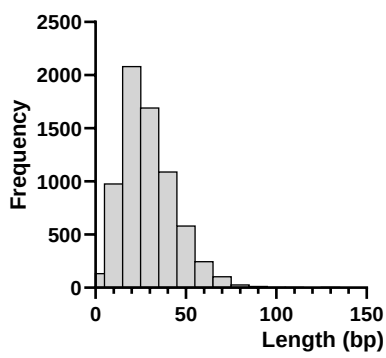


Figure S6. The Integrated Genomics Viewer (IGV) was used to visualize the PCR products obtained from mouse liver edited with donor plasmids containing varying lengths of homology arms (HA190-0, HA85-130, HA85-0, HA600-600). Alignments of 15 randomly selected reads were presented.

A Length distribution of deleted Alb fragments in the junction PCR of F8 donor inserts with HA85-0



B Length distribution of deleted F8 fragments in the junction PCR of F8 donor inserts with HA85-0

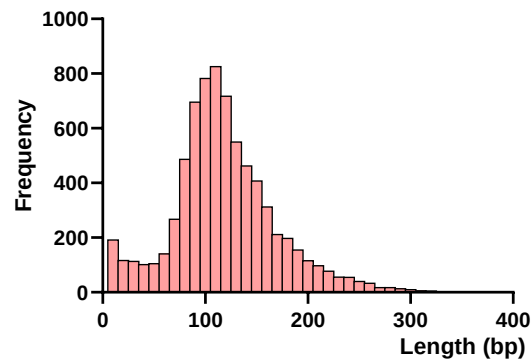


Figure S7. Length distribution of deleted Alb and F8 fragments in the junction PCR of F8 donor inserts with HA85-0.

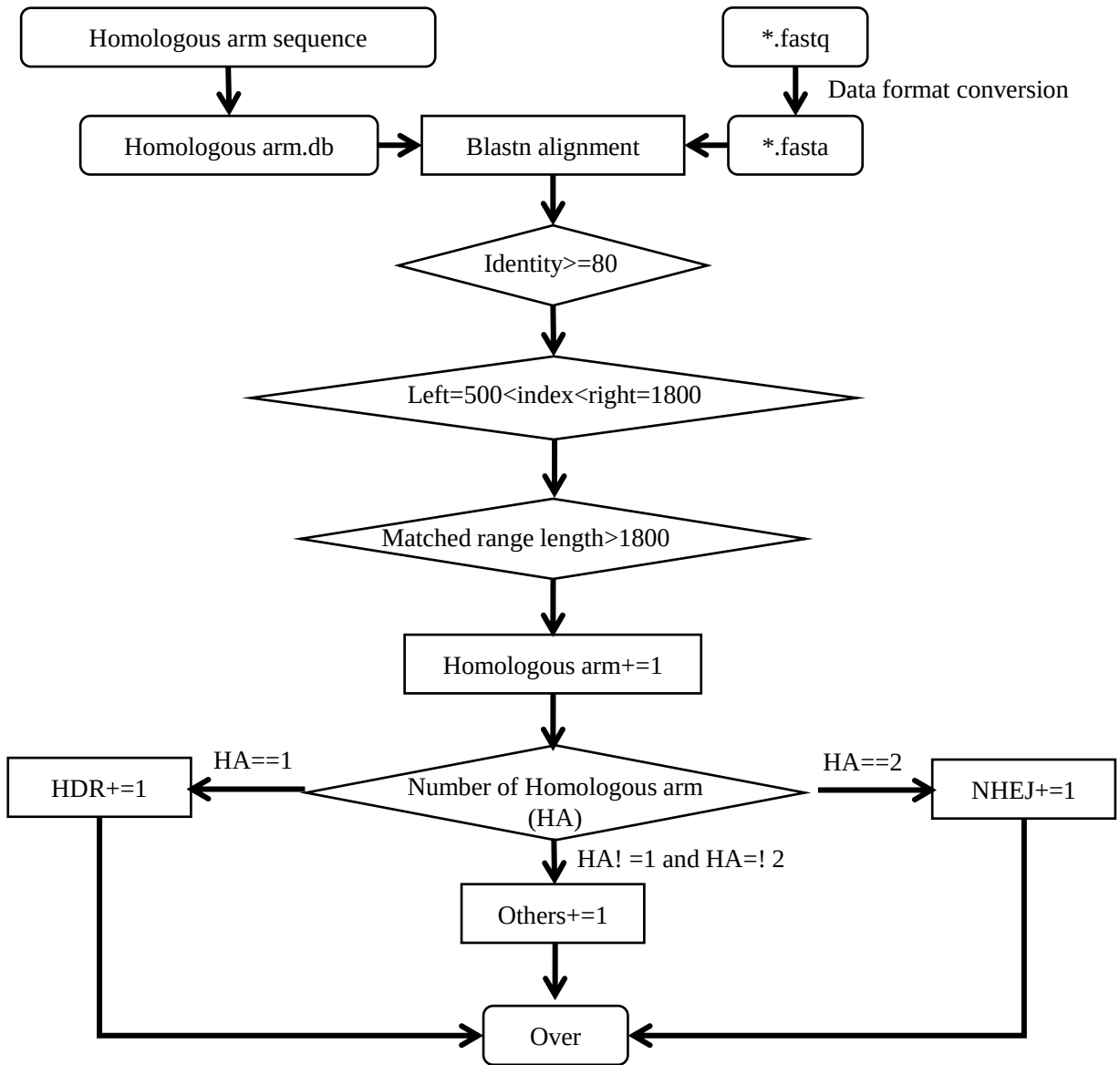
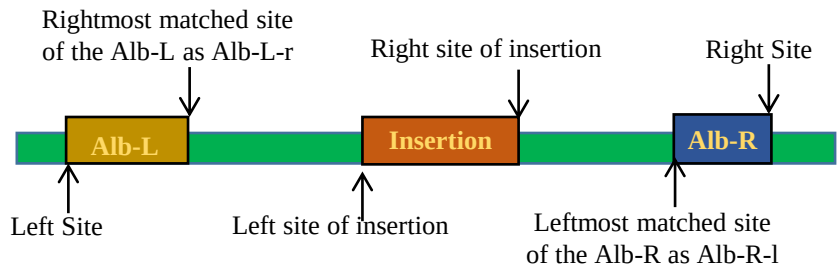


Figure S8. The flow chart of data processing to distinguish between non-homologous end joining (NHEJ) and homology-directed repair (HDR) was employed using a donor with 600bp-homology arms as an example. The corresponding arm sequence was searched using the Basic Local Alignment Search Tool (BLAST), and the proportion of inserts mediated by each repair pathway was determined. First, the homologous arm sequences were aligned with the sequencing file, and reads with an identity score of 80 or more were selected. Next, the range of alignment was restricted to ensure that the homologous arms were located near the target site. Then, to exclude artifacts caused by incomplete sequencing of Nanopore sequences, the length of the screened reads was limited. Finally, reads that matched up to two copies of homologous arms were considered ‘NHEJ,’ while reads that matched up with only one homologous arm were considered ‘HDR.’ Reads that did not meet either condition were considered ‘Others.’ The reference sequence was generated by directly inserting the donor with homologous arms into the cleaved genomic sequence.

A. Schematic definition of terms used in the data processing



B. The flow chart for processing data to analyze endogenous genomic DNA insertion

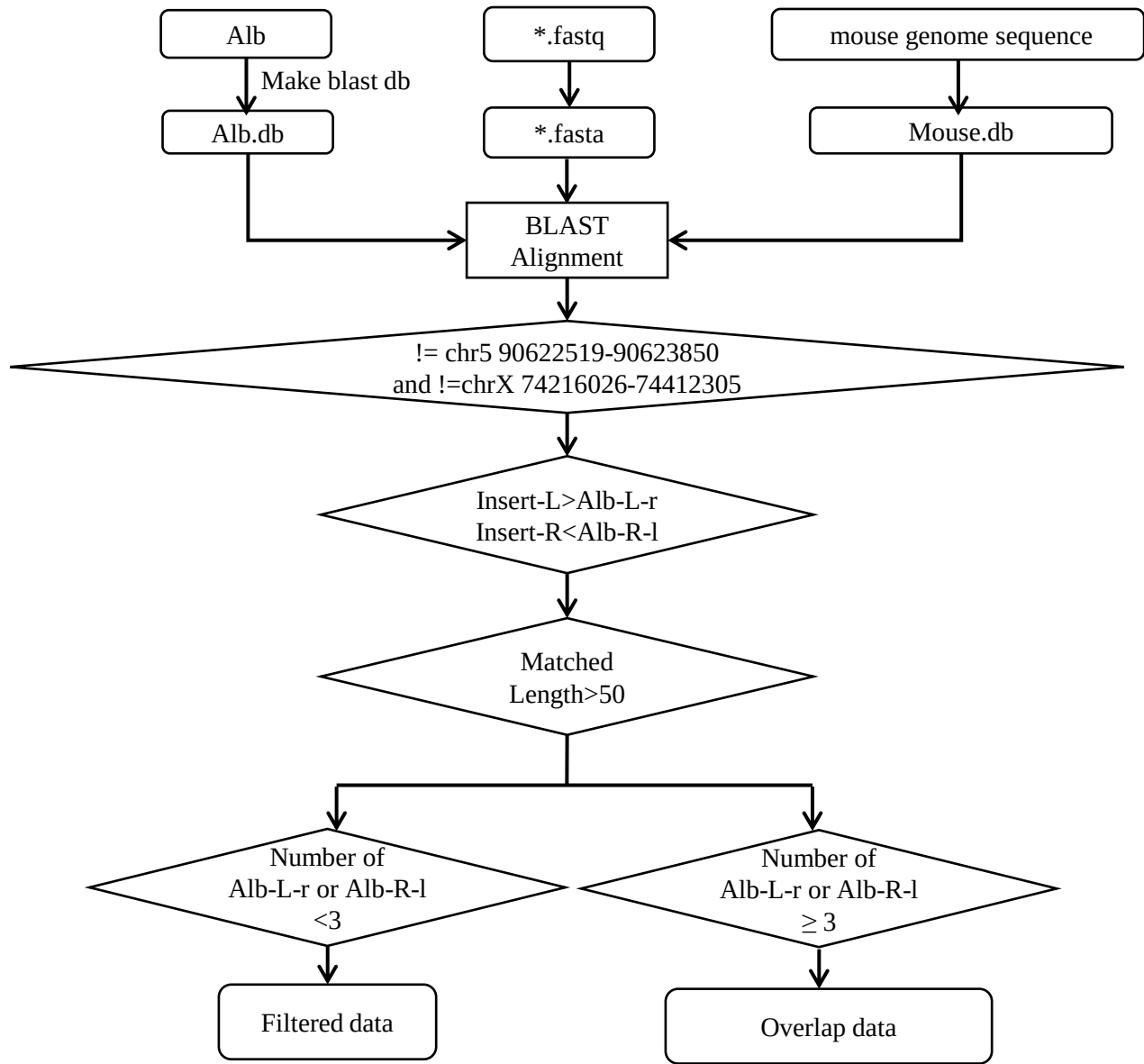


Figure S9. The flow chart outlines the data processing steps for analyzing endogenous DNA insertion. (A) Definition of terms used in the data processing. The upstream homology arm near the cut site is called Alb-L, while the downstream homology arm is called Alb-R. The rightmost matched site of Alb-L is Alb-L-r, and the leftmost matched site of Alb-R is Alb-R-l. (B) Generation of database files containing the 332bp homology arm sequence (represented as Alb in the figure), the mouse genome sequence, and the LINE-1 sequence. The sequencing data format is then converted from *.fastq to *.fasta. Subsequently, the sequencing file is aligned with the homologous arm sequences and the mouse genome sequence (or the LINE-1 sequence), with sequences matching the Alb gene range on chr5 and F8 gene range on chrX being eliminated. The insertions between Alb-L-r and Alb-R-l are limited to ensure that endogenous DNA fragments integrate the target site. Indexes matched with a length of less than 50bp are removed, and the occurrence number of Alb-L-r or Alb-R-l greater than three is considered to derive from the same amplicon and counted as the same type of insertion.

CGCTCACAAGCAATGCAAGGCACGTACGTTTACTTATGTCATTGGCTATGGCTAGAAGTGCAAAATCCCAAGCTCTGCTAATACTTTTCTAAACATCCATCATTTCTTTGTTTTCAGGGTCCAAACCTTGCTACTAGATGCAAGAACGCCCTTT
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GTGACCAGAGCAATGCAAGGCACGTACGTTTACTATGTGCATGGCTATGGCTATGAAGTGCAAATCTCAACAGCTCGCTGCTAATCACTTTTCTAACTCCATCATTTCTTCTTTGTTTCAAGTTCAAACCTCAGCACTTGGGAGGCAGAAAGGCAGA
TGGGTCTCTCAAGTTCACGGCCAGCTGTGCTACAGAGTGAATTTACAGAAACAACAGGCCTACCCAAAACAGTGTCTCACA AAAACCAAAAAAAAAAAGAAAAAGAAAGAAAGAGAGAAAAAGAAAGAGAGAGAGAGAGGGAGGGGTG
CAGGGCTGTCAAAAACAGCTAGATTTATAGCAGGCCAAAAAAAACAGTCTCTAAAAATTTTTTTTAACTCTGGAACCTTTCTTAAATATAGAGTAATAAAATTACATGACACTCATGAGTCCCTGGCTGGCTGGGGAAATTTGAAAA
AGAGCTTAACTCAACATGCAAGCACTCTCCAGGTAACTATCTCTGGGACTTAAAAACATATCATCAATCATTTTCTTCAAAAACGATCAAGACTGAATCACTTTTGAACAAGGCCATACAGACAAGCAACAGCTGGCACTCTTAGGTTCT
TCAAGTATGGTCATCAGTTTGGGTTCCATTATGCCAGATAAGAAAC

[illegible]

ATGTCAAGGCAGTACGTTTACTATGTGACGTTTATAGGCCATGAAGTGCAAATCCTACAGCTCTGCTAATACTTTTCTAACAATCCATCAATCTTGTTGTTCAGGGTCGCAACCTTGCTCAATGATGCAAAAGACGCTTCAGTTTCTCGCCA
 TATTTGGCATCCATTATATTCTCATTTTCGCGAATTTTCAGTTTCTGTCGCCAATATCCAGGTCCTTCAGTGTGCAATTTCTCAITTTCTTTACGTTTTTTAGTGATTTCTGTGATTTTCAAGTCTTCAAGTGGATGTTTCTCATTTTCCA
 TATTTTCAGTTCTTTGTCACATCAACCAACCAACTCTCTTCAGTGCAACTATATTGGGACTTAAAAAACAATATCATATCAATTTTCTCTAAAAAGCTCAAGACTGATAAACCATTGCAAGAGCTATACAGATGCCACAGCTGGCACTCT
 TAGGTCCTTCAGGTATGGTCATCAGTTTGGGTGCCATTTGTAGAT

CGACGACCAGCAATGCAAGGCACGTACGTTTACTATGTCATTGCTATGGCTATGAAGTCGAAATCTCAACAGCTCCTGCTAGCAATACCTTTTCAACATCCATCATTTCTTTGTTTTCAGGGTCCAAACCTTGTCATTAATGCAAGAC
GCTCAGCTGCTTAAAGGTGGAATTTCTCAATTTTCGGTAAATTCAGTTTCTCGCAGATATCCAGGTGCTCAGTGTGCAATCTTCATTTTTCAGGTAATTTAGTGATTTGGGATTTTCAAGTGTGCAAGTGGATGTTTCTCATTTCCATG
TTTTCAGTTTTCAGGCTTCAAGCTCTCAAGCTCTCAAGCTGGGACATTAATTTTCCATCCTTTCTCAACATCAACAACCAAGCTCTTCAGCTAGCTATCTATCTGGGACTAAAAACATATCATATCATTTTCTCAAAACCTCAAGCACTCA
TAACCATTTGAGTAGOCATACAGACAGCACCAGCTGGCACTCTTAGGCTTCAGCTATGGTCATCAGTTTGGGTCCATTTGTACATAAAGATTCAT

GAGCAATGCAAGGCCAGTACGTTTACTATGTCAATGGCTATGGCATGAAGTGCAAACTCTAACAGCTCGTAACTCTTCTCAACATCCATCAATTTCTTGTGTTAGGGTCCAAACCTTGTCATAGATGCAAAACTACTTAATCCTTC
 CAAACAATATGTTGTTTCAGTGAATCACTCACTCAATCTGTGTCACAGTGTGGTTTATCATTTTCCATGTTTTCATTTGTAACCTATTGAATACACTGTTCTACAGAAATCCATTTTCCAAAGAATGGTTTTCAGTGAATCACTC
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AGGACACGGTACGAAATGCAAGGTACTCTACGTTTACTATGTCTAGCCTTAGTGCTAAAGTGCATAACGCTCTGCTATAACTTTCTTAACATCCACTGCTCTCTTTGTTTTCAGGGTCCAAACCTTGTCATAGATGCAAAGACGCTCTCTGGCTCTGAGGCCATCTAGTCTACAGAGTGAGTTGCCAAACCAACGAGGCTACACAGAGAAACCTGCTCTCAATGAACAAAAACACAGAGTAAACAAACAAAGGTTAGAAAGAAAGCTAATGGCTAAACACATCACAACACCAACCTTCTCAGGTAACATACTCTGGAGACTAAAAACATATGATAATCATTTTCTCTAAACGATCAAGACTGATAAOCATTAGCAAGAGCCATACAGACAAGCACAGCTGGCACTCTTAGGGCTCTCTCATGTATGGTCATCAGTTTG GTTCTCACTTGTAGATAAAGAAC

GAGCAATGCAAGGCACTGACGTTTACTATGTGTCATTGCTATGGCTATGAAGTGCAAATCTCAACAGCTCTGCTAATCTTTTCTAACATCATCATCTTCTTGTTTTCACGGGTCCAAACTCTGTGCTCAAGAAATCACTAAAAACGTGAG
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CATCTGACGACTTGAAAAATGAAACATCTAAAAATGACGTGAAAAATGAAATGCACATCAAGCACTGGAATATGGCGAAAAATGAAATCATGAAAAATAGAGAAAATACACATCTTTAGGACCTGACATCAACCAACCACTCTCTCGG
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TC AATT CAG CAGCAAT CCAAGG TAAT GTAC GTT TACT TGT G CATT GCCT ATGG CTATGA AGGCAAA CTCTCA ACAGCT CTTGCTAAT ACTT TCTCAACAT TCATCATT TCTTTG TTTGTTTC CAGGGTCC AAAACC CCGACCC AGCCTG TTTTATTTTA
GGGGTGGGTAGGGGAGGGGGGGTGGGTGGGTATGGGGGACTTTGGGATAGCATTGAATGTAAATGGAGCTAAATACCTTAATAAAAAATGGAAAAA AAAAAATTCGAGAAAAATCACACTATAATAGAAATGGTTCCTAAACACATCAACACCA
CAACCTCTTCAGGTAACTATCTTGGGACTTAAAAAACAATAATCATATCATTTTTCTTAAAACGATCAGACCGATACCATTTTGACAAGAGCCATACAGACAAGCAATTAGCTGGTACTTAGGTCTTCACGTATGGTCACTAGTTTGGCT
CCATTTGTAGAT

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GATAAAGAAACT

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[illegible]

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TGCATCATATATAGTGAACAAACAGTAAAGCAAGTACGACATGCAAAAAATTAGACAAAGTCTAAACACATCACAATGCGCAACCTCTCAGGTAATCACTACCTTGGGACTTAAAAATACAATATCAATTTTCCAAAAACGATCAAGGACGTGAAA
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AGGCTCTTAGCAAGGCACATACATTTTACTATGTGCATTGCTATGGCTATAGAAGTACAAATCTAACAGCTCGTCTGAATACCTTTTCTAACATCCATGTTCTTTTCTTTTTTTTGGGAACACCCAGCTACCCCTCTGACACTTGCCTTCTGCC
CTTCTATCAATCTAGGCATAGTTAACTTAATTAATGAAGGCTCAGCTGACCTTCAAAGTGGGTGTGTCTTGTGATCTCATCTATAGGTTGGGAAGACAGAAAGTACACAGCATACCTCCAAATGATAGTACTATATTAGTGAACAA
ATATAAGACAGCATGCAAAAATTAGATAGTCTAACAGCATCTCAACAGGCTTCTCAGTAGTACTTCTTGGTCTTAAAAAGCTATATATCATATACATCACTTTTCTCAAGCTCAAGACTGATAAACCATTGTGACAAGAGCCATACA
GACAAGTCCAGCTGGCATTCTAGGCTCTCAAGCATGGTCAAGTCAGTTGAGGTTTCCCATCTGATAGAAGAAAC

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TTGATGATAAATAACTG

CAATGCAAGCAGCGTACGTTTACTATGTCAATTGCGTCGTGGCTATGGCGAAATCCCAACAGTCCATAATACTTTTCTAACATCCATCTTCTTTGTTTTCAGGTCCAAACCTTGTCACTAGATGCAAAAGACGCCTTAGCTCCTCACAGGCCTACAGCCATCGAAGGTACGCTGGGCTGGGCTGAGTCACTATCTCTTTAGTGGTCTCAGACAGCTGTAGTGAGTGGCTCTGCBCATGCTCCAGAGTACTGTAATCGCTCAACAGAGGGGCAAGGTTTATTTGGGCGCAAGTCTGCAAGAGTGCCACTGGGTGAGTGTGCTATCTTTCGATAGACATATTAGTAGCAAGATAGATGGCAAGGAAGATGGGCAGGCCAAGATAAATAGCTCTCTGGGTGACAGGCAACAAATGGAGGCTAGGAGGACCAAGGATTCATTGTCCCTCTGTAGCGCAAGCATGCTTCCACAGGCTCCTTCCACAGG600CTCCTCTTCTCCATCTCAGAGGGCTTGACAATGCAAGGCAAGCTTAAACCAAGCTCTTCAGCAATGGGCTTTGAAGATCCAAATACAAACACCTTACAACAGGCACTGGCCAGCCATAGCAAGCTCAGTCTTCTTAAACACATCCAGCAACCTCTTCAGGTAACATAATTTTCTTAACGATCAAGACTATAACCAATTTGACAAGAGCTATACAGACAAGCACCAAGCTGGGATCTTAGGCTCAGCGTCAAGTCTCGGCCCATTTGTAGACAGAAAGATG

Figure S10. (A) The representative read sequences display the insertion of a single piece of genomic DNA fragment at Alb (continued).

AGCACTCTCCAGGCTCTTAGCAATGCAAGGCAGTAGTTTACTATGTCAATGGCTATGGCTAAGTGCAAACTCTAACAGTCCCAAGTATAATCACTTTTCAACATCCCATCTTTCTTTGTTTTCAGGGTCCAAACCTTGTCATAGATG
GCAAAAGAGGCCAAGGTACCACTCTATCCCCAAACATTTCTGGGATTTCTATCTAAGAGCTGTACAAATCGTCCTAAAAATTTTGAATTTCTAGTTAGAAAGTACAAACCTGGTAGTATGCCTAAAGACATACAGAACCAACCT
TCTCAGATAACCATCTTGGGACTTAAAAACATATCATATCATTTTCTTAAACGATCAAGACTGTATAACCATTTTGACAGAGCCATACAGACAGACCAGCTGGCACCCTCTTAGGTTCTACGTATGGTCATCAGTTTGGTCCA
TTTAGATAAGAACTGAGGTGC

GTGACCAAGCAATGCAAGCAGTACGTTTACTATGTCACTGTTTATGGCTATGAAGTGCAAACTCTAACAGCTCTGCTAATCACTTTTCTAACATCTATCATTTTCTTTGTTTTCAGGGTCCAAACCTTGTCATAGATGCAATTTAAACCAAGAGATAGACTCAAGATGTTTCAGAGGAAGAGGGGAAGAAGCTCTCTAATTATAGAGCATCACTATGCCAGGTATAAAGAACGCTGCAAAAGTAGGGCTAGGGGTGCAGCTCATAGAGCCTTAAACACATCATCAAAATCCCAACCTTCTCTCAGGTAACTACTCTGGGACTTAAACATAATCATAACTATTTTCTTAAACGATCAAGACTGATAACATTGTACAAGAGCCATACAGACAAGTACCAGCTGGCACTTCCAGTCTTCTGTATGGTCACTGTGGTTCCTTTGTAGATAAGAAA

[illegible]

AGTCAATGAGCAATGCAAGGCATATGTTTCACTAGGTCATTGCGTATGGCTATGAAGTGCAAATCCTAACAGCTCTGCTAATACCTTTTAAACATCCATTTATTTCTTTGTTTTCAGGGTCCAAACCTAGCTGGATATAAAATTAACCTAAACA
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AAAC

CAGTGACCAGAGCAATGCAAGGCACGTACGTTTACTCGGTGCATTGCGTATGGCATGAAGTGCAAAATAAAATAGTCTGCCAGGTACTTCTAACATCCATCAATTCTTTGTTTCAGGGTTATTGTCTACGCGAGCGGCATATATT
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CAGTCAACAGCAACCATCTGGGCACCTCTGATGTTCTCAAGTATGGTGCATTAAGTTGGTCTCATCTTTTATGATAAG

[illegible][illegible]

CTCTACGGAGCTCTTACCAATGCAAGGCAGTACGTTTACATGTGCTATTGCTATGGCTATGAAGTAAATCCCAACAGTCTGCTAATACTTTTCTAACATCCATCATTTCTTTGTTTTCAGGTCCAAACCTGTGCTAGATGCAAAAGACGCC
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GCATGCAAGGCAAGTACGTTTACTATGTCTATGCCTATGGCTGGGAAGTGCAAATCCTAACAGCTCTGCTAACTCTTCAACATCCATCATTCTTTGTTTGGGTCCAAACCTTGTCAGTACAGTCAAAAGATTATGAGGGCTGAATC
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CGGTGTGAAGCAATGCAAGGCACGTACGTTTACTATGTCAATTGCGTTATGGCTATGAGTGCAAAAACCGAAGCAGCTCTGCTAATACTCTTGACACTCCATCATTTTGGTTGAGGGTCCAAACCTTGTCAACTAGACGCAAGAAGCGCCTTAGAAA
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TCTTGCCATAATACCGCTTTTAGTTCGCGACTTAGTGA~~AACTGAACTGAACTGG~~CTGC

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AGACTGATAACCACTTAAGCAACCTACAGCAACAACACGACTGGCATCTTAGGCTCTTACAGTATGGTGTCACTGAGTTTGGGTCCACTTTGTAGATGAATCTG

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GACACGGTAGCAATGCAAGGCACGTACGTTTACTTCGTGTCATTGCCTATGTATTATGCTGCAACTCTTAAACAGTCCTGCTAATACCTTTTCTAACATCCATCATTCTTTGTTTTCAGGGTCCAAACCTTTGTCACTAGATGCAAGACGTCTTAGGCCCAACATTGCAACCAAGGTAGGGAGAATCTCACTTTTTCAAAATAAGGAGGCTCATTGAGTGATGTGGCACATAOCTTTGTTCCAGCACTCAGGAGGCAGAAGCAAGTGGATCTCTGAGTTTGAGACCAATCTGGTCTATTTAACAGTTTCCAGACCAGCCAAGTTACATAGTGAGCCTAAACACATCACAACCACAACCTTCTCAGGTAACATATACTTGGGACTTAAAAAACATAATCATAATCATTCTTCTCTAAACGATCAAGACTGATAACCATTTGACAAGAGCCATACAGACAAGCACAGCTGGCACTCTTAGGTCTTCAAGTATGGTCATCAGTTTGGGTTCATTGTAGATAAGAAAC

Read #36 Alb-chr11-Alb

CCGTCCACAGCAATGCAAGGCACGTACGTTTGGGCAATTATGTTCATTCGCTATGGCTATGAAGTAAATCCCAACAGTCCTGCTAATACCTTTTCTAACATCCATCATTCTTTGTTTTCAGGGTCCAAACCTTTGTCACTAGATGCAAGACGAGACCTGCCTGCTCTGCTCCGAGTGCTGGGTTATTTTATTTTTTATTTTTTGGTTTTTTCGAGACAGGGTTCTCTGTGTAGCCCTGAGTGCTGGGTTAAAGGCATACCTAGTCTGGTCTGAACCTTTTTTTCTTTTAAACATGTCTTAAACACATCACAACCACAACCTTCTCAGGTAACATATACTTGGGACTTAAAAACATAATCATAATCATTCTTCTAAACGATCAAGACCGTGATAACCATTTGACAAGAGCCATACAGACAAGCACAGCTGGCACTCTTAGGTCTTCAAGTATGGTCATCAGTTTGGGTTCATTGTAGATAAGAAAC

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Read #38 Alb-chr14-Alb

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Read #39 Alb-chr15-Alb

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Read #40 Alb-chr16-Alb

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Read #41 Alb-chrX-Alb

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Figure S10. (A) The representative read sequences display the insertion of a single piece of genomic DNA fragment at Alb (continued).

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[illegible]

20

[illegible]

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Read #50 Alb-F8-chr3-BB-Alb

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Figure S10. (E) The representative read sequence displays the insertion of F8, plasmid backbone, and genomic DNA fragments at Alb.

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gaaatccaaaacaccatcagatccttcaaaaaggctatactcaaaaactggaaaactggacgaatggacaaaattctggacagataccaggtaccaaggtgaatcaggat
caagttgacatgatgaagagctccatcactaaagaataagagaggttattaatagcttccaaacaaaaaaagccaggagaccagatgggtttagtgagagttctatcagagctt
caaagaagatctaattccaattctgcacaaactatttcacaaaatagaagtagaaggtacttaccacactcattttatgaagccactattactctgatacctaaacacagaaagatcc
aacaagatagagaactcagaccaatttctttagaatatcgatgcaaaaatcctcaataaaatctcgtaaccgaatccaagaacacattaaagcaatcatccatcctgaccaag
taggttttattccagggtgagggatggttttaataacgaaaaatccatgaatgaatccattataaaacaaactcaagacaaaaaccacatgatcatctgttagatgcagaaaaa
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aaggagatcaaggggatacaaatggaaaaaggaagtcaaaatatcatttttcagatgatgatagatatataagtgacctaaaaatctaccagagaactcctaaacctga
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agtcacaaaataataaaatatttggcgtgactctaactaaggaggtgaaagatctgtatgataaaaacttcaaatctctgaagaagaatgaagaagatctcagaagatggaa
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gagcaatttgataaaaactgcatggtactggtatagagacagacaagtagaccaatggaatagaattgaagatccagaatgaaccacacaccttaggtcacttgatcttcgacaa
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tggaatcagctggtggttctcagaaaactggacatagtagtaccggaggatccagcaatacctccttgggcataatccagaagatgccccacaggtaagaaggacacatgct
ccactatgttcagagcgttatttataatagccagaagctggaagaacactagatgccccctcaacagaggaaatggatacagaaaatgtgtacatctacacaatggagtactactca
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caaaacacccatggaaggagttacagagacggagtttgagctgagatgaaggatggacatgtagagactgcatagccaggatccacccataatcagatccaaacgctga
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ggtgggcaggggagtgggggtgggtggataggggacttttggtatagcattggaatgtaaatgagttaaatcctaataaaaaatggaaaaaa

Figure S11. The consensus sequence of L1MdA_I in the LINE-1 family.

Read #1 **Alb-L1-Alb** @6054e536-fd9d-4ce6-bf33-b065bed95978
GGGACCTCAACTCTGGAAGCAATGCAAGGCAGTACGTTTACTATGTCATTGCCTATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCCATCATTTCTTTGTTTTTCAGGGTCA
AACCTTGTCTAGTAGTGAAGAGCGCTTAGTCAAAATTTAGAAATTTTAGGGTCTTTATATATACATCATATCATCTGCAAAAAGTGATATTTTGACTTCCTCTTTTCAATTTGTATCTCCTTTGATCTC
CTTTTGTGTGCGAATTTGCTCTAAACACATCACAACCACAACCTTCTCAGGTAACATACTTGGGACTTAAAAACATAATCATAATCATTTTCTCTAAAAACGATCAAGACTGATATACATTTGACAAGAG
CCATACAGACAAGCGCGAGCTGGCACTCTTAGGTCTTCAAGTATGGTCATCAGTTTGGGTTCCATTGTGA

Read #2 **Alb-L1-Alb** @88a19c42-27f1-4911-b00a-1e132alb9c61
ACATGAGGAGCAATGCAAGGCACACTTTTGTACTATGTCATTGCATATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCCATCATTTCTTTGTTTTTCAGGGTCCAAACCTT
GTCCACTTGTCAATGCAAAAAGAGCGCTTAGTCAAAATTTAGAAATTTTAGGGTCTTTATATATACATCATATCATCTGCAAAAAGTGATATTTTGACTTCCTCTTTTCAATTTGTATCTCCTTTGATCTC
GTACCACTAAACACATCACAACCACAACCTTCTCAGGTAACATACTTGGGACTTAAAAACATAATCATAATCATTTTCTCTAAAAACGATCAAGACTGATAGCAAAATTTGACAAGAGCCATACAGACAAGC
ACCAGCTAACTCTTAGGTCTTCAAGTATGGTCATCAGTTTGGTGGGTTCCATTGTAGATAAGAAAA

Read #3 **Alb-L1-Alb** @d5a82961-5d4f-4c2e-b8e2-232b26dbf4d8
TTACCTCGATTACCTCAAGCAATGCAAGGCAGTACGTTTACTATGTCATTGCCTATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCCATCATTTCTTTGTTTTCCAGGGGTG
AAACCTTGTCTAGTAGTGAAGAGCGCTTAGTCAAAATTTGCTAGTGTATGCAATGGTGTATCGTTTGGAAAGCTGGTTATAGGATGGATCCCGAGATAGCAGTCTCTAGATGGTCCATCCTTTCTGTC
CAGCTCAAACTTTGTCTCTTAATACTCTACAAACACATCACAACCACAACCTTCTCGAGTAACATACTTGGGACTTAAAAACATAATCACCACGTTTTTCTCTAAAAACGATCAAGACTGATAACCATTT
GCACAAAGGCCATACAGACAAGCAGCTGGCATAACAGAGTCTTCAAGTATGGTCAATGGTTTGGAGTTCCATTGTAGATAAGAGCTGAGGTGC

Read #4 **Alb-L1-Alb** @0d0a64cb-40d1-46c7-bbae-5601d14b962e_R
CGTTACGTTGCAAGCAATGCAAGGCAGTACGTTTACTATGTCATTGCCTATGGCTAAGAGTGCAAACTCCAGTCAGTCCTGCTAATACTTTTCTAACATCCATCATATTTCTTTGTTTTCGTTAGGTC
AACCTTGTCAATGCAAGAGCGCTTAGTCAAAATTTAGAAATTTTAGGGTCTTTATATATACATCATATCATCTGCAAAAAGTGATATTTTGACTTCCTCTTTTCAATTTGTATCTCCTTTGATCTC
TTGCGACACTAAACACATCACAACCACAACCTTCTCCTTCTCAGGTAACATACTTGGGACTTAAAAACATAATCATAATCATTTTCTCTAAAAACGATCAAGACTGATAACCATTTGACAGAAGCTTT
TTCATACAGAGAGACAAGCAGCTGGCACTCTTAGGTCTTCAAGTATGGTCATCAGTTTGGGTTCCATTGTAGATAAGAAAA

Read #5 **Alb-L1-Alb** @845b268b-2288-4aa5-b915-53780c9fa804_R
AGTCAATGAGCAATGCAAGGCAGTACGTTTACTAGGTCAITGGCTATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCCATCATTTCTTTGTTTTTCAGGGGTCCAAACCTTGTG
CTAGATGCAAGAGCGCTTAGAGCTGGATATAAAATTAAGTCAAAAGTCAATGGCTTCTCTACACAAAGATAACAGGCTGACAAAGAAATAGGAACAATACCTTCTCAATAGCTCACAATAA
TATAAAATACCTTGGCTGACTTAATCAAGACCTAAACACATCACAACCACAACCTTCTCAGGTAACATACTTGGGACTTAAAAACATAATCATAATCATTTTCTCTAAAAACGATCAAGACTGATAACCATTTGACAGAAGCTTT
ATTCTACAAGAGCCATACAGACAAGCAGCTGGCACTCAGTTCTCATGCTAGTGTATCAGTTTGGGTTCCATTGTAGATAAGAAAA

Read #6 **Alb-L1-Alb** @9aca963b-8fb1-4709-905c-f0ba2759f766
GAGCCATGCAATGCAAGGCAGTACGTTTACTATGTCATTGCCTATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCAAGGCCATTTCTTTGTTTTTCAGGGGTCCAAACGCTAC
TAGATGCAAGAGCGCTGGGAAGTAGACACAATAAGAAAAACCAAGCATGAGCAAGCTGAAGATAGAAACCTTAGGAAGAGATCTAGAACCATAGATGCGAGCATCAGCAACAGAATACAAGAAATGG
AAGAGAACTCAAGGTGCGAAGATTCCATAGAGAATCTCAGCTTACATCAACCAACCACTTCTCAGGTAACATACTTGGGACTTAAAAACATAATCATAATCATTTTCTCTAAAAACGATCAAGACTGATAACCATTTGACAGAAGCCATACAGACAG
CTGATCAAGACTGATAACCATTTGACAAGAGCCATACAGCCAGACAAGCAGCTGGCACTCTTGGAGTCTTCAAGTATGGTCATCAGTTTGGGTTCCATTGTAGATAAGAAAA

Read #7 **Alb-L1-Alb** @92f1ed7a-d649-470f-bc21-3215f61678e1
GGCTGACAGCAATACAAAGGCACATTACAGTTTACTATATGTCATTGCCTATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCATCATTTCTTTGTTTTTCAGGGGTCCAAACCTTGT
TCACTAGATGCAAGAGCGCTTAGATATCTATTAAATGGGACTTCCCAACCCCAAACTATCAAAAAGACAAGGAAGGCACTTCATCTCATCCAAAGTTAAATCTTCCAGAGAACTTCCAAATTCCTG
AATATCTATGCTCCAAATGCAAGGCAGCCATTCATTAAAGAGACTTTTGTAAAGCTCAAAAGCATTACCTCATACACAATAATAATAGGAGACTTGGCTACTTTTCAATCAATGGATAGATCTGCTGG
CAGAAAACTTAACACATCACAACCACAACCTTCTCAGGTAACATATGAGGACTTAAACATAATCATAATCATTTTCTCTAAAAACGATCAAGACTGATAACCATTTGACCAAGAGAGCCATACAGACAG
CACAACCTAACACTCTGAGGCTTTCATATGTCATCAGTTTGGGTTCCATTGTAGATAAGAAAA

Read #8 **Alb-L1-Alb** @7a05acea-6e10-403a-bfd9-d05e5b25ef5c_R
ACCACATATCAAGCAATGCAAGGCAGTACGTTTACTATGTCATTGCCTATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCCATCATTTCTTTGTTTTTCAGGGGTCCAAACCTTGT
TCACATAGATGCAAGAGCGCTTAGATATGATGATATCTATTAAATGGGACTTCCCAACCCCAAACTATCAAAAAGACAAGGAAGGCACTTCATCTCATCCAAAGTTAAATCTTCCAGAGAACTTCCAAATTCCTG
TGAAGATCAAGTAGCCATAGGTGTGTGGGTTCAATTTCTGGGTCTTCAATTTCTATTTCCATTGGTCCATTTGTGTCTCTATACCAAGTACCATGCAGTTTTTATTACAATTTGCTCTGTAGTAAAGCTTTAGG
TCGCTAAACACATCACAACCACAACCTTCTCAGGTAACATACTTGGGACTTAAAAACATAATCATAATCATTTTCTCTAAAAACGATCAAGACTGATAACCATTTGACCAAGAGAGCCATACAGACAG
ACCAGCTGGCAGCTTAAATGTTCAAGTATGGTCATCAGTTTGGGTTCCATTGTAGATAAGAAAA

Read #9 **Alb-L1-Alb** @05d5093e-f9d6-4514-8d26-c3a74881845f
ATTACCTCAGCAATGCAAGGCACATACGTTTACTATGTCATTGCCTATGGCTATGAAGTGCAAACTTAACAGTCCTGCTAATACTTTTCTAACATCCATCATTTCTTTGTTTTTCAGGGGTCCAAACCTTGT
CACTAGATGCAAGAGCGCTTAGATATGATGATATCTATTAAATGGGACTTCCCAACCCCAAACTATCAAAAAGACAAGGAAGGCACTTCATCTCATCCAAAGTTAAATCTTCCAGAGAACTTCCAAATTCCTG
TAGAAGAATGCAAGCTGATCCATTCTATCTCTGTACAAAAAAGTCTAAGTGGATTAAAGAACTGCATAAAATAGAGACACTGAAACTTATAGAGGGGAAAGTGGGAAGACCTCAAAGATGTGAG
GAAGGGGAAAAATTCCTTGTGCTGTAAGATTGAGAATGGACAATGGGACCTCAAAAATTTGCAAGCATCTGTAAAAAGACAAGGACATTTATCAAAAAAGACAACCACTGCAACCAACAGATTGGGGAA
AGATCTTTACCAATCTATCTCAGATGGGGCTAATATCCAAGATATATAAGAAAGTCAAGGAAGTTGGTGTGTAGAAAAACCAAGTAACACTATTAATAATGGGTACAGAACTAAACAAAGAAATCTCA
AGGAATACCGACTGGCTGAGAAAGCACCTAACAAAATGTTCAACGTCCCTTAATCTTCAAGGAAATGAAATCAAAAACACCTAAGATTCCCACTCACACCAAGTCAAGATGGCTAACATCAAAAATTC
GGTGACAGCAGATGCTGTAGGATGAGGAGAGGAACTCGTCCATTGCTAGTGGATTATGGCTGGGACAGCCACTGTGGAATCAGTTTGGCATTTCTCTCAGAAAAATGTTTCATAGGTTCTACT
GGAAGGTCAGCAGTACCCTCTGAGACATTTTACAGAGAATGCTCAACTTGAATAAGCACACATACCTCACTATGTTATAGCAGCCCTTATTATAGAGCAGGAAGCTGGAAAGCAACAGATGTCC
TCAACAGAGAAATGGATACAGAAAAATGTGGTACATTTACACAACGAGCTATTAACAACTAATGAGTTTCAATGAAATCTTATAGACAAATGGATGGAATATATAATATCATTTAGTGGGTAAACCCAGTC
ACAAAAGAACACATGATATGCACTCACTGATAAGTGGATATTAGCCAAGTTAAATATCCACAGATACATTTTACAAAACACATGAAACTCAAGAAAGGAAGACCAAGTGGACACTTTGACCCCTTC
ATAGAAAGGAGATATAAAATACCCATGGAAGAGTTACAGAGACAATAGAAGTTTCAGAGACAGACTGAAGGAATAACCATCCAGAGAACTGCCCTAGCTGGGATCCCATCCCCAAAAACAACTAAACCC
AGACACTATTGGGATGCCAACATTAATTTGTTGGCAGGAGCCTAACATAGCTGTCTCTGAGAGGTTCTGACGGTTCTGACTAATACAGGAATGGATGCTCAGCTCATCCATTAGATGGAGCATAGG
GTCCCCAATGGAAAGGGAGCTAGAGGAGTACCAGGGAGCTGAAGGTGTATACAATCCCTAGGAGGGAGGAACAATATAACCTAACAGGATATCTGCACCACCAAGGTGGCACTTTTCAGGGGAAATGAT
GGATGTGAAAGTATTAGCAAGGACTTTAGGATTTGCATCTCATGCGCGAGGAGCTGACATAGTAAACGTACGTGCGCTTGCAAT

Figure S12. (A) The representative read sequences display the insertion of a single LINE-1 fragment at Alb.

Read #10 Alb-chr1-L1-Alb @450abd0c-3536-4496-b7d3-78d412798077_R

ATGCAAGGCACGGTAACGTTTACTATGTCTATGGCTATGGCTATGAAGTGAATCTTAACAGTCTGCGGAGAAGTTCTTAACATCCATCACTTTCTTTGTTTCCAGGGTCGGTACCTTGTCTAGATAGCG
AAAGACGCCTTAGCGTGCAAGGGTCAAGTCAATTGGAGGTGAAGTGTCCATAAGGTCACATTAACCAAAAATCTATCTCCAATTGATATAACCTTTATAAAGAAAAATATTAGTTTACTCCAATGAT
TTCAGTCGAGTGAAGGCCAAACCAATTTTCCAGCAATGGACTCAAGAAACAAGCTGGAGTAGCCATTATATATGGATAAATCTACTTCCAAACCCAAAGTTATCAAAAAGACAAGGAGGGACACTTC
ATACTCATCAAAGTAACTCTCCAGAGGAACTCTCAATTCTTAACACATCACAACCACAACCTTCTCAGGTAACATACTTGGGACTTAAAAACATAATCAATACTATTTTCTTAAAAACCATCA
AAGACTGATAACCATTTGACAAGGCCATACAGACAGTACCAGCTGGTACTCTTAGGCTTCAGTATGGTCATCAGTTTGGGTTCCATTTGTAGATAAGAACTG

Read #11 Alb-L1-chr15-Alb @c7c6b1ba-fd1e-4ca1-aded-92dd0734e698

GCACCTGCAACAGAGGACGAATACGAAGGCAGTACGTTTACTATGTCTAGAGTCTGCTATATGAACATGAAGTGCAATCTTAACAGTCTGCTAATCACTTTCTTAGCATCCATCACTTTCTTTGTTTCA
TGCTTCCAAACCTTGTCTAGATAGTGAAGACGCTGTCTCACTTCCTTTTAAAGTCTAGTATGGTTTGTTCATTTCCTACCTGTTTGGATGTGCTTCTCGTGTTTTCTTAAAGGACTTCTACCTGTGT
GGATTGTGTTTCTTCTTTTCTTAAAGCTGTAACCTTAACACATCACAACCACAACCTTCTGAGTAACTATCTTGGACTTAAAAAACATAATCTAATCAATTTTCCCTTAAAAACGATCAAGACTG
ATAACCATTTGACAAGGCCATACAGACAGCAAGCCAGCTGGCACTCTTAGGTTCTACAGTGTGTCATCAGTTTGGGTTCCATTTGTAGATAAGAACTGAGGTGC

Read #12 Alb-L1-chr17-Alb @9df79b4a-32fc-4a67-b4d7-d517944ee53e

CCGTCAACAGCAATGCAAGGCACGTACGTTTACTATGTCTATGGCTATGAAGTGAATCTTAACAGTCTGCTAATCACTTTCTTAACATCCATCACTTTCTTTGTTTCCAGGGTCCAAACCTT
GTCACTAGATGCAAGACGCCTTAGCTATACAGGTATGTGACAACATACCTGGCTGTGTTCTTAAGAAATAGTCCAAAAAATCTCTATAAACAATATAAAATAAAACTGTCAAGCTCTGAGAGAT
GAAATATTTCTCTGTCAAAAACCCATCTCAGGAGAAAAAGACAGGGCCCTACCTCAGAGTGAAGGGCTGGGAAAAACAATTTTCCAAAGCAATGGACTGAAGAAAAACAGCTGGAGTAGCCATTTTAATAT
GGATAAAATCGACTTCAACCCAAAGTTATCCAAAAAGACAGAAGGAGGAGCTTCTATACCTCAAGGTAAAACTCTCAAGAGAGGAACCTCTCAATTCTGTAATATCTACGCACCAAAATGCAAGGGCAG
CCACATTCATTAGAGACACTTTAGTAAAAACCAAGCATACATTGCACCTCACACAATAATAGTGAGGAGGCTTCAACACACCCTTTCTTCAAGGACAGATCGTGAACAGAACTAAACAGGGACACA
GTGAACCTAACAGAACTTATGAACAAGCAGCAGAAATCATAGGCATTGGGCAAAAATCTTCTCATGTGACTTGTGCCATCAGGACCTGGTCAGGTTCAATCATGCATATACCACCTCCATTTTAAAA
GATTATTGTTTGTGTATACGAGTATACTATAGCTGTCTTCAGACACATCAGAAATGGGCATCAGATCCATTGCAGATGGATTGTGAGCCACCATGTGAATGCTGGGAATGGACTTAGGACCTCTGG
AAGAGCAGTCAAGTCTTAACTGCTGAGCTTTCTCTCAGCTCTATACCACCTCCATTGTAATGGATTGCTGCTGTCATGCTACTTATGATTGTTGTGTGCAATAAATCACTTAGCTCATGTGCTG
CGACCTCTGAGTGCATGTTAACTAGCAGCTATTGCAATGTCTAGTTTCCACTGAGGCCAATCAGAGGCCAGGCTGTCTTTAAAGGAGAAATAGTTGTTCAGATACAGGTGAGACGCTTGTTC
AAAACTCAAAAGGCTCTTTCTGTGATTACCTATTTGGTATGCAAGGCTCCAAACAGGACTTCCCGTCTGTGCTACGACCTCAAGTACCATTGGGCTGTGCTGGATCATGTCTCCAGTGGTAGAACA
GCCTGCACAGTAGCTGGATCTGTTGAGGCTCTCTCTGTGCCAGGCCACACAAAACTAACAGCTTTCCAAAGTCATAGTATATGGCTGGAGTAAACAAACCCATGTGAGAGTTGTAATGCTTCCAGAA
GCCAAATAGACCCACTAAACATTATGCTTCTTCTGTTGGGGGGGGGGTGGGTCACCTGCAATTTATTTATCTTCCATACACAAGGAATATCTCTGCATTCCCCACACCCTGGACTCTTAAGGGATTCT
TGCTGTTGTAGACAGTCTTGAATTTTCTCATCTCTGATTCTACATATCTGTATTATACCAATGATGATAGTACACTTCACTTGGCTGCAGCAGCATAATCTCGTCAATATAATTTGCACCAATGTG
ATATTTTGTGGAAGAGTCAGACAAATCAAGTCTCTTAACCTAAGTTATGACACAGAACAGGAGAGTCTATATATCTTGAAGTAAAACTGTAAAGGTATCTAAACACATCAGAGAAAGCCACCACTTC
TCAGGTAACATGCAAGGACTTAAAAACATAATCATAATCACTTTTCTTAAAAACGATCAGAGCTGATAACCATTTGACAAGAGCCATACAGACAGCACCAGCTGGCACTCTTAGGTTCTCAGTATGGTC
ATCAGTTTGGGTTCCATTGTAGATAAGAACT

Read #13 Alb-L1-chr1-L1-Alb @d2d48a3f-5803-4c82-b0fc-7af9a078f5e7_R

CAACAACACTAGCAATGCAAGGCACGTACGTTTACTATGTCTATGGCTATGAAGTGAATCTTAACAGTCTGCTAATCACTTTCTTAACATCCATCACTTTCTTTGTTTCCAGGGTCCAAACCTTGTCACTAGATGCAAGACGCC
TTAGATTCTATTCTTCTCTGTTGACAAGCTCAAGCTAAGCAGATCAACGAATCCACATAAAAAACAGAGACACTGAACTTATAGAGGAGAAAGTGGGAAAGAGTCTCGATGATATGGGCACAGAGGAAAAATCTCTGAACAGCAACT
AGTGGCTGTGCTGTAAGAAATGGGACCTCAATAAATTAAGGCTTCAATTAAGAAAGAGGACAGTGTCAATAGACAACTAGCAACCAAGCAATGGGAAAAATCTTACCAATCTCAACCAATAGAGGGAATAATCCAAAT
TATTAAGAAGCTCAGAAGTTGCACTCCAGAAAAACCAATTAACCTTATTTAAAAATGGGATACAGAGCAACCAAGAACTCTCAACTGAGGACTACCAAAATGTGTGGAAGCAACAAATTTGTTCAACTCTTAGTCATCAGGAAATG
CAATCAAAAACCAACCTGAGATTCCACTCACAAGCAGTCAAGTGGCTAAGATCAAAAACTCAGGTGACAGCAGACACTGGCAAGAAATAGAGAGAGGAGTACTCTCCATTGCTGGTGGGATGCAAGCTGGTACAAACACTCTGGAATC
TGTTTGGTGGTGTCTCAGAAAAATGGACATAGTACTATCAGAAAGTCCAGCAATACCTCTCTGCGGCACTGTCTGAGAAGATGCTCCAACTGGTAAATGACACGTCGCCACTATGTTCTATAGCAGCTTATTATATAAAGCCAGAGCTGGA
GAGAGAGCCAGATGCTTCCCTCAACAGAGGGATGGATACAGAAAAATGTGGCACAATTACACAATGGTGTACTACATAGCTATTAAGAACTTCTAGACAAATGAATTAATGAAGTTCTTAGACAAATGATTCATCTCAAGTGAGGTAAAC
TCAATCAACAAAGAGCTCATGATATGCACTCACTGATAGTGGATATAGGCCAGTAGCTCGGAATACCAAGATACGATTGTGCAAAATATATGAAATCTCAAAAGGAGGACCAAAAGTATGATGCTCTCTATAGAGAGGGGG
GAGCAAAATATCATGGAAGGAGTTACAGAGCAAGTGTACAGCAGAGACTGAAGAAATGACATACAGATGTGCCCACTCGGGATCCATCCCAATAAACACCAACCAAAACAGACACTATTTGAGACACCAACAGAGCTTGTCTGGC
AGGACCTGATATAGCTGTCTCTGAGAGGCTCTGCCACTAACCTGCAAAATACAGAAAGTGGATGCTCAGAGCCATCCATTGGACAGGAGTATCCAGGAAGTATCCAGGAAGTATGAGGAGGTTAGTAGCCCCATAGAGGAACAAAAATATAAAT
AACCAGTACACTGAAGCTCCCTGGAAATAACTACCAATCAAGAAAAATATGTTAGGATTCTGTTCTAGCTGCATATGATGATAGGATGGCTAGTCAGTCAATTAATGGGAAGAGAGGCTCTTGGTCTGTGATGTTCTATGCCCCAG
TATAGAGAACTTCCAGGGCCAGGAATTTGGGGAGTGGGTAGGTTGGGGGACAGGGGATAGGGGGAAGGGGATAGGGGATTTTGTGAGGAAATACCAATTGGAATGTAAATAGAAAAATATCTAATAAAAAATGAAAAA
TGGGGTACAGAGCTTAAACAAAGATCTTCAATGGAGGAATATCAATGCCCAAGAGCACTTAAAGAAATGTTCAACATCTTATGTTACGAGGAATGCAATCAAAACACCCCTGAGATCTCACTCAGCAGCTCAGGATGATATGATC
AAAAAATCAGGTCACAGCAGATGCTGGCAGGATGTGGAGAAAGGGGAGGCTCTCCATTTTGTGGGATGTATAGCTAATAACAACCACTTGGAAATCAGTTTGGTGGTTCTCAGAAATTTGACATAGCACTACCAAGAAATCCAGCTA
TGATCCAGTATGACTCTCTGGGCATATACCCAGAGATGCTTCAACATGTAAATAGGACACAGTCTGTACTATCTATAGCAGGCTTATTATATAAGCAGAGAGTGGAAAGAACCCAGATGTCCCTCAACAGAGGAATGGATACAG
AAAAATGGGCACATCTACACAATAGAGTACTACTTCAGTTTTTTAAATAGGATTAATGATGAAATCTTAGGCAAAATGCAAGCAAGAAATATCATCTGAGTGAGGTAAACCAATCAGAGAAAGACACATAGTATGCACTCACTGAT
AGTGGATATGTTGTTCAAAACCTTCCAAATACCAAGATACAATACTAGACACCACATGGAAGCTCTTAAACACATCAGGACCAACCACTCTCAGGTAACATACTTGGGACTTAAAAAACATAATCATAATCACTTTTCTTAAAAACGGAT
CAAGACTGATAACCATTTGACAAGGCCATACAGACAGCACCAGCTGGCACTCTTAGGTTCTCAGTATGTCATCAGTTTGGGTTCCATTTGTAGATAAGAACT

Read #14 Alb-chr5-ch1-chr2-L1-Alb @6cbc53de-41a9-7842-9844-df95ef5c762b

GCACCTTGACATAGACAGCAATGCAAGGCACGTACGTTTACTATGTCTATGGCTATGAAGTGAATCTTAACAGTCTGCTACTACTTTCTTAACATCCATCACTTTCTTTGTTTCCAGGGTCCAAACCTTGTCACTAGATGCAAA
GACGCTTTAAAAACAGCTGGATCTATGTGACAGTGTGTGTTACTATTGCACTGAAGATTCTTATTTAGTACAAGTAGAGGTAATTAATAGAATATAGATAATTTTGGCAACATACATATTTAGAAGAGCGAAAGTTAATGCTATGCT
ATAAATGACCACTTAAATTTCTGAGCTGGGACATCTGGCAAGGTACTTGAATTAATAGTTTATAAGGAGAGACTTCTGTTCACTCTGCTCTAAGTTAGGTAATGATATAATTAATTTTGGCAAAATAGACTTGGAGAAACCCAAAGCA
AAGGAAGTGAATAGTTTATGAAAAAATAAATCTCAGAGATTTTATGCAAGCATGTTGTATGTGCCAATAGGTCACCACTGTTTATACATAAATGCAATAAAAAATGAAAAAATAAATCTATGCTTCTAGCTCTCTAGCAAT
CAATAAATGACTCTAGAGATTTTAAACAATATCAAGTTAAACAAAGATATAGGTATAGGTTAAATTTGGCTAATGGAACATACATATGATCAATTTCTCTATGTAACTATACAGACATAATATAGTATCTGCTTGGAGGCTCTTGTCTGAG
TACTGTCATATAATTTGTGCGAGTGTCTTGTCTCAACTGACCGCAGTTGAGCTGCCAATAGAAGGAAGAGTGTCCAAACAGGGAATGTGATTGAGCAGATGCAATAAAGAGGAATTTGCTTTAGTGGGAGAAATGTCTTAACA
TTCACTCTGACATGTTTGGCAACCTAGCTCTCAAGTCAGTACCTAAACCTGTGTTCTTATGCTTGTCTCATCAAACTCTTCTGCTGAGTGAATCAACCTGGCTCTGCTGCTCTTATTTAATGTTTCTGCAAAAAATAGGACACAG
GGCAGTTTAATCTTTAGCCAAAGTTGAAGCAACATTAATTAATAAAAAATGTTCACTAATGAATGCAATGCTGAGCTTCTTCAAGCAGCTACTTAAAGTTTGCATTCCATAGTCTCTACACCTTACTCTAAGGCAGAGTCCAAATG
TCTGTACACAGCTATGTGCCAAAGTTTATACAGAAATGATAAATAGTATGATGAATCAATTTAAACAGCTGAAAACTCAAAAGAACCCCAATCAATTGCAAGTATGAGCACATAGGTTTCTGCTGTGAAGAAAGAAATTTGAAAAAGC
TATGCTTTGATATCTTAACACTATTTTAAATAAATAGGCTTTAGATTTTAAATTAAGTAAATTTAAATACAATTTCTGCACTCTCTTCTTCTCTACTGTTTCTTATATTTCCGATGTGGCCATAAAGGCTCAGCTCATATATGTC
TACTTCTTATTTTGGGTTTGTAGACTCTAGATGATGAATATATATAGGACCCCTAAAAATTCACCAAGAGACTCTTAACCTGATAAAGCAGCTCTGGTGAAGTAGCTGGACATAAAATTAACCTCAAAACAGTCAATGGCCCTTTCTACACAAGAAATAA
ACAGCTGAGAAAGCTTATGGAACAAATATAGGAAACCAACCTCTCAATAGTCACAAATAATATAAATATCTCTATGACTTAACCTAAGGAAGTGAAGACTCTGTATGATATAATCACTCAAGTCTCTGGAAGAAAGAAATTAAGAAGATCTCAGAAGA
TGGAGGATGCAATGCTGCTGGGATTTGGCAGGATCAACATTGTAAAAAATGATCTGTGCGCAAAAGGAATCTAGCAATGCAAGGCCATCAAAATCCAACTGCAATGTCTCAAAATGAAATAGAGAGGAGCAATTTGCAAAATTCATCTA
TGTTAGAATACAAAAACCTAGGATAGCAAAAAAAGAACTCTTCTCAGGATAAAGAAACCTCTGCGTGAATCAACCTGCTGGGCACTAAAGCTTTACTACAGAGCAATTTGGTAAAACTGCTATGATAGAGACAGACAAG
TAGACAAATGGAATGAAGTGAAGCCACAGAAATGAACCTTATTAATCACTGTGCTTCTGCAAGGAGCTCAAAACCTCAATGGAAGAAAGACAGCACTTTTCAACAAATGGTGTGCTGGCAGCACTGGTGTGTTATCATGTAGAAG
AATGGGATGATGATCAATCTTATCTCTGTACTAAGGTCAATCTTAAATGGATCAAGAACTTCACATAAAAACAGAGACACTGAACTTGAAGTGGCGGCGGTGGGGGGAAGGCTGAAGATATGGGCACATCAATGCTCTCAACACTCTT
CTCAGGTAACTATCTTGGGACTTAAAAACATAATCATAATCACTTTTCTTAAAAACGATCAAGACTGATAACCATTTGACAAGAGCCATACAGACAGCACCAGCTGGCACTCTTAGGTTCTCAGTATGTCATCAGTTTGGGTTCCATT
TGTAGATAGAAGAACTAGGTGCCGC

Figure S12. (B) The representative read sequences display the insertion of LINE-1 and genomic DNA fragments at Alb.

AGCAATGCAAGGCAGCTATGAAATATATGTCATTGCGCGGTATGAAGTGCATATCAACAGTCCGAGTACCTTTCTACATCCATCAATTCCTTTGTTTTCGAGGGTCGCAAACTCTGTCACTAGATGCAAACTCTCTTCCACAATCCATT
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GAAAGAAATTTATCCAGACAGATGGTACAGGAAGCAGTAGTGTCCCATCTCAATTAACAAATAAACTTTATTAACCTTTGGTATATCAAGAACCCCTTTCCACATTAACGACAGAGAGAGATAGATCTCAAAATCACTCTCATGATGAT
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AATGATACCTCTCAGATAGTCAAAATACATTAACATACCTTTGGTGTGACAAACCGACTCAGGAAGTTTGTATGAGAAGAACTCAAGTCTCTGAAAGAAATATAAGGAAGTCTCAGAAGATGGAAGAGATGCGCAATCTCATG
GATCGCGACAGATTAATATGTAAGAAGGCCATCTGTGTAAGCAATCTATAGAGTCAATGCAATCTTCAAAATTCGCAACTCTCTTCTCATAGACTTAGAGCAATTTGGCAAAATTTTGCAGAAATTTGCAGAGATCAAAAATCT
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GACCGCCACTTGGAGCGACGATCACACGACGAATTAACGACAGCTGAGCTATAGAAGCGGACGCTGCTCGGAAAGGAGGAGGAGAGACAGAAAGAAAGGGGACAGGTTATCCGGTAGCGCGAGGTGCGACAGGAGAGCGGACGAG
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 GGTACTCGGTTTGGGTGCTATTAT

[illegible]

A The BDDF8 sequence

ATGCAAAATAGAGCTCTCCACCTGCTTCTTTCTGTGCCTTTTTCGCGATTCTGCTTTAGTGCCACCAGAAGATACTACCTGGGTGCAGTGGAAGTGTGCATG
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CAGGACCTCTACTGA

B The plasmid backbone sequence

CAGGTGGCACTTTTCGGGGAATGTGCGCGGAACCCCTATTGTTTATTTTCTAAATACATTCAAAATATGTATCCGCTCATGAGACAATAACCCCTGA
TAAATGCTTCAATAATATGAAAAAGGAAGAGTATGATATTCAACATTTCCGTGTGCGCCCTTATTCCTCTTTTTCGGCGGATTTCCTCTCTGTTTT
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ACGCAATTAATGTGAGTTAGCTCACTATTAGGCACCCAGGCTTACACTTTATGCTTCCGGCTCGTATGTTGTGTGAATTTGtagcgataacaat
ttcacacagga

Figure S13. The sequences of BDDF8 (A) and plasmid backbone (B).

Target site	sgRNA Sequence
sgAlb-In13-371	gTAAACTGTTGTTAGGCCAT
sgDocut	GGTGGTGCAGATGAACTCCA

Table S1. The target sequences of sgRNAs utilized in this study.

Primer	Sequence	Length
Alb-PE150-F-BC1	aacaaggtATTGCCTATGGCTATGAAGTGC	242 bp
Alb-PE150-F-BC2	aacattccATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC3	aaccgtaaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC4	aacgagaaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC5	aacttggaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC6	aagaccaaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC7	aaggtcatATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC8	aatagtggATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC9	aatgccttATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC10	acaatagcATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC11	acaggattATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC12	accgacctATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC13	acgagtccATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC14	acgcataaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC15	acggacgaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC16	acgtatggATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC17	actaaccaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC18	actcaggtATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC19	acttgttgATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC20	agaagtacATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC21	agccactcATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC22	agctctaaATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC23	aggtgtctATTGCCTATGGCTATGAAGTGC	
Alb-PE150-F-BC24	agtccgttATTGCCTATGGCTATGAAGTGC	
Alb-PE150-R	TGCTTGTCTGTATGGCTCTTGT	

Table S2. The primers employed to determine the cleavage efficiencies of Cas9-sgRNA that targets Alb.

Primer	Sequence	Length
Alb-4.9kb-F-BC1	gccggttggaatGAGACCTTCACCTTCCACTCTG	4886 bp
Alb-4.9kb-F-BC2	ggtatagatggTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC3	gtacttgtagTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC4	taagctgcaagTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC5	tcgcctccatcTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC6	ttagaatcacgTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC7	ttcaggtgttcTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC8	ttctgcaccgcTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC9	caatcttacagTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC10	ccaggaggtgtTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC11	cgagactattcTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC12	gacgtgacatcTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC13	aacaacaacacTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC14	aacattgagccTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC15	aagaccataggTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC16	aatagtgtcggTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC17	acaatgcgaatTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC18	accgctatgccTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC19	acgtaggataaTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC20	actattactccTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC21	agctcggacctTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC22	agtctagcggtTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC23	atggaggacggTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-F-BC24	attggtgcataTGAGACCTTCACCTTCCACTCTG	
Alb-4.9kb-R	TGGCTCGTTATTAGCCCAGTTGATAGC	

Table S3. The primers utilized to detect large deletions in Figure 1C.

Primer	Sequence	Length
Alb-4.7kb-F-BC1	aacaccttcttTGTGGGCAAAAACACAGTA	4727 bp
Alb-4.7kb-F-BC2	aaccgtccaccTGTGGGCAAAAACACAGTA	
Alb-4.7kb-F-BC3	aagcgggtataTGTGGGCAAAAACACAGTA	
Alb-4.7kb-F-BC4	aattccgcgctTGTGGGCAAAAACACAGTA	
Alb-4.7kb-F-BC5	acctcctgtaaTGTGGGCAAAAACACAGTA	
Alb-4.7kb-F-BC6	acggaaccagcTGTGGGCAAAAACACAGTA	
Alb-4.7kb-F-BC7	agaagaagagaTGTGGGCAAAAACACAGTA	
Alb-4.7kb-F-BC8	aggtgagtcttTGTGGGCAAAAACACAGTA	
Alb-4.7kb-R	ACCTGGCTCGTTATTAGCCCAGTTGATAG	

Table S4. The primers utilized for long-range PCR amplification in Figure 2A.

Primer	Sequence	Length
Alb-HA600-1.5kb-F1	GGAGCAACTGAAGACTGTCATGGA	1586 bp
Alb-HA600-1.5kb-R1	AGTGTCAAAGTCAGGGGTCTCACC	
Alb-HA600-1.4kb-F2-BC1	aaacactttctcCGGAGCAACTGAAGACTGTCA	1380 bp
Alb-HA600-1.4kb-F2-BC2	ttaacgaaaccgCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC3	aaactctgagaaCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC4	tgtatcaaagacCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC5	aacgtctccataCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC6	tcgattaactgaCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC7	acaaagtaacccCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC8	tagcgaacaaccCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC9	acagcagtttggCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC10	gtagagacatgtCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC11	accatagctaagCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC12	gcactaacctttCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC13	atgcacgaacagCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC14	gatatgatgttgCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC15	caaacacttccaCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-F2-BC16	cgtttccaatacCGGAGCAACTGAAGACTGTCA	
Alb-HA600-1.4kb-R2	AGCCTTCATTATTGCCCTATT	

Table S5. The primers employed for nested PCR amplification of long genomic flanking regions in Supplementary Figure S2.

Primer	Sequence	Length
Alb-HA85-0.5kb-F1	Acaacagatgtcagagagcctgc	499 bp
Alb-HA85-0.5kb-R1	Cagggctaactccttgctctgg	
Alb-HA85-332bp-F2-BC1	acgccacgttAGCAATGCAAGGCACGTACG	332 bp
Alb-HA85-332bp-F2-BC2	cgactagaccAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC3	cagtgaccagAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC4	ccaggctcttAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC5	tcgcgacactAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC6	agccgtcacaAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC7	gtgcatatccAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC8	accgagccatAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC9	cactctcaggAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC10	gtagtcaatgAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC11	ccgtgtggttaAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC12	gaatcgagacAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC13	gacgcggtaaAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC14	gaacaccacaAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC15	caactcctgaAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC16	cgattacctcAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC17	gaccactatcAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC18	gagacacggtAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC19	gatatgcgttAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC20	gcaacagaggAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC21	gccagacaagAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC22	gctaggatctAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC23	ggagttaccgAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC24	ggtacgtgcaAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC25	gtactgacaaAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC26	taacatgaggAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-F2-BC27	tacaacggatAGCAATGCAAGGCACGTACG	
Alb-HA85-332bp-R2	TATCTACAAATGGAACCCAACTGATGACC	

Table S6. The primers utilized for nested PCR amplification of short genomic flanking regions in Figure 3.

Primer	Sequence	Length
qPCR-BDDF8-FL-F	CACGTACGTTTACTATGTCA	261bp
qPCR-BDDF8-FL-R	AGTATCTTCTGGTGGCACTA	
qPCR-BDDF8-FR-F	CTGTAAGCGGATGCCGGGAG	
qPCR-BDDF8-FR-R	GCTGGTGCTTGTCTGTATGG	
qPCR-BDDF8-RL-F	GCACGTACGTTTACTATGTC	283bp
qPCR-BDDF8-RL-R	AAACCTCTGACACATGCAGC	
qPCR-BDDF8-RR-F	CCCAGGTAGTATCTTCTGGT	
qPCR-BDDF8-RR-R	CCAGCTGGTGCTTGTCTGTA	
qPCR-BB-FL-F	CCTATGGCTATGAAGTGCAA	248bp
qPCR-BB-FL-R	GTTGAATACTCATACTCTTC	
qPCR-BB-FR-F	AAGCGGGCAGTGAGCGCAAC	
qPCR-BB-FR-R	GGCTCTTGTCAAATGGTTAT	
qPCR-BB-RL-F	CACGTACGTTTACTATGTCA	277bp
qPCR-BB-RL-R	ACGACAGGTTTCCCGACTGG	
qPCR-BB-RR-F	CGCACATTTCCCCGAAAAGT	
qPCR-BB-RR-R	TCTCCCTGGTTTGGTCTCCT	
qPCR-F8fBBr-junction-F	GCTTGTCTGTAAGCGGATGC	203bp
qPCR-F8fBBr-junction-R	CACTCATTAGGCACCCCAGG	
qPCR-F8rBBf-junction-F	GCACAGAAAGAAGCAGGTGGA	227bp
qPCR-F8rBBf-junction-R	CATTTCCCCGAAAAGTGCCA	

Table S7. The primers employed for qPCR to correlate with the proportion of different insertion outcomes analyzed based on Nanopore sequencing data in Figure 5.

Primer	Sequence	Length
Forward left junction		
Alb-S516-FL-F-BC1	aacattgagccCGTCATGGGTGTGACTTTTG	5.3kb
Alb-S516-FL-F-BC2	aagttcattccCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC3	accacagattaCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC4	aacaccgattagCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC5	aaccactctaagCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC6	aaccgtatccgtCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC7	aaccttgatggCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC8	aacttctctccCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC9	aagaaggttacgCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC10	aagagtggaagtCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC11	aaggatactctcCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-F-BC12	aagtcacacgccCGTCATGGGTGTGACTTTTG	
Alb-S516-FL-HA85-190-R	AAACTCATCAATGTATCTTATCATGTCTG	4.9kb
Alb-S516-FL-HA600-R	CCCAGGCTTTGCAGTCAAAC	
Forward right junction		
Alb-S516-FR-F-BC1	acgtaggataaCCTTGAAATCTCGCCAATA	4.1kb
Alb-S516-FR-F-BC2	attaacatgccCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC3	catacgaccgcCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC4	aatagcaatcggCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC5	aattacgagaggCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC6	acaaccttcagcCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC7	acaatgacaaggCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC8	acaggtaataggCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC9	accacaatgatgCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC10	accgaacgccatCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC11	acctcctgcgaaCCTTGAAATCTCGCCAATA	
Alb-S516-FR-F-BC12	acgccatacataCCTTGAAATCTCGCCAATA	
Alb-S516-FR-HA85-190-R	actcgtgcatgtgtgatataagttgtg	4.1kb
Alb-S516-FR-HA600-F-BC1	aagaggaggtttgactgcaaagcctggg	
Alb-S516-FR-HA600-F-BC2	ctggaaatgtttgactgcaaagcctggg	
Alb-S516-FR-HA600-F-BC3	ctgttggtttgactgcaaagcctggg	
Alb-S516-FR-HA600-F-BC4	tatgcgttgtttgactgcaaagcctggg	
Alb-S516-FR-HA600-R	GTGGGCAGATGACACACTGA	
Reverse left junction		
Alb-S516-RL-F-BC1	ccagagcacacCGTCATGGGTGTGACTTTTG	6.1kb
Alb-S516-RL-F-BC2	cgagactattcCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC3	cttgacgttaaCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC4	acggttctaataCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC5	actcagccggtaCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC6	actgaggtgagcCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC7	agagcataaggaCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC8	aggaagagagagCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC9	aggtaaagcgtccCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC10	agtatctggtgaCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC11	agtccttctatcCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-F-BC12	ataagactcaccCGTCATGGGTGTGACTTTTG	
Alb-S516-RL-R	ACACAGACCTTGCAAAATTTATACTACT	
Reverse right junction		
Alb-S516-RR-F-BC1	gagtgcgtggtAATCACAGCCCATCAACTCC	6.1kb
Alb-S516-RR-F-BC2	ggacaccgtaaAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC3	gtcgtcatgtcAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC4	atctccaaggtaAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC5	atggagattggtAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC6	attgagtcttccAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC7	caacgtagtaagAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC8	cacattcattggAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC9	cacttccgagctAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC10	cagagcaaccatAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC11	caggttgatccgAATCACAGCCCATCAACTCC	
Alb-S516-RR-F-BC12	catcaagaacggAATCACAGCCCATCAACTCC	
Alb-S516-RR-R	ATTGAGAATTCTCGTAATGTTGAAGTATT	

Table S8. The primers utilized to distinguish NHEJ and HDR in Figure 6.