

## Supplementary Sequences Information:

### Development and optimization of CRISPR prime editing system in photoautotrophic cells

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#### 1. Sequences of primary PE2 used in this study

##### pPE2-35SRat:

CCAAAGAAAAAGAGAAAAGTAGATAAGAAGTACTCTATCGGACTCGACATCGGAACCTAACTCTGTGGGATGGGCTGTGAT  
CACCGATGAGTACAAGGTGCCATCTAAGAAGTTCAAGGTTCTCGGAAACACCGATAGGCACTCTATCAAGAAAAACCTTAT  
CGGTGCTCTCCTCTTCGATTCTGGTAAACTGCTGAGGCTACCAGACTCAAGAGAACCGCTAGAAGAAGGTACACCAGA  
AGAAAGAACAGGATCTGCTACCTCCAAGAGATCTTCTCTAACGAGATGGCTAAAGTGGATGATTCTTCTCCACAGGCTC  
GAAGAGTCATTCTCGTGGGAAGAAGATAAGAAGCAGAGAGGCACCCCTATCTTCGGAACATCGTTGATGAGGTGGCATA  
CCACGAGAAGTACCCTACTATCTACCACCTCAGAAAGAAGCTCGTTGATTCTACTGATAAGGCTGATCTCAGGCTCATCTA  
CCTCGCTCTCGCTCACATGATCAAGTTTCAGAGGACACTTCCTCATCGAGGGTGATCTCAACCTGATAACTCTGATGTGG  
ATAAGTTGTTTCATCCAGCTCGTGCAGACCTACAACAGCTTTTCGAAGAGAACCCTATCAACGCTTCAGGTGTGGATGCTA  
AGGCTATCCTCTCTGCTAGGCTCTCTAAGTCAAGAAGGCTTGAGAACCTCATTGCTCAGCTCCCTGGTGAGAAGAAGAAC  
GGACTTTTCGGAACCTTGATCGCTCTCTCTCGGACTCACCCCTAACTTCAAGTCTAACTTCGATCTCGCTGAGGATGCA  
AAGTCCAGCTCTCAAAGGATACCTACGATGATCTCGATAACCTCCTCGCTCAGATCGGAGATCAGTACGCTGATTTG  
TTCCTCGCTGCTAAGAACCTCTCTGATGCTATCCTCCTCAGTGATATCCTCAGAGTGAACACCGAGATCACCAAGGCTCCA  
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CCAGAGAAGTACAAAGAGATTTTCTTCGATCAGTCTAAGAACGGATACGCTGGTTACATCGATGGTGGTGCATCTCAAGAA  
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TCTTCTCAGAAAGCAGAGGACCTTCGATAACGGATCTATCCCTCATCAGATCCACCTCGGAGAGTTGCACGCTATCCTTAG  
AAGGCAAGAGGATTTCTACCCATTCTCAAGGATAACAGGGAAGGATTGAGAAGATTCTCACCTTCAGAATCCCTTACTA  
CGTGGGACCTCTCGCTAGAGGAACTCAAGATTCTGCTTGATGACCAAGGATCTGAGGAAACCATCACCCCTTGGAAAC  
TTCGAAGAGGTGGTGATAAGGGTGCTAGTGCTCAGTCTTTCATCGAGAGGATGACCAACTTCGATAAGAACCTTCCAAA  
CGAGAAGGTGCTCCCTAAGCACTCTTTGCTCTACGAGTACTTCACCGTGTAACAGAGTTGACCAAGGTTAAGTACGTGA  
CCGAGGGAATGAGGAAGCCTGCTTTTTGTCAGGTGAGCAAAAGAAGGCTATCGTTGATCTCTTGTTCAGACCAACAGA  
AAGGTGACCGTGAAGCAGCTCAAAGAGGATTACTTCAAGAAAATCGAGTGCTTCGATTGAGTTGAGATTCTGGTGTTGA  
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CTACGCTCATCTCTTCGATGATAAGGTGATGAAGCAGTTGAAGAGAAGATACACTGGTTGGGGAAGGCTCTCAAGAA  
AGCTCATTAAACGGAATCAGGGATAAGCAGTCTGGAAGACAATCCTTGATTTCCTCAAGTCTGATGGATTTCGTAACAGAA  
ACTTCATGCAGCTCATCCAGATGATTCTCTCACCTTTAAAGAGGATATCCAGAAGGCTCAGGTTTCAGGACAGGGTGATA  
GTCTCCATGAGCATATCGCTAACCTCGCTGGATCTCCTGCAATCAAGAAGGGAATCCTCCAGACTGTGAAGGTTGTGGAT  
GAGTTGGTGAAGGTGATGGGAAGGCATAAGCCTGAGAACATCGTGATCGAAATGGCTAGAGAGAACCAGACCACTCAGA  
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TGAAGAAGTATTGGAGGCAGCTCCTCAACGCTAAGCTCATCACTCAGAGAAAGTTTCGATAACTTGACTAAGGCTGAGAGG  
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CACAGATCTCGATTCTAGGATGAACACCAAGTACGATGAGAACGATAAGTTGATCAGGGAAGTGAAGGTTATCACCTCA  
AGTCAAAGCTCGTGCTGATTTCAGAAAGGATTTCGAATTCTACAAGGTGAGGGGAATCAACAACCTACCACACGCTCAC  
GATGCTTACCTTAACGCTGTTGTTGGAACCGCTCTCATCAAGAAGTATCCTAAGCTCGAGTCAGAGTTCGTGTACGGTGAT  
TACAAGGTGTACGATGTGAGGAAGATGATCGCTAAGTCTGAGCAAGAGATCGGAAAGGCTACCGCTAAGTATTCTCTAC  
TCTAACATCATGAATTTCTCAAGACCGAGATTACCCTCGCTAACGGTGAGATCAGAAAGAGGCCACTCATCGAGACAAAC  
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ACATCGTTAAGAAAACCGAGGTGCAGACCGGTGGATTCTCTAAAGAGTCTATCCTCCCTAAGAGGAAGTCTGATAAGCTCA  
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GCTAAGGTTGAGAAGGGAAAGAGTAAGAAGCTCAAGTCTGTTAAGGAAGTCTCTCGGAATCACTATCATGGAAGGTCATC  
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GTACTCACTCTTCGAACTCGAGAACGGTAGAAAGAGGATGCTCGCTTCTGCTGGTGAGCTTCAAAAGGGAAACGAGCTT  
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CAGAAGCAACTTTTCTGTTGAGCAGCACAAAGCACTACTTGGATGAGATCATCGAGCAGATCTCTGAGTTCTCTAAAAGGT  
GATCCTCGCTGATGCAAACCTCGATAAGGTGTTGCTGCTTACAACAAGCACAGAGATAAGCCTATCAGGGAACAGGCAG  
AGAACATCATCCATCTCTTACCCTTACCAACCTCGGTGCTCCTGCTGCTTTCAAGTACTTCGATACAACCATCGATAGGA  
AGAGATACACCTCTACCAAGAAGTGTCTGATGCTACCCCTATCCATCAGTCTCACTGGACTCTACGAGACTAGGATCG  
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CTACTCCTGAATCTTCTGGTGGATCTTCTGGTGGATCATCTACCCCTAAATATAGAAGATGAGTATCGGCTACATGAGACCTC  
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CTGGCAGTTTCGCCAAGCTCCTCTGATCATACTCTGAAAGCAACCTCTACCCCGTGTCCATAAAACAATACCCCATGTCA  
CAAGAAGCCAGACTGGGGATCAAGCCCCACATACAGAGACTGTTGGACCAGGGAATACTGGTACCCTGCCAGTCCCCCT  
GGAACACGCCCCCTGTACCCGTTAAGAAACCAAGGACTAATGATTATAGGCCTGTCCAGGATCTGAGAGAAGTCAACAAG  
CGGGTGGAAAGACATCCACCCACCGTGGCCAAACCTTACAACCTCTTGAGCGGGCTCCACCGTCCCAAGTGGTAC  
ACTGTGCTTGATTAAAGGATGCCTTTTTCTGCTGAGACTCCACCCACCAAGTCAGCCTCTCTTGCCTTTGAGTGGAG  
AGATCCAGAGATGGGAATCTCAGGACAATTGACCTGGACCAGACTCCACAGGGTTTCAAAACAGTCCACCCCTGTTTA  
ATGAGGCACTGCACAGAGACCTAGCAGACTTCCGGATCCAGCACCCAGACTTGATCCTGCTACAGTACGTGGATGACTTA  
CTGCTGGCCGCCACTTCTGAGCTAGACTGCCAACAAGTACTCGGGCCCTGTTACAAACCCTAGGGAACCTCGGGTATC  
GGCCCTCGGCCCAAGAAAGCCCAAATTTGCCAGAAACAGGTCAAGTATCTGGGGTATCTTCTAAAGAGGGTCAAGATG  
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ACTCTGTTTAATTGGGGCCAGACCAACAAAAGGCCTATCAAGAAATCAAGCAAGCTCTTCTAACTGCCCCAGCCCTGGG  
GTTGCCAGATTTGACTAAGCCCTTTGAACTCTTTGTCGACGAGAAGCAGGGGTACGCCAAAGGTGTCTAACGCAAAAAAC  
TGGGACCTTGGCGTCGGCCCGGTGGCTACCTGTCCAAAAGCTAGACCCAGTAGCAGCTGGGTGGCCCCCTTGCCCTAC  
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CCATGCAGTAGAGCACTAGTCAAACAAACCCCGACCGCTGGCTTTCCAACGCCCGGATGACTCACTATCAGGCCTTG  
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CAGGCCCTAAAGATGGCAGAAGGTAAGAAGCTAAATGTTTATACTGATAGCCGTTATGCTTTTTGCTACTGCCATATCCATG  
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CCACCCCTCGTACCACCTTCACCTACGGCGTGCAGTGTTCAGCCGCTACCCCGACCACATGAAGCAGCAGGACTTCTT  
CAAGTCCGCCATGCCGAAGGCTACGTCCAGGAGCGCACCATCTTCTTCAAGGACGACGGCAACTACAAGACCCGCGC  
CGAGGTGAAGTTCGAGGGCGACACCCCTGGTGAACCGCATCGAGCTGAAGGGCATCGACTTCAAGGAGGACGGCAACAT  
CTGGGGCACAAGCTGGAGTACAACAGCCACAACGCTCTATATCATGGCCGACAAGCAGAAGAACGGCATCAAG  
GTGAACCTTCAAGATCCGCCACAACATCGAGGACGGCAGCGTGCAGCTCGCCGACCACTACCAGCAGAACACCCCATC  
GGCGACGGCCCCGTGCTGCTGCCGACAACCACTACCTGAGCACCCAGTCCGCCCTGAGCAAAGACCCCAACGAGAA  
GCGCGATCACATGGTCTGCTGGAGTTCGTGACCGCCGCCGGGATCACTCACGGCATGGACGAGCTGTACAAGTAA

*Arabidopsis* codon-optimized nCas9(H840A)

*Arabidopsis* codon-optimized RT linker

MLV reverse transcriptase

T2A linker

EGFP protein

NLS

## pS8K-nCas9RT:

ATGGATAAGAAATACTCAATAGGCTTAGATATCGGCACAAATAGCGTCGGATGGGCGGTGATCACTGATGAATATAAGGTTCC  
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TGGAGAGACAGCGGAAGCTCGCCTCAAACGGACAGCTGTAGAAAGTATACACGTGCGGAAGAATCGTATTTGTTATC  
TACAGGAGATTTTTTCAAATGAGATGGCGAAAGTAGATGATATTTCTTTTCATCGACTTGAAGAGTCTTTTTTGGTGGAAGA  
AGACAAGAAGCATGAACGTCATCCTATTTTTGAAATATAGTAGATGAAGTTGCTTATCATGAGAAATATCCAACATCTATCA  
TCTGCGAAAAAATTGGTAGATTCTACTGATAAAGCGGATTTGCGCTTAATCTATTTGGCCTTAGCGCATATGATTAAGTTTC  
GTGGTCATTTTTTATTGAGGGAGATTTAAATCCTGATAATAGTATGTGGACAAACTATTTATCCAGTTGGTACAAACCTAC  
AATCAATATTTGAAGAAAACCTATTAACGCAAGTGGAGTAGATGCTAAAGCGATTCTTTCTGCACGATTGAGTAAATCAA  
GACGATTAGAAAATCTATTGCTCAGCTCCCGGTGAGAAGAAAATGGCTTATTTGGGAATCTATTGCTTTGTATTGG  
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CAGATATCCTAAGAGTAAATACTGAAATAACTAAGGCTCCCTTATCAGCTTCAATGATTAAACGCTACGATGAACATCATCAA  
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AAATTCACCTTTGGGTGAGCTGCATGCTATTTTGAGAAGACAAGAAGACTTTTATCCATTTTTAAAGACAATCGTGAGAAGAT  
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TGACAAACTTTGATAAAAACTTCCAAATGAAAAAGTACTACCAAAACATAGTTTGCTTTATGAGTATTTTACGGTTTATAACG  
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CGTTTGCTCTCGAAAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAAAACAAATATTAGATTTTTGAAATCAGATGGTTTT  
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GAGCATCCTGTTGAAAATACTCAATTGCAAATGAAAAGCTCTATCTTATTATCTCCAAAATGGAAGAGACATGTATGTGG  
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AATGCCGTCGTTGGAACGTGCTTTGATTAAGAAATATCCAAAACCTTGAATCGGAGTTTGCTCATGGTGATTATAAAGTTTATGA  
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GGAGCTCCCGCTGCTTTTAAATATTTTGATACAACAATTGATCGTAAACGATATACGCTACAAAAAGAAGTTTTAGATGCCAC  
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GCATATTCACGCTCTGCTGGATCAAGGCATCCTCGTTCCATGCCAGAGCCCGTGAATACGCCGCTGCTGCCGGTGAAA  
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CAACTGACGTGGACCCGCTGCGCGCAAGGCTTCAAGAACAGCCGACGCTCTTCAATGAAGCGCTGCACCGCGATCTG  
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CCAGTTGCGTATCTGAGCAAAAAGCTGGATCCAGTTGCCGCGGGTTGGCCACCATGCTGCGCATGGTTGCGGCGATTG  
CGGTCTGACGAAAGATGCCGGCAAACTGACCATGGGTCAACCGCTCGTGATTCTGCCCCGCTGCGGTGGAAGCGC  
TGGTGAACCAACCCGATCGTTGGCTGAGCAATGCCCGTATGACGCATTACCAAGCGCTGCTGCTCGATACCCGATCG  
CGTGACGTTTGGCCAGTGTTGCCCTCAATCCGGCGACGCTGCTGCCACTGCCGGAAGAAGGCCTCCAGCACAACCTG  
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TGGGCCAAAGCGCTCCAGCCGGTACGAGTGCCCAACGTGCCGAATGATCGCGCTGACCCAAGCGCTGAAGATGGC  
GGAGGGCAAAAAGCTCAACGTGTACACGGACAGCGTTATGCCTTTGCCACGGCGCACATTGTTGAAATCTATCGC  
CGTCCGCGCTGGCTGACCAAGCAAGGCAAGGATCAAGAAGGATCAAGAACGAGAGATTCTGCGCTCTCTCAAGCCCTCTT  
CTGCCGAAACGTCTGAGCATTATCCACTGCCCGGGCCATCAGAAAGGTCACAGTGCCGAGGCCGCTGGCAACCGTATG  
GCGGATCAAGCCGCGCGTAAGGCGGCCATCACCAGAACGCCAGATACGAGTACGCTGCTGATCGAAAATAGCAGCCCAT  
GA

## 2. Sequences of promoters in protoplast used in this study

### 2×35S promotor:

GGGCCCCCCTCGAGGTCGACGGTATCGATAAGCTTGCATGCCTGCAGGTCAACATGGTGGAGCACGACACACTTGTCT  
ACTCCAAAAATATCAAAGATACAGTCTCAGAAGACCAAAGGGCAATTGAGACTTTTCAACAAAGGGTGATATCCGGAAACC  
TCCTCGGATTCCATTGCCAGCTATCTGTCACTTTATTGTGAAGATAGTGAAAAAGGAAGGTGGCTCCTACAAATGCCATC  
ATTGCGATAAAGGAAAGGCCATCGTTGAAGATGCCTCTGCCGACAGTGGTCCCAAAGATGGACCCCAACCCACGAGGAG  
CATCGTGAAAAAGAAGACGTTCCAACCACGTCTTCAAAGCAAGTGGATTGATGTGATAACATGGTGGAGCACGACACAC  
TTGTCTACTCCAAAAATATCAAAGATACAGTCTCAGAAGACCAAAGGGCAATTGAGACTTTTCAACAAAGGGTAATATCCGG  
AAACCTCCTCGGATTCCATTGCCAGCTATCTGTCACTTTATTGTGAAGATAGTGAAAAAGGAAGGTGGCTCCTACAAATG  
CCATCATTGCGATAAAGGAAAGGCCATCGTTGAAGATGCCTCTGCCGACAGTGGTCCCAAAGATGGACCCCAACCCACG  
AGGAGCATCGTGAAAAAGAAGACGTTCCAACCACGTCTTCAAAGCAAGTGGATTGATGTGATATCTCCACTGACGTAAG  
GGATGACGCACAATCCCATATCCTTCGCAAGACCCTTCCCTATATAAGGAAGTTCATTTTCATTGGAGAGGACCTCGAC  
CTCAACACAACATATACAAAACAACGAATCTCAAGCAATCAAGCATTCTACTTCTATTGCAGCAATTTAAATCATTTCTTTTA  
AAGCAAAAGCAATTTTCTGAAAATTTTACCATTACGAACGATA

### RPS5A promotor:

CTCAACTTTTGATTGCTATTTGCAAGTGCACCTGTGGCGTTTCATCACATCTTTTGTGACACTGTTTGCAGTGGTCATTGCTA  
TTACAAAGGACCTTCTGATGTTGAAGGAGATCGAAAGTAAGTAAGTGCACGCATAACCATTTTCTTTCCGCTCTTTGGCT  
CAATCCATTTGACAGTCAAAGACAATGTTAACCAGCTCCGTTTGATATATTGCTTTATGTGTTTGTCAAGCATGTTTAGT  
TAATCATGCCCTTTGATTGATCTTGAATAGGTTCCAAATATCAACCTGGCAACAAAACCTGGAGTGAGAAACATTGCATTCC  
TCGGTTCTGGACTTCTGCTAGTAAATTATGTTTCAGCCATATCACTAGCTTTCTACATGCCCTCAGGTGAATTCATCTATTCC  
GCTTAACTATTTCCGTTAATTAAGCACGAACACCATTACTGCATGTAGAAGCTTGATAAACTATCGCCACCAATTTATTTT  
TGTGCGATATTGTTACTTTTCTCAGTATGCAGCTTTGAAAAGACCAACCCTCTTATCCTTTAACAATGAACAGGTTTTTGA  
GGTAGCTTGATGATTCCTGCACATGTGATCTTGGCTTCAGGCTTAATTTTCCAGGTAAAGCATTATGAGATACTCTTATATCT  
CTTACATACTTTTGTGATAATGCACAAGAACTTCATACTATATGCTTTAGTTTCTGCATTGACACTGCCAAATTCATTAATC  
TCTAATATCTTTGTTGTTGATCTTTGGTAGACATGGGTACTAGAAAAAGCAAACCTACACCAAGGTAAATACTTTTGTACAAA  
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GATATGCTTCTGAATTTTATATCTTGCAATAAAAAATGCTTGTACCAATTGAAACACCAGCTTTTTGAGTTCTATGATCACT  
GACTTGGTTCTAACCAAAAAAAAAAATGTTAATTTACATATCTAAAGTAGGTTTAGGGAAACCTAAACAGTAAATATTTG  
TATATTATTCGAATTTCACTCATCAAAAACTTAAATTTGCACCATAAAATTTTGTTTTACTATTAAATGATGTAATTTGTGTAAC  
TAAGATAAAAAATAATTTCCGTAAGTTAACCCGGCTAAACACCGTATAAACAGGGAACCTGTTAAACCGGTTCTTTACTGGA  
TAAAGAAATGAAAGCCCAGTAGACAGCTCCATTAGAGCCCAACCTAAATTTCTCATCTATATAAAGGAGTGACATTAG  
GGTTTTTGTTCGTCCTCTTAAAGCTTCTCGTTTTCTGCGCTCTCTCTCATTGCGCGACGCAAAACGATCTTCAGGTGAT  
CTTCTTTCTCCAAATCCTCTCTCATAACTCTGATTTCTGACTTGTGATTTGAGCTCACGCTCTGTTTCTCTACCACAGCC

### UBQ10 promotor:

GTCGACGAGTCAGTAATAAACGGCGTCAAAGTGGTTGCAGCCGGCACACACGAGTCGTGTTTATCAACTCAAAGCACAAA  
TACTTTTCTCAACCTAAATAAGGCAATTAGCCAAAAACAACCTTTGCGTGTAACAACGCTCAATACAGTGTCATTTTAT  
TATTAGCTATTGCTTACCGCCTTAGCTTTCTCGTGACCTAGTCGTCCTCGTCTTTTCTTCTTCTTCTCTATAAAACAATAC  
CCAAAGAGCTCTTCTTCTCACAATTCAGATTTCAATTTCTCAAATCTTAAAACTTTCTCTCAATTTCTCTACCGTGATC  
AAGGTAATTTCTGTGTTCTTATTCTCTCAAAATCTTCGATTTTGTGTTTCTGTTGATCCCAATTTCTGATATGTTCTTTGGTT  
TAGATTCTGTTAATCTTAGATCGAAGACGATTTCTGGGTTTGATCGTTAGATATCATCTTAATTTCTGATTAGGGTTTCATAG  
ATATCATCCGATTTGTTCAAATAATTTGAGTTTTGTGCAATAATTACTCTTCGATTTGTGATTCTATCTAGATCTGGTGTTAGT  
TTCTAGTTTGTGCGATCGAATTTGTGATTAATCTGAGTTTTTCTGATTAACAG

## 3. Sequences of other reverse transcriptase(RT) used in this study

### Fs-RT:

TTTACCATCGACGAGATGCTGAGCAAGAACAACCAACGTCTGGCGTTTGAACACTTTGCGACCAAAAAACGACGGTTGCG  
GCCCCGACGGTATGCAGTTAGCGAACTGGAGAAGTACTGGCGTATGAATCACGACCAGATCATTAGCGATCTGAAGAAC  
CAGGAATACCAGCCGGGTATTATCCTGATTCTGTGAGCACATGAATAAAACCGGCAACCGCGTAATATCGCGAGCCTGAA  
CGTTATTGATCGTTTCATTACCCGTCTGCTGAGCCAGAACTGAACCGTTATCTGGCGCCGATTTTCTGCGAGAACAGCTA  
TGCGTACCAGGACAGCAAGGGCGTTATGCCGCGGTTCTGAAAGCGAAGGAGTACGTTGAGCTGGGTATGCGTCACGT  
GATTGAAATCGATCTGAAAACTACTTTGACACCAATTCGCTGGAAAACTGATCCCGGAGATCGAACGCTACATCACC  
TGAGGCGGTTCTGCATCTGATCAAGCAATACCTGTTTTCGATATTAGCTTCGAGGGCAAAATCAGCCGTAAACCCAAGG  
TATCGTTCAAGGTCAGCGATCAGCCCGATCCTGAGCAACCTGACCTGAACGACTTCGACAAGGAACCTGGACGAGAGC  
AAGCTGTGCTGGATTCTGTTACGCGGACAATATCTACATCTATATGGATAGCTATGAGAAGGCGCTGCTGGTGTATAGCGAG

CTGACCGAGCGTCTGGAGCGTCGCAAGCTGACCGTTAACAAGGAGAAAAAGCGCGTTTTTGTATGTGAGCACCCGTAGCA  
TTCTGGGCTACGACATCCTGATTCTGTAACAAGAAAGTGGACGTTCTGTAAGCATATTTACAAAAGCGTTAATCAGTACAGCA  
ACTGGCACGATAGCCGCTGGAGTTTATCAACGGTCGTTACCACATCACCAGCGATGGCATCCTGAATCGCCAAGACTTC  
GGCCTGCTGTTTCGAGAATGAGCAGAAAAAACTACATCCCGTTGAGGTTAGCGATCAGCTGAACATCTACGGTAATGT  
TACCTTGGCGAGCAATGTGCTGCAAAAGTTTCAGCAACCGCGGAAATCAAAGTGAGCTTCTTCGACAAGTATGGTCTGTA  
TTGGTAGCTTCTGCGGAAAAAAACCAAGAAAAGCGCGGAGATCATTCTGGTGCAGAGCAAGAACTATCTGAACGAAGAT  
GTGCGTATGGATACCGCGCGCCGATGGAATTGCGGGTCTGCACAACATCCGTGCGAATCTGCGCTACTACGATAAGAA  
ACACAAGGGCGACTTTAAAGAGAAGGTTGACGCGATTAGCGGCTACATTGACGCGCTGAACCGTGCGCCGAGCGTTAAT  
GATATGATGCTGCTGGAAGCGAAAGCGCGCCAACGTGATTATACCTGTTTTAACCAAATCCTGGAACCAGCGACTTCCAG  
TTGAAAAAGCGTACCAAGCGTCCGCCGAAAGATGCGATCAATCGTGCAATTAGCTTCGGCAATACCCTGCTGTATAATCTA  
TTTGTGAATATTATCTGGAAGAAGGGTCTGGACCCGCGCTTTGGCGTTGTTACGCGAGCAACAAACGCAATCAAAGCCT  
GAACCTGGACTTCGCGGACATCTTTAAACCGATCGTGATTGACCGCATTATCTTCACCATGATCAATAAGAAAATGCTGAC  
CCTGCTGACCGATTTTGAACCCAGCAACCAGGGTGTGTATCTGAGCCGTGAGGGCAAGAACATCTTCCTGCAAAATGTACG  
AGGAGAAGCTGAAAAACCGCATTAACCATCAAGGGTAAAGAGATGAGCTATTACCAGCTGCTGGAGAGCGAAGTGCAGAA  
TTACAAGAATTTCACTCTGACCGGCGAAACCTATAAACCGTATAAGTATTAT

## Mm-RT:

CTGAATTCCTCTTATAGACGCGGTTTTGCCCTTACGCAAGTGTGGTCATCACACTGCGTTGGCTGTCGCCAAGCAAAAC  
GGGCTTTTTGCATCATGCGGTTTTGCACGCTTGGGTACGCTTTCTCGCTGGCAGTCCAGAACAGTTTAGCGACTTTATCG  
TCGTCGAACCTATAGAAAACGGCCACATTAGTTACCAAGCAGGCGACGGTTACAGGTTTGAATTACCGTGTTAAACGGT  
GGTGAAGCCTGCTCGATACGCTGTTCTCTTCGTTAAACCGGCTCCCAGAAAGCGCCGCTAATCACCAGACATAGCGG  
GCGCTTTCTCGGACAACCTCGTCTTAGAAAAAATCGAAGATACATTTGAGCACCATCAAGTCACACAAATAGAAGACCTAA  
GCGTGTGTTGATTAATGCGCTAATGCTCGAAACCGCGGTTTGGTCACGTCAACGACGTTCAAAGTGGCCTTCAACACC  
CCAGCGAGGCTCGTCAAACCCAAGCCAGAAGATGGCACAGAGCTAAAAGGCCAAAACCGTTACTGCCGTGATAAATCCG  
ACTTAAACTGGCAGCTCTTTACGCATCGCCTCACCAGATACCTTTATTAACTCTTTCAAAGCCGAACCTGGCGAGCGTTTTAC  
AAAGGCAAACTGGCCCCGAAGCGCAACTCCACGCAAGGTTAGCGGTTTGGCTAAACAACAGTTACACCAATAAAAAAGA  
GAAAAAAGTCAAAGACGCCAGCGGCATGTTGGCGCAATGCAATCGAGATTGATGACGACTTCCCTGCCGATTTACTCG  
CGCTTCTGTTCTGGGTCAATACATCGGCATGGGCCAAAATCGCGCATTGCGTATGGGGCAATATCAACTGCAAGATGCTT  
ATGGTTACTGCAGCTACCCTCGCCCTCAAGCGGCCAAAAGTCTGCTCGAAAAAGTCTATCTGATGCAAGCTTACACCAA  
GCCTGCCAAACCATGTACCCAAGACAAGCTAATTTGACTCGTCGGACACCGACGAAGAATCATCAGACGCCATCGACG  
AGCTGCTTACCAAACCTCTATGTAAGCCGCGAAGCTATTTCAAACGAGAGTTTACTCCAAGCCAGTTACACTCTGTGCAAA  
TCGAAAAGCCAGAAGGCGGAACACGACTGCTGTGCGTTCCCAATTGGCACGACCGCACCTTACAAAAAGCGGTAACAGA  
ATGCCTTGGCAACACCCTAGAACACATATGGATGAAGCACAGCTATGGCTACCGAAAGGGGACACTCTCGCTACAGGCC  
GAGATCAAATCAACCAATACATTGAGCAAGGCTACGAATGGGTACTCGAAAGCGACATAGAAAAGCTTCTTCGACAGTGTCA  
ATTGGCTGAACCTAGAACACGACTGAACTACTATTGCCTAATGAACCGTTAGTCCCCTTACTCATGCAATGGGTCAAGT  
CAGCGAAACAAACCGAAGATGAGCAAACGCTTGGCGGCCATAACGGCCTGCCACAAGGCGCGCGGATCAGTCCGATAC  
TGGCTAACCTATTACTTGATGACCTCGACCAAGATATGATCGCCAAAGGGCATCAAATCGTCCGCTACGCTGATGATTTGT  
CTTACTTTTTAAATCAAAGCGGCGGCAGAAAGCGCACTCGACGACATAATAACAGCCCTTAAAGAGCATCATCTCGCTAT  
CAACCTTGA AAAACGCGTATTGTGCAAGCGTCGCAAGGGTCCGCTATTTAGGCTACTTATTTGTGATGGCTACGCGAT  
CGAAACCAAACGCGAATACCGCAAGAGCAGCTCAACTCGACAAACAGCTGAACGCTCTTCGCTCGAAAACGAGGCC  
TCTCTACAACAGGAACCTGCTGTACAAAACGAACAAAGCACGCTTATTGGAGAGCGCGAAAAGCTAGGCACATTGCTCAT  
CATAGCAGGGGACATTGCGATGCTAAGCAGTGAAAAACAACGCCTAATAGTCGAACAATACGACGAGCTGCATACTTACC  
CTTGGGCCACGTTGAGTTCCGTGTTGCTTGTAGGCCCGCACACATCACACCCCGCTCTAAATCGGCTATGTTCCAC  
AATGTACCCGTACACTTTGCTAGCCAATATGGCCGCTACCAAGGGGTTCCGCGAGTGCTGCGCCCACTGTGTTTGGCG  
CCGATTTTTGGTTACTTCAAGCTCAATACTTACAACAAGAAACAAACGCACTCAACATTAGCCAAGTGCTAATACAAGCCAG  
AATAGAGGGTATAAGAGCCGCTCATAAGCCGTAGAGAAAAGATGCCCTGAGCTGAACAAAATTCACGCTTGGACGAAA  
AACGCTTACGGGCAGAAACATTAGATCAATTACGAGGCTATGAAGGCCAAGCCAGCAAACTGTGGGCATTCTTCCAG  
CGTATACTCGAAGAAGATTGGGGCTTTACAGGGCGTAATAGACGCCCTCCCAAAGACCCGATCAACGCCCTACTTTTATTA  
GGCTACACCTATCTATACAGCTTAGTAGACAGTGCAATAGAACGTTGGACTCTACCTTGGCAAGGCGCACTGCACCA  
GCGTCATGTTTACCATCACACCCTAGCTTCTGACCTAATGGAACCTTGGCGTTACCTTGTGCAACACGTCGCTTTAACCT  
AATAACTCGTCACCAATACATAAGGATGACTTTGTATCAAAGAAAATGGTTGCGAAATGAGCAGTGGCGCGAGAAAAAC  
ACTTCTAAAGAACTCTTGTTCAACTGACTAAAGTGCCTAAGGGAGGAAACAGTCTGCTCACCGAAATGCAACCAAT  
CTTACCGTTTAGCCCTAAGCTGCAAAATGCAACAACGCTTTATCGCTTGGAGCCCTAAAAAG

## Vv-RT:

GCTATTCACCTTACGATTGAGGAATTGCAAAACAAGCTGGAAGAAGGTGTCTGCCAATAAAGGCATTGCAGGGGTGATGG  
CGTTACCATTTCAAACATTTGCAATCCACTTGGATACCAACTTAAACACGTTACTCAGCGCATGGAACCACGGCAACTATGC  
GCCGTACCCCTATCGTCCACTCACCATTCAACCCAACGAAAAGAAAACCCGGCAGCTTGCCATCCCCACCGTTGCTGAC  
CGGATTATTCATACCGCCATCGCACAAAAGTTGGTTGCCAAGTTTGAACCAAGTTTGAACATATAAGCTACGGCTATCGA  
CCGAATCGCTCCTACACCATGCAATTCGTATATCGAACAACCTGCGAAATCAAGGCTACCTATACGTTCTTGATGCGGATA  
TCAAAGGTTACTTCGACCATATCTGCCACAAGCGGCTCAAACAGATTTTGCAAAAATACCTTGAGGACAACCTGGGTTGAAT  
CGATCATGACGCTGCTATTGTGCGAGCAAAATGCCCGCGCAACCTTATTGTTTGGTGTGAACTGGGGCGCGGCATCCCA  
CAAGGTTTCGCCACTTTCTCGCTGCTGGCCAATCTCTATTGGACGGGTTTGACGAAGCCCTGCTCGATAGAGGTGAGC  
AAATCGTTCGATATGCCGACGATTTTGTGTTCTGGTCACCCACGAACAACAGCCCAACACTGTTTAGCTTTTGTACAC  
AATACTTAGCGAGTTTAAACTCCAGTTAAATACTGAGAAAACCTCGGGTTGTTAGCTTTCAAGATGGTTTACTTTTCTGGT  
GTCTCATTT

## At-RT:

ACTCTTAATATTGAAGATGAGTATAGGCTTCATGAACTTCTAAGGAACCTGATGTTTCTTTGGGATCTACTTGGCTTTGAGA  
TTTTCTCAAGCATGGGCTGAACTGGAGGAATGGGACTTGCTGTGAGACAAGCTCCTCTTATAATTCCTCTTAAAGCTAC  
TTCTACTCCTGTTAGTATTAAGCAATATCCTATGTCTCAGGAAGCTAGGCTTGGAATTAACCTCATATTCAAAGACTTCTTG  
ATCAAGGAATTTTGGTGCCTTGTCATCACCTTGGAAATACCCCTCTTTTACCTGTTAAAAAGCCTGGAACATAATGATTATAG  
GCCAGTTCAGGATCTTAGAGAGGTTAATAAGAGAGTTGAAGATATTCATCCTACCGTTCTTAATCCTTACAACCTTGCTTTCT  
GGACTTCCTCCTCTCATCAATGGTATACTGTGTTGGATCTTAAAGATGCTTTTTTTTGTCTTAGATTGCATCCTACTTCTCA  
ACCTCTTTTTGCTTTTGAATGGAGAGATCCTGAAATGGGAATTTCTGGTCAACTTACTTGGACTAGGCTTCCTCAAGGATTT  
AAGAATAGTCTACTTTGTTAATGAAGCACTCCATAGAGATTTGGCTGATTTTGAATCCAACATCCTGATCTTATTTTGT  
TCAATATGTTGATGATTTGCTTCTTGCTGCTACTTCTGAGTTGGATTGTCAGCAGGGTACTAGAGCTTTGCTTCAAACCTCT  
GGAAATTTGGGATATAGAGCTTCTGCAAAGAAAGGCTCAAATTTGTCAGAAGCAGGTAAATATCTTGATATTTGTTGAAGG  
AGGGACAAAGGTGGTTGACTGAGGCTAGAAAAGAACTGTTATGGGACAGCCAACACCAAAAAACCAAGACAACCTTAG  
GGAATTTCTTGAAAGGCAGGATTTTGTAGACTTTTTTATTCCTGGATTTGCTGAGATGGCTGCTCCTTTGTATCCTCTTACT  
AAGCCAGGAACCTCTTCAACTGGGGACCTGATCAGCAAAAGGCTTATCAGGAAATTAAGCAGGCACTTCTTACTGCTCC  
TGCACTTGGACTTCTGATCTTACTAAGCCTTTGCAACTTTTTGTTGGATGAAAAACAAGGATATGCTAAGGGAGTTTGGACT  
CAAAAGTTGGGACCTTGGAGAAGACCTGTTGCTTATCTTTCTAAGAACTTGATCCTGTTGCAGCTGGTTGGCCTCCTGTG  
CTTAGAATGGTTGCTGCTATTGCTGTTCTTACTAAGGATGCTGGTAAGCTCACTATGGGACAACCTCTTGTTATTCTCGCAC  
CTCATGCTGTTGAAGCTCTTGTTAAGCAACCTCCTGATAGATGGCTTTCTAATGCTAGAATGACTCATTATCAAGCTCTTCT  
TCTCGATACTGATAGGGTTCAATTTGGACCTGTTGTTGCTTTAAATCCTGCTACTCTTCTTCTCCTCCCTGAAGAAGGTCTT  
CAACACAACCTGTTTAGATATTCTTGCTGAGGCTCATGGAAGTACCTGATCTTACCGATCAACCTCTTCTGATGCTGATC  
ACACTTGGTATACTGATGGTTCTTCTTTGCTTCAAGAAGGACAAAGAAAGGCTGGAGCTGCTGTTACTACCGAACTGAA  
GTTATATGGGCAAAAGCACTTCTGCTGGAACCTTCTGCTCAAAGAGCTGAATTGATTGCTTTACACAAGCTCTTAAATG  
GCAGAAGGAAAGAACTTAATGTTTATACTGATAGTAGGTATGCTTTTGAAGCTGCTCATATTCATGGAGAAATTTACAGAAG  
AAGGGGATGGTTGACTTCAGAAGGAAAGGAAATTAAGAATAAGGATGAAATCCTCGCTCTTTGAAGGCTTTGTTTTGCC  
TAAGAGACTTTCTATTATTCAATTGCTGACACCAAAAGGGACATAGTGCAGAAGCTAGAGGAAATAGAATGGCTGATCA  
AGCTGCTAGAAAGGCTGCTATTACTGAACTCCAGATACCTCAACTCTTCTATTGAAATTTCTTCCATCAGGAGGATCT  
AAGAGGACAGCTGATGGATCTGAATTTGAA

## 4. Sequences of PBS and RT templates used in this study

Target sites	sgRNA	PBS	RT templates
Cm <sup>R</sup> H139Y	GACATGGAAGCCATCACAAA	GTGATGGCTTCCA	CATCATGCCGTTT
<i>PDS3-1</i>	CCTCCAGATAGCTGCATGGA	ATGCAGCTATCTG	TCATCCTACC
<i>PDS3-2</i>	TTCATGTTCTTGTTGGAAGT	TCCAACAAGAACATG	TCGGATAAGCACTGACT
<i>ALS</i>	TGGTTATGCAATGGGAAGAT	TTCCCATTCGATAAC	TGTAGAACCGACC

## 5. Primers used in amplicon

Prime Name	Sequence
Cm-F1	TTATCCCCTGATTCTGTGGATAACCG
Cm-R1	TTCCATGAGCAAAGTGAACGTTTTTCAT
SDCX-F1	TCAGTCTTGTGCTACACACCGC
SDCX-R1	CGGATAAGCACCGACTTCCAACAAG
SDCX-F2	TGCATGGAAGGATGAAGATGGGG
SDCX-R2	CAGCTGACTAGCAAGTAAGAATATGCG
ALS-F1	GGCGCAGTTCTACAATTACAAGAAACCA
ALS-R1	CCATTTCGGGATCATCGGCAAC
ED-PDS1-F2	AGAGTAGTTTACTGGAAGATATCTTTTGGATATATATTTTGTAAAGT
ED-PDS1-F2	TAACCAAGTGTTTTGCAACTTTCTTCAAATTGAT
ED-PDS2-F1	TCCAAAACCTCATACCCTCTCTG
ED-PDS2-R1	CCATTTAAGGGTGCTGGTAG
ED-ALS-F1	CCTGCTGCGATTGGAGCG
ED-ALS-R1	CCAACAGGTAAGGTCCTGGTGT