

**Construction and application of an efficient dual-base editing platform for  
*Bacillus subtilis* evolution employing programmable base conversion**

Wenliang Hao<sup>#</sup>, Wenjing Cui<sup>#</sup>, Feiya Suo, Laichuang Han, Zhongyi Cheng\*, Zhemin Zhou\*

The Key Laboratory of Industrial Biotechnology (Ministry of Education), School of Biotechnology, Jiangnan University, 1800 Lihu Avenue, Wuxi 214122, China

**Supplementary Information**

Table S1. The strains used in this study.

Table S2. The primers used for gene cloning in this study.

Table S3. The plasmids used in this study.

Table S4. The protospacer sequences used in this study.

Table S5. The mutations of PsdB.

Fig. S1. The base editing efficiency of the dual-base editor for the *bceB* gene and *pks* operon.

Fig. S2. Genome-wide off-target evaluation of dual-base editor.

Fig. S3. Sample image output of the sequencing data of the editing of *bceB* from the BEAT analysis.

Fig. S4. Base conversion efficiencies of the dual-base editor with an sgRNA array (B1-7) targeting *bceB* at different xylose concentration.

Fig. S5. Identification of genetic diversity for multiplex editing of *bceB* at different xylose concentrations.

Fig. S6. Identification and comparison of genetic diversification between multiplex editing and multiple rounds of single editing at the single-clone level.

Fig. S7. Identification of PsdB mutants by single-clone sequencing.

Supplementary method. The preparation of relevant medias.

Supplementary sequences. Sequence of key genetic parts.

**Table S1. The strains used in this study**

Strains	Description	References or sources
<i>E. coli</i> JM109	<i>recA1, supE44 endA1 hsdR17 (r<sup>-</sup>k,m<sup>+</sup>k) gyrA96 relA1 thi (lac-proAB) F'</i> [ <i>traD36 proAB<sup>+</sup> lacI<sup>q</sup> lacZΔM15</i> ]	Lab stock
<i>B. subtilis</i> 168	<i>trpC2</i>	Lab stock
BS1	Derived from <i>B. subtilis</i> 168, <i>lacA::P<sub>xylA</sub>-ABE7.10-CDA-nCas9, Cm<sup>R</sup></i>	This study
BS2	Derived from <i>B. subtilis</i> 168, <i>lacA::P<sub>xylA</sub>-CDA-ABE7.10-nCas9, Cm<sup>R</sup></i>	This study
BS3	Derived from <i>B. subtilis</i> 168, <i>lacA::P<sub>xylA</sub>-ABE7.10-nCas9-CDA , Cm<sup>R</sup></i>	This study
BS4	Derived from <i>B. subtilis</i> 168, <i>lacA::P<sub>xylA</sub>-ABE8e-CDA-nCas9, Cm<sup>R</sup></i>	This study
BS5	Derived from <i>B. subtilis</i> 168, <i>lacA::P<sub>xylA</sub>-CDA-ABE8e-nCas9, Cm<sup>R</sup></i>	This study
BS6	Derived from BS4, <i>amyE::P<sub>veg</sub>-B1/P<sub>veg</sub>-B2/P<sub>veg</sub>-B3/P<sub>veg</sub>-B4/P<sub>veg</sub>-B5/P<sub>veg</sub>-B6/P<sub>veg</sub>-B7, Cm<sup>R</sup>, Spc<sup>R</sup></i>	This study
BS7	Derived from BS4, <i>amyE::P<sub>veg</sub>-B2/P<sub>veg</sub>-B3/P<sub>veg</sub>-B4, Cm<sup>R</sup>, Spc<sup>R</sup></i>	This study
BS8	Derived from BS4, <i>amyE::P<sub>veg</sub>-P1/P<sub>veg</sub>-P2/P<sub>veg</sub></i>	This study

	P3/P <sub>veg</sub> -P4/P <sub>veg</sub> -P5, Cm <sup>R</sup> , Spc <sup>R</sup>	
BS9	Derived from BS4, <i>amyE</i> ::P <sub>veg</sub> -P1/P <sub>veg</sub> -P5, Cm <sup>R</sup> , Spc <sup>R</sup>	This study
BS4-pJOE-B2	Derived from BS4, harboring pJOE-B2 plasmid, Kan <sup>R</sup> , Cm <sup>R</sup>	This study
BS4-pJOE-B3	Derived from BS4, harboring pJOE-B3 plasmid, Kan <sup>R</sup> , Cm <sup>R</sup>	This study
BS4-pJOE-B4	Derived from BS4, harboring pJOE-B4 plasmid, Kan <sup>R</sup> , Cm <sup>R</sup>	This study

**Table S2. Primers used in this study**

Primers	Sequences (5'-3')
pHY-B1-F	cgcaacaaacagttcattaaggtagagctagaaatagcaagtaaaataag
pHY-B1-R	ttaatgaactgttgcgttatatttacataatcgcgcg
pHY-B2-F	agccgctacattgttcaggttagagctagaaatagcaagtaaaataag
pHY-B2-R	ctgaacaaaatgtagcggcttataatttacataatcgcgcg
pHY-B3-F	tcaacattgcgtcaggacgttagagctagaaatagcaagtaaaataag
pHY-B3-R	gtcctgcgtcaagcaaattgttgcgttatatttacataatcgcgcg
pHY-B4-F	acagcaagctgcataattgcgttttagagctagaaatagcaagtaaaataag
pHY-B4-R	ggcaaatatgcagctgcgttttagagctagaaatagcaagtaaaataag
pHY-B5-F	ccccccgttgtaaacgtgttttagagctagaaatagcaagtaaaataag
pHY-B5-R	acacgtttacaagcggggcttataatttacataatcgcgcg
pHY-B6-F	cacccttgcgtttaaataagttagagctagaaatagcaagtaaaataag
pHY-B6-R	ttattttaaacaaatgggtttatatttacataatcgcgcg
pHY-B7-F	aacaccatcaccataatcatgttttagagctagaaatagcaagtaaaataag
pHY-B7-R	atgattatggtgatgggtttatatttacataatcgcgcg
pHY-pksA1-F	atcagccagaaatattgcgttttagagctagaaatagcaagtaaaataag
pHY-pksA1-R	ttgcaatattctggctgatatttacataatcgcgcg
pHY-pksA2-F	cacgcgcacagggtcaagcgttttagagctagaaatagcaagtaaaataag
pHY-pksA2-R	tgcttgaccctgtgcgcgtgtttatatttacataatcgcgcg
pHY-pksB-F	cattcaaagaataaaagtgcgggttttagagctagaaatagcaagtaaaataag
pHY-pksB-R	ccgactttattcttgaatgtttatatttacataatcgcgcg
pHY-pksC-F	tcatgcataaagaaaagatgggttttagagctagaaatagcaagtaaaataag

pHY-pksC-R	catctttcttatgcgatgattatttacataatcgcg
pHY-pksD1-F	gttcccaatactatcacatggtttagagctagaaatagcaagtaaaataag
pHY-pksD1-R	catgtgatagtattggaaacttatatttacataatcgcg
pHY-pksD2-F	actcaatcataaaaatggcggttagagctagaaatagcaagtaaaataag
pHY-pksD2-R	cggcattttatgattgagttatatttacataatcgcg
pHY-pksE1-F	acacaatatcgcatggtagagctagaaatagcaagtaaaataag
pHY-pksE1-R	atggctgacgatattgtgtttatatttacataatcgcg
pHY-pksE2-F	tccgcggcagacatttagagtttagagctagaaatagcaagtaaaataag
pHY-pksE2-R	tctcaatgtctgccgggatttatatttacataatcgcg
pHY-pksF-F	cacgggatttagcatatacggttagagctagaaatagcaagtaaaataag
pHY-pksF-R	ccgtatatgctaattccgtgttatatttacataatcgcg
pHY-pksG-F	gcaccggacaatgtcgtagtttagagctagaaatagcaagtaaaataag
pHY-pksG-R	tacgcatcattgtccggtgcttatatttacataatcgcg
ABE7.10-CDA-nCas9-b-F	tggaggaaggcacagatgccgaatacgttcg
ABE7.10-CDA-nCas9-b-R	aacttcgctcatggatcccattcccccttgattttta
TadA1-F	ggaaatggatccatgagcgaagttgaattcagcc
TadA1-R	cggcatctgtgcctccatcgatgaggcctc
ABE8e-CDA-nCas9-b-F	tggaggaaggcacagatgccgaatacgttcg
ABE8e-CDA-nCas9-b-R	cttctgacatggatcccattcccccttgattttta
ABE8e1-F	aatgggatccatgtcagaagttgaatttcacatg
ABE8e1-R	cggcatctgtgcctccatcgatgaggcctc
CDA-ABE7.10-nCas9-b-F	tctggaggaagcgataagaaatactcaataggcttagctatcg
CDA-ABE7.10-nCas9-b-R	caacttcgctagactctggagttgcagactc
TadA2-F	tccagagtctagcgaagttgaattcagccac
TadA2-R	gagtatttcttatgcgcctccatcgatgaggcctc
CDA-ABE8e-nCas9-b-F	atcactcacacgcataaaagtgttttagagctagaaatagcaagtaaaataag
CDA-ABE8e-nCas9-b-R	actttatgcgtgtgagtgatttatatttacataatcgcg
ABE8e2-F	cctgcaggattcaattcaagtttagagctagaaatagcaagtaaaataag
ABE8e2-R	ttgaaagtgaatcctgcaggttatatttacataatcgcg
ABE7.10-nCas9-CDA-b-F	tctggaggaagcgataagaaatactcaataggcttagctatcg
ABE7.10-nCas9-CDA-b-R	aacttcgctcatggatcccattcccccttgattttta
TadA3-F	ggaaatgggatccatgagcgaagttgaattcagcc
TadA3-R	gagtatttcttatgcgcctccatcgatgaggcctc



P2-Go-R	ggtctcgatggaaaaaaggcaccgactcg
P3-Go-F	ggtctcaccatttattaacgttgatataatttaaatttatggacaaaatgg
P3-Go-R	ggtctcgagccaaaaagcaccgactcg
P4-Go-F	ggtctcaggcttattaacgttgatataatttaaatttatggacaaaatgg
P4-Go-R	ggtctcggcataaaaaagcaccgactcg
P5-Go-F	ggtctcaatgcttattaacgttgatataatttaaatttatggacaaaatgg
P5-Go-R	ggtctcgaagaaaaagcaccgactcg
psdB-Go-b-F	ggtctcagcttaagctgggcttaattaatggactc
psdB-Go-b-R	ggtctctggaggatcccgtcgacgc
pJOE-F	atgcgaattcttattaacgttgatataatttaaatttatggacaaaatgg
pJOE-R	attattaaaaaaaagcaccgactcg
pJOE-b-F	gtgcctttttttaataatccaaatggataaaaatgtcatgcattg
pJOE-b-R	acgttaataagaattcgcatcacacgcaaaaag

**Table S3. The plasmids used in this study**

Plasmids	Description	References or sources
pHYT-P43-G10	<i>E. coli-B. subtilis</i> shuttle vector, P43 promoter, gRNA targeting GFP, Tet <sup>R</sup>	Lu et al., 2019 <sup>1</sup>
pHY-ECBE	Derived from pHYT-P43-G10, gRNA targeting <i>sigE</i>	Lab stock
pHY-B1	Derived from pHYT-P43-G10, gRNA targeting <i>bceB</i> (B1)	This study
pHY-B2	Derived from pHYT-P43-G10, gRNA targeting <i>bceB</i> (B2)	This study
pHY-B3	Derived from pHYT-P43-G10, gRNA targeting <i>bceB</i> (B3)	This study
pHY-B4	Derived from pHYT-P43-G10, gRNA targeting <i>bceB</i> (B4)	This study
pHY-B5	Derived from pHYT-P43-G10, gRNA targeting <i>bceB</i> (B5)	This study
pHY-B6	Derived from pHYT-P43-G10, gRNA targeting <i>bceB</i> (B6)	This study
pHY-B7	Derived from pHYT-P43-G10, gRNA targeting <i>bceB</i> (B7)	This study
pHY-pksA-1	Derived from pHYT-P43-G10, gRNA targeting <i>pksA</i> ( <i>pksA-1</i> )	This study
pHY-pksA-2	Derived from pHYT-P43-G10, gRNA targeting <i>pksA</i> ( <i>pksA-2</i> )	This study
pHY-pksB	Derived from pHYT-P43-G10,	This study

	gRNA targeting <i>pksB</i> ( <i>pksB</i> )	
pHY-pksC	Derived from pHYT-P43-G10, gRNA targeting <i>pksC</i> ( <i>pksC</i> )	This study
pHY-pksD-1	Derived from pHYT-P43-G10, gRNA targeting <i>pksD</i> ( <i>pksD-1</i> )	This study
pHY-pksD-2	Derived from pHYT-P43-G10, gRNA targeting <i>pksD</i> ( <i>pksD-2</i> )	This study
pHY-pksE-1	Derived from pHYT-P43-G10, gRNA targeting <i>pksE</i> ( <i>pksE-1</i> )	This study
pHY-pksE-2	Derived from pHYT-P43-G10, gRNA targeting <i>pksE</i> ( <i>pksE-2</i> )	This study
pHY-pksF	Derived from pHYT-P43-G10, gRNA targeting <i>pksF</i> ( <i>pksF</i> )	This study
pHY-pksG	Derived from pHYT-P43-G10, gRNA targeting <i>pksG</i> ( <i>pksG</i> )	This study
pAD123	<i>E. coli-Bacillus</i> shuttle plasmid, promoter-less gfpmut3, Cm <sup>R</sup> in <i>Bacillus</i>	Lab stock
pAD-B1	Derived from pAD123, gRNA targeting <i>bceB</i> (B1)	This study
pAD-B2	Derived from pAD123, gRNA targeting <i>bceB</i> (B2)	This study
pAD-B3	Derived from pAD123, gRNA targeting <i>bceB</i> (B3)	This study
pAD-B4	Derived from pAD123, gRNA targeting <i>bceB</i> (B4)	This study
pAD-B5	Derived from pAD123, gRNA targeting <i>bceB</i> (B5)	This study
pAD-B6	Derived from pAD123, gRNA targeting <i>bceB</i> (B6)	This study
pAD-B7	Derived from pAD123, gRNA targeting <i>bceB</i> (B7)	This study
pAD-P1	Derived from pAD123, gRNA targeting <i>psdB</i> (P1)	This study
pAD-P2	Derived from pAD123, gRNA targeting <i>psdB</i> (P2)	This study
pAD-P3	Derived from pAD123, gRNA targeting <i>psdB</i> (P3)	This study
pAD-P4	Derived from pAD123, gRNA targeting <i>psdB</i> (P4)	This study
pAD-P5	Derived from pAD123, gRNA targeting <i>psdB</i> (P5)	This study
pDGT-GFP	<i>B. subtilis</i> integration vector, P43- GFP cassette, spec <sup>R</sup>	Lu et al., 2019 <sup>1</sup>

pDGT-GFP-Amp <sub>m</sub>	Derived from pDGT-GFP, P43-GFP cassette, synonymous mutation in AmpR (TCT <u>240</u> TCC), spec <sup>R</sup>	Lab stock
pDGT-B2-4	pDGT-GFP-Amp <sub>m</sub> derivative, P <sub>veg</sub> promoter, containing gRNA expression cassette targeting <i>bceB</i> (B2, B3, and B4)	This study
pDGT-B1-7	pDGT-GFP-Amp <sub>m</sub> derivative, P <sub>veg</sub> promoter, containing gRNA expression cassette targeting <i>bceB</i> (B1, B2, B3, B4, B5, B6, and B7)	This study
pDGT-P1-5	pDGT-GFP-Amp <sub>m</sub> derivative, P <sub>veg</sub> promoter, containing gRNA expression cassette targeting <i>psdB</i> (P1, P2, P3, P4, and P5)	This study
pDGT-P1-P5	pDGT-GFP-Amp <sub>m</sub> derivative, P <sub>veg</sub> promoter, containing gRNA expression cassette targeting <i>psdB</i> (P1 and P5)	This study
pAX-CDA-nCas9	<i>B. subtilis</i> integration vector, P <sub>xylA</sub> -CDA-nCas9 expression cassette, spec <sup>R</sup> , Cm <sup>R</sup>	Lab stock
pAX-ABE7.10-CDA-nCas9	pAX-CDA-nCas9 derivative, P <sub>xylA</sub> -ABE7.10-CDA-nCas9 expression cassette, spec <sup>R</sup> , Cm <sup>R</sup>	This study
pAX-ABE8e-CDA-nCas9	pAX-CDA-nCas9 derivative, P <sub>xylA</sub> -ABE8e-CDA-nCas9 expression cassette, spec <sup>R</sup> , Cm <sup>R</sup>	This study
pAX-CDA-ABE7.10-nCas9	pAX-CDA-nCas9 derivative, P <sub>xylA</sub> -CDA-ABE7.10-nCas9 expression cassette, spec <sup>R</sup> , Cm <sup>R</sup>	This study
pAX-CDA-ABE8e-nCas9	pAX-CDA-nCas9 derivative, P <sub>xylA</sub> -CDA-ABE8e-nCas9 expression cassette, spec <sup>R</sup> , Cm <sup>R</sup>	This study
pAX-ABE7.10-nCas9-CDA	pAX-CDA-nCas9 derivative, P <sub>xylA</sub> -ABE7.10-nCas9-CDA expression cassette, spec <sup>R</sup> , Cm <sup>R</sup>	This study
pJOE8999	<i>E. coli</i> - <i>B. subtilis</i> shuttle vector, temperature sensitive replication origin of pE194 <sup>ts</sup> for <i>B. subtilis</i> , Kan <sup>R</sup> in <i>E. coli</i> and <i>B. subtilis</i>	Lab stock
pJOE-B2	pJOE8999 derivative, gRNA targeting <i>bceB</i> (B2), Kan <sup>R</sup>	This study

pJOE-B3	pJOE8999 derivative, gRNA targeting <i>bceB</i> (B3), Kan <sup>R</sup>	This study
pJOE-B4	pJOE8999 derivative, gRNA targeting <i>bceB</i> (B4), Kan <sup>R</sup>	This study

**Table S4. The protospacer sequences used in this study**

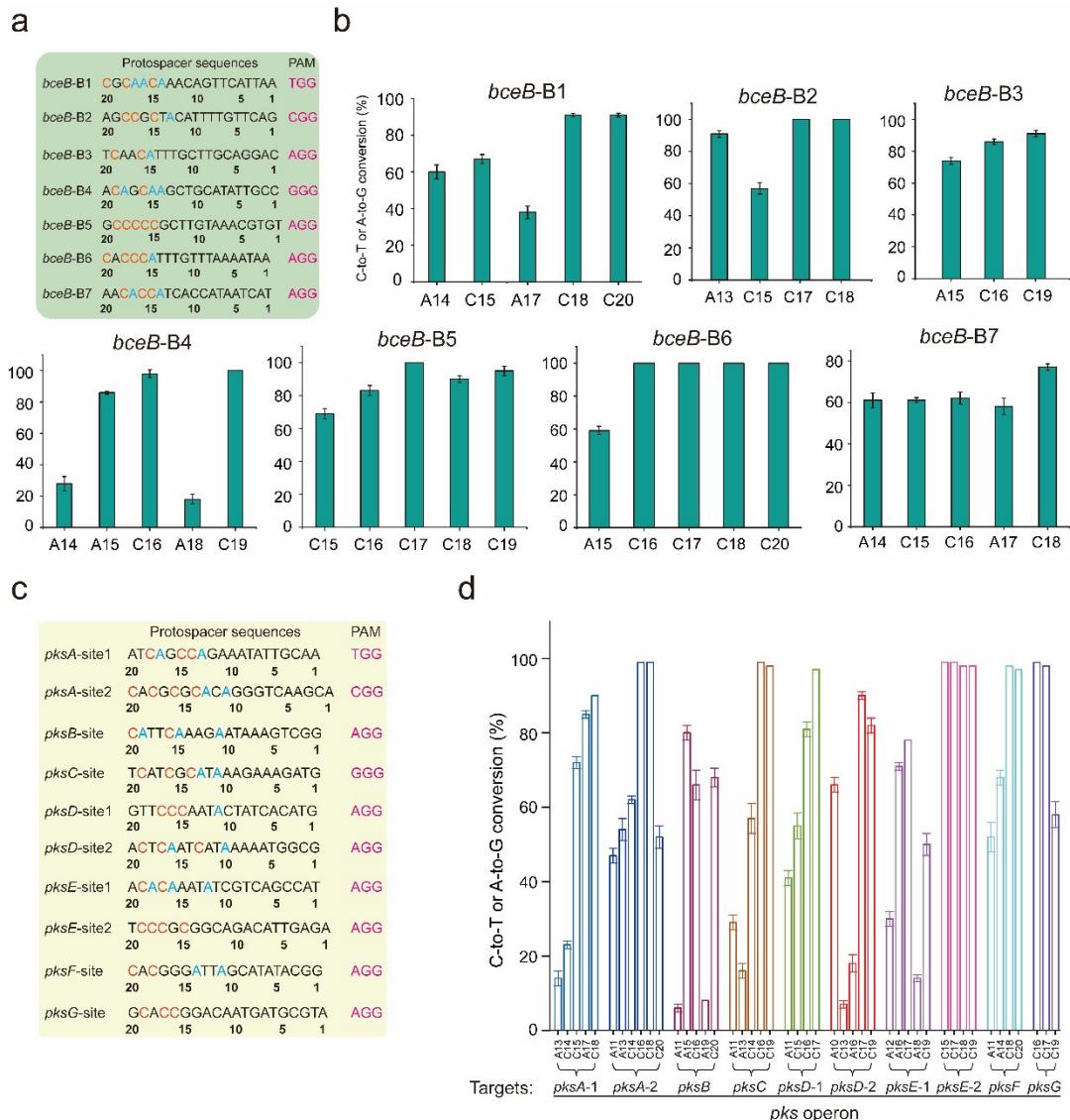
sgRNA Sequences (5'-3')	PAM	Purpose
GCCTCCATTATCTAAAGATG	AGG	Targeting <i>sigE</i>
CGCAACAAACAGTTCATTAA	TGG	Targeting <i>bceB</i> (B1)
AGCCGCTACATTGTTTCAG	CGG	Targeting <i>bceB</i> (B2)
TCAACATTGCTTGAGGAC	AGG	Targeting <i>bceB</i> (B3)
ACAGCAAGCTGCATATTGCC	GGG	Targeting <i>bceB</i> (B4)
GCCCCCGCTTGTAAACGTGT	AGG	Targeting <i>bceB</i> (B5)
CACCCATTGTTAAAATAA	AGG	Targeting <i>bceB</i> (B6)
AACACCATCACCATATCAT	AGG	Targeting <i>bceB</i> (B7)
ATCAGCCAGAAATATTGCAA	AGG	Targeting <i>pksA</i> ( <i>pksA-1</i> )
CACGCGCACAGGGTCAAGCA	TGG	Targeting <i>pksA</i> ( <i>pksA-2</i> )
CATTCAAAGAATAAAGTCGG	AGG	Targeting <i>pksB</i> ( <i>pksB</i> )
TCATCGCATAAAGAAAGATG	CGG	Targeting <i>pksC</i> ( <i>pksC</i> )
GTTCCCAATACTATCACATG	GGG	Targeting <i>pksD</i> ( <i>pksD-1</i> )
ACTCAATCATAAAATGGCG	GGG	Targeting <i>pksD</i> ( <i>pksD-2</i> )
ACACAAATATCGTCAGCCAT	CGG	Targeting <i>pksE</i> ( <i>pksE-1</i> )
TCCCGCGGGCAGACATTGAGA	AGG	Targeting <i>pksE</i> ( <i>pksE-2</i> )
CACGGGATTAGCATATACGG	TGG	Targeting <i>pksF</i> ( <i>pksF</i> )
GCACCGGACAATGATGCGTA	AGG	Targeting <i>pksG</i> ( <i>pksG</i> )
AAACACACAGCTAAAAAGT	AGG	Targeting <i>psdB</i> (P1)
CGCTCAAGCATGTTTGACA	AGG	Targeting <i>psdB</i> (P2)
TAACAGGCCTGCTCCAATGC	CGG	Targeting <i>psdB</i> (P3)
CTGAAACAGGATGAGAAAGC	CGG	Targeting <i>psdB</i> (P4)
ATTAACACTAAAATCAAAAT	TGG	Targeting <i>psdB</i> (P5)

**Table S5. The mutations of PsdB**

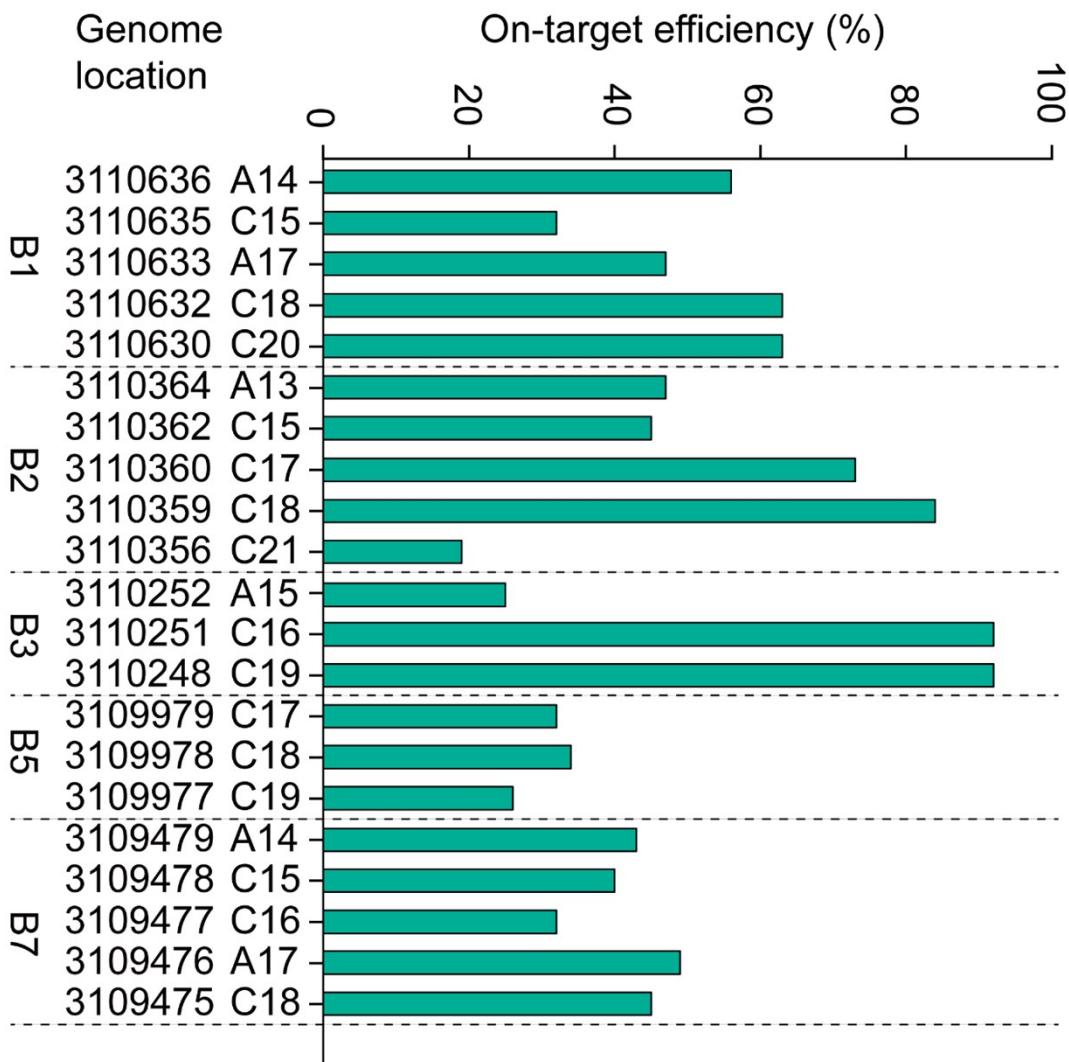
Mutants	Position of mutation
M1	PsdB (V26T/L59P/L126P/I164T, F166L/V236A, L237S)
M2	PsdB (V26A/S60N/L126P/I164T, L165P, F166L/V236A)
M3	PsdB (V26A/L59S, S60N/L126P/L165P, F166L/L235S, V236A)

M4	PsdB (C25R, V26A/L59P/L126P/L165P, F166L/V236A, L237S)
M5	PsdB (V26A/L59S, S60N/L126P/I164T, L165P, F166S/V236A, L237P)
M6	PsdB (V26A/L59S, S60N, A61T/L126P, L127S/F166L/V236A, L237S)
M7	PsdB (V26A)
M8	PsdB (V26A/L235S)

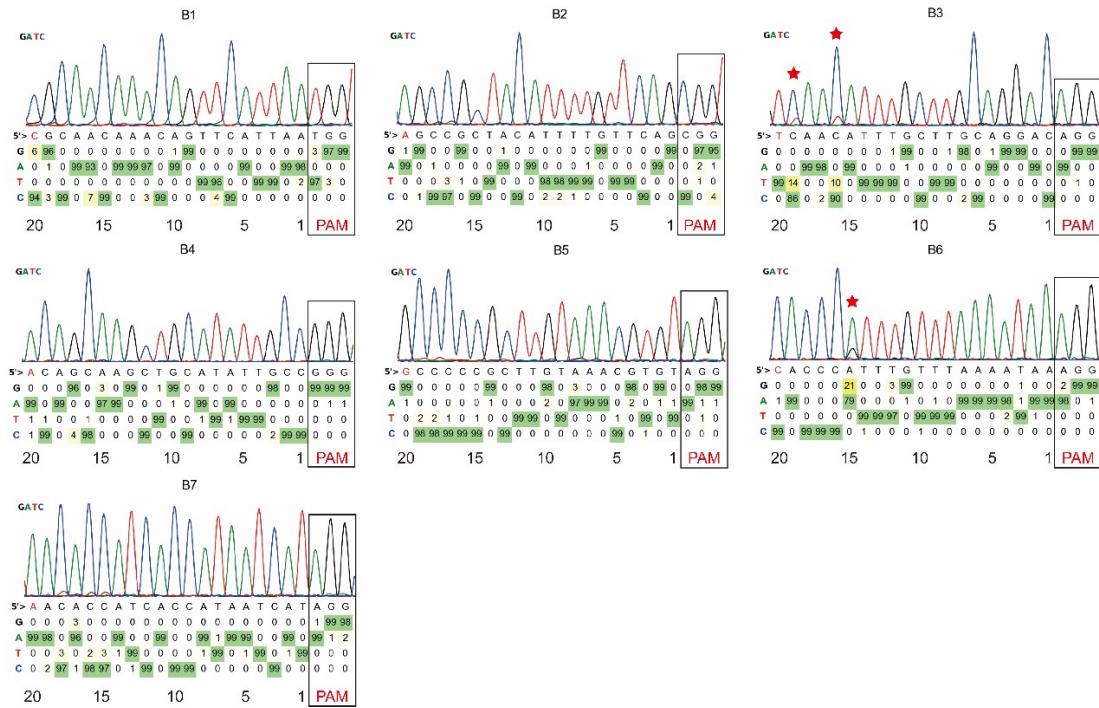
## Supplementary Figure



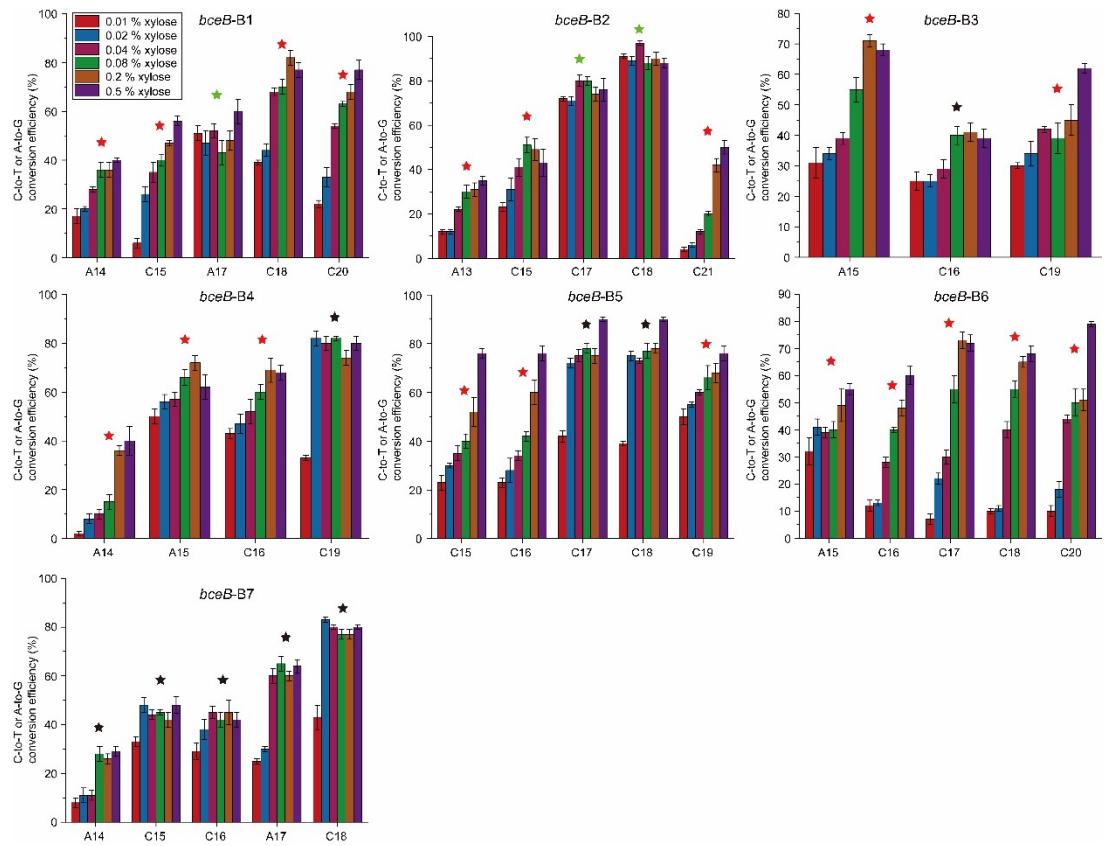
**Fig. S1 The base editing efficiency of the dual-base editor for the *bceB* gene and *pks* operon. (a)** The protospacer sequences for the editing of *bceB*. **(b)** Base conversion efficiencies of the dual-base editor with the corresponding single sgRNA (B1-B7) targeting *bceB*. **(c)** The protospacer sequences for the editing of *pks* operon. **(d)** Base conversion efficiencies of the dual-base editor with the corresponding single sgRNA (*pksA*-1, *pksA*-2, *pksB*, *pksC*, *pksD*-1, *pksD*-2, *pksE*-1, *pksE*-2, *pksF*, and *pksG*) targeting *pks* operon.



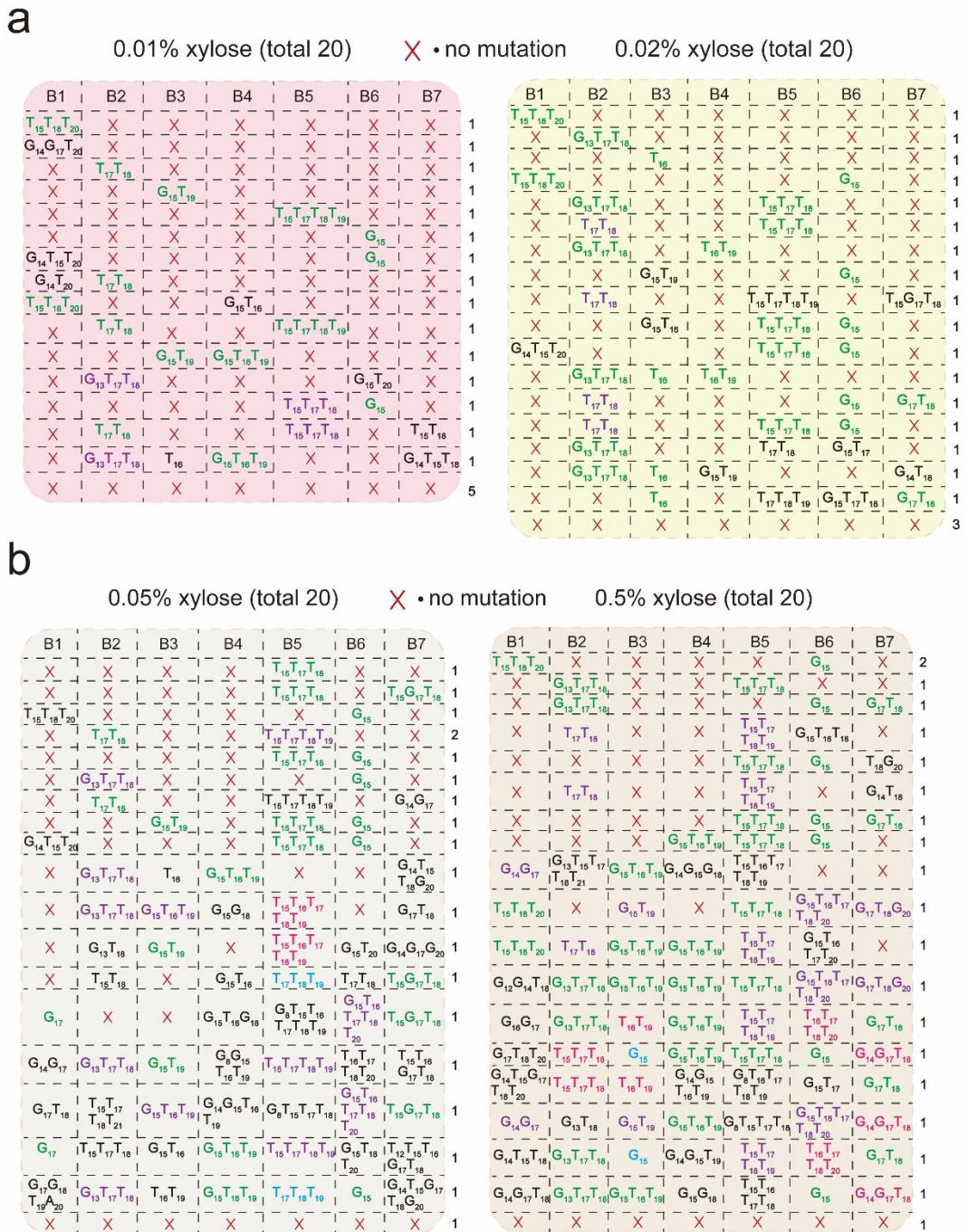
**Fig. S2 Genome-wide off-target evaluation of dual-base editor.** The high-throughput sequencing results shown that there were no mutations at non-specific sites except for the sgRNA-targeting specific sites (B1, B2, B3, B5, and B7). Thus, the contrast on-target efficiencies of *bceB* sites (B1, B2, B3, B5, and B7) were shown. The corresponding positions of DNA on-target are indicated at the genome-scale. Corresponding sgRNA sequences targeting *bceB* are listed in Table S4. The high-throughput sequencing data of this study are available at the Sequence Read Archive (PRJNA808834) of the NCBI.



**Fig. S3 Sample image output of the sequencing data of the editing of *bceB* from the BEAT analysis.** The base conversion efficiencies of the dual-base editor with an sgRNA array (B1-7) targeting *bceB* under the absence of xylose. The raw sequencing data is quantitatively analyzed by BEAT<sup>2</sup>. The order of partial bases is numbered and PAM motifs are framed with black rectangle. The mutated bases are indicated in red stars.



**Fig. S4 Base conversion efficiencies of the dual-base editor with an sgRNA array (B1-7) targeting *bceB* at different xylose concentration.** Quantitative analyses of base conversion efficiencies of the dual-base editor for the editing of *bceB* with an sgRNA array (B1-7). Similar editing pattern is indicated with stars of different colors.



**Fig. S5 Identification of genetic diversity for multiplex editing of *bceB* at the single-clone level under different xylose concentrations.** (a) Identification of genetic diversity for multiplex editing of *bceB* with an sgRNA array (B1-7) under 0.01% and 0.02% xylose concentrations, respectively. (b) Identification of genetic diversity for multiplex editing of *bceB* with an sgRNA array (B1-7) under 0.05% and 0.5% xylose concentrations, respectively. The identical genotype at the same site is showed in the same color.

a

- • no mutation

## Multiplex editing (total 30)

<i>bceB-B2</i>	<i>bceB-B3</i>	<i>bceB-B4</i>	
A13C17C18	-	-	2
-	C16C19	-	1
-	-	A14A15C16C19	1
A13C15C17	A15C16	-	1
C15C17C18	A15C19	-	1
C17	A15C19	-	1
C15C18	A15	-	2
A13C17C18	-	A14A15	2
C17C18	-	A14A15A18	1
-	C16C19	A14C19	1
C18	A15C16C19	C16A18C19	1
A13C18	A15	A14C16C19	1
A13C15C17	A15C16C19	A14C16C19	1
A13C15C18	A15C16C19	A14A15C16	1
A13C15C17C18	A15C16C19	A14A18C19	5
A13C15C17C18	A15C16C19	A14C16C19	8

## Sequential editing (total 30)

<i>bceB-B2</i>	<i>bceB-B3</i>	<i>bceB-B4</i>	
A13C15C17C18	A15C16C19	A14A15C16C19	2
C15C17C18	A15C16C19	A15C16C19	2
C15C17C18	A15C16	A14A15C16	2
C15C17C18	A15C16C19	C16C19	2
A13C15C17C18	A15C16C19	A14A15C16A18C19	3
A13C17C18	A15C19	C16C19	3
C15C17C18	C16C19	A15C16C19	4
A13C15C17C18	A15C16	A15C16C19	5
A13C17C18	C16C19	A14C16C19	7

VS.

b

- • no mutation

## Multiplex editing (total 50)

<i>bceB-B2</i>	<i>bceB-B3</i>	<i>bceB-B4</i>	
A13C17C18	-	-	4
A11C17C18	-	-	2
-	A15C16C19	-	2
-	C16C19	-	2
C17	A15C19	-	2
A13C17C18	C19	-	1
C17C18	C16C19	-	1
A13C15C17	C16C19	-	1
C17C18	-	C16C19	2
A13C17C18	-	A14A15A18	5
-	C16C19	C15C16C19	6
-	C16C19	A14C16C19	2
A13C15C17C18	A15C16C19	A14C16C19	6
A13C15C17	A15C16C19	C15C16C19	4
A11A13	A15C16C19	C16C19	4
C15C18	C16C19	A14C16C19	2
A13C15C17	A15C16C19	A14C16C19	2
C15C17C18	C16	C16C19	2

## Sequential editing (total 50)

<i>bceB-B2</i>	<i>bceB-B3</i>	<i>bceB-B4</i>	
A13C15C17C18	A15C16C19	A14A15C16C19	8
C15C17C18	A15C16C19	A15C16C19	6
C15C17C18	A15C16	A14A15C16	5
A13C15C17C18	A15C16C19	A14C16C19	6
C15C17C18	C16C19	A14A15C16	2
A13C17C18	A15C19	C16C19	8
C15C18	C16C19	A15C16C19	4
A13C15C17C18	A15C16	A15C16C19	5
A13C17C18	C16C19	A14C16C19	4
C17C18	C16C19	C16C19	2

VS.

**Fig. S6 Identification and comparison of genetic diversification between multiplex editing and multiple rounds of single editing at the single-clone level. (a)** Identification of genetic diversification of 30 colonies from multiplex editing system and multiple rounds of single editing system, respectively. **(b)** Identification of genetic diversification of 50 colonies from multiplex editing system and multiple rounds of single editing system, respectively. The purple rectangles suggest that new mutants are different from the previous identification in 30 colonies.

sgRNA Variants \	P1	P2	P3	P4	P5
M1	C15A16C17	A14A15	A16C17	A10A15C20	A14A17
M2	A14A16	C16C18	A16C17	A10A13A15C20	A14C15
M3	A14A16C17	A15C18	A16C17	A13A15C20	A11A14
M4	A12A14A16	A14A15	A16C17	A13A15C20	A14A17
M5	A16C17	A15C18	A16C17	A10A13A16	A14A16A17
M6	A14A16	A15C18C20	A16A19	A15A17C20	A14A17
M7	A16C17				
M8	A16C17				A11

**Fig. S7 Identification of PsdB mutants by single-clone sequencing.** Six mutants (M1, M2, M3, M4, M5, and M6) with different tolerance to nisin were selected to identify the types of mutations by sequencing. Moreover, the mutants PsdB-V26A (M7) and PsdB-V26A/L235S (M8) were also identified by sequencing. P1-5 denote sgRNAs targeting different loci of *psdB*, respectively. All sgRNA sequences targeting PsdB and amino acid substitutions in PsdB are shown in Table S4 and Table S5.

## Supplementary method

The preparation of relevant medias:

- 1) Every 2mL SPI contains 980  $\mu$ L SPI-A, 980  $\mu$ L SPI-B, 20  $\mu$ L Glucose (50%), and 20  $\mu$ L CAYE;
- 2) Every 2mL SPII contains 1960  $\mu$ L SPI, 20  $\mu$ L CaCl<sub>2</sub> (5 mM), and 20  $\mu$ L MgCl<sub>2</sub> (250mM);
- 3) SPI-A contains 4 g/L (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, 28 g/L K<sub>2</sub>HPO<sub>4</sub>·3H<sub>2</sub>O, 12 g/L KH<sub>2</sub>PO<sub>4</sub>, and 2 g/L sodium citrate;
- 4) SPI-B was 0.4 g/L Mg<sub>2</sub>SO<sub>4</sub>·7H<sub>2</sub>O;
- 5) CAYE contains 20 g/L casamino acid and 100 g/L yeast extract;
- 6) SPI-A, SPI-B, 50% Glucose, CAYE, 5 mM CaCl<sub>2</sub>, 250mM MgCl<sub>2</sub>, and 10 mM EGTA (adjusting pH to 8.0 by NaOH) were sterilized at 121 °C for 15 min separately.

## Supplementary sequences

pHY plasmid related key genetic parts

TATTTTTTGCCAAAGCTGTAATGGCTGAAAATTCTACATTATTTACAT

TTTTAGAAATGGCGTGAAAAAAAGCGCGCGATTATGTAAAATATAAANN  
NNNNNNNNNNNNNNNNNTTTAGAGCTAGAAATAGCAAGTAAAATA  
AGGCTAGTCGTTATCAACTGAAAAAGTGGCACCGAGTCGGTGCCTTTT

Annotations:

P43 promoter, alternative 20 base target site, tracr RNA terminator

pDGT plasmids related key genetic parts

pDGT-GFP

ATGTTGCAAAACGATTCAAAACCTCTTACTGCCGTATTGCTGGATT  
TTATTGCTGTTCATGGTCTGGCAGGACCGCGGCTGCAGTGCTGAA  
ACGGCGAACAAATCGAATGAGCTACAGCACCGTCGATCAAAGCGGAA  
CCATTCTTCATGCATGGAATTGGCGTTCAATACGTTAAACACAATATGA  
AGGATATTGATGCAGGATATACAGCCATTGACACATCTCCGATTAAC  
CAAGTAAAGGAAGGAAATCAAGGAGATAAAAGCATGTCGAACCTGGTACT  
GGCTGTATCAGCCGACATCGTATCAAATTGGCAACCGTTACTTAGGTACT  
GAACAAGAATTAAAGAAATGTGTGCAGCCGCTGAAGAATATGGCATAA  
AGGTCAATTGTTGACGCCGTCATCAATCATACCACCACTGATTATGCCGCG  
ATTTCCAATGAGGTTAACGAGTATTCAAACGGACACATGGAAACACACA  
AATTAAAAACTGGTCTGATGGATCTTCAGGCATCAAATAAAACGAAAGG  
CTCAGTCGAAAGACTGGCCTTCGTTATCTGTTGTCGGTGAACG  
CTCTCCTGAGTAGGACAAATCCGCCGCTCTAGCTAACGAGGCCATCC  
TGACGGATGGCCTTTACGCGTCGACGGGATCCTCCAAGAGACCTGATAG  
GTGGTATGTTCGCTGAACTTAAATACAGCCATTGAACATACGGTTG  
ATTTAATAACTGACAAACATCACCCCTTGCTAAAGCGGCCAAGGACGCT  
GCCGCCGGGCTGTTGCGTTTGGCGTATTGCTGTATCATTGGTTAC  
TTATTTTTGCCAAAGCTGTAATGGCTGAAAATTCTTACATTATTTACA  
TTTTAGAAATGGCGTGAAAAAAAGCGCGCATTATGTAAAATATAAAG  
TGATAGCGGTACCAATTAGAAAGGAGGTGATAAAATGCGTAAAGGAG  
AAGAACTTTCACTGGAGTTGTCCTAACATTCTGTTGAATTAGATGGTATG  
TTAATGGGACAAATTCTGTCAGTGGAGAGGGTGAAGGTGATGCAACA  
TACGGAAAACCTACCCCTAAATTATTCGACTACTGGAAAACACTACCTGTT  
CCATGGCCAACACTGTCACTACTTCGGTTATGGTGTCAATGCTTGCG  
AGATACCCAGATCATGAAACGGCATGACTTTCAAGAGTGCATGCC  
CGAAGGTTATGTACAGGAAAGAACTATATTTCAAAGATGACGGGAAC  
ACAAGACACGTGCTGAAGTCAAGTTGAAGGTGATACCCCTGTTAATAGA  
ATCGAGTTAAAGGTATTGATTTAAAGAAGATGGAAACATTCTGGACA  
CAAATTGGAATACAACACTAACTCACACAATGTATACATCATGGCAGACA  
AACAAAAGAATGGAATCAAAGTTAACTTCAAAATTAGACACAAACATTGA  
AGATGGAAGCGTTCAACTAGCAGACCATTACACAAACTTCAATTG  
GCGATGGCCCTGTCCTTACAGACAACCAATTACCTGTCCACACAATCTG  
CCCTTCGAAAGATCCACGAAAAGAGAGACCACATGGTCCTTCTGAG  
TTTGTAAACAGCTGCTGGGATTACACATGGCATGGATGAACTATACAAATA

AGGTCTCAGCTTAAGCTGGGCTTAATTAATTAAGACTCCTGTTGATAGAT  
CCAGTAATGACCTCAGAACTCCATCTGGATTGTCAGAACGCTCGGTTGC  
CGCCGGCGTTTTATTGGTGAGAATCCGGGAATTCCCTGCAGCCCTGG  
CGAATGGCGATTTCGTCGTGAATACATGTTATAATAACTATAACTAATA  
ACGTAACGTGACTGGCAAGAGATATTTAAAACAATGAATAGGTTACA  
CTTACTTAGTTATGGAAATGAAAGATCATATCATATATAATCTAGAAT  
AAAATTAACACTAAATAATTATTCTAGATAAAAAATTAGAACCCAATG  
AAATCTATAAATAAACTAAATTAGTTATTAAATTAACAACTATGGATAT  
AAAATAGGTACTAATCAAAATAGTGAGGAGGATATTGAATACACATACG  
AACAAATTAATAAAAGTAAAAAAACTTCGGAAACATTAAAAAATAAC  
CTTATTGGTACTTACATGTTGGATCAGGAGTTGAGAGTGGACTAAAACC  
AAATAGTGTCTGACTTTAGTCGTCGTATCTGAACCATTGACAGATCA  
AAGTAAAGAAACTTACACAAAAATTAGACCTATTCAAAAAAATAG  
GAGATAAAAGCAACTACGATATATTGAATTAACAATTATTACAGCAA  
GAAATGGTACCGTGBATCATCCTCCAAACAAGAATTATTATGGAGA  
ATGGTTACAAGAGCTTATGAACAAGGATACATTCCCTCAGAAGGAATTAA  
ATTCAGATTAAACATAATGCTTACCAAGCAAAACGAAAAATAAAAGA  
ATATACGGAAATTATGACTTAGAGGAATTACTACCTGATATTCCATTTCT  
GATGTGAGAAGAGCCATTATGGATTGTCAGAGGAATTAGATAATT  
TCAGGATGATGAAACCAACTCTATATTAACTTATGCCGTATGATTAAAC  
TATGGACACGGTAAAATCATACAAAAGATATTGCGGGAAATGCAGTG  
GCTGAATCTCTCCATTAGAACATAGGGAGAGAATTGTTAGCAGTCGT  
AGTTATCTGGAGAGAATTGAATGGACTAATGAAAATGAAATTAAAC  
TATAAAACTATTAAATAACAGATTAAAAAAATTATAAAAAAATTGAAAAAA  
ATGGTGGAAACACTTTCAATTGGTTATTATTAAATATTGGGA  
AATATTCAATTCTAATTGTAATCAGATTAGAAAACAATAAACCCCTGCA  
TAGGGGGATCTCGACATGGATGAGCGATGATGATATCCGTTAGGCTGG  
CGGTGATAGCTCTCGTCAGGCAGTACGCCCTTTCTTCCAGACCTG  
AGGGAGGCGAAATGGTGTGAGGTTCCGGGGAAAAGCCAAATAGGCAG  
TCGCGGGAGTGCTTATTGAAGATCAGGCTATCACTGCGGTCAATAGATT  
TCACAATGTGATGGCTGGACAGCCTGAGGAACCTCGAACCGAATGGAA  
ACAACCAGATATTATGAATCAGCGCGCTCACATGGCGTTGCTGGCA  
AATGCAGGTTCATCCTCTGTCTCTAATACGGCAACAAATTGCCTGAT  
GGCAGGTATGACAATAAGCTGGAGCGGGTCATTCAAGTGAACGATGG  
TAAACTGACAGGCACGATCAATGCCAGGTCTGTAGCTGCTTATCCTG  
ATGATATTGCAAAAGCGCCTCATGTTTCTTGAGAATTACAAACAGGT  
GTAACACATTCTTCAATGATCAACTGACGATTACCTGCGTCAGATGCG  
AATACAACAAAAGCCATTATCAAATCAATAATGGACCAGACGACAGGC  
GTTAAGGATGGAGATCAATTACAATCGAAAAGGAGATCCAATTGGC  
AAAACATACACCACATGTTAAAAGGAACGAACAGTGATGGTGTACGA  
GGACCGAGAAATACAGTTGTTAAAAGAGATCCAGCGTCGGCCAAAACC  
ATCGGCTATCAAATCCGAATCATTGGAGCCAGGTAAATGCTTATCTA  
TAAACATGATGGAGCCAGTAATTGAATTGACCGGATCTGGCCTGGAA  
AACCAATGACTAAAATGCAGACGGAATTACACGCTGACGCTGCCTGCG

GACACGGATACAACCAACGCAAAAGTGATTTAATAATGGCAGCGCCA  
AGTGCCCGGTCAAATCAGCCTGGCTTGATTACGTGCTAAATGGTTATA  
TAATGACTCGGGCTAACCGGTTCTCTCCCCATTGA

Annotations:

*amyE* upstream homologous arm, *rrnB* T1 terminator, *rrnB* T2 terminator, P43 promoter, RBS, *GFP* gene, lambda t0 terminator, spectinomycin resistant gene expression cassette, *amyE* downstream homologous arm

pDGT-B1-B7

ATGTTGCAAAACGATTCAAAACCTCTTACTGCCGTATTGCTGGATT  
TTATTGCTGTTCATGGTCTGGCAGGACCGCGGCTGCAGTGCTGAA  
ACGGCGAACAAATCGAATGAGCTACAGCACCGTCGATAAAAGCGGAA  
CCATTCTTCATGCATGGAATTGGCGTTCAATACGTTAAAACACAATATGA  
AGGATATTGATGCAGGATATACAGCCATTGACACATCTCCGATTAAC  
CAAGTAAAGGAAGGGAAATCAAGGAGATAAAAGCATGTCGAACCTGGTACT  
GGCTGTATCAGCCGACATCGTATCAAATTGGCAACCGTTACTTAGGTACT  
GAACAAGAATTAAAGAAATGTGTCAGCCGCTGAAGAATATGGCATAA  
AGGTCAATTGTTGACGCCGTCATCAATCATACCACCACTGATTATGCCGCG  
ATTCCAATGAGGTTAACGAGTATTCAAACGGACACATGGAAACACACA  
AATTAAAAACTGGTCTGATGGATCTCAGGCATCAAATAAAAGGAAAGG  
CTCAGTCGAAAGACTGGCCTTCGTTATCTGTTGTCGGTGAACG  
CTCTCCTGAGTAGGACAAATCCGCCGCTAGCTAACGAGAAGGCCATCC  
TGACGGATGGCCTTTACGCGTCGACGGGATCCTCCAAGAGACCTTATTA  
ACGTTGATATAATTAAATTGACAAAAATGGCCTGTTGACA  
ATAAATGTAGCCGCTACATTGTTCACTGGATCTCAGGTTAGAGCTAGAAATAGCAA  
GTTAAAATAAGGCTAGTCCGTTATCAACTGAAAAAGTGGCACCGAGTCG  
GTGCTTTGGTGTATTAAACGTTGATATAATTAAATTGACAAAA  
AATGGCCTGTTGACAATAATGTTCAACATTGCTTGCAGGACGTT  
TAGAGCTAGAAATAGCAAGTTAAATAAGGCTAGTCCGTTATCAACTG  
AAAAGTGGCACCGAGTCGGCTTTCCATTATAACGTTGATATAAT  
TTAAATTGACAAAAATGGCCTGTTGACA  
AAGCTGCATATTGCCGTTAGAGCTAGAAATAGCAAGTTAAATAAGGC  
TAGTCCGTTATCAACTGAAAAAGTGGCACCGAGTCGGCTTTGGCT  
TTATTAAACGTTGATATAATTAAATTGACAAAAATGGCCTGTTG  
TGTACAATAATGTACCCATTGTTAAATAAGTTAGAGCTAGAAAT  
AGCAAGTTAAATAAGGCTAGTCCGTTATCAACTGAAAAAGTGGCACCG  
AGTCGGTCTTTATGCTTATTAAACGTTGATATAATTAAATTG  
ACAAAAATGGCCTGTTGACAATAATGTCGCAACAAACAGTCATT  
AAGTTTAGAGCTAGAAATAGCAAGTTAAATAAGGCTAGTCCGTTATCA  
ACTGAAAAAGTGGCACCGAGTCGGTCTTTACTTTATTAAACGTTGA  
TATAATTAAATTGACAAAAATGGCCTGTTGACA  
TGCCCCCGCTGTAAACGTGTTAGAGCTAGAAATAGCAAGTTAAA  
TAAGGCTAGTCCGTTATCAACTGAAAAAGTGGCACCGAGTCGGTCTT

TTTAGCTTACGTTGATATAATTAAATTAAATTGACAAAAATGGG  
CTCGTGTACAATAAATGTAACACCACCATCACCATAATCATGTTTAGAGC  
TAGAAATAGCAAGTAAAATAAGGCTAGTCGTTATCAACTGAAAAAGT  
GGCACCGAGTCGGTGCTTTGCTTAAGCTGGGCTTAATTAAAGAC  
TCCTGTTGATAGATCCAGTAATGACCTCAGAACTCCATCTGGATTGTTCA  
GAACGCTCGGTTGCCGCCGGCGTTTTATTGGTGAGAATCCCGGGAA  
TTCCTGCAGCCCTGGCGAATGGCGATTTCGTTGTAATACATGTTATAA  
TAACTATAACTAATAACGTAACGTGACTGGCAAGAGATATTTAAAACA  
ATGAATAGGTTACACTTACTTAGTTATGGAAATGAAAGATCATATCA  
TATATAATCTAGAATAAAATTAACTAAAATAATTATTCTAGATAAAAAA  
ATTTAGAACCAATGAAATCTATAAAACTAAATTAAAGTTATTAAATT  
AACAACTATGGATATAAAATAGGTACTAATCAAAATAGTGAGGAGGATAT  
ATTTGAATACATACGAACAAATTAAATAAAGTGAACAAAAAAACTTCGGAAA  
CATTAAAAAAATAACCTTATTGGTACTTACATGTTGGATCAGGAGTTGAG  
AGTGGACTAAAACCAAATAGTGTACTGACTTTAGTCGTCGTACTGAA  
CCATTGACAGATCAAAGTAAAGAAACTTATACAAAAAAATTAGACCTAT  
TTCAAAAAAAATAGGAGATAAAAGCAACTACGATATATTGAATTAACAA  
TTATTATTCAAGCAAGAAATGGTACCGTGGAAATCATCCTCCAAACAAGAA  
TTTATTATGGAGAATGGTTACAAGAGCTTATGAACAAAGGATACATTCT  
CAGAAGGAATTAAATTCAAGATTAAACCATAATGCTTACCAAGCAAAACG  
AAAAAAATAAAAGAATATACGGAAATTATGACTTAGAGGAATTACTACCTG  
ATATTCCATTCTGATGTGAGAAGAGCCATTATGGATTGTCAGAGGAAT  
TAATAGATAATTATCAGGATGATGAAACCAACTCTATATTAACTTTATGCC  
GTATGATTAACTATGGACACGGTAAAATCATACCAAAAGATATTGCG  
GGAAATGCAGTGGCTGAATCTCTCCATTAGAACATAGGGAGAGAATT  
GTTAGCAGTCGTAGTTATCTGGAGAGAATATTGAATGGACTAATGAAA  
ATGAAATTAACTATAAACTATTAAATAACAGATTAAAAAAATTATAA  
AAAAATTGAAAAAAATGGTGGAAACACTTTTCAATTGGTTATTGTTATT  
TTAATATTGGAAATATTCAATTGTAATCAGATTAGAAAAC  
AATAAACCTTGCAAGGGGATCTGACATGGATGAGCGATGATGATAT  
CCGTTAGGCTGGCGGTGATAGCTCTCGTTAGGCAGTACGCCTTT  
CTTTCCAGACCTGAGGGAGGCAGGAAATGGTGTGAGGTTCCGGGGAAAA  
GCCAAATAGGCATCGCGGAGTGCTTATTGAAGATCAGGCTACT  
GCGGTCATAGATTCAACATGTGATGGCTGGACAGCCTGAGGAACCTC  
GAACCGAATGGAAACAACCAGATATTATGAATCAGCGCGCTCACATG  
GCGTTGTGCTGGCAAATGCAGGTCATCCTCTGTCTATCAATACGGAA  
CAAAATTGCCTGATGGCAGGTATGACAATAAGCTGGAGCGGGTCATT  
CAAGTGAACGATGGTAAACTGACAGGCACGATCAATGCCAGGTCTGTAGC  
TGTGCTTATCCTGATGATATTGAAAAGCGCCTCATGTTTCTTGAGAA  
TTACAAAACAGGTGTAACACATTCTTCAATGATCAACTGACGATTACCT  
GCGTGCAGATGCGAATACAACAAAAGCCGTTATCAAATCAATAATGGAC  
CAGACGACAGGCAGGTTAAGGATGGAGATCAATTACAATCGGAAAAGGA  
GATCCAATTGGCAAAACATACACCACATGTTAAAAGGAACGAACAGTG  
ATGGTGTACGAGGACCGAGAAATACAGTTGTTAAAAGAGATCCAGCG

TCGGCCAAACCATCGGCTATCAAAATCCGAATCATTGGAGGCCAGGTAAA  
TGCTTATATCTATAAACATGATGGGAGCCGAGTAATTGAATTGACCGGAT  
CTTGGCCTGGAAAACCAATGACTAAAAATGCAGACGGAATTACACGCTG  
ACGCTGCCTGCGGACACGGATACAACCAACGCAAAAGTATTAAATAA  
TGGCAGCGCCAAGTGCCTGGTCAGAATCAGCCTGGCTTGATTACGTGC  
TAAATGGTTATATAATGACTCGGGCTTAAGCGGTTCTCCCCATTGA

Annotations:

*amyE* upstream homologous arm, rrnB T1 terminator, rrnB T2 terminator, P43 promoter, RBS, GFP gene, lambda t0 terminator, Pveg promoter, sgRNA scaffold, spectinomycin resistant gene expression cassette, *amyE* downstream homologous arm  
The highlighted part in turn indicates the targeted sequence of B2, B3, B4, B6, B1, B5, and B7.

pAX plasmids related key genetic parts

pAX-ABE7.10-CDA-nCas9

GTGATGTCAAAGCTTGGAAAAAACGCACGTAACAAAAGCAAAATTATGCT  
CCATGGGGGAGACTACAACCCGATCAGTGGCTGGATCGGCCGATATT  
TAGCTGACGATATCAAACGTGATGAAGCTTCTCATACGAATACGTTTCTG  
TCGGCATTTCATGGAGCGCACTTGAGCCGGAGGGAGGGCGTATATCAA  
TTTGAATGGCTGGATGATATTGAGCGGATTCACAGTATAGGCGGCCG  
GGTCATATTAGCAACGCCAGCGGAGGCCGTCCGGCCTGGCTGCGCAAA  
CCTATCCGGAAGTTCGCGCTCAATGCCTCCCGCTCAAACAGCTGCAC  
GGCGGAAGGCACAACCACTGCCTCACATCTAAAGTCTACCGAGAAAAAA  
CACGGCACATCAACCGCTTATTAGCAGAACGATACGGACATCACCGGGCG  
CTGTTAATGTGGCACATTCAAACGAATACGGGGAGATTGCCACTGTGA  
TTTATGCCAGCATGCTTCCGGAGTGGCTGAAATCGAAATATGACAACA  
GCCTCAAGACATTGAACCATGCGTGGTGACCCCTTTGGAGCCATACG  
TTCAATGACTGGTCACAAATTGAAAGCCCTCGCCGATCGGTAAAATGG  
CTTGCATGGCCTGAATTAGATTGGCGCCGGTTCGTCACCGATCAAACGAT  
TTCGTTTATGAAAATGAAATCATTCCGCTGAAAGAATTGACGCGCTGATAT  
CCCTATCACAACGAATTATGGCTGACACACCGGATTGATCCGTATAC  
CGTCGTATAGCATACTTACGAAAGTTGACCGATAGTGAACGGGATG  
CTGCGGAATGGACGACGGCAATAGTTACCTTATTATCAAGATAAGAAA  
GAAAAGGATTTCGCTACGCTCAAATCCTTAAAAAACACAAAAGACC  
ACATTTTAATGTGGCTTTATTCTCAACTAAAGCACCCATTAGTCAA  
CAAACGAAAATTGGATAAAGTGGATATTAAAATATATTATGTTA  
CAGTAATATTGACTTTAAAAAGGATTGATTCTAATGAAGAAAGCAGAC  
AAGTAAGCCTCCTAAATTCACTTAGATAAAAATTAGGAGGCATATCAA  
ATGAACCTTAATAAAATTGATTAGACAATTGGAAGAGAAAAGAGATATT  
TAATCATTATTGAACCAACAAACGACTTTAGTATAACCACAGAAATTG  
ATATTAGTGTGTTATACCGAAACATAAAACAAGAAGGATATAAATTTC  
CCTGCATTATTTCTTAGTGACAAGGGTGATAAACTCAAATACAGCTTT

AGAACTGGTTACAATAGCGACGGAGAGTTAGGTTATTGGGATAAGTTAGA  
GCCACTTATACAATTTGATGGTGATCTAAAACATTCTCTGGTATTG  
GAECTCCTGTAAAGAACATGACTCAAAGAGTTTATGATTATACCTTCTGA  
TGTAGAGAAATATAATGGTCGGGAAATTGTTCCAAAACACCTATAC  
CTGAAAATGCTTTCTCTTCTATTATTCCATGGACTCATTACTGGTT  
TAACTTAAATATCAATAATAAGTAATTACCTCTACCCATTATTACAGC  
AGGAAAATTCTTAAATAAAGGTAACTCAATATATTACCGCTATCTTACA  
GGTACATCATTCTGTTGTATGGTTATCATGCAGGATTGTTATGAAC  
TATTCAAGGAAATTGTCAGATAGGCCTAATGACTGGCTTTATAATATGAGAT  
AATGCCGACTGTACTTTACAGTCGGTTCTAAAACGATACATTAATAG  
GTACGAAAAGCAACTTTTGCCTTAAACACCAGTCATACCAATAAT  
AACTCGTATAGCATACATTACGAACGGTATTCAAGCCTCGGTTGC  
CGCCGGCGTTTTATGCAGCAATGGCAAGAACGCTCCGGGAGCTCCT  
AACTTATAGGGTAACACTAAAAAGAACATCAATAACGATAGAAACCGCT  
CCTAAAGCAGGTGCATTTCTAACGAAGAACGCAATAGTCACATT  
ATTGTCTAAATGAGAACATGGACTCTAGAAGAAACTTCGTTTAATCGTATT  
TAAAACAATGGGATGAGATTCAATTATGATTCTCAAGATAACAGCTT  
CTATATCAAATGTATTAAGGATATTGGTAATCCAATTCCGATATAAAAGC  
CAAAGTTTGAAGTGCATTTAACATTTCTACATCATTATTGCGCGTTC  
CACAACTCTTTCGAGAAATATTCTTCTTCTTAGAGAGCGAACGCCAG  
TAACGCTTTTCAGAACGCATATAATTCCAACAGCCTCGATTCCACAGCT  
GCATTGGGCCATTAATCTATCGTCATATGACCCATTCCCCAGAAAA  
ACCCTGAACACCTTATACAATTGGTTAATAACAAGTCCAGTCCAAT  
TCCGATATTAATAACTGATGTAACGATGTTTCAAGTTTCGATACC  
AAATACTTTCACCGTATGCTCCTGCATTAGCTCATTTCACAAACAAAAC  
CGGAACATTAAACTCACTCTCAATTAAAAACTGCAAATCTTGATATTCCA  
ATTAAAGTTAGGCATGAAAATAATTGCTGATGACGATCTACAGGCCTG  
GAACACAAATTCCATTCCGACTAGACCATAAGGGACTCAGGCATATGG  
GTTACAAAACCAGTGAATAAGTCAAATAAAACTCTTTACTTCAGTC  
GGAAGAACTAGACAAGTCAGAACGCTCTCGAGAACATAATTCCCTCTA  
AGTCGGTTAGAATTGGTTAAGATAGTCGACTCCTATATCAATACCAATCG  
AGTAGCCTGCATTCTTATTAAAAACAAAGCATTACAGGTCTCTGCCGCTC  
TAGATTGCCCTGCCCAATTCAAAAATAAAACTTTCAAGCAGTGTAT  
TTACTTGAGAGGAGACAGTAGACTGTTAATCCTGTAATCTCAGAGAGA  
GTTGCCCTGGAGACAGGGAGTTCTCAAATTCATCTAATATTAAATT  
TGATTCAATTCTTACTAAAGCTGATCTGCAATTGAATAATAACCACTC  
CTTGTATCCACCGAACTAAGTGGTTTTGAAGCTGAATTAGAT  
ATTAAAAGTATCATCTAATATTAAACTAAATTCTAAAAAAACAT  
TGAAATAAACATTATTGTATATGATGAGATAAAGTTAGTTATTGGAT  
AAACAAACTAACTCAATTAAAGATAGTTGATGGATAAAACTGTTCACTAA  
ATCAAAGGGGGAAATGGGATCCATGAGCGAAGTTGAATTGCCACGAGTAC  
TGGATGAGACATGCTCTGACACTGGCCAAACGCGCTGGGACGAAAGAG  
AAGTCCCAGCTGGAGCTGTTCTGGTCCACAATAATCGCGTCATGGCGAG

GGCTGGAATCGCCCGATTGGAAGACATGACCCAACGGCCCACGCTGAAAT  
CATGGCTCTTAGACAAGGC GGACTTGTATGCAGAACTACCGCCTATTG  
ACGCTACGCTGTACGTACACTGGAACCGTGTGTTATGTGTGCCGGAGCC  
ATGATCCACTCCCGATTGCCCGCGTCTTTGGAGCCCGCATGCCAAA  
ACGGCGCTGCCGGAACCTTATGGATGTCCCTCACCAACCCGGAAATGAA  
TCATAGAGTTGAGATCACGGAGGGCATTCTGCCGACGAATGTGCCGCC  
TTCTGTCCGATTTTCCGCATGCCGCCAAGAAATCAAGGCCAAAAG  
AAAGCCCAGAGCAGCACGGATTCCGGCGGTCCAGTGGTGGATCCTCTGG  
ATCTGAGACACCTGGAACGTCTGAATCTGCTACACCAGAACCTCTGGAG  
GATCTTCTGGTGGCTCCAGCGAAGTCGAGTTCTCCCACGAATACTGGATG  
GCCATGCCCTTACACTGCCAACCGCGCTCGCGATGAACCGGAAGTCCC  
AGTTGGCGCCGTTCTTGTCTTAACAAACCGCGTACCGGAGAACGGCTGGA  
ACCGCGCTATCGGACTTCATGATCCGACAGCTCATGCCGAAATTATGGCT  
CTGCGCCAAGGC GGACTTGTCTGCAGAACATTACAGACTTATTGATGCCAC  
GCTTACGTACGTTGAACCGTGCCTATGTGCCGCCATGATTCA  
TAGCCGCATCGGCAGAGTTGTCTCGCGTCCGCAATGCTAAAACGGGCG  
CCGCCGGCTCCCTTATGGACGTCCATTACCCGGGCATGAATCACCGCG  
TTGAAATCACAGAACAGGCATTCTGGCCGATGAGTGC CGCCGCTCTGCTGTG  
TACTTCTTCAGAATGCCGAGACAAGTCTCAACGCCAACAGAACAGCCCA  
AACGAGCACAGACTCTGGAGGGATCATCCGGAGGCAGCTCTGGAAGTGAA  
ACACCAGGAACAAGCGAATCAGCTACACCAGAGTCCTCTGGAGGCTCATC  
TGGAGGAAGCACAGATGCCGAATACGTTGCATCCACGAGAACGCTGGAT  
ATCTACACGTTAAAAAGCAGTTTTAACAAATAAGAACAGAGCGTCTCCCA  
CCGCTGCTATGTTCTTCGAACTGAAACCGCAGAGGGCGAAAGACCGCCTT  
GCTTCTGGGATATGCCGTTAACAAACCGCAGTCCGGCACCGAACCGCGC  
ATTACGCCGAGATCTCAGCATCCGCAAGGTTGAGGGAGTATCTCGCGA  
TAACCCGGGCCAGTTACGATCAACTGGTACAGCAGCTGGAGGCCGTG  
CCGATTGCGCCGAAAAGATTCTTGAGTGGTACAACCAAGAACCTCGCGC  
AATGGCCACACGCTGAAAATCTGGCTTGCAAGCTGTACTACGAGAACGAA  
CGCCCGCAATCAGATCGGACTTGGAAATCTCGCGATAATGGCGTGGAC  
TTAACGTCTGGCTCCGAACACTACCAAGTGCTGCCGCAAGATCTCATCC  
AGTCCTCCCACAACCAGCTAACGAAAACCGCTGGCTGGAGAACACTG  
AAACCGCCTGAAAAGCGCCGCTCCGAGCTGAGCATCATGATCCAAGTTAA  
GATTCTCATACGACGAAGAGGCCGGCGTCTCAGGTTCTGAAACTCCTG  
GAACCAAGTGAGTCTGCAACTCCAGAGTCTATGGATAAGAAACTCAATA  
GGCTTAGCTATCGGCACAAATAGCGTCGGATGGCGGTGATCACTGATGA  
ATATAAGGTTCCGTAAAAAGTTCAAGGTTCTGGAAATACAGACCGCC  
ACAGTATCAAAAAAAATCTTATAGGGCTCTTTATTGACAGTGGAGAG  
ACAGCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGTATACAC  
GTCGGAAGAATCGTATTGTTATCTACAGGAGATTTTCAAATGAGATGG  
CGAAAGTAGATGATAGTTCTTCATCGACTTGAAGAGTCTTTGGTGG  
AAGAAGACAAGAACATGAACGTACCTATTGGAAATATAGTAGAT  
GAAGTTGCTTATCATGAGAAATATCCAACATCTATCATCTGCGAAAAAA  
ATTGGTAGATTCTACTGATAAAGCGGATTGCGCTTAATCTATTGGCCTT

AGCGCATATGATTAAGTTCGTGGCATTTCAGTTGATTGAGGGAGATTAAA  
TCCTGATAATAGTGTGGACAAACTATTATCCAGTTGGTACAAACCTA  
CAATCAATTATTGAAGAAAACCCTATTAACGCAAGTGGAGTAGATGCTA  
AAGCGATTCTTCTGCACGATTGAGTAAATCAAGACGATTAGAAAATCTC  
ATTGCTCAGCTCCCCGGTGAGAAGAAAAATGGCTATTGGGAATCTCAT  
TGCTTGTCAATTGGGTTGACCCCTAATTAAATCAAATTGATTGGCA  
GAAGATGCTAAATTACAGCTTCAAAAGATACTACGATGATGATTAGA  
TAATTATTGGCGCAAATTGGAGATCAATATGCTGATTGTTTGGCAGC  
TAAGAATTATCAGATGCTATTTCAGATATCCTAACAGAGTAAATAC  
TGAAATAACTAAGGCTCCCCTACAGCTCAATGATTAACGCTACGATG  
AACATCATCAAGACTTGACTCTTAAAAGCTTAGTCGACAACAACCTC  
CAGAAAAGTATAAGAAATCTTTGATCAATCAAAAAACGGATATGCA  
GGTTATATTGATGGGGAGCTAGCCAAGAAGAATTAAATTATCAA  
ACCAATTAGAAAAATGGATGGTACTGAGGAATTATTGGTAAACTAA  
ATCGTGAAGATTGCTGCGCAAGCAACGGACCTTGACAACGGCTCTATT  
CCCCATCAAATTCACTGGGTGAGCTGCATGCTATTGAGAAGACAAGA  
AGACTTTATCCATTAAAGACAATCGTGAGAAGATTGAAAAATCTT  
GACTTTCGAATTCTTATTATGTTGGTCCATTGGCGCGTGGCAATAGTCG  
TTTGATGGATGACTCGGAAGTCTGAAGAAACAATTACCCATGGAATT  
TTGAAGAAGTTGTCGATAAAGGTGCTTCAGCTCAATCATTATTGAACGCA  
TGACAAACTTGATAAAAATCTTCAAATGAAAAAGTACTACCAAAACAT  
AGTTGCTTATGAGTATTACGGTTATAACGAATTGACAAAGGTCAAA  
TATGTTACTGAAGGAATGCGAAAACCAGCATTCTTCAGGTGAAACAGAA  
GAAAGCCATTGTTGATTACTCTTCAAAACAAATCGAAAAGTAACCGTTA  
AGCAATTAAAAGAAGATTATTCAAAAAAATAGAATGTTGATAGTGT  
GAAATTTCAGGAGTTGAAGATAGATTAATGCTTCATTAGGTACCTACCAT  
GATTGCTAAAATTATAAGATAAAGATTGGATAATGAAGAAAA  
TGAAGATATCTTAGAGGATATTGTTAACATTGACCTTATTGAAGATAG  
GGAGATGATTGAGGAAAGACTAAAACATATGCTCACCTCTTGATGATA  
AGGTGATGAAACAGCTAAACGTCGCCGTATACTGGTGGGGACGTTG  
TCTCGAAAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAAAACAAT  
ATTAGATTTTGAAATCAGATGGTTGCCAATCGCAATTTCAGCT  
GATCCATGATGATAGTTGACATTAAAGAAGACATTCAAAAGCACAAG  
TGTCTGGACAAGGCATAGTTACATGAACATATTGCAAATTAGCTGGT  
AGCCCTGCTATTAAAAAGGTATTACAGACTGTAAAAGTTGTTGATGA  
ATTGGTCAAAGTAATGGGGCGGCATAAGCCAGAAAATATCGTTATTGAA  
TGGCACGTAAAATCAGACAACCTAAAAGGGCCAGAAAATCGCGAGA  
GCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGAAGTCAGATT  
CTTAAAGAGCATCCTGTTAAAATACTCAATTGCAAATGAAAAGCTCTA  
TCTCTATTATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAATTAG  
ATATTAATCGTTAAGTGATTATGATGTCGATCACATTGTTCCACAAAGTT  
TCCTTAAAGACGATTCAATAGACAATAAGGTCTAACGCCAGTGAAGAAGT  
AATCGTGGTAAATCGGATAACGTTCCAAGTGAAGAAGTAGTCAAAAAGAT  
GAAAAACTATTGGAGACAACCTCTAAACGCCAAGTTAATCACTCAACGTA

AGTTTGATAATTAACGAAAGCTGAACGTGGAGGTTGAGTGAACTTGAT  
AAAGCTGGTTTATCAAACGCCAATTGGTTGAAACTGCCAAATCACTAA  
GCATGTGGCACAAATTGGATAGTCGCATGAATACTAAATACGATGAAA  
ATGATAAACTTATTGAGAGGTTAAAGTGATTACCTTAAATCTAAATTA  
GTTTCTGACTCCGAAAAGATTCCAATTCTATAAAAGTACGTGAGATTAAC  
AATTACCATCATGCCCATGATGCGTATCTAAATGCCGCGTTGGAACGTGCT  
TTGATTAAGAAATATCCAAAACCTGAATCGGAGTTGTCTATGGTGATTAT  
AAAGTTATGATGTCGAAATGATTGCTAAGTCTGAGCAAGAAATAGG  
CAAAGCAACCGCAAAATATTCTTTACTCTAATATCATGAACCTCTCAA  
AACAGAAATTACACTTGCAAATGGAGAGATCGCAAACGCCCTCTAATCG  
AAACTAATGGGGAAACTGGAGAAATTGTCTGGGATAAAGGGCGAGATTT  
GCCACAGTGCAGCAAGTATTGTCATGCCCAAGTCAATATTGTCAAGAA  
AACAGAAGTACAGACAGGCCGATTCTCCAAGGAGTCAATTACCAAAAAA  
GAAATTCCGACAAGCTTATTGCTCGTAAAAAAGACTGGGATCCAAAAAAA  
TATGGTGGTTTGTAGTCCAACGGTAGCTTATTCAAGTCCTAGTGGTTGCT  
AAGGTGGAAAAAGGGAAATCGAAGAAGTTAAATCCGTTAAAGAGTTAC  
TAGGGATCACAATTATGGAAAGAAGTTCCTTGAAAAAAATCCGATTGAC  
TTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAGACTTAATCATTAA  
ACTACCTAAATATAGCTTTGAGTTAGAAAACGGTCGAAACGGATGCT  
GGCTAGTGCAGGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGC  
AAATATGTGAATTTCATTTAGCTAGTCATTATGAAAAGTTGAAGGGT  
AGTCCAGAAGATAACGAACAAAAACAATTGTTGTGGAGCAGCATAAGC  
ATTATTAGATGAGATTATTGAGCAAATCAGTGAATTTCATAAGCGTGT  
TTTAGCAGATGCCATTAGATAAAGTTCTAGTCATATAACAAACATA  
GAGACAAACCAATACGTGAACAAGCAGAAAATTATTCAATTACG  
TTGACGAATCTGGAGCTCCGCTGTTAAATATTGATACAACAAATT  
GATCGTAAACGATATACGTCTACAAAAGAAGTTAGATGCCACTCTTAT  
CCATCAATCCATCACTGGTCTTATGAAACACGCATTGATTGAGTCAGCT  
AGGAGGTGACTAAGTCAAGGATCTCCAGGCATCAAATAACGAA  
AGGCTAGTCGAAAGACTGGGCCTTCGTTTATCTGTTGTGGTGA  
ACGCTCTCTACTAGAGTCACACTGGCTCACCTCGGGTGGCCTTCTGCG  
TTTACCTAGGGATATTCCGCTTCCTCGCTACTGCAGCGTCATCAG  
AAAGAACAAAGACTTTACCATAAAACTGCTGATCGTCCCAGTGT  
TTAACATACACAGGCGATGGCATCCGGATCTCAAGCTATATTGGAGT  
TGAGCCTCTGAAACGGACACCCGTATCCGAAAGGATCGAAACGCTGTCA  
GCTACCGCAGCAAATATGAAATGAAGGATTATGCAACCGTATTGAT  
GTAAAGACAGCTCAGTGGAAAGCGGTGTATCAAGAAGATTTCATGCG  
CACGCCAGCGGTACAAGCCATGAGTATCAGCAGGGCAAGGCGTATT  
TCGGCGCGCTTGGAGGATCAATTCAAGCTGATTCTATGAGGGTCTGA  
TCACAGACCTGTCTCTCCAGTTCCGGTCCGGCACGGAAAAGGCG  
TCTCCGTACAAGCGAGGCAGGATCAGGACAATGATTATTTGT  
AATTTCACGGAAGAAAACAGCTGGTCACGTTGATCAGAGTGTGAAGGA

CATAATGACAGGAGACATATTGTCAGGCACCTGACGATGGAAAAGTATG  
AAGTGAGAATTGTCGTAAACACACATTAG

pAX-CDA-ABE7.10-nCas9

GTGATGTCAAAGCTGAAAAACGCACGTAACAAAAGCAAAATTATGCT  
CCATGGGGAGACTACAACCCGATCAGTGGCTGGATCGGCCGATATTT  
TAGCTGACGATATCAAACGTGAGCTTCTCATACGAATACGTTTCTG  
TCGGCATTTCATGGAGCGCACTTGAGCCGGAGGAGGGCGTATATCAA  
TTTGAATGGCTGGATGATATTTGAGCGGATTCACAGTATAGGCAGGCCG  
GGTCATATTAGCAACGCCAGCGGAGCCGTCCGGCCTGGCTGCGCAA  
CCTATCCGGAAGTTGCGCGTCAATGCCTCCCGCGTCAAACAGCTGCAC  
GGCGGAAGGCACAACCACTGCCTCACATCTAAAGTCTACCGAGAAAAAA  
CACGGCACATCAACCGCTTATTAGCAGAACGATACGGACATCACCCGGCG  
CTGTTAATGTGGCACATTCAAACGAATACGGGGAGATTGCCACTGTGA  
TTTATGCCAGCATGCTTCCGGAGTGGCTGAAATCGAAATATGACAACA  
GCCTCAAGACATTGAACCATGCGTGGTGACCCCTTTGGAGGCCATACG  
TTCAATGACTGGTCACAAATTGAAAGCCCTCGCCGATCGGTGAAAATGG  
CTTGCATGGCCTGAATTAGATTGGCGCCGGTTCGTACCGATCAAACGAT  
TTCGTTTATGAAAATGAAATCATTCCGCTGAAAGAATTGACGCCTGATAT  
CCCTATCACAACGAATTTATGGCTGACACACCGGATTGATCCGTATAC  
CGTCGTATAGCATACTACGAAAGTTATGCCATAGTGAUTGGCGATG  
CTGTCGAATGGACGACGGCAATAGTTACCCCTATTATCAAGATAAGAAA  
GAAAAGGATTTCGCTACGCTCAAATCCTTAAAAAACACAAAAGACC  
ACATTTTAATGTGGCTTTATTCTCAACTAAAGCACCATTAGTTCAA  
CAAACGAAAATTGGATAAAGTGGATATTAAAATATATTTATGTTA  
CAGTAATATTGACTTTAAAAAAGGATTGATTCTAATGAAGAAAGCAGAC  
AAGTAAGCCTCCTAAATTCACTTAGATAAAAATTAGGAGGCATATCAA  
ATGAACCTTAATAAAATTGATTAGACAATTGGAAAGAGAAAAGAGATATT  
TAATCATTATTGAACCAACAAACGACTTTAGTATAACCACAGAAATTG  
ATATTAGTGTCTACCGAAACATAAAACAAGAAGGATATAATTTCAC  
CCTGCATTATTTCTTAGTGACAAGGGTATAACTCAAATACAGCTTT  
AGAACTGGTTACAATAGCGACGGAGAGTTAGGTATTGGATAAGTTAGA  
GCCACTTATACAATTGGATGGTATCTAAAACATTCTCTGGTATTG  
GAECTCTGTAAAGAATGACTCAAAGAGTTATGATTACCTTCTGA  
TGTAGAGAAATATAATGGTCGGGAAATTGTTCCAAAACACCTATAC  
CTGAAAATGCTTCTCTTCTATTATTCCATGGACTCATTACTGGGTT  
TAACCTAAATATCAATAATAAGTAATTACCTCTACCCATTATTACAGC  
AGGAAAATTCAATAAAAGGTAAATTCAATATATTACCGCTATCTTACA  
GGTACATCATTCTGTTGTGATGGTTATCATGCAGGATTGTTATGAAC  
TATTCAAGAATTGTCAGATAGGCCTAATGACTGGCTTTATAATATGAGA  
AATGCCGACTGTACTTTACAGTCGGTTCTAAAACGATACATTAATAG  
GTACGAAAAGCAACTTTTGCGCTAAAACCAGTCATACCAATAAAT  
AACTCGTATAGCATACATTATCGAACGGTATTCAAGAACGCTCGGTTGC  
CGCCGGCGTTTATGCAGCAATGGCAAGAACGTCGGGAGCTCCT

AACTTATAGGGGTAACACTAAAAAAGAATCAATAACGATAGAAACCGCT  
CCTAAAGCAGGTGCATTTCTAACGAAGAAGGCAATAGTCACATT  
ATTGTCTAAATGAGAATGGACTCTAGAAGAAACTTCGTTTAATCGTATT  
TAAAACAATGGGATGAGATTCAATTATATGATTCTCAAGATAACAGCTT  
CTATATCAAATGTATTAAGGATATTGGTTAACATTCCGATATAAAAGC  
CAAAGTTTGAAGTGCATTAAACATTCTACATCATTATTGCGCGTTC  
CACAACTCTTTCGAGAAATATTCTTCTTAGAGAGCGAAGCCAG  
TAACGCTTTCAAGCATATAATTCCAACAGCCTGATTCCACAGCT  
GCATTGGTCCATTAAAATCTATCGTCATATGACCCATTCCCCAGAAAA  
ACCCTGAACACACCTTATAACAATTGTTAACAAAGTCCAGTCCAAT  
TCCGATATTAATACTGATGTAACGATGTTCATAGTTTGTACACC  
AAATACTTTTACCGTATGCTCCTGCATTAGCTCATTTCACAAAAAC  
CGGAACACATTAAACTCACTCTCAATTAAAATGCAAATCTTGATATTCCA  
ATTTAAGTTAGGCATGAAAATAATTGCTGATGACGATCTACAAGGCCTG  
GAACACAAATT CCTATTCCGACTAGACCATAAGGGACTCAGGCATATGG  
GTTACAAAACC ATGAATAAGTCAAATAAAATCTCTTACTTCAGTC  
GGAAGAACTAGACAAGTCAGAAGTCTCTCGAGAATAATATTCCCTCTA  
AGTCGGTTAGAATTCCGTTAACGATAGTCGACTCCTATATCAATACCAATCG  
AGTAGCCTGCATTCTTATTAAAACAAGCATTACAGGTCTGCCGCCTC  
TAGATTGCCCTGCCCAATTCAAAAATAAAATCTTTCAAGCAGTGTAT  
TTACTTGAGAGGAGACAGTAGACTTGTAAATCCTGTAATCTCAGAGAGA  
GTTGCCCTGGAGACAGGGAGTTCTCAAATTCATCTAATATTAAATT  
TGATTCACTTTTACTAAAGCTTGATCTGCAATTGAATAATAACCAACTC  
CTTGTTATCCACCGAACTAAGTTGGTTGAAGCTTGAATTAGAT  
ATTTAAAAGTATCATATCTAATATTAACTAAATTCTAAAAAAACAT  
TGAAATAAACATTATTGTATATGAGATAAAGTTAGTTATTGGAT  
AAACAAACTAACTCAATTAAAGATAGTTGATGGATAAAACTGTTCACTAA  
ATCAAAGGGGAAATGACAAATGGCCAAACTAGTGATATCTAAAAATC  
AAAGGGGAAATGGGATCCATGACAGATGCCAATACGTCGATCCAC  
GAGAAGCTGGATATCTACACGTTAAAAGCAGTTTAAACAATAAGAA  
GAGCGTCTCCCACCGCTGCTATGTTCTTCAACTGAAACCGCAGAGGCG  
AAAGACGCGCTGCTCTGGGATATGCCGTTAACAAACCGCAGTCCGGC  
ACGGAACGCGGCATTCACGCCGAGATCTCAGCATCCGCAAGGTTGAGGA  
GTATCTCGCGATAACCCGGGCCAGTTACGATCAACTGGTACAGCAGCT  
GGAGCCCGTGTGCCGATTGCCGAAAAGATTCTTGAGTGGTACAACCAA  
GAACCTCGCGCAATGCCACACGCTGAAAATCTGGCTTGCAAGCTGTA  
CTACGAGAAGAACGCCGCAATCAGATGGACTTGGATCTCGCGATA  
ATGGCGTTGGACTTAACGTATGGTCTCCGAACACTACCAGTGTGCCGC  
AAGATCTTCATCCAGTCCTCCCACAAACCAAGCTAACGAAAACCGCTGGCT  
GGAGAAGACACTGAAACCGCCTGAAAAGCGCCGCTCCGAGCTGAGCATC  
ATGATCCAAGTTAAGATTCTCATACGACGAAGAGGCCGGCGTCTCAGG  
TTCTGAAACTCCTGGAACCAAGTGAGTCTGCAACTCCAGAGTCTAGCGAAG  
TTGAATTCAGCCACGAGTACTGGATGAGACATGCTCTGACACTGGCCAAA  
CGCGCTTGGGACGAAAGAGAAGTCCGGCTGGAGCTGTTCTGGTCCACAA

TAATCGCGTCATGGCGAGGGCTGGAATGCCCGATTGGAAGACATGACC  
CAACGGCCCACGCTGAAATCATGGCTCTTAGACAAGGCGGACTTGTATG  
CAGAACTACCGCCTATTGACGCTACGCTGTACACTGGAACCGTG  
TGTTATGTGTGCCGGAGCCATGATCCACTCCGCATTGGCCGTCGTTT  
TGGAGCCCGCGATGCCAAAACGGCGCTGCCGGAAGCCTATGGATGTCC  
TTCACCACCCGGGAATGAATCATAGAGTTGAGATCACGGAGGGCATTCTT  
GCCGACGAATGTGCCGCCCTCTGTCCGATTTCGCATGCGCCGCAA  
GAAATCAAGGCCAAAAGAAAGCCCAGAGCAGCACGGATTCCGGCGTT  
CCAGTGGTGGATCCTCTGGATCTGAGACACCTGGAACGTCTGAATCTGCT  
ACACCAGAATCTTCTGGAGGATCTTCTGGTGGCTCCAGCGAAGTCGAGTT  
CTCCCACGAATACTGGATGCGCCATGCCCTACACTGCCAAACGCGCTC  
GCGATGAACCGCGAAGTCCCAGTTGGCGCCGTTCTGTTCTTAACAACCGC  
GTCATCGGAGAAGGCTGGAACCGCGCTATGGACTTCATGATCCGACAGC  
TCATGCCGAAATTATGGCTCTGCGCCAAGGGGACTTGTATGCAGAATT  
ACAGACTTATTGATGCCACGCTTACGTCACGTTGAACCGTGCATGT  
GCGCCGGCGCCATGATTCATAGCCGCATGGCAGAGTTGTCTCGCGTC  
CGCAATGCTAAAACGGCGCCGCCGCTCCCTATGGACGTCCTTCATTA  
CCCGGGCATGAATCACCGCGTTGAAATCACAGAAGGCATTCTGGCCGATG  
AGTGGCCGCTCTGCTGTGCTACTTCTTCAGAATGCCGAGACAAGTCTTCA  
ACGCCAGAAGAAAGCCAAAGCAGCACAGACTCTGGAGGGATCATCCGG  
AGGCAGCTCTGGAAGTGAACACCAAGGAACAAGCGAATCAGCTACACCA  
GAGTCCTCTGGAGGCTCATCTGGAGGAAGCGATAAGAAATACTCAATAGG  
CTTAGCTATCGCACAAATAGCGTCGGATGGCGGTGATCACTGATGAAT  
ATAAGGTTCCGTCTAAAAGTTCAAGGTTCTGGAAATACAGACCGCCAC  
AGTATCAAAAAAAATCTTATAGGGCTTTTATTGACAGTGGAGAGAC  
AGCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGTATACAGTC  
GGAAGAATCGTATTGTTATCTACAGGAGATTTTCAAATGAGATGGCG  
AAAGTAGATGATAGTTCTTCATCGACTGAAGAGTCTTTGGTGGAA  
GAAGACAAGAAGCATGAACGTACCTATTGGAAATATAGTAGATGA  
AGTTGCTTATCATGAGAAATATCCAACATCTATCATCTGCACAAAAAATT  
GGTAGATTCTACTGATAAAGCGGATTGCGCTTAATCTATTGGCCTAGC  
GCATATGATTAAGTTCGTGGCATTTGATTGAGGGAGATTAAATCC  
TGATAATAGTGTGGACAAACTATTATCCAGTTGGTACAAACCTACA  
ATCAATTATTGAAGAAAACCTATTAACGCAAGTGGAGTAGATGCTAAA  
GCGATTCTTCTGCACGATTGAGTAAATCAAGACGATTAGAAAATCTCATT  
GCTCAGCTCCCCGGTGAGAAGAAAAATGGCTATTGGAAATCTCATTGC  
TTTGTCAATTGGTTGACCCCTAATTAAATCAAATTGATTGGCAGA  
AGATGCTAAATTACAGCTTCAAAAGATACTACGATGATGATTAGATA  
ATTATTGGCGCAAATTGGAGATCAATATGCTGATTGTTTGGCAGCTA  
AGAATTATCAGATGCTATTTCAGATATCCTAACAGAGTAAATACTG  
AAATAACTAAGGCTCCCTATCAGCTCAATGATTAAACGCTACGATGAA  
CATCATCAAGACTTGACTCTTTAAAAGCTTAGTCGACAACAACCTCCA  
GAAAAGTATAAAGAAATCTTTTGATCAATCAAAAAACGGATATGCAGG  
TTATATTGATGGGGAGCTAGCCAAGAAGAATTAAATTATCAAAC

CAATTTAGAAAAATGGATGGTACTGAGGAATTATTGGTGAAACTAAAT  
CGTGAAGATTGCTGCGCAAGCAACGGACCTTGACAACGGCTCTATTCC  
CCATCAAATTCACTTGGGTGAGCTGCATGCTATTGAGAAGACAAGAAG  
ACTTTATCCATTAAAAGACAATCGTGAGAAGATTGAAAAAAATCTTGA  
CTTTGCAATTCTTATTATGTTGGTCATTGGCGCGTGGCAATAGTCGTT  
TGCATGGATGACTCGGAAGTCTGAAGAAACAATTACCCATGGAATTTG  
AAGAAGTTGTCGATAAAGGTGCTTCAGCTCAATCATTATTGAACGCATG  
ACAAACTTGATAAAATCTCCAAATGAAAAAGTACTACCAAAACATAG  
TTTGCTTATGAGTATTACGGTTATAACGAATTGACAAAGGTCAAATA  
TGTTACTGAAGGAATGCGAAAACCAGCATTCTTCAGGTGAACAGAAGA  
AAGCCATTGTTGATTACTCTCAAAACAAATCGAAAAGTAACCGTTAAG  
CAATTAAAAGAAGATTATTCAAAAAAATAGAATGTTTGATAGTGTGA  
AATTTCAGGAGTTGAAGATAGATTAAATGCTTCATTAGGTACCTACCATGA  
TTTGCTAAAAATTATTAAAGATAAAGATTGGATAATGAAGAAAATG  
AAGATATCTTAGAGGATATTGTTAACATTGACCTTATTGAAGATAGGG  
AGATGATTGAGGAAAGACTAAAACATATGCTCACCTCTTGATGATAAG  
GTGATGAAACAGCTAACCGTCCGTTACTGGTGGGGACGTTGTCT  
CGAAAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAAAACAATATT  
AGATTGAAATCAGATGGTTGCCAATCGCAATTATGCAGCTGAT  
CCATGATGATAGTTGACATTAAAGAAGACATTCAAAAAGCACAAGTGT  
CTGGACAAGGCGATAGTTACATGAACATATTGCAAATTAGCTGGTAGC  
CCTGCTATTAAAAAGGTATTACAGACTGTAAAAGTTGATGAATTG  
GTCAAAGTAATGGGCGGCATAAGCCAGAAAATATCGTTATTGAAATGGC  
ACGTAAAATCAGACAACCTCAAAAGGGCCAGAAAATTCGCGAGAGCGT  
ATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGAAGTCAGATTCAA  
AGAGCATCCTGTTGAAAATACTCAATTGCAAATGAAAGCTCTATCTCT  
ATTATCTCCAAATGGAAGAGACATGTATGTGGACCAAGAATTAGATATT  
AATCGTTAAGTGATTATGATGTCGATCACATTGTTCCACAAAGTTCC  
AAAGACGATTCAATAGACAATAAGGTCTAACCGCTCTGATAAAAATCG  
TGGTAAATCGGATAACGTTCAAGTGAAGAAGTAGTCAAAAAGATGAAA  
AACTATTGGAGACAACCTCTAAACGCCAAGTTAATCACTCAACGTAAGTT  
TGATAATTAAACGAAAGCTGAACCGTGGAGGTTGAGTGAACCTGATAAG  
CTGGTTTATCAAACCCAATTGGTTGAAACTCGCCAATCACTAACGAT  
GTGGCACAAATTGGATAGTCGATGAATACTAAATACGATGAAAATGA  
TAAACTATTGAGAGGTTAAAGTGATTACCTAAATCTAAAGTACGTGAGATT  
TGACTTCCGAAAAGATTCCAATTCTATAAAGTACGTGAGATTACAATT  
CCATCATGCCCATGATCGTATCTAAATGCCGTTGGAAC TGCTTGAT  
TAAGAAATCTCAAAACTTGAATCGGAGTTGTCTATGGTGATTATAAAG  
TTTATGATGTCGAAATGATTGCTAAGTCTGAGCAAGAAATAGGCAAA  
GCAACCGCAAAATATTCTTACTCTAATATCATGAACTTCTCAAAACA  
GAAATTACACTGCAAATGGAGAGATTGCAACCGCCCTCTAATCGAAAC  
TAATGGGGAAACTGGAGAAATTGCTGGGATAAAGGGCGAGATTGCA  
CAGTGCCTGCAAAGTATTGTCATGCCCAAGTCAATTGCAAGAAAACA  
GAAGTACAGACAGGGATTCTCCAAGGAGTCAATTACCAAAAAGAA

ATTCGGACAAGCTTATTGCTCGTAAAAAAGACTGGGATCCAAAAAAATAT  
GGTGGTTTGATAGCCAACGGTAGCTTATTCACTCCTAGTGGTTGCTAAG  
GTGGAAAAAGGGAAATCGAAGAAGTTAAAATCCGTTAAAGAGTTACTAG  
GGATCACAATTATGGAAAGAAGTTCCCTTGAAAAAAATCCGATTGACTTT  
TTAGAAGCTAAAGGATATAAGGAAGTTAAAAGACTTAATCATTAAACT  
ACCTAAATATAGTCTTTGAGTTAGAAAACGGTCGTAACGGATGCTGG  
CTAGTGCCTGGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGCAA  
ATATGTGAATTTTTATATTAGCTAGTCATTATGAAAAGTTGAAGGGTAG  
TCCAGAAGATAACGAACAAAAACAATTGTTGTGGAGCAGCATAAGCATT  
ATTTAGATGAGATTATTGAGCAAATCAGTGAATTCTAAGCGTGTATT  
TAGCAGATGCCAATTAGATAAAAGTTCTAGTCATATAACAAACATAGA  
GACAAACCAATACGTGAACAAGCAGAAAATTATTCAATTACGTT  
GACGAATCTGGAGCTCCGCTGTTAAATATTGATACAACAATTGA  
TCGTAACGATATACTGCTACAAAAGAAGTTAGATGCCACTCTTATCCA  
TCAATCCATCACTGGTCTTATGAAACACGCATTGATTGAGTCAGCTAGG  
AGGTGACTAACTCGAGTAAGGATCTCAGGCATCAAATAAACGAAAGG  
CTCAGTCGAAAGACTGGGCCTTCGTTATCTGTTGTGCGTGAACG  
CTCTCTACTAGAGTCACACTGGCTCACCTCGGGTGGGCCTTCTCGT  
ATACCTAGGGATATATTCCGCTCCTCGCTCACTGCAGCGTCATCAC  
GAACAAAGACTTTCACCATAAAACTGCTGATCGTCCCAGTGTGATT  
ATCAGCGAGGACACCGTTCCGTTAAAAGCGTTACGGCTGACGGCGG  
CACCTAGTCATGACGTATATCAGCGGGTTGTGAATGAGCATGACTAA  
CATACACAGGCGGATGGCATCCGGATCTCAAGCTATATTGGAGTTGAG  
CCTCTGAAACGGACACCGTATCCGAAGGATCGAAACGCTGTCAGCTA  
CCGAGCCAAATATGAAATGAAGGATTATGCAACCGTATTGATGTAA  
AGACAGCTTCAGTGGAAAGCGGTGTATCAAGAAGATTATTGCGCGCAG  
CCAGCGGTACAAGCCATGAGTATCAGCAGGGCAAGGCATTTATCGG  
CGCGCGTTGGAGGATCAATTTCAGCGTATTCTATGAGGGTCTGATCAC  
AGACCTGTCTCTCTCCAGTTCCGGTTGGCACGGAAAAGCGTCTC  
CGTACAAGCGAGGCAGGATCAGGACAATGATTATTTGTATGAATT  
TCACGGAAGAAAAACAGCTGGTACGTTGATCAGAGTGTGAAGGACATA  
ATGACAGGAGACATATTGTCAGGCGACCTGACGATGGAAAAGTATGAAG  
TGAGAATTGTCGTAACACACACATTAG

pAX-ABE7.10-nCas9-CDA

GTGATGTCAAAGCTGAAAAAACGCACGTAACAAAAGCAAAATTATGCT  
CCATGGGGAGACTACAACCCGATCAGTGGCTGGATCGGCCGATATT  
TAGCTGACGATATCAAACGATGAGCTTCTCATACGAATACGTTCTG  
TCGGCATTTGCATGGAGCGCACTGAGCCGGAGGAGGGCGTATATCAA  
TTTGAATGGCTGGATGATTTTGAGCGGATTACAGTATAGGCGGCCG  
GGTCATATTAGCAACGCCAGCGGAGGCCGTCCGGCTGGCTGCGCAA  
CCTATCCGGAAGTTGCGCGTCAATGCCTCCCGCGTCAAACAGCTGCAC  
GGCGGAAGGCACAACCAACTGCCTCACATCTAAAGTCTACCGAGAAAAAA  
CACGGCACATCAACCGTTATTAGCAGAACGATACGGACATCACCGCG

CTGTTAATGTGGCACATTCAAACGAATACTGGGGAGATTGCCACTGTGA  
TTTATGCCAGCATGCTTCCGGAGTGGCTGAAATCGAAATATGACAACA  
GCCTCAAGACATTGAACCATGCGTGGTGGACCCCTTTGGAGCCATACG  
TTCAATGACTGGTCACAAATTGAAAGCCCTCGCCGATCGTGAAAATGG  
CTTGCATGGCCTGAATTAGATTGGCGCCGGTCGTACCGATCAAACGAT  
TTCGTTTATGAAAATGAAATCATTCCGCTGAAAGAATTGACGCCTGATAT  
CCCTATCACAACGAATTATGGCTGACACACCGGATTGATCCCCTGATAC  
CGTCGTATAGCATACATTATACGAAGTTATGCCATAGTGAUTGGCGATG  
CTGTCGAATGGACGACGGCAATAGTTACCCATTATCAAGATAAGAAA  
GAAAAGGATTTCGCTACGCTCAAATCCTTAAAAAAACACAAAAGACC  
ACATTTTAATGTGGCTTTATTCTCAACTAAAGCACCATTAGTCAA  
CAAACGAAAATTGGATAAAGTGGATATTAAAATATATATTATGTTA  
CAGTAATATTGACTTTAAAAAAGGATTGATTCTAATGAAGAAAGCAGAC  
AAGTAAGCCTCCTAAATTCACTTAGATAAAAATTAGGAGGCATATCAA  
ATGAACTTTAATAAAATTGATTAGACAATTGGAAAGAGAAAAGAGATATT  
TAATCATTATTGAACCAACAAACGACTTTAGTATAACCACAGAAATTG  
ATATTAGTGTAACTACCGAAACATAAAACAAGAAGGATATAAATTTCAC  
CCTGCATTATTTCTTAGTGACAAGGGTGATAAACTCAAATACAGCTTT  
AGAACTGGTTACAATAGCGACGGAGAGTTAGGTTATTGGGATAAGTTAGA  
GCCACTTATACAATTTGATGGTGTATCTAAAACATTCTCTGGTATTTG  
GAECTCCTGAAAGAATGACTTCAAAGAGTTATGATTATACCTTCTGA  
TGTAGAGAAATATAATGGTCGGGGAAATTGTTCCAAAACACCTATAC  
CTGAAAATGCTTTCTCTTCTATTATTCCATGGACTTCATTACTGGTT  
TAACCTAAATATCAATAATAAGTAATTACCTCTACCCATTATTACAGC  
AGGAAAATTCAATTAAAGGTAAATTCAATATATTACCGCTATCTTACA  
GGTACATCATTCTGTTGTGATGGTTATCATGCAGGATTGTTATGAAC  
TATTCAAGGAAATTGTCAGATAGGCCTAATGACTGGCTTTATAATATGAG  
AATGCCGACTGTACTTTACAGTCGGTTCTAAAACGATACATTAAATAG  
GTACGAAAAGCAACTTTTGCCTTAAACAGTCATACCAATAAAT  
AACTCGTATAGCATACATTATACGAACGGTATTCAAGAACGCTCGGTTGC  
CGCCGGCGTTTTATGCAGCAATGGCAAGAACGTCCCAGGGAGCTCCT  
AACTTATAGGGTAACACTAAAAAGAATCAATAACGATAGAAACCGCT  
CCTAAAGCAGGTGCATTTCCTAACGAAGAAGGAATAGTCACATT  
ATTGTCTAAATGAGAATGGACTCTAGAAGAAACTTCGTTTAATCGTATT  
TAAAACAATGGGATGAGATTCAATTATGATTCTCAAGATAACAGCTT  
CTATATCAAATGTATTAAGGATATTGGTTAACGATATTCCGATATAAAGC  
CAAAGTTTGAAGTGCATTAAACATTCTACATCATTATTGCGCGTT  
CACAACTCTTTCGAGAAATATTCTTCTTCTTAGAGAGCGAAGCCAG  
TAACGCTTTCAAGCATATAATTCCAACAGCCTCGATTCCACAGCT  
GCATTGGTCCATTAAATCTATCGTCATATGACCCATTCCCCAGAAAA  
ACCCTGAACACCTTATACAATTGTTAACGATGTTCTAGTTTGTAC  
TCCGATATTAAACTGATGTAACGATGTTCTAGTTTGTAC  
AAATACTTTCACCGTATGCTCCTGCATTAGCTCATTTCAC  
CGGAACATTAAACTCACTCAATTAAAAGTCAAATCTTGATATTCCA

ATTTAAGTTAGGCATGAAAATAATTGCTGATGACGATCTACAAGGCCTG  
GAACACAAATT CCTATTCCGACTAGACCATAAGGGGACTCAGGCATATGG  
GTTACAAAACCATGAATAAGTCAAATAAAATCTCTTACTTCAGTAGC  
GGAAGAACTAGACAAGTCAGAAGTCTCTCGAGAATAATATTCCCTCTA  
AGTCGGTTAGAATTCCGTTAACAGATAGTCGACTCCTATATCAATACCAATCG  
AGTAGCCTGCATTCTTATTAAAAACAGCATTACAGGTCTGCCGCCTC  
TAGATTGCCCTGCCCAATTCAAATAAAATCTTTCAAGCAGTGTAT  
TTACTTGAGAGGAGACAGTAGACTGTTAACCTGTAATCTCAGAGAGA  
GTTGCCCTGGAGACAGGGAGTTCTCAAATTCATCTAATATTAAATT  
TGATTCATTTTTTACTAAAGCTGATCTGCAATTGAATAATAACCAACTC  
CTTTGTTATCCACCGAACTAACAGTTGGTGTCTTGAAGCTGAATTAGAT  
ATTTAAAAGTATCATATCTAATATTATAACTAAATTCTAAACAT  
TGAAATAAACATTATTTGTATATGATGAGATAAAGTTAGTTATTGGAT  
AAACAAACTAACTCAATTAAAGATAGTTGATGGATAAACTTGTCACTAA  
ATCAAAGGGGAAATGACAAATGGTCCAAACTAGTGATCTAAAC  
AAAGGGGAAATGGGATCCATGAGCGAAGTTGAATTCCAGGCCACGAGTAC  
TGGATGAGACATGCTCTGACACTGCCAACCGCGCTGGACGAAAGAG  
AAAGTCCC CGGTGGAGCTGTTCTGGTCCACAATAATCGCGTCATGGCGAG  
GGCTGGAATGCCCGATTGGAAGACATGACCCAACGGCCACGCTGAAAT  
CATGGCTCTAGACAAGGCGGACTTGTATGCAGAACTACCGCCTTATTG  
ACGCTACGCTGTACGTACACTGGAACCGTGTGTTATGTGTGCCGGAGCC  
ATGATCCACTCCCCGATTGCCCGTGTCTTGGAGCCCGATGCCAAA  
ACGGCGCTGCCGGAAAGCCTTATGGATGTCCTCACCAACCGGGAAATGAA  
TCATAGAGTTGAGATCACGGAGGGATTCTGCGACGAATGTGCCGCC  
TTCTGTCCGATTTTCCGATGCGCCGCCAAGAAATCAAGGCCAAAAG  
AAAGCCCAGAGCAGCACGGATTCCGGCGGTCCAGTGGTGGATCCTCTGG  
ATCTGAGACACCTGGAACGTCTGAATCTGCTACACCAGAAATCTCTGGAG  
GATCTCTGGTGGCTCCAGCGAAGTCGAGTTCTCCACGAATACTGGATG  
GCCATGCCCTTACACTGCCAACCGCGCTCGCGATGAACCGAAGTCCC  
AGTTGGCGCCGTTCTGTTCTAACAAACCGCGTCATGGAGAAGGCTGGA  
ACCGCGCTACGGACTTCATGATCCGACAGCTCATGCCGAAATTATGGCT  
CTGCGCAAGGCGGACTTGTCTGAGAATTACAGACTATTGATGCCAC  
GCTTACGTACGTTGAACCGTGCATGTGCGCCGGCGCATGATTCA  
TAGCCGCATCGGCAGAGTTGCTTCGGCGTCCGCAATGCTAAAACGGCG  
CCGCCGGCTCCCTATGGACGTCTTCATTACCCGGGATGAATACCGCG  
TTGAAATCACAGAAGGCATTCTGGCCGATGAGTGCGCCGCTGTG  
TACTTCTTCAGAATGCCGAGACAAGTCTCAACGCCAGAAGAAAGCCA  
AAGCAGCACAGACTCTGGAGGATCATCCGGAGGCAGCTCTGGAAAGTGA  
ACACCAGGAACAAGCGAACAGCTACACCAGAGTCCTCTGGAGGCTCATC  
TGGAGGAAGCGATAAGAAATACTCAATAGGCTTAGCTATCGGCACAAATA  
GCGTCGGATGGCGGTGATCACTGATGAATATAAGGTTCCGTCTAAAAG  
TTCAAGGTTCTGGAAATACAGACCGCCACAGTATCAAAAAAAATCTTAT  
AGGGGCTTTATTGACAGTGGAGAGACAGCGGAAGCGACTCGTCTCA  
AACGGACAGCTCGTAGAAGGTATACACGTGGAAAGAATCGTATTGTTAT

CTACAGGAGATTTTCAAATGAGATGGCGAAAGTAGATGATAGTTCTT  
CATCGACTTGAAGAGTCTTTGGGAAGAACAGAAGCATGAACG  
TCATCCTATTGGAAATATAGTAGATGAAGTGTCTATCATGAGAAATA  
TCCAACATCTATCATCTGCAGAAAAATTGGTAGATTCTACTGATAAAAG  
CGGATTGCGCTTAATCTATTGGCCTAGCGCATATGATTAAGTTCGTG  
GTCATTTGATTGAGGGAGATTAAATCCTGATAATAGTGTGGACA  
AACTATTATCCAGTGGTACAAACCTACAATCAATTATTGAAGAAAAC  
CCTATTAACGCAAGTGGAGTAGATGCTAAAGCGATTCTTCTGCACGATT  
GAGTAAATCAAGACGATTAGAAAATCTCATTGCTCAGCTCCCCGGTGAGA  
AGAAAAATGGCTATTGGGAATCTCATTGCTTGTCAATTGGGTTGACCC  
CTAATTAAATCAAATTGATTGGCAGAACAGATGCTAAATTACAGCTT  
CAAAAGATACTTACGATGATGATTAGATAATTATTGGCGCAAATTGGA  
GATCAATATGCTGATTGTTTGGCAGCTAAGAATTATCAGATGCTATT  
TTACTTCAGATATCCTAACAGATAACTGAAATAACTAAGGCTCCCCTA  
TCAGCTTCAATGATTAACGCTACGATGAACATCATCAAGACTGACTCTT  
TTAAAAGCTTAGTCGACAACAACTCCAGAAAAGTATAAAGAAATCTT  
TTTGATCAATCAAAAAACGGATATGCAGGTTATTGATGGGGAGCTA  
GCCAAGAAGAATTTATAAATTCAAACCAATTAGAAAAATGGAT  
GGTACTGAGGAATTATTGGTGAAAACTAAATCGTGAAGATTGCTGCGCAA  
GCAACGGACCTTGACAACGGCTCTATTCCCCATCAAATTCACTGGGTGA  
GCTGCATGCTATTGAGAACAGAACAGACTTTATCCATTAAAGA  
CAATCGTGAGAACAGATTGAAAAATCTGACTTTCGAATTCTTATTATGT  
TGGTCCATTGGCGCGTGGCAATAGCTGTTGCATGGATGACTCGGAAGT  
CTGAAGAACAAATTACCCATGGAATTGAGAACAGATTGCTGATAAAGGT  
GCTTCAGCTCAATCATTATTGAACGCATGACAAACTTGATAAAAATCTT  
CCAAATGAAAAAGTACTACCAAAACATAGTTGCTTATGAGTATTACG  
GTTTATAACGAATTGACAAAGGTCAAATATGTTACTGAAGGAATGCGAAA  
ACCAGCATTCTTCAGGTGAACAGAACAGAAAGCCATTGTTGATTACTCTT  
CAAAACAAATCGAAAAGTAACCGTTAACGCAATTAAAAGAACAGATTATTCA  
AAAAAATAGAATGTTGATAGTGTGAAATTTCAGGAGTTGAAGATAGA  
TTAATGCTTCATTAGGTACCTACCATGATTGCTAAAAATTATTAAAGAT  
AAAGATTGGATAATGAAGAAAATGAAGATATCTTAGAGGATATTGT  
TTAACATTGACCTTATTGAAGATAGGGAGATGATTGAGGAAAGACTTA  
AAACATATGCTCACCTCTTGATGATAAGGTGATGAAACAGCTAACGT  
CGCCGTTACTGGTGGGACGTTGTCTGAAAATTGATTAATGGTATT  
AGGGATAAGCAATCTGGCAAAACAATTAGATTGTTGAAATCAGATGG  
TTTGCCAATCGCAATTGAGCTGATCCATGATGATAGTTGACATT  
TAAAGAACATTCAAAAGCACAAAGTGTCTGGACAAGGCATAGTTAC  
ATGAACATATTGCAAATTAGCTGGTAGCCCTGCTATTAAAAAGGTATT  
TACAGACTGAAAAGTTGATGAAATTGGTCAAAGTAATGGGCGGCAT  
AAGCCAGAAAATATCGTTATTGAAATGGCACGTGAAAATCAGACAACCTCA  
AAAGGGCCAGAAAATTCGCGAGAGCGTATGAAACGAATCGAAGAACGGT  
ATCAAAGAATTAGGAAGTCAGATTCTAAAGAGCATCCTGTTGAAAATAC  
TCAATTGCAAATGAAAAGCTCTATCTATTCTCCAAAATGGAAGAG

ACATGTATGTGGACCAAGAATTAGATATTAATCGTTAAGTGATTATGATG  
TCGATCACATTGTTCCACAAAGTTCTTAAAGACGATTCAATAGACAATA  
AGGTCTAACGCCTCTGATAAAAATCGTGGTAAATCGGATAACGTTCCA  
AGTGAAGAAGTAGTCAAAAGATGAAAAACTATTGGAGACAACCTCTAA  
ACGCCAAGTTAATCACTCAACGTAAGTTGATAATTAACGAAAGCTGAA  
CGTGGAGGTTGAGTGAACTTGATAAAGCTGGTTTATCAAACGCCAATT  
GGTTGAAACTCGCCAAATCACTAACGATGTGGCACAAATTGGATAGTC  
GCATGAATACTAAATACGATGAAAATGATAAAACTTATCGAGAGGTTAAA  
GTGATTACCTAAAATCTAAATTAGTTCTGACTCCGAAAAGATTCCAA  
TTCTATAAAAGTACGTGAGATTAACAATTACCATCATGCCCATGATGCGTAT  
CTAAATGCCGTCGTTGGAAC TGCTT GATT AAGAAAT ATCCAAA ACTTGA  
ATCGGAGTTGTCTATGGT GATT ATAAGTTATGATGTTGTA AAAATGAT  
TGCTAAGTCTGAGCAAGAAATAGGCAAAGCAACCGCAAATATTCTTT  
ACTCTAATATCATGAACCTCTTCAAAACAGAAATTACACTGCAAATGGA  
GAGATTGCAAACGCCCTCTAACGAAACTAATGGGGAAACTGGAGAAAT  
TGTCTGGATAAAGGGCGAGATTTGCCACAGTGCACAAAGTATTGTCCA  
TGCCCCAAGTCAATATTGTCAAGAAAACAGAAGTACAGACAGGCGGATT  
TCCAAGGAGTCAATTTACCAAAAAGAAATCGGACAAGCTTATTGCTCG  
TAAAAAAAGACTGGATCCAAAAAAATGGTGGTTGATAGTCCAACGG  
TAGCTTATTCACTCAGTGGTCTAGTGGT GCTAAGGTGGAAAAGGGAAATCGAAG  
AAGTTAAAATCCGTTAAAGAGTTACTAGGGATCACAATTATGGAAAGAAG  
TTCCTTGAAAAAAATCCGATTGACTTTAGAAGCTAAAGGATATAAGG  
AAGTTAAAAAGACTTAATCATTAAACTACCTAAATATAGCTTTGAGT  
TAGAAAACGGTCGAAACGGATGCTGGCTAGTGCCTGGAGAATTACAAAA  
AGGAAATGAGCTGGCTCTGCCAAGCAAATATGTGAATTGGTATTTAGC  
TAGTCATTATGAAAAGTTGAAGGGTAGTCCAGAAGATAACGAACAAAAA  
CAATTGTTGTGGAGCAGCATAAGCATTATTAGATGAGATTATTGAGC  
AATCAGTGAATTCTAACGCGTTATTAGCAGATGCCATTAGATAA  
AGTTCTTAGTGCATATAACAAACATAGAGACAAACCAATACGTGAACAAG  
CAGAAAATATTATTACATTATTACGTTGACGAATCTGGAGCTCCGCTG  
CTTTAAATATTGATACAACAATTGATCGTAAACGATATACGTCTACAA  
AAGAAGTTTAGATGCCACTCTTACCATCAATCCATCACTGGTCTTATG  
AAACACGCATTGATTGAGTCAGCTAGGAGGTGACGGTCTGCAGCTCT  
AGAATGACAGATGCCAATACGTTCGCATCCACGAGAAGCTGGATATCTA  
CACGTTAAAAAGCAGTTTAACAATAAGAAGAGCGTCTCCACCGCT  
GCTATGTTCTTCGAACTGAAACCGAGAGCGAAAGACGCGCTTGCTTC  
TGGGATATGCCGTTAACAAACCGCAGTCCGGCACGGAACGCCATTCA  
CGCCGAGATCTCAGCATCCGCAAGGTTGAGGAGTATCTCGCGATAACC  
CGGGCCAGTTACGATCAACTGGTACAGCAGCTGGAGCCCGTGTGCCGAT  
TGCGCCGAAAAGATTCTTGAGTGGTACAACCAAGAACCTCGCGGCAATGG  
CCACACGCTGAAAATCTGGCTTGCAAGCTGTACTACGAGAAGAACGCC  
GCAATCAGATCGGACTTTGGAATCTCGCGATAATGGCGTGGACTAAC  
GTCATGGTCTCCGAACACTACCAGTGCTGCCAAGATCTCATCCAGTCC  
TCCCACAACCAGCTAACGAAAACCGCTGGCTGGAGAAGACACTGAAAC

GCGCTGAAAAGGCCGCTCCGAGCTGAGCATCATGATCCAAGTTAAGATT  
CTTCATAACGACAAGAGCCGGCGTCAACTCGAGTAAGGATCTCCAGG  
CATCAAATAAAACGAAAGGCTCAGTCAGAACAGACTGGGCCTTCGTTTAT  
CTGTTGTTGTCGGTGAACGCTCTACTAGAGTCACACTGGCTCACCTTC  
GGGTGGGCCTTCTCGTTATACCTAGGGATATTCGCTCCTCGCTC  
ACTGCAGCGTCATCACGAAAGAACAAAGACTTTCACCATATAACTGCTG  
ATCGTCCCAGTGTATTAAATCAGCGAGGACACCCTCCGTTAAAAA  
GCGTTACGGCTGACGGCGCACCTAGTCATGACGTATATCAGCGGGGT  
TGTGAATGAGCATGACTAACATACACAGGCAGTGGCATCCGGATCTC  
AAGCTATATTGGAGTTGAGCCTCTGAAACGGACACCCTGTATCCGAAG  
GATCGAAACGCTGTCAGCTACCGCAGCCAAATATGAAATGAAGGATTA  
TGCAACCCTGATTGATGTAAGACAGCTTCAGTGGAAAGCGGTGTATCAAG  
AAGATTTTATGCGCGCACGCCAGCGGTACAAGCCATGAGTATCAGCAG  
GGCAAGGCATTTATCGCGCGCGTTGGAGGATCAATTTCAGCGTGA  
TTTCTATGAGGGTCTGATCACAGACCTGTCTCTCCAGTTTCCGGTT  
CGGCACGGAAAAGGCCTCCGTACAAGCGAGGCAGGATCAGGACAATG  
ATTATATTTGTATGAATTTCACGGAAGAAAAACAGCTGGTCACGTTG  
ATCAGAGTGTGAAGGACATAATGACAGGAGACATATTGTCAGGCGACCTG  
ACGATGGAAAAGTATGAAGTGAGAATTGTCGTAACACACACATTAG

pAX-ABE8e-CDA-nCas9

GTGATGTCAAAGCTGAAAAAAACGCACGTAACAAAAGCAAAATTATGCT  
CCATGGGGGAGACTACAACCCGATCAGTGGCTGGATCGGCCGATATT  
TAGCTGACGATATCAAACGATGAAAGCTTCTCATACGAATACGTTTCTG  
TCGGCATTTCGATGGAGCGCACTTGAGCCGGAGGGAGGGCGTATATCAA  
TTTGAATGGCTGGATGATATTGAGCGGATTCACAGTATAGGCGGCCG  
GGTCATATTAGCAACGCCAGCGGAGCCCGTCCGGCTGGCTGCGAAA  
CCTATCCGGAAGTTGCGCGTCAATGCCTCCCGTCAAACAGCTGCAC  
GGCGGAAGGCACAACCACTGCCTCACATCTAAAGTCTACCGAGAAAAAA  
CACGGCACATCAACCGCTTATTAGCAGAACGATACGGACATCACC GGCG  
CTGTTAATGTGGCACATTCAAACGAATACGGGGAGATTGCCACTGTGA  
TTTATGCCAGCATGCTTCCGGAGTGGCTGAAATCGAAATATGACAACA  
GCCTCAAGACATTGAACCATGCGTGGTGACCCCTTTGGAGGCCATACG  
TTCAATGACTGGTCACAAATTGAAAGCCCTCGCCGATCGTGAAAATGG  
CTTGCATGGCCTGAATTAGATTGGCGCCGTTCGTCACCGATCAAACGAT  
TTCGTTTATGAAAATGAAATCATTCCGCTGAAAGAATTGACGCCTGATAT  
CCCTATCACACGAATTATGGCTGACACACCGGATTGATCCGTATAC  
CGTCGTATAGCATACTACATTACGAAGTTATGCCATAGTGA CACTGGCGATG  
CTGTCGGAAATGGACGACGGCAATAGTTACCCCTATTATCAAGATAAGAAA  
GAAAAGGATTTCGCTACGCTCAAATCCTTAAAAAAACACAAAAGACC  
ACATTTTAATGTGGCTTTATTCTCAACTAAAGCACCCATTAGTTCAA  
CAAACGAAAATTGGATAAAGTGGATATTAAAATATATATTATGTTA  
CAGTAATATTGACTTTAAAAAAGGATTGATTCTAATGAAGAAAGCAGAC  
AAGTAAGCCTCCTAAATTCACTTAGATAAAAATTAGGAGGCATATCAA

ATGAACCTTAATAAAATTGATTAGACAATTGGAAGAGAAAAGAGATATT  
TAATCATTATTGAACCAACAAACGACTTTAGTATAACCACAGAAATTG  
ATATTAGTGTTCATACGAAACATAAAACAAGAAGGATATAAATTTCAC  
CCTGCATTATTTCTTAGTGACAAGGGTATAAAACTCAAATACAGCTTT  
AGAACTGGTTACAATAGCGACGGAGAGTTAGGTTATTGGGATAAGTTAGA  
GCCACTTATACAATTGGTATCTAAAACATTCTCTGGTATTG  
GACTCCTGTAAAGAACATGACTCAAAGAGTTATGATTATACCTTCTGA  
TGTAGAGAAATATAATGGTCGGGAAATTGTTCCAAAACACCTATAC  
CTGAAAATGCTTTCTTTCTATTATTCCATGGACTCATTACTGGGTT  
TAACCTAAATATCAATAATAAGTAATTACCTCTACCCATTATTACAGC  
AGGAAAATTCAATAAAAGGTAACTCAATATATTACCGCTATCTTACA  
GGTACATCATTCTGTTGTGATGGTTATCATGCAGGATTGTTATGAAC  
TATTCAAGGAAATTGTCAGATAGGCCTAATGACTGGCTTTATAATATGAG  
AATGCCGACTGTACTTTACAGTCGGTTCTAAAACGATACATTAATAG  
GTACGAAAAGCAACTTTTGCGCTAAAACCAGTCATACCAATAAAT  
AACTCGTATAGCATACATTATACGAACGGTATTCAAACGCTCGGTTGC  
CGCCGGCGTTTTATGCAGCAATGGCAAGAACGTCCCAGGGAGCTCCT  
AACTTATAGGGTAACACTAAAAAGAACATCAATAACGATAGAAACCGCT  
CCTAAAGCAGGTGCATTTCTAACGAAGAAGGAATAGTCACATT  
ATTGTCTAAATGAGAATGGACTCTAGAAGAAACTTCGTTTTAATCGTATT  
TAAAACAATGGATGAGATTCAATTATATGATTCTCAAGATAACAGCTT  
CTATATCAAATGTATTAAGGATATTGGTTAATCCAATTCCGATATAAAGC  
CAAAGTTTGAAGTGCATTAACATTCTACATCATTATTCGCGTTC  
CACAACTCTTTCGAGAAATATTCTTCTTCTAGAGAGCGAACGCCAG  
TAACGCTTTCAAGCATATAATTCCAACAGCCTCGATTCCACAGCT  
GCATTGGGCCATTAATCTATCGTCATATGACCCATTCCCCAGAAAA  
ACCCTGAACACCTTATACAATTGTTAATAACAAGTCCAGTCCAAT  
TCCGATATTAATACTGATGTAACGATGTTCTAGTTTGTACACC  
AAATACTTTCACCGTATGCTCCTGCATTAGCTCATTTCACAAAAAC  
CGGAACATTAAACTCACTCTCAATTAAAAGTCGAAATCTTGATATTCCA  
ATTAAAGTTAGGCATGAAAATAATTGCTGATGACGATCTACAAGGCCTG  
GAACACAAATTCCATTCCGACTAGACCATAAGGGACTCAGGCATATGG  
GTTACAAAACCATGAATAAGTGCAGAAATAAAATCTCTTACTTCAG  
GGAAGAACTAGACAAGTCAGAAGTCTCTCGAGAATAATATTCCCTCA  
AGTCGGTTAGAATTCCGTTAAGATAGTCGACTCCTATATCAACCAATCG  
AGTAGCCTGCATTCTATTAAAACAAGCATTACAGGTCTCTGCCGCTC  
TAGATTGCCCTGCCCAATTCAAAAATAATCTTTCAAGCAGTGTAT  
TTACTTGAGAGGAGACAGTAGACTGTTAATCCTGTAATCTCAGAGAGA  
GTTGCCCTGGAGACAGGGAGTTCTCAAAATTCTCATCTAATATTAAATT  
TGATTCACTTTTACTAAAGCTGATCTGCAATTGAATAATAACCACTC  
CTTTGTTATCCACCGAACTAAGTTGGTGTGTTGAAGCTGAATTAGAT  
ATTAAAAGTATCATCTAATATTAACTAAATTCTAAAAAAACAT  
TGAAATAAACATTATTGTATATGATGAGATAAAGTTAGTTATTGGAT  
AAACAAACTCAATTAGATAGTTGATGGATAACTTGTCACTTAA

ATCAAAGGGGGAAATGACAAATGGTCCAAACTAGTGATATCTAAAAATC  
AAAGGGGGAAATGGGATCCATGTCAAGAGTTGAATTTCACATGAATATT  
GGATGAGACATGCAGACTGGCAAAAAGAGCAAGAGATGAAAGAGA  
AGTTCCGGTTGGCGAGTTCTGGTTCTGAATAATAGAGTTATTGGCGAAG  
GCTGGAATAGAGCAATTGGCCTGCATGATCCGACAGCACATGCAGAAATT  
ATGGCACTGAGACAAGGCAGGCCTGGTTATGCAAAATTATAGACTGATTGA  
TGCAACACTGTATGTTACATTGAACCGTGCCTATGTGCGCGGGCGCAAT  
GATTCAATTCAAGAATTGGCAGAGTTGTTGGCGTTAGAAATTCAAAAAA  
GAGGCGCAGCGGGCTCACTGATGAATGTTCTGAATTATCCGGGCATGAAT  
CATAGAGTTGAAATTACAGAACGGCATTCTGGCAGATGAATGCGCAGCACT  
GCTGTGCGATTTTATAGAATGCCGAGACAAGTTTAATGCACAAAAAA  
AAGCACAATCATCAATTAAATTCTGGAGGATCATCCGGAGGCAGCTCTGG  
AGTGAAACACCAAGGAACAAGCGAACAGCTACACCAGAGTCCTCTGGAG  
GCTCATCTGGAGGAAGCACAGATGCCGAATACGTTCGCATCCACGAGAAG  
CTGGATATCTACACGTTAAAAAGCAGTTTAACAATAAGAAGAGCGT  
CTCCCACCGCTGCTATGTTCTTCGAACTGAAACCGCAGAGGCAGAAAGAC  
GCGCTTGCTCTGGGGATATGCCGTTAACAAACCGCAGTCCGGCACGGAA  
CGCGGCATTACGCCGAGATCTTCAGCATCCGCAAGGTTGAGGAGTATCT  
TCGCGATAACCCGGGCCAGTTACGATCAACTGGTACAGCAGCTGGAGCC  
CGTGTGCCGATTGCCCGAAAAGATTCTTGAGTGGTACAACCAAGAAACTT  
CGCGGCAATGCCACACGCTGAAAATCTGGGCTTGCAAGCTGTACTACGA  
GAAGAACGCCGCAATCAGATGGACTTGGAAATCTCGCGATAATGGCG  
TTGGACTTAACGTCATGGCTCCGAAACACTACCAGTGCTGCCGAAAGATCT  
TCATCCAGTCCTCCCACAACCAGCTAACGAAAACCGCTGGCTGGAGAAG  
ACACTGAAACCGCCTGAAAAGGCCGCTCCGAGCTGAGCATCATGATCCA  
AGTTAAGATTCTTCATACGACGAAGAGCCGGCGTCTCAGGTTCTGAAA  
CTCCTGGAACCAGTGAGTCTGCAACTCCAGAGTCTATGGATAAGAAATAC  
TCAATAGGCTTAGCTATGGCACAAATAGCGTCGGATGGCGGTGATCAC  
TGATGAATATAAGGTTCCGTCTAAAAGTTCAAGGTTCTGGAAATACAG  
ACCGCCACAGTATCAAAAAAAATCTTATAGGGGCTTTTATTGACAGT  
GGAGAGACAGCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGT  
ATACACGTCGGAAGAACATCGTATTGTTATCTACAGGGAGATTTTCAAATG  
AGATGGCGAAAGTAGATGATAGTTCTTCATCGACTGAAAGAGTCTTTT  
TGGTGGAAAGAACAGAACAGCATGAACGTCATCCTATTTGGAAATATA  
GTAGATGAAGTTGCTTATCATGAGAAATATCCAACATCTATCATCTGCGA  
AAAAAAATTGGTAGATTCTACTGATAAAAGCGGATTGCGCTTAATCTATTG  
GCCTAGCGCATATGATTAAGTTCGTGGCATTTTGATTGAGGGAGAT  
TTAAATCCTGATAATAGTGATGTGGACAAACTATTATCCAGTTGACAA  
ACCTACAATCAATTATTGAAGAAAACCTATTACGCAAGTGGAGTAGA  
TGCTAAAGCGATTCTTCTGCACGATTGAGTAAATCAAGACGATTAGAAA  
ATCTCATTGCTCAGCTCCCCGGTGAGAAGAAAAATGGCTATTGGGAAT  
CTCATTGCTTGTATTGGGTTGACCCCTAATTAAATCAAATTGATT  
TGGCAGAAGATGCTAAATTACAGCTTCAAAAGATACTACGATGATGAT  
TTAGATAATTATTGGCGCAAATTGGAGATCAATATGCTGATTGTTTG

GCAGCTAAGAATTATCAGATGCTATTTACTTCAGATATCCTAACAGAGTA  
AATACTGAAATAACTAAGGCTCCCTATCAGCTCAATGATTAAACGCTA  
CGATGAACATCATCAAGACTGACTCTTAAAAGCTTAGTCGACAACA  
ACTTCCAGAAAAGTATAAAGAAATCTTTTGATCAATCAAAAAACGGAT  
ATGCAGGTTATATTGATGGGGAGCTAGCCAAGAAGAATTTATAAATT  
ATCAAACCAATTAGAAAAAATGGATGGTACTGAGGAATTATTGGTGA  
ACTAAATCGTAAGATTGCTGCGCAAGCAACGGACCTTGACAACGGCT  
CTATTCCCCATCAAATTCACTGGGTGAGCTGCATGCTATTGAGAAGAC  
AAGAAGACTTTATCCATTAAAAGACAATCGTGAGAAGATTGAAAAA  
ATCTGACTTTCGAATTCTTATTATGTTGGTCCATTGGCGCGTGGCAAT  
AGTCGTTTGCATGGATGACTCGGAAGTCTGAAGAAACAATTACCCATG  
GAATTGAGAAGATTGTCGATAAAGGTGCTCAGCTCAATCATTATTGA  
ACGCATGACAAACTTGATAAAAATCTTCAAATGAAAAAGTACTACCAA  
AACATAGTTGCTTATGAGTATTACGGTTATAACGAATTGACAAAGG  
TCAAATATGTTACTGAAGGAATGCGAAAACCAGCATTCTTCAGGTGAA  
CAGAAGAAAGCCATTGTTGATTTACTCTTCAAACAAATCGAAAAGTAAC  
CGTTAAGCAATTAAAAGAAGATTATTCAAAAAAATAGAATGTTGATA  
GTGTTGAAATTTCAGGAGTTGAAGATAGATTAAATGCTCATTAGGTACCT  
ACCATGATTGCTAAAATTATTAAAGATAAAGATTGGATAATGAA  
GAAAATGAAGATATCTTAGAGGATATTGTTAACATTGACCTTATTGAA  
GATAGGGAGATGATTGAGGAAAGACTTAAACATATGCTCACCTCTTGA  
TGATAAGGTGATGAAACAGCTTAAACGTCGCCGTATACTGGTGGGAC  
GTTTGTCTCGAAAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAA  
ACAATATTAGATTGAAATCAGATGGTTGCCATCGCAATTGAA  
CAGCTGATCCATGATGATGACATTAAAGAAGACATTCAAAAAGC  
ACAAGTGTCTGGACAAGGCGATAGTTACATGAACATATTGCAAATTAG  
CTGGTAGCCCTGCTATTAAAAAGGTATTACAGACTGTAAAAGTTGTTG  
ATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCAGAAAATCGTTATT  
GAAATGGCACGTGAAAATCAGACAACCTAAAAGGCCAGAAAATTCGC  
GAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGAAGTCA  
GATTCTAAAGAGCATCCTGTTGAAAATCTCAATTGCAAATGAAAAGC  
TCTATCTCTATTCTCCAAATGGAAGAGACATGTATGTGGACCAAGAA  
TTAGATATTAATCGTTAAGTGATTATGATGTCGATCACATTGTTCCACAA  
AGTTCCCTAAAGACGATTCAATAGACAATAAGGTCTAACCGCTCTGAT  
AAAAATCGTGGTAAATCGGATAACGTTCCAAGTGAAGAAGTAGTCAAAA  
AGATGAAAAACTATTGGAGACAACCTCTAAACGCCAAGTTAATCACTCAA  
CGTAAGTTGATAATTAAACGAAAGCTGAACGTGGAGGTTGAGTGAAC  
TGATAAGCTGGTTTATCAAACGCCAATTGGTGAAGACTCGCCAAATCA  
CTAACGCATGTGGCACAAATTGGATAGTCGATGAATACTAAATACGAT  
GAAAATGATAAAACTATTGAGAGGTTAAAGTGATTACCTAAAATCTAA  
ATTAGTTCTGACTTCCGAAAAGATTCCAATTCTATAAAGTACGTGAGAT  
TAACAAATTACCATCATGCCCATGATGCGTATCTAAATGCCGCTGTTGGAAC  
TGCTTGATTAAGAAATATCCAAAACCTGAATCGGAGTTGTCTATGGTGA  
TTATAAAGTTATGATGTTCGTAAATGATTGCTAAGTCTGAGCAAGAAAT

AGGCAAAGCAACCGCAAAATATTCTTTACTCTAATATCATGAACCTTCTT  
CAAAACAGAAATTACACTGCCAAATGGAGAGATTGCAACGCCCTCTAA  
TCGAAACTAATGGGAAACTGGAGAAATTGTCTGGATAAAGGGCGAGA  
TTTGCCACAGTGCAGCAAAACTATTGTCCATGCCCAAGTCAATATTGTCAA  
GAAAACAGAAGTACAGACAGGCAGGATTCTCCAAGGAGTCAATTACCAA  
AAAGAAATTGGACAAGCTTATTGCTCGTAAAAAGACTGGATCCAAA  
AAATATGGTGGTTTGATAGTCCAACGGTAGCTTATTGAGCTTAGTGGTT  
GCTAAGGTGGAAAAAGGGAAATCGAAGAAGTTAAAATCCGTTAAAGAGT  
TACTAGGGATCACAATTATGGAAAGAAGTTCTTGAAAAAAATCCGATT  
GACTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAGACTTAATCAT  
TAAACTACCTAAATATAGCTTTGAGTTAGAAAACGGTGTAAACCGGA  
TGCTGGCTAGTGCCGGAGAATTACAAAAAGGGAAATGAGCTGGCTCTGCCA  
AGCAAATATGTGAATTTTTATTTAGCTAGTCATTATGAAAAGTTGAAG  
GGTAGTCCAGAAGATAACGAACAAAAACAATTGTTGTGGAGCAGCATA  
AGCATTATTAGATGAGATTATTGAGCAAATCAGTGAATTCTAACCGTG  
TTATTAGCAGATGCCATTAGATAAAGTTCTTAGTGCATATAACAAAC  
ATAGAGACAAACCAATACGTGAACAAGCAGAAAATATTACATTATT  
ACGTTGACGAATCTGGAGCTCCGCTGCTTTAAATATTGATACAACA  
ATTGATCGTAAACGATATACTACGTTACAAAAGAAGTTAGATGCCACTCTT  
ATCCATCAATCCATCACTGGTCTTATGAAACACGCATTGATTGAGTCAG  
CTAGGAGGTGACTAACTCGAGTAAGGATCTCCAGGCATCAAATAACGA  
AAGGCTCAGTCGAAAGACTGGCCTTCGTTATCTGTTGTGGCT  
AACGCTCTACTAGAGTCACACTGGCTCACCTCAGGCTGGCCTTCTGC  
GTTTATACCTAGGGATATATTCCGCTCCTCGCTACTGCAGCGTCATCAC  
GAAAGAACAAAGACTTTACCATATAAACTGCTGATCGTCCCAGCTGT  
ATTTAATCAGCGAGGACACCGTTCCGTTAAAAGCGTTACGGCTGAC  
GGCGCACCTAGTCATGACGTATATCAGCGGGTTGTGAATGAGCATGA  
CTTAACATACACAGGGCATGGCATTCAAGCTATATTGGAG  
TTGAGCCTTGTAAACGGACACCGTTCCGTTAAAAGCGTTACGGCTGAC  
AGCTACCGCAGCCAAATATGAAATGAAGGATTATGCAACCGTATTGA  
TGTAAAGACAGCTTCAGTGGAAAGCGGTGTATCAAGAAGATTGCG  
GCACGCCAGCGGTACAAGCCATGAGTATCAGCAGGGCAAGCGTATTT  
ATCGGCGCGCTTGGAGGATCAATTCAAGCTGATTCTATGAGGGCTG  
ATCACAGACCTGTCTCTCCAGTTCCGGTTCGGCACGGAAAAGGC  
GTCTCCGTACAAGCGAGGCAGGATCAGGACAATGATTATTTGTCAT  
GAATTTCACGGAAGAAAAACAGCTGGTCACGTTGATCAGAGTGTGAAGG  
ACATAATGACAGGAGACATATTGTCAGGCGACCTGACGATGGAAAAGTAT  
GAAGTGAGAATTGTCGTAAACACACATTAG

pAX-CDA-ABE8e-nCas9

GTGATGTCAAAGCTGAAAAAACGCACGTAACAAAAGCAAAATTATGCT  
CCATGGGGGAGACTACAACCCGATCAGTGGCTGGATCGGCCGATATT  
TAGCTGACGATATCAAACGATGAGCTTCTCATACGAATACGTTCTG  
TCGGCATTGGCATGGAGCGCACTGAGCCGGAGGAGGGGTATATCAA

TTTGAATGGCTGGATGATATTTGAGCGGATTACAGTATAGGCGGCCG  
GGTCATATTAGCAACGCCAGCGGAGCCCGTCCGGCCTGGCTGCGCAA  
CCTATCCGGAAGTTGCGCGTCAATGCCTCCCGGTCAAACAGCTGCAC  
GGCGGAAGGCACAACCACTGCCTCACATCTAAAGTCTACCGAGAAAAAA  
CACGGCACATCAACCGCTTATTAGCAGAACGATAACGGACATCACCCGGCG  
CTGTTAATGTGGCACATTCAAACGAATACGGGGAGATTGCCACTGTGA  
TTTATGCCAGCATGCTTCCGGAGTGGCTGAAATCGAAATATGACAACA  
GCCTCAAGACATTGAACCATGCGTGGTGACCCCTTTGGAGGCCATACG  
TTCAATGACTGGTCACAAATTGAAAGCCCTCGCCGATCGGTGAAAATGG  
CTTGCATGGCCTGAATTAGATTGGCGCCGGTCTCGTCACCGATCAAACGAT  
TTCGTTTATGAAAATGAAATCATTCCGCTGAAAGAATTGACGCGCTGATAT  
CCCTATCACAACGAATTTATGGCTGACACACCGGATTGATCCCCTATAC  
CGTCGTATAGCATACATTATACGAAGTTATGCCATAGTGAUTGGCGATG  
CTGTCGAATGGACGACGGCAATAGTTACCCCTTATTATCAAGATAAGAAA  
GAAAAGGATTTCGCTACGCTCAAATCCTTAAAAAAACACAAAAGACC  
ACATTTTAATGTGGTCTTTATTCTCAACTAAAGCACCATTAGTTCAA  
CAAACGAAAATTGGATAAAGTGGATATTAAAATATATATTATGTTA  
CAGTAATATTGACTTTAAAAAAGGATTGATTCTAATGAAGAAAGCAGAC  
AAGTAAGCCTCCTAAATTCACTTAGATAAAAATTAGGAGGCATATCAA  
ATGAACCTTAATAAAATTGATTAGACAATTGGAAGAGAAAAGAGATATT  
TAATCATTATTGAACCAACAAACGACTTTAGTATAACCACAGAAATTG  
ATATTAGTGTCTTATACGAAACATAAAACAAGAAGGATATAATTTCAC  
CCTGCATTATTTCTTAGTGACAAGGGTATAACTCAAATACAGCTTT  
AGAACTGGTTACAATAGCGACGGAGAGTTAGGTTATTGGGATAAGTTAGA  
GCCACTTATACAATTGGTATGGTATCTAAAACATTCTCTGGTATTG  
GACTCCTGAAAGAATGACTCAAAGAGTTATGATTATACCTTCTGA  
TGTAGAGAAATATAATGGTCGGGAAATTGTTCCAAAACACCTATAC  
CTGAAAATGCTTCTCTTCTATTATTCCATGGACTTCATTACTGGGTT  
TAACTTAAATATCAATAATAAGTAATTACCTCTACCCATTATTACAGC  
AGGAAAATTCAATAAAAGGTAACTCAATATATTACCGCTATCTTACA  
GGTACATCATTCTGTTGTGATGGTTATCATGCAGGATTGTTATGAAC  
TATTAGGAAATTGTCAGATAGGCCTAATGACTGGCTTATAATATGAGAT  
AATGCCGACTGTACTTTACAGTCGGTTCTAAAACGATAACATTAAAG  
GTACGAAAAAGCAACTTTTGCGCTTAAACAGTCATAACCAATAAAT  
AACTCGTATAGCATACATTACGAACGGTATTCAAGAACGCTCGGTG  
CGCCGGCGTTTATGCAGCAATGGCAAGAACGTCGGGGAGCTCCT  
AACTTATAGGGTAACACTAAAAAGAATCAATAACGATAGAAACCGCT  
CCTAAAGCAGGTGCATTTCCTAACGAAGAACGGCAATAGTTACATT  
ATTGTCTAAATGAGAATGGACTCTAGAAGAAACTCGTTTAATCGTATT  
TAAAACAATGGGATGAGATTCAATTATGATTCTCAAGATAACAGCTT  
CTATATCAAATGTATTAAGGATATTGGTTAATCCAATTCCGATATAAAAGC  
CAAAGTTTGAAGTGCATTAAACATTCTACATCATTGCGCGTTC  
CACAACTCTTCTGAGAAATATTCTTCTTCTAGAGAGCGAAGCCAG  
TAACGCTTTCAAGCATATAATTCCAACAGCCTCGATTCCACAGCT

GCATTGGGTCCATTAATCTATCGTCATATGACCCATTCCCCAGAAAA  
ACCCTGAACACCTTATAACAATTGTTAATAACAAGTCCAGTCCAAT  
TCCGATATTAAACTGATGTAACGATGTTTCAAGTTTGTACATACC  
AAATACTTTCACCGTATGCTCCTGCATTAGCTCATTTCACAAACAAA  
CGGAACATTAAACTCACTCTCAATTAAAAGTCAAATCTTGATATTCCA  
ATTAAAGTTAGGCATGAAAATAATTGCTGATGACGATCTACAAGGCCTG  
GAACACAAATTCCATTCCGACTAGACCATAAGGGACTCAGGCATATGG  
GTTACAAAACCATGAATAAGTCAAATAAAATCTCTTACTTCAGTAGC  
GGAAGAACTAGACAAGTCAGAAGTCTCTCGAGAATAATATTCCCTCTA  
AGTCGGTTAGAATTCCGTTAAGATAGTCGACTCCTATATCAATACCAATCG  
AGTAGCCTGCATTCTTATTAAAACAAGCATTACAGGTCTGCCGCCTC  
TAGATTGCCCTGCCCAATTCAAAAATAAAATCTTTCAAGCAGTGTAT  
TTACTTGAGAGGAGACAGTAGACTGTTAACCTGTAATCTCAGAGAGA  
GTTGCCCTGGAGACAGGGAGTTCTCAAATTCATCTAATATTAAATT  
TGATTCATTTTTACTAAAGCTGATCTGAAATTGAATAATAACCAACTC  
CTTGTTATCCACCGAACTAAGTTGGTTGAAGCTGAATTAGAT  
ATTAAAAGTATCATATCTAACATTATAACTAAATTCTAAAAAAACAT  
TGAAATAAACATTATTTGTATATGAGATAAGTTAGTTATTGGAT  
AAACAAACTAACTCAATTAAAGATAGTGATGGATAACTTGTCACTTAA  
ATCAAAGGGGAAATGACAAATGGCCAACACTAGTGATATCTAAAAATC  
AAAGGGGAAATGGGATCCATGACAGATGCCAATACGTCGCATCCAC  
GAGAAGCTGGATATCTACACGTTAAAAGCAGTTTAAACAATAAGAA  
GAGCGTCTCCCACCGCTGCTATGTTCTTCGAACTGAAACCGCAGAGCG  
AAAGACGCGCTTGCTCTGGGATATGCCGTTAACAAACCGCAGTCCGGC  
ACGGAACGCGGCATTCACGCCGAGATCTCAGCATCCGCAAGGTTGAGGA  
GTATCTCGCGATAACCCGGGCCAGTTACGATCAACTGGTACAGCAGCT  
GGAGCCCGTGTGCCGATTGCGCCAAAAGATTCTGAGTGGTACAACCAA  
GAACCTCGCGCAATGCCACACGCTGAAAATCTGGCTTGCAAGCTGTA  
CTACGAGAAGAACGCCGCAATCAGATGGACTTGGATCTCGCGATA  
ATGGCGTTGGACTTAACGTATGGTCTCCGAACACTACCAGTGCTGCCGC  
AAGATCTTCATCCAGTCCTCCCACAACCAGCTAACGAAAACCGCTGGCT  
GGAGAAGACACTGAAACGCGCTGAAAAGCGCCGCTCCGAGCTGAGCATC  
ATGATCCAAGTTAAGATTCTCATACGACGAAGAGGCCGGCGTCTCAGG  
TTCTGAAACTCCTGGAACCAAGTGAGTCTGCAACTCCAGAGTCTCAGAAG  
TTGAATTTCACATGAATATTGGATGAGACATGCACTGACACTGGCAAAA  
AGAGCAAGAGATGAAAGAGAAGTTCCGGTGGCGCAGTTCTGGTTCTGAA  
TAATAGAGTTATTGGCGAAGGCTGGAATAGAGCAATTGGCCTGCATGATC  
CGACAGCACATGCAGAAATTATGGCACTGAGACAAGGCAGCCTGGTTATG  
CAAAATTATAGACTGATTGATGCAACACTGTATGTTACATTGAACCGTGC  
GTTATGTGCGGGCGCAATGATTCAAGAATTGGCAGAGTTGTTT  
GGCGTTAGAAATTCAAAAAGAGGCGCAGCGGGCTCACTGATGAATGTTCT  
GAATTATCCGGGCATGAATCATAGAGTTGAAATTACAGAAGGCATTCTGG  
CAGATGAATGCGCAGCACTGCTGTGCGATTTCATAGAATGCCGAGACAA  
GTTTTAATGCACAAAAAAAGCACAATCATCAATTCTGGAGGATC

ATCCGGAGGCAGCTCTGGAAGTGAACACCAGGAACAAGCGAATCAGCT  
ACACCAGAGTCCTCTGGAGGCTCATCTGGAGGAAGCGATAAGAAATACTC  
AATAGGCTTAGCTATCGGCACAAATAGCGTCGGATGGCGGTGATCACTG  
ATGAATATAAGGTTCCGTCTAAAAAGTTCAAGGTTCTGGAAATACAGAC  
GCCACAGTACAAAAAAATCTTATAGGGCTCTTATTGACAGTGG  
AGAGACAGCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGTAT  
ACACGTCGGAAGAACGTTATCTACAGGAGATTTTCAAATGAG  
ATGGCGAAAGTAGATGATAGTTCTTCATCGACTGAAGAGTCTTTTG  
GTGGAAGAAGACAAGAACGATGAACGTCTCCTATTGGAAATATAGT  
AGATGAAGTTGCTTATCATGAGAAATATCCAACATCTATCATCTCGAA  
AAAAATTGGTAGATTCTACTGATAAAGCGGATTGCGCTTAATCTATTGG  
CCTTAGCGCATATGATTAAGTTCGTGGTCATTTTGATTGAGGGAGATT  
TAAATCCTGATAATAGTGTGGACAAACTATTATCCAGTTGGTACAA  
ACCTACAATCAATTATTGAAGAAAACCCTATTAACGCAAGTGGAGTAGA  
TGCTAAAGCGATTCTTCTGCACGATTGAGTAAATCAAGACGATTAGAAA  
ATCTCATTGCTCAGCTCCCCGGTGAGAAGAAAAATGGCTATTGGGAAT  
CTCATTGCTTGTCAATTGGTTGACCCCTAATTAAATCAAATTGATT  
TGGCAGAAGATGCTAAATTACAGCTTCAAAAGATACTTACGATGATGAT  
TTAGATAATTATTGGCGCAAATTGGAGATCAATATGCTGATTGTTTG  
GCAGCTAAGAATTTCAGATGCTATTTCAGATATCCTAAGAGTA  
AATACTGAAATAACTAAGGCTCCCCTATCAGCTCAATGATTAAACGCTA  
CGATGAACATCATCAAGACTTGACTCTTAAAAGCTTAGTCGACAACA  
ACTTCCAGAAAAGTATAAGAAATCTTTTGATCAATCAAAAAACGGAT  
ATGCAGGTTATTGATGGGGGAGCTAGCCAAGAAGAATTTCATAAATT  
ATCAAACCAATTAGAAAAAAATGGATGGTACTGAGGAATTATTGGTGA  
ACTAAATCGTAAGATTGCTGCGCAAGCAACGGACCTTGACAACGGCT  
CTATTCCCCATCAAATTCACTGGTGAGCTGCATGCTATTGAGAAGAC  
AAGAAGACTTTATCCATTAAAAGACAATCGTGAGAAGATTGAAAAAA  
ATCTTGACTTTGAATTCTTATTATGTTGGTCCATTGGCGGTGGCAAT  
AGTCGTTTGCATGGATGACTCGGAAGTCTGAAGAAACAATTACCCATG  
GAATTGAGAAGATTGTCGATAAAGGTGCTCAGCTCAATCATTATTGA  
ACGCATGACAAACTTGATAAAAATCTTCAAATGAAAAAGTACTACCAA  
AACATAGTTGCTTATGAGTATTACGGTTATAACGAATTGACAAAGG  
TCAAATATGTTACTGAAGGAATGCGAAAACCAGCATTCTTCAGGTGAA  
CAGAAGAAAGCCATTGTTGATTACTCTTCAAAACAAATCGAAAAGTAAC  
CGTTAAGCAATTAAAAGAAGATTATTCAAATAGAATGTTGATA  
GTGTTGAAATTTCAGGAGTTGAAGATAGATTAATGCTTATTAGGTACCT  
ACCATGATTGCTAAAATTATTAAAGATAAAGATTGGTGGATAATGAA  
GAAAATGAAGATATCTTAGAGGATATTGTTAACATTGACCTTATTGAA  
GATAGGGAGATGATTGAGGAAAGACTAAAACATATGCTCACCTCTTGA  
TGATAAGGTGATGAAACAGCTTAAACGTCGCCGTTACTGGTGGGGAC  
GTTTGTCTGAAAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAA  
ACAATATTAGATTGGTAAATCAGATGGTTGCCAATCGCAATTGAA  
CAGCTGATCCATGATGATGACATTAAAGAAGACATTCAAAAAGC

ACAAGTGTCTGGACAAGGCGATAGTTACATGAACATATTGCAAATTAG  
CTGGTAGCCCTGCTATTAAAAAAGGTATTTACAGACTGTAAAAGTTGTG  
ATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCAGAAATATCGTTATT  
GAAATGGCACGTAAAATCAGACAACCTAAAAGGCCAGAAAAATTGCG  
GAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGAAGTCA  
GATTCTAAAGAGCATCCTGTTAAAATACTCAATTGCAAATGAAAAGC  
TCTATCTCTATTATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAA  
TTAGATATTAATCGTTAAGTGATTATGATGTCGATCACATTGTTCCACAA  
AGTTCTTAAAGACGATTCAATAGACAATAAGGTCTAACCGCGTCTGAT  
AAAAATCGTGGTAAATCGGATAACGTTCCAAGTGAAGAAGTAGTCAAA  
AGATGAAAAACTATTGGAGACAACCTCTAACGCCAAGTTAATCACTCAA  
CGTAAGTTGATAATTAAACGAAAGCTGAACGTGGAGGTTGAGTGA  
TGATAAGCTGGTTTATCAAACGCCAATTGGTTGAAACTCGCCAAATCA  
CTAAGCATGTGGCACAAATTGGATAGTCGATGAATAACTAAATACGAT  
GAAAATGATAAACTATTGAGAGGTTAAAGTGATTACCTAAAATCTAA  
ATTAGTTCTGACTTCCGAAAAGATTCCAATTCTATAAAGTACGTGAGAT  
TAACAATTACCATCATGCCCATGATGCGTATCTAAATGCCGTCGTTGGAAC  
TGCTTGATTAAGAAAATATCCAAAACCTGAATCGGAGTTGTCTATGGTGA  
TTATAAAAGTTATGATGTTCGTAAATGATTGCTAAGTCTGAGCAAGAAA  
AGGCAAAGCAACCGCAAATATTCTTTACTCTAAATATCATGAACCTCTT  
CAAAACAGAAATTACACTTGCAAATGGAGAGATTGCAAACGCCCTCTAA  
TCGAAACTAATGGGGAAACTGGAGAAATTGTCTGGGATAAAGGGCGAGA  
TTTGCCACAGTGCGBAAAGTATTGTCATGCCCAAGTCATATTGTCAA  
GAAAACAGAAGTACAGACAGGCGGATTCTCCAAGGAGTCAATTACCAA  
AAAGAAAATCGGACAAGCTTATTGCTCGTAAAAAGACTGGATCCAAA  
AAATATGGTGGTTTGATAGTCAAACGGTAGCTTATTCACTGCTAGTGGTT  
GCTAAGGTGGAAAAGGGAAATCGAAGAAGTTAAAATCCGTTAAAGAGT  
TACTAGGGATCACAATTATGGAAAGAAGTTCCTTGAAAAAAATCCGATT  
GACTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAGACTTAATCAT  
TAAACTACCTAAATATAGTCTTTGAGTTAGAAAACGGTCGTAACCGGA  
TGCTGGCTAGTGCAGGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCA  
AGCAAATATGTGAATTCTTATTTAGCTAGTCATTATGAAAAGTTGAAG  
GGTAGTCCAGAAGATAACGAACAAAAACAATTGTTGTGGAGCAGCATA  
AGCATTATTAGATGAGATTATTGAGCAAATCAGTGAATTCTAAGCGTG  
TTATTAGCAGATGCCAATTAGATAAAGTTCTTAGTCATATAACAAAC  
ATAGAGACAAACCAATACGTGAACAAAGCAGAAAATATTCAATTATT  
ACGTTGACGAATCTGGAGCTCCGCTGCTTTAAATATTGATACAACA  
ATTGATCGTAAACGATATACTGCTACAAAAGAAGTTAGATGCCACTCTT  
ATCCATCAATCCATCACTGGCTTATGAAACACGCATTGATTGAGTCAG  
CTAGGAGGTGACTAAGTCAAGGATCTCCAGGCATCAAATAAACGA  
AAGGCTAGTCGAAAGACTGGGCCTTCGTTATCTGTTGTTGTCGGTG  
AACGCTCTACTAGAGTCACACTGGCTCACCTCGGGTGGCCTTCTGC  
GTTTATACCTAGGGATATATTCCGCTCCTCGCTACTGCAGCGTCATCAC  
GAAAGAACAAAGACTTTCACCATATAAAACTGCTGATCGTCCCAGTGT

ATTTAATCAGCGAGGACACCGTTCCGTTAAAAGCGTTACGGCTGAC  
GGCGGCACCTTAGTCATGACGTATATCAGCGGGTTGTGAATGAGCATGA  
CTTAACATACACAGGCAGGATGGCATCCGGATCTCAAGCTATATTGGAG  
TTGAGCCTCTGAAACGGACACCCTGTATCGAAGGATCGAAACGCTGTC  
AGCTACCGCAGCCAAATATGAAATGAAGGATTATGCAACCGTATTGA  
TGTAAAGACAGCTTCAGTGGAAAGCGGTGTATCAAGAAGATTTATGCGC  
GCACGCCAGCGGTACAAGCCATGAGTATCAGCAGGGCAAGGCGTATTT  
ATCGGCGCGCTTGGAGGATCAATTTCAGCGTGATTCTATGAGGGTCTG  
ATCACAGACCTGTCTCTCCAGTTTCCGGTTCGGCACGGAAAAGGC  
GTCTCCGTACAAGCGAGGCAGGATCAGGACAATGATTATTTTGTAT  
GAATTTCACGGAAGAAAAACAGCTGGTCACGTTGATCAGAGTGTGAAGG  
ACATAATGACAGGAGACATATTGTCAGGCGACCTGACGATGGAAAAGTAT  
GAAGTGAGAATTGTCGTAAACACACATTAG

Annotations:

*lacA* upstream homologous arm, chloramphenicol resistance gene, lambda t0 terminator, *Bacillus megaterium* *xylR*, xylose promoter (*Pxyl*), RBS, ABE7.10 gene (The highlighted parts indicate linkers), ABE8e gene, PmCDA gene, XTEN linker, GSAASR linker, nCas9 (D10A) gene, rrnB T1 terminator, *lacA* downstream homologous arm

References

- 1 Lu, Z. *et al.* CRISPR-assisted multi-dimensional regulation for fine-tuning gene expression in *Bacillus subtilis*. *Nucleic Acids Res* **47**, e40, doi:10.1093/nar/gkz072 (2019).
- 2 Xu, L., Liu, Y. & Han, R. BEAT: A python program to quantify base editing from sanger sequencing. *CRISPR J* **2**, 223-229, doi:10.1089/crispr.2019.0017 (2019).