# **Supplementary information**

# Programmable deletion, replacement, integration and inversion of large DNA sequences with twin prime editing

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# Programmable deletion, replacement, integration, and inversion of large DNA sequences with twin prime editing

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**Supplementary Table 1:** Sequences of pegRNAs and sgRNAs used in mammalian cell experiments

All sequences are shown in 5' to 3' orientation. pegRNAs are a concatenation of the spacer sequence, the sgRNA scaffold, and the 3' extension (contains PBS and RT template, and a 3' motif in the case of epegRNAs).

sgRNA scaffold sequence (5' to 3') gttttagagctagaaatagcaagttaaaataaggctagtccgttatcaacttgaaaaagtggcaccgagtcggtgc

mar DNA		21 automaion	Edita mada bu tha
pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
HEK3_attB_A_38	ggcccagactgagcacgtga	at gate ct gac gac g gac g cc g t c g t c gac a a g cc c g t g ct c a g t ct g	indicated on the x-axis
HEK3_attB_A_34	ggcccagactgagcacgtga	tectgaegaeggagaecgeegtegtegaeaageeegtgeteagtetg	indicated on the x-axis
HEK3_attB_A_30 HEK3_attB_B_38	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	gacgacggagaccgccgtcgtcgacaagcccgtgctcagtctg ggcttgtcgacgacggcggtctccgtcgtcaggatcatccgggatactgg	indicated on the x-axis indicated on the x-axis
HEK3_attB_B_34	gtcaaccagtatcccggtgc	tgtcgacgacggcggtctccgtcgtcaggatcatccgggatactgg	indicated on the x-axis
HEK3_attB_B_30	gtcaaccagtatcccggtgc	gacgacggcggtctccgtcgtcaggatcatccgggatactgg	indicated on the x-axis
HEK3_attP_A_43 HEK3_attP_A_39	ggcccagactgagcacgtga	taccgtacaccactgagaccgcggtggttgaccagacaaacctcgtgctcagtctg	indicated on the x-axis
HEK3_attP_A_39 HEK3 attP A 35	ggcccagactgagcacgtga ggcccagactgagcacgtga	gtacaccactgagaccgcggtggttgaccagacaaacctcgtgctcagtctg accactgagaccgcggtggttgaccagacaaacctcgtgctcagtctg	indicated on the x-axis indicated on the x-axis
HEK3_attP_B_44	gtcaaccagtatcccggtgc	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctccgggatactgg	indicated on the x-axis
HEK3_attP_B_40	gtcaaccagtatcccggtgc	ggtcaaccaccgcggtctcagtggtgtacggtacaaacctccgggatactgg	indicated on the x-axis
HEK3_attP_B_36	gtcaaccagtatcccggtgc	aaccaccgcggtctcagtggtgtacggtacaaacctccgggatactgg	indicated on the x-axis
Figure 2b			
pegRNA	spacer sequence	3' extension	Edits made by the
PE3_HEK3_FKBP_ins12	ggcccagactgagcacgtga	tggaggaagcagggetteettteetetgeeateaeacetgeaeteeegtgeteagtetg	specified pegRNA indicated on the x-axis
bp	220000 Page 12	.PPPPPP PP	marcarea on the h and
PE3_HEK3_FKBP_ins36 bp	ggcccagactgagcacgtga	tggaggaagcagggcttcctttcctctgccatcacccgtctcctggggagatggtttcc acctgcactcccgtgctcagtctg	indicated on the x-axis
PE3_HEK3_FKBP_ins10 8bp	ggcccagactgagcacgtga	tggaggaagcagggetteettteetetgecateaaaatttettteeatetteaagcateee ggtgtagtgeaceaegcaggtetggeegcgettggggaaggtgegeeegteteetgg ggagatggttteeacetgeacteeegtgeteagtetg	indicated on the x-axis
twinPE_HEK3_FKBP_in s108bp_A	ggcccagactgagcacgtga	accacgcaggtctggccgcgcttggggaaggtgcgcccgtctcctggggagatggtt tccacctgcactcccgtgctcagtctg	indicated on the x-axis
twinPE_HEK3_FKBP_in s108bp_B	gtcaaccagtatcccggtgc	accttccccaagcgcggccagacctgcgtggtgcactacaccgggatgcttgaagat ggaaagaaatttccgggatactgg	indicated on the x-axis
sgRNA	spacer sequence		
HEK3_3b_+90_nicking	gtcaaccagtatcccggtgc		
Figure 2c			
pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
		gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc	exon 4 24-bp overlap (64
PAH_E4.2_45	gcccaagaaccattcaagagc		bp recoded)
PAH_E4.4_43	gctacgggccatggactcaca	a a a tott g to ctacg g a g ccga a ctt g a c g ct g a to a tot g to g a g constant g c	bp recoded) exon 4 24-bp overlap (64 bp recoded)
PAH_E4.4_43 PAH_E4.2_45_EvoPreQ1	gctacgggccatggactcaca gcccaagaaccattcaagagc	aaatettgteetaeggageegaaettgaegetgateateetgtgagteeatggee gtteggeteegtaggaeaagatttgattagegaaeetateaagttettgaatggttetetet etettgaegeggttetatetagttaegegttaaaceaaetagaaa	bp recoded) exon 4 24-bp overlap (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded)
PAH_E4.4_43 PAH_E4.2_45_EvoPreQ1 PAH_E4.4_43_EvoPreQ1	gctacgggccatggactcaca gcccaagaaccattcaagagc gctacgggccatggactcaca	aaatettgteetaeggageegaacttgaegetgateateetgtgagteeatggee gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttetetet etettgaegeggttetatetagttaegegttaaaceaactagaaa aaatettgteetaeggageegaacttgaegetgateateetgtgagteeatggeetetet etettgaegeggttetatetagttaegegttaaaceaactagaaa	bp recoded) exon 4 24-bp overlap (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded)
PAH_E4.4_43  PAH_E4.2_45_EvoPreQ1  PAH_E4.4_43_EvoPreQ1  PAH_E42_50	getaegggeeatggaeteaea geecaagaaceatteaagage getaegggeeatggaeteaea geecaagaaceatteaagage	aaatettgteetaeggageegaaettgaegetgateateetgtgagteeatggee gtteggeteegtaggacaagatttgattagegaaeetateaagttettgaatggttetetet etettgaegeggttetatetagttaegegttaaaceaaetagaaa aaatettgteetaeggageegaaettgaegetgateateetgtgagteeatggeetetet etettgaegeggttetatetagttaegegttaaaceaaetagaaa gteaagtteggeteegtaggacaagatttgattagegaaeetateaagttettgaatggtt e	bp recoded) exon 4 24-bp overlap (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap (64 bp recoded)
PAH_E4.4_43  PAH_E4.2_45_EvoPreQ1  PAH_E4.4_43_EvoPreQ1  PAH_E42_50  PAH_E44_50	getaegggeeatggaeteaea geecaagaaceatteaagage getaegggeeatggaeteaea geecaagaaceatteaagage getaegggeeatggaeteaea	aaatettgteetaeggageegaaettgaegetgateateetgtgagteeatggee gtteggeteegtaggacaagatttgattagegaaeetateaagttettgaatggttetetet etettgaegeggttetatetagttaegegttaaaeeaaetagaaa aaatettgteetaeggageegaaettgaegetgateateetgtgagteeatggeetete etettgaegeggttetatetagttaegegttaaaeeaaetagaaa gteaagtteggeteegtaggaeaagatttgattagegaaeetateaagttettgaatggtt e getaateaaatettgteetaeggageegaaettgaegetgateateetgtgagteeatgg ee	bp recoded) exon 4 24-bp overlap (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap (64 bp recoded) exon 4 36-bp overlap (64 bp recoded)
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PAH_E4.4_43  PAH_E4.2_45_EvoPreQ1  PAH_E4.4_43_EvoPreQ1  PAH_E42_50  PAH_E44_50	getaegggeeatggaeteaea geecaagaaceatteaagage getaegggeeatggaeteaea geecaagaaceatteaagage getaegggeeatggaeteaea	aaatettgteetaeggageegaacttgaegetgateateetgtgagteeatggee gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttetetet etettgaegeggttetatetagttaegegttaaaceaactagaaa aaatettgteetaeggageegaacttgaegetgateateetgtgagteeatggeetetet etettgaegeggttetatetagttaegegttaaaceaactagaaa gteaagtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggtt e getaateaaatettgteetaeggageegaacttgaegetgateateetgtgagteeatgg ec gteaagtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggtt etetetetettgaegeggttetatetagttaegegtaaacetateaagttettgaatggtt etetetetettgaegeggttetatetagttaegegttaaaceaactagaaa getaateaaatettgteetaeggageegaacttgaegetgateateetgtgagteeatgg	bp recoded) exon 4 24-bp overlap (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap (64 bp recoded) exon 4 36-bp overlap (64 bp recoded) exon 4 36-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap exon 4 36-bp overlap exon 4 36-bp overlap
PAH_E4.4_43  PAH_E4.2_45_EvoPreQ1  PAH_E4.4_43_EvoPreQ1  PAH_E42_50  PAH_E44_50  PAH_E42_50_EvoPreQ1	gctacgggccatggactcaca gcccaagaaccattcaagage gctacgggccatggactcaca gcccaagaaccattcaagage gctacgggccatggactcaca gcccaagaaccattcaagage	aaatettgteetaeggageegaacttgaegetgateateetgtgagteeatggee gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttetete ctettgaegeggttetatetagttaegegttaaaceaactagaaa aaatettgteetaeggageegaacttgaegetgateateetgtgagteeatggeetete ctettgaegeggttetatetagttaegegttaaaceaactagaaa gteaagtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggtt c getaateaaatettgteetaeggageegaacttgaegetgateateetgtgagteeatgg ce gteaagtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggtt ctetetettgaegeggttetatetagttaegegttaaaceaactagaaa	bp recoded) exon 4 24-bp overlap (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap (64 bp recoded) exon 4 36-bp overlap (64 bp recoded) exon 4 36-bp overlap (64 bp recoded)
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PAH_E4.4_43  PAH_E4.2_45_EvoPreQ1  PAH_E4.4_43_EvoPreQ1  PAH_E42_50  PAH_E44_50  PAH_E44_50_EvoPreQ1  PAH_E44_50_EvoPreQ1  PAH_E44_50_EvoPreQ1  PAH_E44_50_EvoPreQ1	getaegggecatggacteaca geccaagaaccatteaagage getaegggecatggacteaca geccaagaaccatteaagage getaegggecatggacteaca geccaagaaccatteaagage getaegggecatggacteaca getaegggecatggacteaca	anatettgteetaeggageegaacttgaegetgateateetgtgagteeatggee gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttetete ctettgaegeggttetatetagttaegegttaaaceaactagaaa aaatettgteetaeggageegaacttgaegetgateateetgtgagteeatggeetete ctettgaegeggttetatetagttaegegtaaaceaactagaaa gteaagtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggtt c getaateaaatettgteetaeggageegaacttgaegetgateateetgtgagteeatgg ce gteaagtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggtt ctetetettgaegeggttetatetagttaegegtaaaceaactagaaa getaateaaatettgteetaeggageegaacttgaegetgateateetgtgagteeatgg cetetetettgaegeggttetatetagttaegegttaaaceaactagaaa aggatgateageggteagtegateggetegateaggacaagatttgattagegaacetateaa gttettgaatggtte ttgataggttegetaateaaatettgteetaeggageegaacttgaegetgaacetgaegetgateateetgt ttgataggttegetaateaaatettgteetaeggageegaacttgaegetgaateateetgt	bp recoded) exon 4 24-bp overlap (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 24-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap (64 bp recoded) exon 4 36-bp overlap (64 bp recoded) exon 4 36-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap epegRNA (64 bp recoded) exon 4 36-bp overlap epegRNA (64 bp recoded) exon 4 59-bp overlap (64 bp recoded) exon 4 59-bp overlap (64

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PAH_E7.2_34	gtggtttccgcctccgacctg	agaaagtetetaetgeteaagageeeggeaaegggteggaggeg	exon 7 22-bp overlap (46 bp recoded)
PAH_E7.5_34	gagtggaagactcggaaggcc	tettgageagtagagaetttetggggggtetegeetteegagtette	exon 7 22-bp overlap (46 bp recoded)
PAH_E7.2_34_EvoPreQ1	gtggtttccgcctccgacctg	agaaagtetetaetgeteaagageeeggeaaegggteggaggegtetetete	exon 7 22-bp overlap epegRNA (46 bp recoded)
PAH_E7.5_34_EvoPreQ1	gagtggaagactcggaaggcc	tettgageagtagagaetttetggggggtetegeetteegagtettetetete	exon 7 22-bp overlap epegRNA (46 bp recoded)
PAH_E7.2_44	gtggtttccgcctccgacctg	gagaccccccagaaagtctctactgctcaagagcccggcaacgggtcggaggcg	exon 7 42-bp overlap (46 bp recoded), exon 7 24-bp
PAH_E7.5_44	gagtggaagactcggaaggcc	gttgccgggctcttgagcagtagagactttctggggggtctcgccttccgagtcttc	overlap (64 bp recoded) exon 7 42-bp overlap (46 bp recoded)
PAH_E7.2_44_EvoPreQ1	gtggtttccgcctccgacctg	$gagaccccccagaaagtctctactgctcaagagcccggcaacgggtcggaggcgtct\\ctctcttgacgcggttctatctagttacgcgttaaaccaactagaaa$	exon 7 42-bp overlap epegRNA (46 bp recoded), exon 7 24-bp overlap epegRNA (64 bp
PAH_E7.5_44_EvoPreQ1	gagtggaagactcggaaggcc	gttgeegggetettgageagtagagaetttetggggggtetegeetteegagtettetet etetettgaegeggttetatetagttaegegttaaaceaactagaaa	recoded) exon 7 42-bp overlap epegRNA (46 bp recoded)
PAH_E7.6_44	gtctgatgtactgtgtgcag	agtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagtaca	exon 7 24-bp overlap (64
PAH_E7.6_44_EvoPreQ1	gtctgatgtactgtgtgcag	agtagagactttetggggggtetegeatteegegtgttteattgeacacagtacatetete tettgaegeggttetatetagttaegegttaaaceaactagaaa	bp recoded) exon 7 24-bp overlap epegRNA (64 bp recoded)
PAH_E7.2_55	gtggtttccgcctccgacctg	acgcggaatgcgagacccccagaaagtctctactgctcaagagcccggcaacggg	exon 7 47-bp overlap (64
PAH_E7.6_56	gtctgatgtactgtgtgcag	teggaggeg gggetettgagcagtagagactttetggggggtetegeatteegegtgttteattgeaca	bp recoded) exon 7 47-bp overlap (64 bp recoded)
PAH_E7.2_55_EvoPreQ1	gtggtttccgcctccgacctg	cagtaca acgcggaatgcgagacccccagaaagtctctactgctcaagagcccggcaacggg	exon 7 47-bp overlap epegRNA (64 bp recoded)
PAH_E7.6_56_EvoPreQ1	gtctgatgtactgtgtgcag	teggaggegtetetettgaegeggttetatetagttaegegttaaaceaactagaaa gggetettgageagtagagaetttetggggggtetegeatteegegtgttteattgeaea eagtaeatetetetettgaegeggttetatetagttaegegttaaaceaactagaaa	exon 7 47-bp overlap epegRNA (64 bp recoded)
Fig 2a			
Figure 2e pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
HEK3_DF_A_SA_ del77nt	ggcccagactgagcacgtga	teetetgeeateaegtgeteagtetg	SA (Δ 77nt)
HEK3_DF_B_SA_ del77nt	gtcaaccagtatcccggtgc	tgatggcagaggaccgggatactgg	SA (Δ 77nt)
	gteaaceagtateeeggtge ggeeeagaetgageaegtga	tgatggcagaggaccgggatactgg tggaggaagcagggcttcctttcct	SA (Δ 77nt) SA (Δ 56nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_			
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_	ggcccagactgagcacgtga	tggaggaagcagggcttcctttcctctgccatcacgtgctcagtctg	SA (Δ 56nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tggaggaagcagggcttcctttcctctgccatcacgtgctcagtctg tgatggcagaggaaaggaa	SA (Δ 56nt) SA (Δ 56nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_B_HA_	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga	tggaggaagcagggcttcctttcctctgccatcacgtgctcagtctg tgatggcagaggaaaggaa	SA (Δ 56nt) SA (Δ 56nt) HA (Δ 64nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_PD_	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tggaggaagcagggetteettteetetgecateaegtgeteagtetg tgatggeagaggaaaggaageeetgetteeteeaeegggataetgg tgcaggagetgeateetetgeeateaegtgeteagtetg tgatggeagaggatgeageteetgcaeegggataetgg	SA (Δ 56nt) SA (Δ 56nt) HA (Δ 64nt) HA (Δ 64nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_A_SA_	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga	tggaggaagcagggcttcctttcctctgccatcacgtgctcagtctg  tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_A_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tggaggaagcagggcttcctttcctctgccatcacgtgctcagtctg  tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_A_SA_ del77nt_EvoPreQ1	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga	tggaggaagcagggetteettteetetgecateacgtgeteagtetg tgatggeagaggaaaggaagceetgetteeteeacegggataetgg tgcaggagetgeateetetgecateacgtgeteagtetg tgatggeagaggatgeageteetgeacegggataetgg geceagceaaacttgteaaceagtateeeggegtgeteagtetg gggteaateettggggeeeagaetgageaegeegggataetgg teetetgeeateacgtgeteagtetgttaaataacgeggttetatetagttaegegttaaaceaactagaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_A_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga	tggaggaagcagggcttcctttcctctgccatcacgtgctcagtctg  tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 77nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvOPreQ1 HEK3_DF_A_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga	tgatggaaggaaggaaggaagcctgcttcctccaccgggatactgg  tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 56nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_B_SA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_B_PD_ del90nt HEK3_DF_A_PD_ del90nt HEK3_DF_A_SA_ del77nt_EvoPreQI HEK3_DF_B_SA_ del77nt_EvoPreQI HEK3_DF_B_SA_ del56nt_EvoPreQI HEK3_DF_B_SA_ del56nt_EvoPreQI HEK3_DF_B_SA_ del56nt_EvoPreQI HEK3_DF_B_SA_ del56nt_EvoPreQI HEK3_DF_B_SA_ del56nt_EvoPreQI HEK3_DF_B_SA_ del56nt_EvoPreQI	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgatggcagaggaaaggaagccctgcttcctccaccgggatactgg  tgatggcagaggaaaggaa	SA ( $\Delta$ 56nt)  SA ( $\Delta$ 56nt)  HA ( $\Delta$ 64nt)  HA ( $\Delta$ 64nt)  PD ( $\Delta$ 90nt)  PD ( $\Delta$ 90nt)  SA-EvoPreQ1 ( $\Delta$ 77nt)  SA-EvoPreQ1 ( $\Delta$ 77nt)  SA-EvoPreQ1 ( $\Delta$ 56nt)  SA-EvoPreQ1 ( $\Delta$ 56nt)  SA-EvoPreQ1 ( $\Delta$ 64nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_B_SA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgatggaaggaaggaaggaagccctgcttcctccaccgggatactgg  tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 64nt)  SA-EvoPreQ1 (Δ 64nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_B_SA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_PD_ del90nt_EvoPreQ1	ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgatggaaggaaggattcetttcetetgcateacgtgeteagtetg  tgatggcagaggaaaggaagccctgettcetceacegggatactgg  tgatggcagaggatgcagctcetgcacegggatactgg  tgatggcagaggatgcagctcetgcacegggatactgg  gcccagccaaacttgtcaaccagtateceggegtgctcagtetg  gggtcaatcettggggcccagactgagcacgcgggatactgg  tcctctgccatcacgtgctcagtctgttaaataacgcggttctatcta	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 64nt)  SA-EvoPreQ1 (Δ 64nt)  SA-EvoPreQ1 (Δ 64nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_B_SA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgatggaaggaaggaaggaagccctgcttcctccaccgggatactgg  tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 64nt)  SA-EvoPreQ1 (Δ 64nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_PD_ del90nt_EvoPreQ1 HEK3_DF_B_PD_ del90nt_EvoPreQ1	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgatggaaggaaggaaggaagccctgcttcctccaccgggatactgg tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 64nt)  SA-EvoPreQ1 (Δ 64nt)  PD-EvoPreQ1 (Δ 90nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_A_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_HA_ del64nt_EvoPreQ1 HEK3_DF_B_PD_ del90nt_EvoPreQ1 HEK3_DF_B_PD_ del90nt_EvoPreQ1	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgatggaaggaaggattcetttcetetgcatcacgtgetcagtetg  tgatggcagaggaaaggaagccetgettcetccacegggatactgg  tgatggcagaggatgcatcetctgccatcacgtgetcagtetg  tgatggcagaggatgcagctcetgcacegggatactgg  gcccagccaaacttgtcaaccagtatcccggcgtgetcagtetg  gggtcaatcettggggcccagactgagcacgcegggatactgg  tcetetgccatcacgtgetcagtetgttaaataacgcggttctatctagttacgcgttaaaccaactagaa  tgatggcagaggaccgggatactggaaaatatacgcggttctatcta	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 64nt)  SA-EvoPreQ1 (Δ 64nt)  PD-EvoPreQ1 (Δ 90nt)
del77nt HEK3_DF_A_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_B_SA_ del56nt HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA_ del64nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_PD_ del90nt HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del77nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del56nt_EvoPreQ1 HEK3_DF_B_SA_ del64nt_EvoPreQ1 HEK3_DF_A_HA_ del64nt_EvoPreQ1 HEK3_DF_A_PD_ del90nt_EvoPreQ1 HEK3_DF_A_PD_ del90nt_EvoPreQ1 HEK3_DF_B_D_ del90nt_EvoPreQ1 Figure 2f pegRNA  DMD-Exon51-A1_a_SA	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgatggaaggaaggaaggaagcctgcttcctcaccgggatactgg tgatggcagaggaaaggaa	SA (Δ 56nt)  SA (Δ 56nt)  HA (Δ 64nt)  HA (Δ 64nt)  PD (Δ 90nt)  PD (Δ 90nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 77nt)  SA-EvoPreQ1 (Δ 56nt)  SA-EvoPreQ1 (Δ 64nt)  SA-EvoPreQ1 (Δ 64nt)  PD-EvoPreQ1 (Δ 90nt)  PD-EvoPreQ1 (Δ 90nt)  Edits made by the specified pegRNA SA-1 (Δ 780nt)

DMD-Exon51-b1-a3_a-	gcagttgcctaagaactggt	accacttccacaatgtatatgattgttactgagttcttagg	PD-1 (Δ 627nt)
PD DMD-Exon51-b1-a3_b-	gcagttgcctaagaactggt	accacttccacaatgtatatgattgttactgagttcttaggcaa	PD-2 (Δ 627nt)
PD DMD-Exon51-A3_b_attB	gtatatgattgttactgaga	atgatectgaegaeggagaeegeegtegtegaeaageeeagtaaeaate	tPE-1 attB ( $\Delta$ 589nt); tPE-2 attB ( $\Delta$ 589nt); tPE-1 attB ( $\Delta$ 558nt); tPE-2 attB
DMD-Exon51-A3_c_attB	gtatatgattgttactgaga	atgateetgaegaeggagaeegeegtegtegaeaageeeagtaaeaateata	( $\Delta$ 558nt) tPE-3 attB ( $\Delta$ 589nt); tPE-4 attB ( $\Delta$ 589nt); tPE-3 attB ( $\Delta$ 558nt); tPE-4 attB
DMD-Exon51-B1_b_attB	gcagttgcctaagaactggt	ggettgtegaegaeggeggteteegtegteaggateatagttettagge	(Δ 558nt) tPE-1 attB (Δ 589nt); tPE- 3 attB (Δ 589nt)
DMD-Exon51-B1_c_attB	gcagttgcctaagaactggt	ggettgtegaegaeggeggteteegtegteaggateatagttettaggeaae	tPE-2 attB ( $\Delta$ 589nt); tPE-4 attB ( $\Delta$ 589nt)
DMD-Exon51-B2_b_attB	gaggagagtaaagtgattgg	ggettgtegaegaeggeggteteegtegteaggateatateaetttaete	tPE-1 attB ( $\Delta$ 558nt); tPE-3 attB ( $\Delta$ 558nt)
DMD-Exon51-B2_c_attB	gaggagagtaaagtgattgg	ggcttgtcgacgacggcggtctccgtcgtcaggatcatatcactttactctcc	tPE-2 attB ( $\Delta$ 558nt); tPE-4 attB ( $\Delta$ 558nt)
sgRNA	spacer sequence		Edits made by the paired sgRNA
DMD-Exon51-A1 DMD-Exon51-A3 DMD-Exon51-B1	gattggetttgattteeeta gtatatgattgttaetgaga geagttgeetaagaaetggt		Cas9 (Δ 818nt) Cas9 (Δ 627nt) Cas9 (Δ 818nt); Cas9 (Δ 627nt)
Figure 3b			,
pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
CCR5_A223c	gtcatcctgataaactgcaaa	atgateetgaegaeggagaeegeegtegtegaeaageegeagtttateagg	indicated on the x-axis
CCR5_B272a	gaaggaaaaacaggtcagaga	ggettgtegaegaeggeggteteegtegteaggateatetgaeetg	indicated on the x-axis
CCR5_B291b	gcccagaaggggacagtaaga	ggettgtegaegaeggeggteteegtegteaggateattaetgteeeet	indicated on the x-axis
CCR5_B305a	ggcagcatagtgagcccaga	ggettgtegaegaeggeggteteegtegteaggateatgggeteaet	indicated on the x-axis
CCR5_B326b	gatttccaaagtcccactggg	ggettgtegacgacggeggteteegtegteaggateatagtgggactttg	indicated on the x-axis
CCR5_B330b	gttgtatttccaaagtcccac	ggettgtegaegaeggeggteteegtegteaggateatggaetttggaa	indicated on the x-axis
CCR5_A260c	gtgacatctacctgctcaacc	atgatcctgacgacggagaccgccgtcgtcgacaagcctgagcaggtagat	indicated on the x-axis
CCR5_B305c	ggcagcatagtgagcccaga	ggettgtegaeggeggteteegtegteaggateatgggeteactatge	indicated on the x-axis
CCR5_B330c	gttgtatttccaaagtcccac	ggcttgtcgacgacggcggtctccgtcgtcaggatcatggactttggaaat	indicated on the x-axis indicated on the x-axis
CCR5_A325b CCR5_B414a	gctcactatgctgccgcccag	atgatectgaegaeggagaegeegtegtegtegaeaageeggeggeageat	indicated on the x-axis
CCR5_B414a CCR5_A360b	ggtacctatcgattgtcagg	ggettgtegaegaeggeggteteegtegteaggateatgaeaatega atgateetgaegaeggagaeegeegtegtegaeaageeaagagttgaeae	indicated on the x-axis
CCR5_A5000 CCR5_A506c	gacaatgtgtcaactcttgac gacaagtgtgatcacttggg	atgateetgaegaeggagaeegeegtegtegaeaageeaagtgateaeaett	indicated on the x-axis
CCR5_A500c CCR5_B584a		ggettgtegaegaeggeggteteegtegteaggateatgeteteatt	indicated on the x-axis
CCR5_B564a CCR5_A509a	gtatggaaaatgagagctgc	atgatectgaegaeggagaeegeegtegtegaeaageeeeeaagtga	indicated on the x-axis
CCR5_A509a CCR5_B535c	gaagtgtgatcacttgggtgg gatctggtaaagatgattcc	ggettgtegaegaeggeggteteegtegteaggateatateatetttaeeag	indicated on the x-axis
CCR5_B555c	getgtgtttgegteteteee	atgateetgaegaeggagaeegeegtegtegaeaageeagagaegeaaaea	indicated on the x-axis
CCR5_B584b	gtatggaaaatgagagctgc	ggettgtegaegaeggegteteegtegteaggateatgeteteatttte	indicated on the x-axis
Figure 3c			
pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
AAVS1_A1077b	gcagagccaggaacccctgt	taccgtacaccactgagaccgcggtggttgaccagacaaacctggggttcctgg	indicated on the x-axis
AAVS1_B1154b	gtccttggcaagcccaggag	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgggcttgcc	indicated on the x-axis
AAVS1_A1098b	gggaaggggcaggagagcca	taccgtacaccactgagaccgcggtggttgaccagacaaacctctctcctgccc	indicated on the x-axis
AAVS1_B1154a	gtccttggcaagcccaggag	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgggcttg	indicated on the x-axis
AAVS1_A1246c	gaatatgtcccagatagcac	taccgtacaccactgagaccgcggtggttgaccagacaaacctctatctgggacat	indicated on the x-axis
AAVS1_B1314b	gtgcgtcctaggtgttcacc	gtetggteaaceacegeggteteagtggtgtaeggtacaaacetgaacacetagg	indicated on the x-axis
AAVS1_B1376a	gtcctggcagggctgtggtg	gtetggteaaceacegeggteteagtggtgtaeggtaeaaaceteacagecet	indicated on the x-axis
AAVS1_A1267c	ggggactctttaaggaaaga	taccgtacaccactgagaccgcggtggttgaccagacaaacctttccttaaagagt	indicated on the x-axis
AAVS1_A1293a	gagaaagagaaagggagtag	taccgtacaccactgagaccgcggtggttgaccagacaaacctctccctttc	indicated on the x-axis indicated on the x-axis
AAVS1_A1307b AAVS1_B1314a	gagtagaggcggccacgacc	taccgtacaccactgagaccgcggtggttgaccagacaaacctcgtggccgcct gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgaacaccta	indicated on the x-axis
AAVS1_B1514a	gtgcgtcctaggtgttcacc		indicated on the x-axis
AAVS1_A1582c AAVS1_B1640a	gatcagtgaaacgcaccaga gtgacctgcccggttctcag	taccgtacaccactgagaccgcggtggttgaccagacaaacctggtgcgtttcact gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctagaaccggg	indicated on the x-axis
AAVS1_B1640a AAVS1_B1676a	gagcttggcagggggtggga	gtetggteaaceacegeggteteagtggtgtacggtacaaacetagaaceggg	indicated on the x-axis
AAVS1_B1701a	gagccagagaggatcctggg	gtetggteaaceacegeggteteagtggtgtaeggtaeaaacetaggateete	indicated on the x-axis
AAVS1_B1705b	gatggagccagagaggatcc	gtetggteaaceacegeggteteagtggtgtaeggtaeaaacetteetetetgge	indicated on the x-axis
AAVS1_A1615b	gcagctcaggttctgggaga	taccgtacaccactgagaccgcggtggttgaccagacaaacctcccagaacctg	indicated on the x-axis
AAVS1 B1640a	gtgacctgcccggttctcag	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctagaaccggg	indicated on the x-axis
AAVS1_A1615a	gcagctcaggttctgggaga	taccgtacaccactgagaccgcggtggttgaccagacaaacctcccagaacc	indicated on the x-axis
AAVS1_B1676a	gagcttggcagggggtggga	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctcaccccctg	indicated on the x-axis
AAVS1_A1647b	gtggccactgagaaccgggc	taccgtacaccactgagaccgcggtggttgaccagacaaacctcggttctcagt	indicated on the x-axis
AAVS1_B1676b	gagcttggcagggggtggga	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctcacccctgcc	indicated on the x-axis
AAVS1_B1701a	gagccagagaggatcctggg	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctaggatcctc	indicated on the x-axis
AAVS1 B1705a	gatggagccagagaggatcc	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttcctctctg	indicated on the x-axis

gtetggteaaccacegeggtetcagtggtgtacggtacaaaccttcetcttg taccgtacaccactgagaccgegtggttgaccagacaaaccttcetgttagge gtetggteaaccacegeggtctagtggtgtacggtacaaacctctgtccctagt

gatggagccagaggaggatcc gaatctgcctaacaggaggt

ggggccactagggacaggat

AAVS1\_B1705a AAVS1\_A1810b AAVS1\_B1883b

indicated on the x-axis

indicated on the x-axis

AAVS1_B1902a	gtccctccaccccacagtg	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttgtggggtg	indicated on the x-axis
			indicated on the x-axis
AAVS1_A1890b	gtcaccaatcctgtccctag	taccgtacaccactgagaccgcggtggttgaccagacaaacctgggacaggatt	
AAVS1_A1890c	gtcaccaatcctgtccctag	taccgtacaccactgagaccgcggtggttgaccagacaaacctgggacaggattgg	indicated on the x-axis
AAVS1 B1962c	gggaccaccttatattccca	tetggteaaceacegeggteteagtggtgtaeggtacaaacetgaatataaggtgg	indicated on the x-axis
AAVS1 A3786c	getggeececeaeegeecea	taccgtacaccactgagaccgcggtggttgaccagacaaacctggcggtgggggc	indicated on the x-axis
AAVS1 B3839c	gacetgeecageacaceetg	tctggtcaaccaccgcggtctcagtggtgtacggtacaaacctggtgtgctgggca	indicated on the x-axis
AAVS1_A3786a	getggeececacegeecea	taccgtacaccactgagaccgcggtggttgaccagacaaacctggcggtggg	indicated on the x-axis
AAVS1_B3903b	gcgactcctggaagtggcca	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctccacttccagg	indicated on the x-axis
AAVS1 B3930a	ggacttcccagtgtgcatcg	gtetggteaaceacegeggteteagtggtgtaeggtaeaaacettgeacaetg	indicated on the x-axis
AAVS1 A3835b	gacgtcacggcgctgcccca	taccgtacaccactgagaccgcggtggttgaccagacaaacctggcagcgccgt	indicated on the x-axis
_			
AAVS1_B3930b	ggacttcccagtgtgcatcg	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttgcacactggg	indicated on the x-axis
AAVS1_A3856a	ggtgtgctgggcaggtcgcg	taccgtacaccactgagaccgcggtggttgaccagacaaacctgacctgccc	indicated on the x-axis
Figure 3d			
		21 - 4	EPG I. b. di.
pegRNA	spacer sequence	3' extension	Edits made by the
			specified pegRNA
CCR5 A325a	geteactatgetgeegeecag	atgateetgaegaeggagaeegeegtegtegaeaageeggeggeage	325/414
CCR5 B414b	ggtacctatcgattgtcagg	ggettgtcgacgacggcggtctccgtcgtcaggatcatgacaatcgata	325/414
CCR5 A506c			506/584
	gacaagtgtgatcacttggg	atgatcctgacgacggagaccgccgtcgtcgacaagccaagtgatcacactt	
CCR5_A509b	gaagtgtgatcacttgggtgg	atgateetgaegaeggagaeegeegtegtegaeaageeeeeaagtgate	509/584
CCR5_A531b	gctgtgtttgcgtctctccc	atgateetgaegaeggagaeegeegtegtegaeaageeagagaegeaaa	531/584
CCR5 B584b	gtatggaaaatgagagetge	ggettgtegaegaeggeggteteegtegteaggateatgeteteatttte	506/584, 509/584,
	888	8888888-888888	531/584
A A V/C1 A 1077	gangaga	tagastagasastassassasttt t	
AAVS1_A1077c	gcagagccaggaacccctgt	taccgtacaccactgagaccgcggtggttgaccagacaaacctggggttcctggct	1077/1154
AAVS1_B1154c	gtccttggcaagcccaggag	tctggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgggcttgccaa	1077/1154
AAVS1 A3786c	getggeececacegeecea	taccgtacaccactgagaccgcggtggttgaccagacaaacctggcggtgggggc	3786/3903, 3786/3930
AAVS1 B3903c	gegaeteetggaagtggeea	tetggteaaceacegeggteteagtggtgtaeggtaeaaacetecaetteeaggag	3786/3903
	0 0 00 000		
AAVS1_B3930c	ggacttcccagtgtgcatcg	tctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttgcacactgggaa	3786/3930
T: 2			
Figure 3e			
pegRNA	spacer sequence	3' extension	Edits made by the
			specified pegRNA
CCR5 A531b	getgtgtttgegteteteee	atgatectgaegaeggagaeegeegtegtegaeaageeagagaegeaaa	attB 38
_			
CCR5_B584b	gtatggaaaatgagagctgc	ggettgtegaegaeggeggteteegtegteaggateatgeteteatttte	attB 38
CCR5_A7_attB_30	gctgtgtttgcgtctctccc	tcctgacgacggagaccgccgtcgtcgacaagccagagacgcaaa	attB 30
CCR5 B8 attB 30	gtatggaaaatgagagctgc	tgtcgacgacggcggtctccgtcgtcaggatcatgctctcattttc	attB 30
CCR5 A7 attB 20	getgtgtttgegteteteee	acgacggagaccgccgtcgtcgacaagccagagacgcaaa	attB 20
CCR5 B8 attB 20			attB 20
	gtatggaaaatgagagctgc	acgacggcggtctccgtcgtcaggatcatgctctcattttc	
CCR5_A7_attB_GA_38	gctgtgtttgcgtctctccc	atgateetgaegaeggagteegeegtegtegaeaageeagaagaegeaaa	attB-GA 38
CCR5_B8_attB_GA_38	gtatggaaaatgagagctgc	ggettgtegaeggeggaeteegtegteaggateatgeteteatttte	attB-GA 38
CCR5 A7 attB GA 30	getgtgtttgegteteteee	tcctgacgacggagtccgccgtcgtcgacaagccagagacgcaaa	attB-GA 30
CCR5 B8 attB GA 30		tgtcgacgacggcggactccgtcgtcaggatcatgctctcattttc	attB-GA 30
CCR3_D6_anD_GA_30	gtatggaaaatgagagctgc		
CCD 5 A 7 UD C A 20			
CCR5_A7_attB_GA_20	gctgtgtttgcgtctctccc	acgacggagtccgccgtcgtcgacaagccagagacgcaaa	attB-GA 20
CCR5_A7_attB_GA_20 CCR5_B8_attB_GA_20	getgtgtttgegteteteee gtatggaaaatgagagetge	acgacggagtccgccgtcgtcaggatcatgctctcattttc	attB-GA 20
CCR5_B8_attB_GA_20	gtatggaaaatgagagctgc	acgacggcggactccgtcgtcaggatcatgctctcattttc	attB-GA 20
		acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg	
CCR5_B8_attB_GA_20 CCR5_A7_attP_50	gtatggaaaatgagagetge getgtgtttgegteteteee	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa	attB-GA 20 attP 50
CCR5_B8_attB_GA_20	gtatggaaaatgagagctgc	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcatttt	attB-GA 20
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50	gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcatttt c	attB-GA 20 attP 50 attP 50
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_A7_attP_40	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaaaccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa	attB-GA 20 attP 50 attP 50 attP 40
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_A7_attP_40 CCR5_B8_attP_40	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge	acgaeggeggaetcegtegteaggateatgeteteatttte gggtttgtaeegtaeaceactgagaeeggggggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgaeggtaeaaaeeegeteteatttt c tgtaeegtaeaceaetgagaeegeggtggttgaeeagaeaaaeeagaegaeaa tgtetggteaaceaeegeggteteagtggtgtaeggtaeaaaeeegeteteatttte	attB-GA 20 attP 50 attP 50 attP 40 attP 40
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_A7_attP_40	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaaaccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa	attB-GA 20 attP 50 attP 50 attP 40
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_A7_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee	acgaeggeggaetcegtegtegggateatgeteteatttte gggtttgtaeegtaeaceactgagaeegggtggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgaeggtaeaaaeeegeteteatttt c tgtaeegtaeaceaetgagaeegeggtggttgaeeagaeaaaeeaagagaegeaaa tgtetggteaaeeaeegeggteteagtggtgaeggtaeaaaeeegeteteatttte egtaeaceaetgagaeegeggtggttgaeeagaeaaaeeaagagaegeaaa	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_A7_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30 CCR5_B8_attP_30	gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgacggtacaaaccagcgctctcattttc cgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcattttc	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_A7_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee	acgacegcegactcegtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccagcgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgctggtcaaccaccgcggtctcagtggtgacggtacaaaccagcgctctcattttc cgtacaccactgagaccgcggtgttgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgacagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgacggtacaaacccgctctcattttc gggtttgtaccgtacacacactgagtccgcggtggttgaccagacaaaccaagagacg	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_30	gtatggaaaatgagagctgc gctgtgtttgegtetetece gtatggaaaatgagagctgc gctgtgtttgegtetetece gtatggaaaatgagagctgc gctgtgtttgegtetetece gtatggaaaatgagagctgc gctgtgtttgegaaatgagagctgc gctgtgtttgegtetetece	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcattttc cgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcattttc gggtttgtaccgtacaccactgagtcgtggttgaccggtacaaacccgctctcattttc gggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_A7_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30 CCR5_B8_attP_30	gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc	acgacegcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcattttc cgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgtacggtacaaacccgctctcattttc gggtttgtaccgtacaccactgagtccgcggtggtgacggtacaaacccgctctcatttt gggtttgtaccgtacaccactgagtccgcggtggtgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgtacggtacaaacccgctctcattt	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee	acgaeggeggaetcegtegteaggateatgeteteatttte gggtttgtaeegtaeaceaetgagaeegggtggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgaeggtaeaaaeeegeteteatttt c tgtaeegtaeaceaetgagaeegeggtggttgaeeagaeaaaeeagagaegeaaa tgtetggteaaceaeegeggteteagtggtgtaeggtaeaaaeeegeteteatttte egtaeaceaetgagaeegeggtggttgaeeagaeaaaeeagagaegeaaa ggteaaceaeegeggteteagtggtgaeeggaeaaaeeagagaegeaaa ggteaaceaeegeggteteagtggtgaeeggaeaaaeeegeteteatttte gggtttgtaeegtaeaceaetgagteegeggtggttgaeeagaeaaaeeagagaeg caaa tggtttgtetggteaaeeaeegeggaeteagtggtgtaeggtaeaaaeeegeteteattt te	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30 CCR5_B8_attP_30 CCR5_A7_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee	acgacgccggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccaggagacg catggttgtctggtcaaccaccgcggtctcagtggtgtaccggtacaaaccagcgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccggtacaaacccgctctcattttc gggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgacaggtacaaacccgctctcattt tc tgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge getgtgtttgegteteteee	acgaeggeggaetcegtegteaggateatgeteteatttte gggtttgtaeegtaeaceaetgagaeegggtggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgaeggtaeaaaeeegeteteatttt c tgtaeegtaeaceaetgagaeegeggtggttgaeeagaeaaaeeagagaegeaaa tgtetggteaaceaeegeggteteagtggtgtaeggtaeaaaeeegeteteatttte egtaeaceaetgagaeegeggtggttgaeeagaeaaaeeagagaegeaaa ggteaaceaeegeggteteagtggtgaeeggaeaaaeeagagaegeaaa ggteaaceaeegeggteteagtggtgaeeggaeaaaeeegeteteatttte gggtttgtaeegtaeaceaetgagteegeggtggttgaeeagaeaaaeeagagaeg caaa tggtttgtetggteaaeeaeegeggaeteagtggtgtaeggtaeaaaeeegeteteattt te	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_A7_attP_30 CCR5_B8_attP_30 CCR5_A7_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50	gtatggaaaatgagagctgc gctgtgtttgcgtctctccc  gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gctgtgtttgcgtctctccc	acgacgccggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccaggagacg catggttgtctggtcaaccaccgcggtctcagtggtgtaccggtacaaaccagcgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccggtacaaacccgctctcattttc gggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgacaggtacaaacccgctctcattt tc tgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40
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CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 Figure 3f pegRNA	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge	acgaeggeggaeteegtegteaggateatgeteteatttte gggtttgtaeegtaeaceactgagaeegggtggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgtaeeggtaeaaaceegeteteatttt c tgtaeegtaeaceaetgagaeegeggtggttgaeeagaeaaaceaagagaegeaaa tgettggteaaeeaeegeggteteagtggtgaeeggaeaaaceagagaegeaaa tgtetggteaaeeaeegeggteteagtggtgaeeagaeaaaeeagagaegeaaa ggteaaeaeegeggteteagtggtgaeeggaeaaaeeagagaegeaaa ggttaaeeaeegeggteteagtggtaeeggtaeaaaeeegeteteatttte gggtttgtaeegtaeaeeaetgagteegeggtggttgaeeagaeaaaeeagagaege caaa tggtttgtetggteaaeeaeegeggaeteagtggtgtaeggtaeaaaeeegeteteattt te tgtaeegtaeaeeaeegeggaeteagtggtgtaeeggaeaaaeeagagaegeaaa tgetggteaaeeaeegeggaeteagtggtgtaeeggaeaaaeeegeteteatttte egtaeegtae	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_A7_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30	gtatggaaaatgagagetge getgtgtttgegtetetece  gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gatggaaaatgagagetge	acgacgcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtaccggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgcttggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgctggtcaaccaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgctggtcaaccaccgcggactcagtggtgaccagacaaaccaccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat gaaacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 50
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge	acgaeggeggaetcegtegteaggateatgeteteatttte gggtttgtaeegtaeaceaetgagaeegggtggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgaeagaeaaaceagagaegeaaa tggttgtetggteaaceaeegeggteteagtggtgaeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggteteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggteteagtggtgaeeagaeaaaceagagaegeaaa ggteaaceaeegeggteteagtggtgaeeggaeaaaceagagaegeaaa ggttaaceaeegeggteteagtggtgaeeggaeaaaceagagaegeaaa tggtttgteegtaeaceaeegeggaeteaggtggtgaeeagaeaaaceagagaeg caaa tggtttgtetggteaaceaeegeggaeteagtggtgaeeggaeaaaceagagaeg caaa tggtttgtetggteaaceaeegeggaeteagtggtgaeeggaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa ggteaaceaeegeggaeteagtggtgaeeggaeaaaceacgeteteatttte  3' extension  aaetteacagaggettgtegaegaeggeggteteegtegteaggateat gaaactteacagaggettgtegaegaeggeggteteegtegteaggateat gaaactteacagaggettgtegaegaeggeggteteegtegteaggateat ggettgtegaegaeggeggteteegtegteaggateat	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30  Edits made by the specified pegRNA indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30	gtatggaaaatgagagetge getgtgtttgegtetetece  gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gtatggaaaatgagagetge getgtgtttgegtetetece gatggaaaatgagagetge	acgacgcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtaccggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgcttggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgctggtcaaccaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgctggtcaaccaccgcggactcagtggtgaccagacaaaccaccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat gaaacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 30
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge	acgaeggeggaetcegtegteaggateatgeteteatttte gggtttgtaeegtaeaceaetgagaeegggtggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgaeagaeaaaceagagaegeaaa tggttgtetggteaaceaeegeggteteagtggtgaeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggteteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggteteagtggtgaeeagaeaaaceagagaegeaaa ggteaaceaeegeggteteagtggtgaeeggaeaaaceagagaegeaaa ggttaaceaeegeggteteagtggtgaeeggaeaaaceagagaegeaaa tggtttgteegtaeaceaeegeggaeteaggtggtgaeeagaeaaaceagagaeg caaa tggtttgtetggteaaceaeegeggaeteagtggtgaeeggaeaaaceagagaeg caaa tggtttgtetggteaaceaeegeggaeteagtggtgaeeggaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa ggteaaceaeegeggaeteagtggtgaeeggaeaaaceacgeteteatttte  3' extension  aaetteacagaggettgtegaegaeggeggteteegtegteaggateat gaaactteacagaggettgtegaegaeggeggteteegtegteaggateat gaaactteacagaggettgtegaegaeggeggteteegtegteaggateat ggettgtegaegaeggeggteteegtegteaggateat	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30  Edits made by the specified pegRNA indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 Figure 3f pegRNA CCR5_A277b CCR5_B258b CCR5_B358b CCR5_B358c Figure 3g	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge spacer sequence gactgaaacttcacagaata gactgaaacttcacagaata gatttatgagatcaacageae gatttatgagatcaacageae	acgacgccggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccagacaaaccaagagacgcaaa tgttggtcaaccaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaaccagcgctctattttc cgtacaccactgagtccgcggtgtgtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgtacggtacaaacccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat gaaacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA indicated on the x-axis
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge	acgaeggeggaetcegtegteaggateatgeteteatttte gggtttgtaeegtaeaceaetgagaeegggtggttgaeeagaeaaaceaagagaeg caaa tggtttgtetggteaaceaeegeggteteagtggtgaeagaeaaaceagagaegeaaa tggttgtetggteaaceaeegeggteteagtggtgaeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggteteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggteteagtggtgaeeagaeaaaceagagaegeaaa ggteaaceaeegeggteteagtggtgaeeggaeaaaceagagaegeaaa ggttaaceaeegeggteteagtggtgaeeggaeaaaceagagaegeaaa tggtttgteegtaeaceaeegeggaeteaggtggtgaeeagaeaaaceagagaeg caaa tggtttgtetggteaaceaeegeggaeteagtggtgaeeggaeaaaceagagaeg caaa tggtttgtetggteaaceaeegeggaeteagtggtgaeeggaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa tgtetggteaaceaeegeggaeteagtggtgaeeagaeaaaceagagaegeaaa ggteaaceaeegeggaeteagtggtgaeeggaeaaaceacgeteteatttte  3' extension  aaetteacagaggettgtegaegaeggeggteteegtegteaggateat gaaactteacagaggettgtegaegaeggeggteteegtegteaggateat gaaactteacagaggettgtegaegaeggeggteteegtegteaggateat ggettgtegaegaeggeggteteegtegteaggateat	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA
CCR5_B8_attB_GA_20 CCR5_A7_attP_50  CCR5_B8_attP_50  CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30  Figure 3f pegRNA  CCR5_A277b CCR5_B258b CCR5_B358b CCR5_B358b CCR5_B358c  Figure 3g pegRNA	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgttttgegteteteee gattggaaaatgagagetge gattggaaaatgagagetge spacer sequence	acgacgcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtaccggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggttgtcggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggttgaccagacaaaccagcgctctcattttc cgtacaccactgagtccgcggtgtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgaccagacaaaccagccgctctattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat gaaacttcacagaggctgtcgacgacggcggtctccgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctcat  3' extension	attB-GA 20 attP 50 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA on the x-axis indicated on the x-axis
CCR5_B8_attB_GA_20 CCR5_A7_attP_50 CCR5_B8_attP_50 CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_50 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 Figure 3f pegRNA CCR5_A277b CCR5_B258b CCR5_B358b CCR5_B358c Figure 3g	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge spacer sequence gactgaaacttcacagaata gactgaaacttcacagaata gatttatgagatcaacageae gatttatgagatcaacageae	acgacgccggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccagacaaaccaagagacgcaaa tgttggtcaaccaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaaccagcgctctattttc cgtacaccactgagtccgcggtgtgtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgtacggtacaaacccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat gaaacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA
CCR5_B8_attB_GA_20 CCR5_A7_attP_50  CCR5_B8_attP_50  CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30  Figure 3f pegRNA  CCR5_A277b CCR5_B258b CCR5_B358b CCR5_B358b CCR5_B358c  Figure 3g pegRNA	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgttttgegteteteee gattggaaaatgagagetge gattggaaaatgagagetge spacer sequence	acgacgcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtaccggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggttgtcggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggttgaccagacaaaccagcgctctcattttc cgtacaccactgagtccgcggtgtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgaccagacaaaccagccgctctattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat gaaacttcacagaggctgtcgacgacggcggtctccgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctcat  3' extension	attB-GA 20 attP 50 attP 50 attP 50 attP 40 attP 40 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA on the x-axis indicated on the x-axis
CCR5_B8_attB_GA_20 CCR5_A7_attP_50  CCR5_B8_attP_50  CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30  Figure 3f pegRNA  CCR5_A277b CCR5_B277c CCR5_B358b CCR5_B358c  Figure 3g pegRNA  CCR5_A7_attB_20	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge spacer sequence gactgaaacttcacagaata gatttatgagatcaacageae gatttatgagatcaacageae gatttatgagatcaacageae gatttatgagatcaacageae	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtgtttgaccagacaaaccaagagacgcaaa tggttgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggttctagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttagacgtaccaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccacctgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccggtacaaacccgctctcattt tc tgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaccacgctctcatttt cgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaacccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat ggacttgtcgacgacggcggtctcgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcattgtgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcattgtgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcattgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcattgttgatctc  3' extension acgacggagaccgccgtcgtcgacaagccagagacgcaaa	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30  Edits made by the specified pegRNA indicated on the x-axis
CCR5_B8_attB_GA_20 CCR5_A7_attP_50  CCR5_B8_attP_50  CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30  Figure 3f pegRNA  CCR5_A277b CCR5_B258b CCR5_B358b CCR5_B358b CCR5_B358c  Figure 3g pegRNA	gtatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgtgtttgegteteteee gatggaaaatgagagetge getgttttgegteteteee gattggaaaatgagagetge gattggaaaatgagagetge spacer sequence	acgacgcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgtaccggtacaaacccgctctcatttt c tgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggttgtcggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggttgaccagacaaaccagcgctctcattttc cgtacaccactgagtccgcggtgtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgaccagacaaaccagccgctctattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat gaaacttcacagaggctgtcgacgacggcggtctccgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctcat  3' extension	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30  Edits made by the specified pegRNA indicated on the x-axis indicated o
CCR5_B8_attB_GA_20 CCR5_A7_attP_50  CCR5_B8_attP_50  CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30  Figure 3f pegRNA  CCR5_A277b CCR5_B358b CCR5_B358c  Figure 3g pegRNA  CCR5_A7_attB_20 CCR5_B8_attB_20 CCR5_B8_attB_20	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge spacer sequence gaetgaaacttcacagaata gatttatgagatcaacageae gatttatgagatcaacageae gatttatgagateaeee getgtgtttgegteteteee getgtgtttgegteteteee	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtttgtctggtcaaccaccgcggtgttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaaccagcgctctatttt c tgaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaacccgctctcattttc cgtacaccactgagtccgcggtgttgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgtacggtacaaaacccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctcat  3' extension  acgacggagaccgccgtcgtcgacaagccagagacgcaaa acgacgggggtctccgtcgtcaggatcatgctcatttttc	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 50 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA
CCR5_B8_attB_GA_20 CCR5_A7_attP_50  CCR5_B8_attP_50  CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30  Figure 3f pegRNA  CCR5_A277b CCR5_B277c CCR5_B358b CCR5_B358c  Figure 3g pegRNA  CCR5_A7_attB_20	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge spacer sequence gactgaaacttcacagaata gatttatgagatcaacageae gatttatgagatcaacageae gatttatgagatcaacageae gatttatgagatcaacageae	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtgtttgaccagacaaaccaagagacgcaaa tggttgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccactgagaccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggttctagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttagacgtaccaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccacctgagtccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccggtacaaacccgctctcattt tc tgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaccacgctctcatttt cgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaacccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat ggacttgtcgacgacggcggtctcgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcattgtgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcattgtgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcattgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcattgttgatctc  3' extension acgacggagaccgccgtcgtcgacaagccagagacgcaaa	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 50 attP-GA 40 attP-GA 50 attP-GA 40 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA
CCR5_B8_attB_GA_20 CCR5_A7_attP_50  CCR5_B8_attP_50  CCR5_B8_attP_40 CCR5_B8_attP_40 CCR5_B8_attP_30 CCR5_B8_attP_30 CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_50  CCR5_B8_attP_GA_40 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30 CCR5_B8_attP_GA_30  Figure 3f pegRNA  CCR5_A277b CCR5_B358b CCR5_B358c  Figure 3g pegRNA  CCR5_A7_attB_20 CCR5_B8_attB_20 CCR5_B8_attB_20	gtatggaaaatgagagetge getgtgtttgegteteteee gtatggaaaatgagagetge spacer sequence gaetgaaacttcacagaata gatttatgagatcaacageae gatttatgagatcaacageae gatttatgagateaeee getgtgtttgegteteteee getgtgtttgegteteteee	acgacggcggactccgtcgtcaggatcatgctctcattttc gggtttgtaccgtacaccactgagaccgcggtggttgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtttgtctggtcaaccaccgcggtgttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggttaaccaccgcggtctcagtggtgaccagacaaaccaagagacgcaaa ggtttgtaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tggtttgtctggtcaaccaccgcggactcagtggtgaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccagacaaaccaagagacg caaa tggtttgtctggtcaaccaccgcggactcagtggtgtaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaaccagcgctctatttt c tgaccgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa tgtctggtcaaccaccgcggactcagtggtgtacggtacaaaacccgctctcattttc cgtacaccactgagtccgcggtgttgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgtacggtacaaaacccgctctcattttc  3' extension  aacttcacagaggcttgtcgacgacggcggtctccgtcgtcaggatcat ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctc ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctcat  3' extension  acgacggagaccgccgtcgtcgacaagccagagacgcaaa acgacgggggtctccgtcgtcaggatcatgctcatttttc	attB-GA 20 attP 50 attP 50 attP 40 attP 40 attP 30 attP 30 attP-GA 50 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 50 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 50 attP-GA 40 attP-GA 30 attP-GA 30 attP-GA 30 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA 30 attP-GA 40 attP-GA

CCR5_B358c	gatttatgagatcaacagcac	ggettgtegaegaeggeggteteegtegteaggateatetgttgateteat	ALB attB (HEK293T and Huh7)
Figure 4b pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
IDS2_DF_A1_a_attP_rev IDS2_DF_A1_a_	gacaccaaaaaactgccacagg gacaccaaaaaactgccacagg	taccgtacaccactgagaccgcggtggttgaccagacaaacctgtggcagtta gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgtggcagtta	A1B2 (attP rev) A1B2 (attP fwd)
attP_fwd IDS2_DF_A1_c_attP_rev	gacaccaaaaactgccacagg	taccgtacaccactgagaccgcggtggttgaccagacaaacctgtggcagtttta	A1B3 (attP rev); A1B4
IDS2_DF_A1_c_ attP_fwd	gacaccaaaaactgccacagg	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgtggcagtttta	(attP rev) A1B3 (attP fwd); A1B4 (attP fwd)
IDS2_DF_A4_b_attP_rev IDS2_DF_A4_b_ attP_fwd	gcactcatttcctccaagete gcactcatttcctccaagete	taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctcttggaggaaa	A4B7 (attP rev) A4B7 (attP fwd)
IDS2_DF_B2_a_attP_rev IDS2_DF_B2_a_ attP_fwd	gtaggtacaggacagggcag gtaggtacaggacagggcag	gtetggteaaceacegeggteteagtggtgtaceggtacaaacetecetgtee tacegtacaceactgagacegeggtggttgaceagacaaacetecetgtee	A1B2 (attP rev) A1B2 (attP fwd)
IDS2_DF_B3_a_attP_rev IDS2_DF_B3_a_ attP_fwd	gagataggtaggtacaggaca gagataggtaggtacaggaca	tetggteaaceacegeggteteagtggtgtaeggtaeaaaceteetgtaeet taeegtaeaceactgagaeegeggtggttgaeeagaeaaaceteetgtaeet	A1B3 (attP rev) A1B3 (attP fwd)
IDS2_DF_B4_b_attP_rev IDS2_DF_B4_b_ attP_fwd	gtgaaaagataggtaggtac gtgaaaagataggtaggtac	gtetggteaaccacegeggteteagtggtgtacggtacaaacctcctacctatcta taccgtacaccactgagaccgeggtggttgaccagacaaacctcctacctatcta	A1B4 (attP rev) A1B4 (attP fwd)
IDS2_DF_B7_b_attP_rev IDS2_DF_B7_b_ attP_fwd	gttatggtttactccatcta gttatggtttactccatcta	gtetggteaaccacegeggteteagtggtgtacggtacaaacctatggagtaaacct taccgtacaccacegagaccgeggtggttgaccagacaaacctatggagtaaacc	A4B7 (attP rev) A4B7 (attP fwd)
IDS_DF_C2_c_attB_rev	gttttggtttaccctatcta	atgateetgaegaeggagaeegeegtegtegaeaageeatagggtaaaeea	C2D2 (attB rev); C2D2 (attB rev)
IDS_DF_C2_c_attB_fwd	gttttggtttaccctatcta	ggettgtegaegaeggeggteteegtegteaggateatatagggtaaacea	C2D1 (attB fwd); C2D2 (attB fwd)
IDS_DF_D1_b_attB_rev IDS_DF_D1_b_attB_fwd IDS_DF_D2_c_attB_rev IDS_DF_D2_c_attB_fwd	getgtggaaetgeaacacact getgtggaaetgeaacacact gtgecaectaacagtgagetg gtgecaectaacagtgagetg	ggettgtegaegaeggegteteegtegteaggateatgtgttgeagt atgateetgaegaeggagaeegeegtegtegaeaageegtgttgeagt ggettgtegaegaeggeggteteegtegteaggateateteaetgttaggt atgateetgaegaeggagaeegeegtegtegaeaageeeteaetgttaggt	C2D1 (attB rev) C2D1 (attB fwd) C2D2 (attB rev) C2D2 (attB fwd)
Figure 4c pegRNA	spacer sequence	3' extension	Edits made by the
IDS2_DF_A4_b_a ttP_rev	gcactcatttcctccaagetc	taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa	specified pegRNA pegRNA set1 installing attP_rev in IDS2 and
IDS2_DF_B7_b_ attP_rev	gttatggtttactccatcta	gtetggteaaccaccgeggteteagtggtgtacggtacaaacctatggagtaaacct	attB_fwd in IDS pegRNA set1 installing attP_rev in IDS2 and
IDS_DF_C2_c_ attB_fwd	gttttggtttaccctatcta	ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca	attB_fwd in IDS pegRNA set1 installing attP_rev in IDS2 and attB_fwd in IDS
IDS_DF_D1_b_ attB_fwd	gctgtggaactgcaacacact	at gate ctg acg acg gag accg ccg tcg tcg acaag ccg tg ttg cag t	pegRNA set1 installing attP_rev in IDS2 and attB_fwd in IDS
IDS2_DF_A4_b_ attP_fwd	geacteattteeteeaagete	gtetggteaaccaccgeggteteagtggtgtacggtacaaacctettggaggaaa	pegRNA set2 installing attP_fwd in IDS2 and attB_rev in IDS
IDS2_DF_B7_b_ attP_fwd	gttatggtttactccatcta	taccgtacaccactgagaccgcggtggttgaccagacaaacctatggagtaaacc	pegRNA set2 installing attP_fwd in IDS2 and attB_rev in IDS
IDS_DF_C2_c_attB_rev	gttttggtttaccctatcta	atgatectgaegaeggagaeegeegtegtegaeaagceatagggtaaaeea	pegRNA set2 installing attP_fwd in IDS2 and attB_rev in IDS
IDS_DF_D1_b_attB_rev	getgtggaactgcaacacact	ggcttgtcgacgacggcggtctccgtcgtcaggatcatgtgttgcagt	pegRNA set2 installing attP_fwd in IDS2 and attB_rev in IDS
Extended Data Figures ED Figure 1a - Compariso pegRNA	on of twinPE- and PE3-medi spacer sequence	iated <i>FKBP</i> insertion at <i>CCR5</i> region 1 3' extension	Edits made by the
PE3 CCR5 1 F414a 34	ggtacctategattgteagg	tactgtcccttctgggctcactatgctgccgccaaatttctttc	specified pegRNA indicated on the x-axis
_FKBP108	66	gtgtagtgcaccacgcaggtctggccgcgtttggggaaggtgcgcccgtctctggg gagatggtttccacctgcactccgacaatcga	on the A water
PE3_CCR5_1_F414a_29 _FKBP108	ggtacctatcgattgtcagg	tecettetgggeteactatgetgeegecaaatttetttecatetteaageateeeggtgta gtgeaceaegeaggtetggeegeegettggggaaggtgegeeegteteetggggaga tggtttecacetgeacteegacaatega	indicated on the x-axis
PE3_CCR5_1_F414a_23 _FKBP108	ggtacctatcgattgtcagg	tetgggeteactatgetgeegecaaattetttecatetteaageateeeggtgtagtgea ceaegeaggtetggeegegttggggaaggtgegeeegteteetggggagatggttt ceaectgeaeteegacaatega	indicated on the x-axis

twinDE CCD5 1 E414a	anto actota antitatan an	anattananananananananananan saturantanan ataun sanaran tarattanan art	indicated on the very
twinPE_CCR5_1_F414a_ FKBP108	ggtacctatcgattgtcagg	acettececaagegeggecagacetgegtggtgeactacacegggatgettgaagat ggaaagaaatttgacaatega	indicated on the x-axis
twinPE_CCR5_1_E325b_ FKBP108	gctcactatgctgccgcccag	accacgcaggtctggccgcgttggggaaggtgcgcccgtctcctggggagatggtt tccacctgcactccggcggcagcat	indicated on the x-axis
sgRNA	spacer sequence		
PE3_CCR5_A1_sgRNA PE3_CCR5_A2_sgRNA	gcatcctgataaactgcaaa ggacatctacctgctcaacc		
PE3_CCR5_A4_sgRNA	gcaatgtgtcaactcttgac		
ED Figure 1b - Compariso	on of twinPE- and PE3-med	iated FKBP insertion at CCR5 region 2	
pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
PE3_CCR5_2_F2_34_ FKBP108	gtgaaagacagcctggagtc	agattggagaaacccttgaaaagacatcaagcacaaatttctttc	indicated on the x-axis
PE3_CCR5_2_F2_28_ FKBP108	gtgaaagacagcctggagtc	gagaaaccttgaaaagacatcaagcacaaatttetttccatettcaagcatcccggtgt agtgcaccacgcaggtctggccgcttgggggaaggtgcgcccgtctcctggggag atggtttccacctgcactcctccaggct	indicated on the x-axis
PE3_CCR5_2_F2_23_FK BP108	gtgaaagacagcctggagtc	accettgaaaagacatcaagcacaaaattictttccatcttcaagcatcccggtgtagtgca ccacgcaggtctggccgcgcttggggaaggtgcgcccgtctcctggggagatggttt ccacctgcactcctccaggct	indicated on the x-axis
twinPE_CCR5_2_F2a_ FKBP108	gtgaaagacagcctggagtc	acottococaagogggccagacotgcgtggtgcactacacogggatgcttgaagat ggaaagaaattttocaggct	indicated on the x-axis
twinPE_CCR5_2_E2c_ FKBP108nt	gaaaagacatcaagcacaga	accacgcaggtctggccgcgcttggggaaggtgcgcccgtctcctggggagatggtt tccacctgcactccgtgcttgatgtctt	indicated on the x-axis
sgRNA	spacer sequence		
PE3_CCR5_C1_sgRNA PE3_CCR5_C1.5	gatgcagagtcagcagaact ggaagtgagggtcagagagg		
sgRNA			
PE3_CCR5_C4_sgRNA	gatggattggtgtaaaagga		
ED Figure 1c - Long twinl pegRNA	PE insertions at CCR5 spacer sequence	3' extension	Edits made by the
CCR5 A7 attP spacer27	getgtgtttgegtetetece	ttegttataegeeeattettegegaaaggtttgtaeegtaeaeeaetgagaeegeggtgg	specified pegRNA attB-spacer-attP
CCR5 B8 spacer attB	gtatggaaaatgagagctgc	ttgaccagacaaaccagagacgcaaa tttgaccagaagaacgagacgcaaa tttcgcgaagaatgggcgtataacgaaggcttgtcgacgacggcggtctccgtcgtca	attB-spacer-attP, attB-
CCR5 A7 attB spacer27	getgtgtttgegtetetece	ggatcatgctctattttc ttcgttatacgcccattcttcgcgaaaatgatcctgacgacggagaccgccgtcgtcga	spacer-attB attB-spacer-attB
CCICS_II/_uuB_spucci2/	geigigingegietetete	caagccagagacgcaaa	attb spacer attb
ED Figure 2 - <i>PAH</i> exon r	ecoding via twinPE		
ED Figure 2 - <i>PAH</i> exon r pegRNA	ecoding via twinPE spacer sequence	3' extension	Edits made by the
pegRNA PAH_2.1.1	_		specified pegRNA indicated on the x-axis
pegRNA PAH_2.1.1 PAH_2.1.2	spacer sequence geteaaataagegeaataett geteaaataagegeaataett	3' extension  tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgcttatt	specified pegRNA indicated on the x-axis indicated on the x-axis
pegRNA  PAH_2.1.1 PAH_2.1.2 PAH_2.1.3	spacer sequence gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt	3' extension  tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatttg	specified pegRNA indicated on the x-axis indicated on the x-axis indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1	spacer sequence gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gaagacaactgcaatcaaaa	3' extension  tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgcttatttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcag	specified pegRNA indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2	gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gaagacaactgcaatcaaaa gaagacaactgcaatcaaaa	3' extension  tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tcttccttcaggctgaagatcagaagagatagcgccgttctgattgcag tcttccttcaggctgaagatcagaagagatagcgccgttctgattgcagttg	specified pegRNA indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1	spacer sequence gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gaagacaactgcaatcaaaa	3' extension  tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaagatcagaagagatagcgccgttctgattgcag tcttccttcaggctgaagatcagaagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagaagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttgt aagatttgattagcgaacctatcaagttcctgaattgccgtggaaaccacggcactgaa	specified pegRNA indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaateatt gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa	3' extension  tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaagateagaagatagegeegteetgattgeag tetteetteaggetgaagateagaagaatagegeegttetgattgeagt tetteetteaggetgaagateagaagaatagegeegttetgattgeagttg tetteetteaggetgaagateagaagatagegeegttetgattgeagttgt	specified pegRNA indicated on the x-axis indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gateetetgtgttteagtgeee	3' extension  tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaagateagagagatagegeegttetgattgeag tetteetteaggetgaagateagaagaatagegeegttetgattgeagttg tetteetteaggetgaagateagagagatagegeegttetgattgeagttg tetteetteaggetgaagateagagagatagegeegttetgattgeagttgt aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa ae aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa	specified pegRNA indicated on the x-axis indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1	spacer sequence geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett gaagacaactgeaateaaaa gaagacaactgeaateaaaa gaagacaactgeaateaaaa gttetetgtgttteagtgeee gttetetgtgtttteagtgeee	tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaaggatgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcag tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagt tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttgtcaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa ac aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acac aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acac aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa	specified pegRNA indicated on the x-axis indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1 PAH_4.1.2 PAH_4.1.3	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gttetetgtgttteagtgeee gttetetgtgttteagtgeee	tgatetteageetgaaggaagagtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagagtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagagtgggegeeetggegaaggtattgegettatt tgatetteegeetgaaggaagagtgggegeeetggegaaggtattgegettatt teatetteegeetgaagateagaagatagegeegttetgattgeag tetteetteaggetgaagateagagagatagegeegttetgattgeagttg tetteetteaggetgaagateagagagatagegeegttetgattgeagttg tetteetteaggetgaagateagagagatagegeegttetgattgeagttgte aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa ae aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acae aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acaeg gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acaeg gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet	specified pegRNA indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1 PAH_4.1.2 PAH_4.1.4	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett gaagacaactgeaateaaaa gaagacaactgeaateaaaa gaagacaactgeaateaaaa gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee	tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegett tgatetteageetgaaggaaggaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaaggaaggaggggggegeeetggegaaggtattgegettatt tgatetteageetgaaggaagaggggggegeeetggegaaggtattgegettatttg tetteetteaggetgaagateagaagaatagegeegttetgattgeagt tetteetteaggetgaagateagaaggaaggatagegeegttegattgeagttg tetteetteaggetgaagateagaagagatagegeegttetgattgeagttgt eaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa ae aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acae aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acaeag gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acaeg gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet	specified pegRNA indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1 PAH_4.1.2 PAH_4.1.5 PAH_4.1.6 PAH_4.2.1	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee	tgatetteageetgaaggaagagtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagagtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagagtgggegeeetggegaaggtattgegettatt tgatetteageetgaaggaagagtgggegeeetggegaaggtattgegettatt tgatetteageetgaagateagaagatagegeegttetgattgeag tetteetteaggetgaagateagagagatagegeegttetgattgeagt tetteetteaggetgaagateagagagatagegeegttetgattgeagttg tetteetteaggetgaagateagagagatagegeegttetgattgeagttg tetteetteaggetgaagateagagagatagegeegttetgattgeagttg tagagtttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa ae aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acaeag gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaac gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaacae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaacae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaacae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaacaeg ggeteegtaggacaagatttgattagegaacetatcaagttettgaattgteegtggaaaceaeggeaet gaacaeag	specified pegRNA indicated on the x-axis
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PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1  PAH_4.1.2 PAH_4.1.3 PAH_4.1.4 PAH_4.1.6 PAH_4.2.1 PAH_4.2.1 PAH_4.2.2 PAH_4.2.3 PAH_4.2.3 PAH_4.2.4	gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gaagacaactgcaatcaaaa gaagacaactgcaatcaaaa gttctctgtgtttcagtgccc gtcccaagaaccattcaagagc gcccaagaaccattcaagagc gcccaagaaccattcaagagc gcccaagaaccattcaagagc	tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatttg tcttccttcaggctgaagatcagaagatagcgccgttctgattgcag tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttgt aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa ac aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acac aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acaca gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaac gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaacac gacaagatttgattagcgaacctatcaagttctgaattgtcgtggaaaccacggcact gaaacaca ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggt ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc ggttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttcttg gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttcttg gatgatcagcgtcaagttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttcttg	specified pegRNA indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1  PAH_4.1.2  PAH_4.1.4  PAH_4.1.5  PAH_4.1.6  PAH_4.2.1 PAH_4.2.2 PAH_4.2.3 PAH_4.2.3 PAH_4.2.4 PAH_4.2.5 PAH_4.2.6	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gttetetgtgttteagtgeee geecaagaaceatteaagage geecaagaaceatteaagage geecaagaaceatteaagage geecaagaaceatteaagage geecaagaaceatteaagage geecaagaaceatteaagage geecaagaaceatteaagage	tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegett tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettatt tgatetteageetgaaggaagaggtgggegeeetggegaaggtattgegettattt teteetteaggetgaagateagagagatagegeegttetgattgeagt tetteetteaggetgaagateagaagatagegeegttetgattgeagttg tetteetteaggetgaagateagaagatagegeegttetgattgeagttgt aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa ace aagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acae agatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaetgaa acae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaac gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaacae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaacae gacaagatttgattagegaacetateaagtteetgaattgteegtggaaaceaeggeaet gaaacae ggeteegtaggacaagatttgattagegaacetateaagttettgaatggt ggeteegtaggacaagatttgattagegaacetateaagttettgaatggtte ggeteegtaggacaagatttgattagegaacetateaagttettgaatggttet gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggt gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttett gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttett gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttett gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttett gtteggeteegtaggacaagatttgattagegaacetateaagttettgaatggttett gtteggeteegtaggacaagatttgattagegaaceaagaaceagttettgaatggttett gtteggeteegtaggacaagatttgattagegaaceaagatttgattagegaacetateaagttettgaatggttett gttegatgateageteaagtteggeteegtaggacaagaatttgattagegaacetateaagttettgaatggt gatgateagegteaagtteggeteegtaggacaagaattgattagegaacetateaagtt ettgaatgg gatgateaggteaagtteggeteegtaggacaagatttgattagegaacetateaagtt ettgaatgg gatgateagegteaagtteggeteegtaggacaagatttgattagegaacetateaagtt	specified pegRNA indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1  PAH_4.1.2  PAH_4.1.4  PAH_4.1.5  PAH_4.1.6  PAH_4.2.1 PAH_4.2.1 PAH_4.2.2 PAH_4.2.3 PAH_4.2.4 PAH_4.2.5 PAH_4.2.5 PAH_4.2.6 PAH_4.2.7	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee geeeaagaaecatteaagage geeeaagaaecatteaagage geeeaagaaecatteaagage geeeaagaaecatteaagage geeeaagaaecatteaagage geeeaagaaecatteaagage geeeaagaaecatteaagage geeeaagaaecatteaagage geeeaagaaecatteaagage	tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagagaggtgggcgccctggcgaaggtattgcgcttatttg tcttccttcaggctgaagatcagagagatagcgcgttctgattgcag tcttccttcaggctgaagatcagagagatagcgccgttctgattgcag tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttgt aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acc aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acaca gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acacag gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaac gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaacac gacaagatttgattagcgaacctatcaagttctgaattgtccgtggaaaccacggcact gaaacacag ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggt ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc ggttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcgatcgctcagttcagt	indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1  PAH_4.1.2 PAH_4.1.4 PAH_4.1.5 PAH_4.1.6  PAH_4.2.1 PAH_4.2.2 PAH_4.2.3 PAH_4.2.4 PAH_4.2.5 PAH_4.2.6 PAH_4.2.7 PAH_4.2.8	gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gctcaaataagcgcaatactt gaagacaactgcaatcaaaa gaagacaactgcaatcaaaa gaagacaactgcaatcaaaa gttctctgtgtttcagtgccc gttctctgtgtttcagtgccc gttctctgtgtttcagtgccc gttctctgtgtttcagtgccc gttctctgtgtttcagtgccc gttctctgtgtttcagtgccc gttctctgtgtttcagtgccc gttctctgtgtttcagtgccc gcccaagaaccattcaagagc	tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagagaggtgggcgccctggcgaaggtattgcgcttattt tcatctcaggctgaagatcagagagatagcgcgttctgattgcag tcttccttcaggctgaagatcagagagatagcgcgttctgattgcag tcttccttcaggctgaagatcagagagatagcgcgttctgattgcagtt tcttccttcaggctgaagatcagagagatagcgcgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgcgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgcgttctgattgcagttg aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acc aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acacag gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaac gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaacac gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaacac gacaagatttgattagcgaacctatcaagttctgaattgtcgtggaaaccacggcact gaaacaca gggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatgg ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggt ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggt gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatgg gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttcttg gatgatcagcgtcaagttcggctccgtaggacaagatttgattagcgaacctatcaagtt cttgaatggt gatgatcagcgtcaagttcggctccgtaggacaagatttgattagcgaacctatcaagtt cttgaatggttc gatgatcagcgtcaagttcggctccgtaggacaagatttgattagcgaacctatcaagtt cttgaatggttcttg ataggttcgctaatcaaatcttgcctcacggagccgaacttgacgctgatcatcctgtga ataggttcgctaatcaaatcttgcctcacggagccgaacttgacgctgatcatcctgtga ataggttcgctaatcaaatcttgctctacggagccgaacttgacgctgatcatcctgtga	indicated on the x-axis
PAH_2.1.1 PAH_2.1.2 PAH_2.1.3 PAH_2.2.1 PAH_2.2.2 PAH_2.2.3 PAH_4.1.1  PAH_4.1.2  PAH_4.1.4  PAH_4.1.5  PAH_4.1.6  PAH_4.2.1 PAH_4.2.2 PAH_4.2.3 PAH_4.2.3 PAH_4.2.4 PAH_4.2.5 PAH_4.2.5 PAH_4.2.6 PAH_4.2.7  PAH_4.2.8  PAH_4.2.9	geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett geteaaataagegeaataett gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gaagacaaetgeaateaaaa gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee gttetetgtgttteagtgeee geecaagaaceatteaagage	tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgctt tgatcttcagcctgaaggaagagtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgcttatt tgatcttcagcctgaaggaagaggtgggcgccctggcgaaggtattgcgcttattt tcttccttcaggctgaagatcagagagatagcgccgttctgattgcag tcttccttcaggctgaagatcagagagatagcgccgttctgattgcag tcttccttcaggctgaagatcagagagatagcgccgttctgattgcag tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttg tcttccttcaggctgaagatcagagagatagcgccgttctgattgcagttgt aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acc aagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcactgaa acacag gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaac gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaacac gacaagatttgattagcgaacctatcaagttcctgaattgtccgtggaaaccacggcact gaaacac gacaagatttgattagcgaacctatcaagttctgaattgtcgtggaaaccacggcact gaaacacag ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggt ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc ggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc ggttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttc gttcggctccgtaggacaagatttgattagcgaacctatcaagttcttgaatggttctg gatgatcagcgtcaagttcggctccgtaggacaagatttgattagcgaacctatcaagtt cttgaatggt gatgatcagcgtcaagttcggctccgtaggacaagatttgattagcgaacctatcaagtt cttgaatggttc gatgatcagcgtcaagttcggctccgtaggacaagatttgattagcgaacctatcaagtt cttgaatggttctg cttgaatggttcttg	indicated on the x-axis

PAH_4.3.3			
	gcgggccatggactcacaggg	ataggttegetaateaaatettgteetaeggageegaaettgaegetgateateetgtga	indicated on the x-axis
	8-86886868	gtccatgg	
DAH 424	an an annotan an atom an an a		indicated on the very
PAH_4.3.4	gcgggccatggactcacaggg	taatcaaatettgteetaeggageegaaettgaegetgateateetgtgagtee	indicated on the x-axis
PAH_4.3.5	gegggeeatggaeteaeaggg	taatcaaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtccat	indicated on the x-axis
PAH_4.3.6	gegggeeatggaeteaeaggg	taatcaaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtccatgg	indicated on the x-axis
PAH_4.4.1	gctacgggccatggactcaca	ggttegetaateaaatettgteetaeggageegaaettgaegetgateateetgtgagte	indicated on the x-axis
_		catg	
PAH_4.4.2	gctacgggccatggactcaca	ggttcgctaatcaaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtc	indicated on the x-axis
17111_4.4.2	getaegggeeatggaeteaea		maleated on the x-axis
D. IV. 4.4.2		catggc	
PAH_4.4.3	gctacgggccatggactcaca	ggttcgctaatcaaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtc	indicated on the x-axis
		catggcc	
PAH 4.4.4	gctacgggccatggactcaca	aaatettgteetaeggageegaaettgaegetgateateetgtgagteeatg	indicated on the x-axis
PAH 4.4.5	gctacgggccatggactcaca	aaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtccatggc	indicated on the x-axis
PAH 4.4.6	gctacgggccatggactcaca	aaatettgteetaeggageegaaettgaegetgateateetgtgagteeatggee	indicated on the x-axis
PAH_4.5.1	gaaatctcatcctacgggcca	taatcaaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtccatggcc	indicated on the x-axis
		cgtaggat	
PAH_4.5.2	gaaatctcatcctacgggcca	taatcaaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtccatggcc	indicated on the x-axis
		cgtaggatga	
PAH_4.5.3	gaaatctcatcctacgggcca	taatcaaatcttgtcctacggagccgaacttgacgctgatcatcctgtgagtccatggcc	indicated on the x-axis
	8	cgtaggatgag	
DAH 5 1 1	anagatatatattttataata		indicated on the verying
PAH_5.1.1	gcaggtgtctcttttctccta	gaattgcttacggcgggcgcgataaacggggtccttgaagccctaggagaaaagag	indicated on the x-axis
PAH_5.1.2	gcaggtgtctcttttctccta	gaattgettaeggegggegegataaaeggggteettgaageeetaggagaaaagag	indicated on the x-axis
		ac	
PAH_5.1.3	gcaggtgtctcttttctccta	gaattgcttacggcgggcgcgataaacggggtccttgaagccctaggagaaaagag	indicated on the x-axis
		acac	
PAH 5.2.1	gaagcaaggcagacttactgg	ategegeegegtaageaattegeegatattgeatataattategeeagtaagtetg	indicated on the x-axis
PAH 5.2.2	gaagcaaggcagacttactgg	ategegecegetaageaattegeegatattgeatataattategeeagtaagtetge	indicated on the x-axis
PAH 5.2.3			
_	gaagcaaggcagacttactgg	atcgcgccgccgtaagcaattcgccgatattgcatataattatcgccagtaagtctgcc	indicated on the x-axis
PAH_7.1.1	getttteateceagettgeae	tactgctcaagagcccggcaacggggggggagtcgaaagccagtacaagctggg	indicated on the x-axis
PAH_7.1.2	getttteateceagettgeae	tactgctcaagagcccggcaacggggggggggtcgaaagccagtacaagctgggat	indicated on the x-axis
PAH_7.1.3	getttteateceagettgeae	tactgctcaagagcccggcaacggggggggagtcgaaagccagtacaagctgggatg	indicated on the x-axis
_		a	
PAH_7.1.4	getttteateceagettgeae	agaaagtetetaetgeteaagageeeggcaaeggggggggagtegaaageeagtaca	indicated on the x-axis
1111_,	BennenceanBengene	agctggg	marearea on the n and
PAH_7.1.5	gattttaataaaa gattgaa		indicated on the x-axis
r AII_/.1.3	getttteateceagettgeae	agaaagtetetaetgeteaagageeeggeaaegggggggg	illulcated oil the x-axis
D. 177 . 7.1 . 6		agctgggat	
PAH_7.1.6	getttteateeeagettgeae	agaaagtetetaetgeteaagageeeggeaaegggggggg	indicated on the x-axis
		agctgggatga	
PAH_7.2.1	gtggtttccgcctccgacctg	agaaagtetetaetgeteaagageeeggeaaegggteggagg	indicated on the x-axis
PAH_7.2.2	gtggtttccgcctccgacctg	agaaagtetetaetgeteaagageeeggeaaegggteggaggeg	indicated on the x-axis
PAH 7.2.3	gtggtttccgcctccgacctg	agaaagtetetaetgeteaagageeeggeaaegggteggaggegga	indicated on the x-axis
PAH 7.2.4	gtggtttccgcctccgacctg	gagaccccccagaaagtctctactgctcaagagcccggcaacgggtcggagg	indicated on the x-axis
PAH_7.2.5	gtggtttccgcctccgacctg	gagacccccagaaagtctctactgctcaagagcccggcaacgggtcggaggcg	indicated on the x-axis
PAH_7.2.6	gtggtttccgcctccgacctg	gagaccccccagaaagtctctactgctcaagagcccggcaacgggtcggaggcgga	indicated on the x-axis
PAH_7.2.7	gtggtttccgcctccgacctg	aacacgcggaatgcgagacccccagaaagtctctactgctcaagagcccggcaac	indicated on the x-axis
		gggtcggagg	
_			
_	gtggtttccgcctccgacctg	aacacgcggaatgcgagacccccagaaagtctctactgctcaagagcccggcaac	indicated on the x-axis
PAH_7.2.8	gtggtttccgcctccgacctg	aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac	indicated on the x-axis
PAH_7.2.8		gggtcggaggcg	
_	gtggtttccgcctccgacctg gtggtttccgcctccgacctg	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac	indicated on the x-axis
PAH_7.2.8 PAH_7.2.9	gtggtttccgcctccgacctg	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga	indicated on the x-axis
PAH_7.2.8 PAH_7.2.9 PAH_7.3.1		gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac	indicated on the x-axis indicated on the x-axis
PAH_7.2.8 PAH_7.2.9 PAH_7.3.1 PAH_7.3.2	gtggtttccgcctccgacctg	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga	indicated on the x-axis
PAH_7.2.8 PAH_7.2.9 PAH_7.3.1	gtggtttccgcctccgacctg ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc	indicated on the x-axis indicated on the x-axis
PAH_7.2.8 PAH_7.2.9 PAH_7.3.1 PAH_7.3.2	gtggtttccgcctccgacctg ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag	indicated on the x-axis indicated on the x-axis indicated on the x-axis
PAH_7.2.8 PAH_7.2.9 PAH_7.3.1 PAH_7.3.2 PAH_7.3.3	gtggtttccgcctccgacctg ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcagg	indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis
PAH_7.2.8 PAH_7.2.9 PAH_7.3.1 PAH_7.3.2 PAH_7.3.3 PAH_7.3.4	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcaggc tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag	indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis indicated on the x-axis
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PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.6	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcagg gcggaatgcgagaccccccagaaagtctctacaggaaagcagg tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag c tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag	indicated on the x-axis
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PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag c tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag taggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag taggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag taggaaagc	indicated on the x-axis
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PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcaggc tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag c tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cagg taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc	indicated on the x-axis
PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcaggc tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag c tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cagg taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc	indicated on the x-axis
PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7  PAH_7.3.8	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcagg tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag c tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagacccccagaaagtctctaca	indicated on the x-axis
PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7  PAH_7.3.8  PAH_7.3.9	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc ggctggcctgctttcctctc	gggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcagg gcggaatgcgagaccccccagaaagtctctacaggaaagcagg tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cagg taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag	indicated on the x-axis
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PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7  PAH_7.3.8  PAH_7.3.9  PAH_7.3.9  PAH_7.5.1  PAH_7.5.2  PAH_7.5.3  PAH_7.5.4  PAH_7.5.5  PAH_7.5.6  PAH_7.6.1  PAH_7.6.2	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtgaagactcggaaggcc gagtgaagactcggaaggcc gattgatgtactgtgtgcag gtctgatgtactgtgtgcag	aggtcggaggcg aacacgggaatgcgagaccccccagaaagtctctactgctcaagagccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcctgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag c tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag tagtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag tatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcagg tttgccgggctcttgagcagtagagactttctggggggtctcgcttccgagt gttgccgggctcttgagcagtagagaactttctgggggggtctcgcttccgagtct tcttgagcagtagagactttctgggggggtctcgcttccgagt tcttgagcagtagagactttctgggggggtctcgccttccgagtct tcttgagcagtagagactttctgggggggtctcgccttccgagtct tcttgagcagtagagactttctgggggggtctcgccttccgagtctt tcttgagcagtagagactttctgggggggtctcgccttccgagtctt tcttgagcagtagagactttctgggggggtctcgccttccgagtctt tcttgagcagtagagactttctgggggggtctcgcattccgcgtgtttcattgcacacagta tcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta tcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta tcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta tcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta ca	indicated on the x-axis
PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7  PAH_7.3.8  PAH_7.3.9  PAH_7.5.1  PAH_7.5.2  PAH_7.5.3  PAH_7.5.4  PAH_7.5.5  PAH_7.5.6  PAH_7.5.6  PAH_7.5.6	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcagaagaccggaaggcc gagtggaagactcggaaggcc	acacegegaatgegagaceccccagaaagtetetactgeteaagageceggeaac gggteggagegega geggaatgegagaceccccagaaagtetetacaggaaage geggaatgegagaceccccagaaagtetetacaggaaage geggaatgegagaceccccagaaagtetetacaggaaageage geggaatgegagaceccccagaaagtetetacaggaaageage tgggtacaatgaaacacgeggaatgegagaceccccagaaagtetetacaggaaag c tgggtacaatgaaacacgeggaatgegagaceccccagaaagtetetacaggaaag tgggtacaatgaaacacgeggaatgegagaceccccagaaagtetetacaggaaag taggtacaatgaaacacgeggaatgegagaceccccagaaagtetetacaggaaag taggtacaatgaaacacgeggaatgegagaceccccagaaagtetetacaggaaag taatatactgggtacaatgaaacacgeggaatgegagaceccccagaaagtetetaca ggaaage taatatactgggtacaatgaaacacgeggaatgegagaceccccagaaagtetetaca ggaaageag taatatactgggtacaatgaaacacgeggaatgegagaceccccagaaagtetetaca ggaaagcag tattactgggtacaatgaaacacgeggaatgegagaceccccagaaagtetetaca ggaaagcagg tttgcegggetettgageagtagagactttetggggggtetegcettecgagt gttgcegggetettgagcagtagagactttetggggggtetegcettecgagtet tettgagcagtagagactttetggggggtetegcettecgagtet tettgagcagtagagactttetgggggggtetegcettecgagtett tettgagcagtagagactttetggggggtetegcettecgagtett tettgagcagtagagactttetggggggtetegcettecgagtett tettgagcagtagagactttetggggggtetegcattecgegtgtttcattgcacacagta ca tettgagcagtagagactttetggggggtetegcattecgegtgtttcattgcacacagta	indicated on the x-axis
PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.6  PAH_7.3.7  PAH_7.3.8  PAH_7.3.9  PAH_7.5.1  PAH_7.5.2  PAH_7.5.3  PAH_7.5.4  PAH_7.5.5  PAH_7.5.6  PAH_7.6.1  PAH_7.6.2  PAH_7.6.2	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcagactcggaaggcc gagtggaagactcggaaggcc gtctgatgtactgtgtgcag gtctgatgtactgtgtgcag	acacacgegaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcaggc tgggtacaatgaaaccacgcggaatgcgagaccccccagaaagtctctacaggaaagcagc tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag caggc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcagc gttgccgggtacaatgagaactttctggggggtctcgccttccgagt gttgccgggctcttgagcagtagagaactttctggggggtctcgccttccgagt tgtgccgggctttgagcagtagagaactttctggggggtctcgccttccgagtt tcttgagcagtagagactttctgggggggtctcgccttccgagtt tcttgagcagtagagactttctggggggtctcgccttccgagttt tcttgagcagtagagactttctgggggggtctcgccttccgagttt tcttgagcagtagagactttctgggggggtctcgccttccgagttt tcttgagcagtagagactttctggggggtctcgccttccgagttttctttgagcagtagagactttctggggggtctcgccttccgagttttctttgagcagtagagactttctgggggggtctcgccttccgagttttctttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta tcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagacttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagacttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagacttctggggggtctcgcattccgcgtgtttcattgcacacagta catc	indicated on the x-axis
PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.7  PAH_7.3.8  PAH_7.3.9  PAH_7.3.9  PAH_7.5.1  PAH_7.5.2  PAH_7.5.2  PAH_7.5.3  PAH_7.5.4  PAH_7.5.5  PAH_7.6.1  PAH_7.6.2  PAH_7.6.3  PAH_7.6.3	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtggaagactcggaaggcc gagtgaagactcggaaggcc gagtgaagactcggaaggcc gattgatgtactgtgtgcag gtctgatgtactgtgtgcag	aggtcggaggcg aacacgcggaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcgga gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaagcag gcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cagg taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag caggc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag gttgccgggctcttgagcagtagagactttctggggggtctcgccttccgagt gttgccgggctcttgagcagtagagaactttctggggggtctcgccttccgagtct tcttgagcagtagagactttctggggggtctcgccttccgagtct tcttgagcagtagagactttctgggggggtctcgccttccgagtct tcttgagcagtagagactttctgggggggtctcgccttccgagtct tcttgagcagtagagactttctgggggggtctcgccttccgagtct tcttgagcagtagagactttctgggggggtctcgccttccgagtct tcttgagcagtagagactttctgggggggtctcgccttccgagtttc tcttgagcagtagagactttctggggggtctcgccttccgagtttc tcttgagcagtagagactttctggggggtctcgccttccgagtttc tcttgagcagtagagactttctggggggtctcgccttccgagtttc tcttgagcagtagagactttctgggggggtctcgcattccgcgtgtttcattgcacacagta ca tcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta cat agtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta cat agtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta	indicated on the x-axis
PAH_7.2.8  PAH_7.2.9  PAH_7.3.1  PAH_7.3.2  PAH_7.3.3  PAH_7.3.4  PAH_7.3.5  PAH_7.3.6  PAH_7.3.6  PAH_7.3.7  PAH_7.3.8  PAH_7.3.9  PAH_7.5.1  PAH_7.5.2  PAH_7.5.3  PAH_7.5.4  PAH_7.5.5  PAH_7.5.6  PAH_7.6.1  PAH_7.6.2  PAH_7.6.2	gtggtttccgcctcgacctg  ggctggcctgctttcctctc ggctggcagactcggaaggcc gagtggaagactcggaaggcc gtctgatgtactgtgtgcag gtctgatgtactgtgtgcag	acacacgegaatgcgagaccccccagaaagtctctactgctcaagagcccggcaac gggtcggaggcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagc gcggaatgcgagaccccccagaaagtctctacaggaaagcaggc tgggtacaatgaaaccacgcggaatgcgagaccccccagaaagtctctacaggaaagcagc tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag tgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag cag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctacaggaaag caggc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagc taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcag taatatactgggtacaatgaaacacgcggaatgcgagaccccccagaaagtctctaca ggaaagcagc gttgccgggtacaatgagaactttctggggggtctcgccttccgagt gttgccgggctcttgagcagtagagaactttctggggggtctcgccttccgagt tgtgccgggctttgagcagtagagaactttctggggggtctcgccttccgagtt tcttgagcagtagagactttctgggggggtctcgccttccgagtt tcttgagcagtagagactttctggggggtctcgccttccgagttt tcttgagcagtagagactttctgggggggtctcgccttccgagttt tcttgagcagtagagactttctgggggggtctcgccttccgagttt tcttgagcagtagagactttctggggggtctcgccttccgagttttctttgagcagtagagactttctggggggtctcgccttccgagttttctttgagcagtagagactttctgggggggtctcgccttccgagttttctttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta tcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagacttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagacttctggggggtctcgcattccgcgtgtttcattgcacacagta catcttgagcagtagagacttctggggggtctcgcattccgcgtgtttcattgcacacagta catc	indicated on the x-axis

pAH 7.6.7 gelquight-eight-gelge grant path 7.6.7 geograph-eight-eight-gelge grant path 7.6.7 geograph-eight-eight-gelge grant path 7.6.7 geograph-eight-eight-gelge grant-gelge-grant-georgaph-eight-eight-gelge-grant-gelg-grant-gelge-grant-gelge-grant-gelge-grant-gelge-grant-gelge-gr	PAH 7.6.6	gtctgatgtactgtgtgcag	agtagagactttctggggggtctcgcattccgcgtgtttcattgcacacagtacatc	indicated on the x-axis
PAHL 7.6.8 getrologistic gloring grant getrologistic grant g				
PAH, 7.7.1  PAH, 7.7.2  PAH, 7.7.3  PAH, 7.7.3  PAH, 7.7.5  PAH, 7.7.5  PAH, 7.7.5  PAH, 7.7.6  PAH, 7.7.7  PAH, 7.7.7  PAH, 7.7.8  PAH, 7.8.1  PAH, 7.8.2  PAH, 7.8.2  PAH, 7.8.3  Reacher-coagging general pathing general p	PAH_7.6.8			indicated on the x-axis
pNH_7.7.2 glicpggggdatacatggget glicgeaged g	PAH_7.6.9	gtctgatgtactgtgtgcag	tggggggtctcgcattccgcgtgtttcattgcacacagtacatc	indicated on the x-axis
pAH 7.7.3 git-goggatine-tiggert part of the part of th	PAH_7.7.1	gttcgggggtatacatgggct		indicated on the x-axis
DAIL 7.7.4 git-page-gistonicitagest git-page-gistonicitagest git-page-gistonicitagest git-page-gistonicitagest git-page-gistonicitagest git-page-gistonicitagest git-page-gistonicitagest git-page-gistonicitagest git-page-git-page	PAH_7.7.2	gttcgggggtatacatgggct		indicated on the x-axis
PAHI 7.7.4 glt-geggesthatereggest glt-geggest glt-geggest glt-geggesthatereggest glt-geggesthateregg	PAH_7.7.3	gttcgggggtatacatgggct		indicated on the x-axis
PAHI 7.7.5 gtt-geggetianteragget planteragget planteragget gtt-geggetianteragget gtt-geggetianteragget gtt-geggetianteragget gtt-geggetianteragget gtt-geggetianteragget gtt-geggetianteraggetig gtt-geggetig gtg-geggetianteraggetig gtg-geggetig gtg-geggetig-geggetig gtg-geggetig-geggetig gtg-geggetig-geggetig-gegggetig-gegggetig-gegggetig-gegggetig-gegggetig-gegggetig-gegggetig-gegggetig-gegggggggggg	PAH_7.7.4	gttcgggggtatacatgggct		indicated on the x-axis
PAHI_7.7.7 gltegeggdatnetigged phat agging phat agging glterapproceaplatuage and gradient control of the x-axis indicated on t				indicated on the x-axis
PAHI_7.8.1 gtteggggathactigget PAHI_7.8.2 gracegathactorigget PAHI_7.8.2 gracegathactorigget PAHI_7.8.3 gracegathactorigget PAHI_7.8.3 gracegathactorigget PAHI_7.8.4 gracegathactorigget PAHI_7.8.5 gracegathactorigget PAHI_7.8.5 gracegathactorigget PAHI_7.8.6 gracegathactorigget PAHI_7.8.6 gracegathactorigget PAHI_8.1 gtgeartefeecatgaget PAHI_8.1.1 gtgeartefeecatgaget PAHI_8.1.2 gtgeartefeecatgaget PAHI_8.1.2 gtgeartefeecatgaget PAHI_8.1.3 gtgeartefeecatgaget PAHI_8.1.3 gtgeartefeecatgaget PAHI_8.2.1 gtgeartefeecatgaget PAHI_8.2.1 gtgeartefeecatgaget PAHI_8.2.1 gtgeartefeecatgaget PAHI_8.2.1 gtgeartefeecatgaget PAHI_8.2.2 gtsamantecaticettor PAHI_8.2.3 gtgeartefeecatgaget PAHI_8.3 gtgeartefeecatgaget PAHI_8.2.3 gtgeartefeecatgaget PAHI_8.3 gtgeartefeecatgaget PAHI_8.4 gtgeartefeecatgaget PAHI_8.5 gtgeartefeecatgaget PAHI_8.5 gtgeartefeecatgaget PAHI_8.6 gtgeartefeecatgaget PAHI_8.7 gtgeartefeecatgaget PAHI_8.8 gtgeartefeecatgaget PAHI_8 gtgeartefeecatgaget PAHI_8 gtgeartefeecatgaget PAHI_8 gtgeartefeecatgaget PAHI_8 gtgeartefeecatgaget PAHI_8 gtgeartefeecatgaget	PAH_7.7.6			indicated on the x-axis
PAHL 7.8.1 geographic angular part of the	PAH_7.7.7	gttcgggggtatacatgggct	gtgtttcattgtacccagtatattaggcatggttcaaaacccatgtatac	indicated on the x-axis
PAH 7.8.2 ggacagiacteaeggtteg ggacagtateaegtteg gtgacateaegtteg gtgacateaegtteg gtgacateaegtteg gtgacateaegtteggattegattegattegattegatte	PAH_7.7.8	gttcgggggtatacatgggct	gtgtttcattgtacccagtatattaggcatggttcaaaacccatgtataccc	indicated on the x-axis
PAH 7.8.1 ggacagtactacaggttag PAH 7.8.4 ggacagtactacaggttag PAH 7.8.5 ggacagtactacaggttag PAH 7.8.6 ggacagtactacaggttag PAH 7.8.6 ggacagtactacaggttag PAH 7.8.6 ggacagtactacaggttag PAH 8.8.1 gtacatataggactagtacagtaggataggataggatag		gttcgggggtatacatgggct	attccgcgtgtttcattgtacccagtatattaggcatggttcaaaacccatgtatacccc	indicated on the x-axis
PAH 7.8.4 ggacagtactacoggticgg PAH 7.8.4 ggacagtactacoggticgg PAH 7.8.5 ggacagtactacoggticgg PAH 7.8.6 ggacagtactacoggticgg PAH 7.8.6 ggacagtactacoggticgg PAH 7.8.6 ggacagtactacoggticgg PAH 7.8.6 ggacagtactacoggticgg PAH 8.1.1 gtgacattqccatgagctit PAH 8.1.2 gtgacattqccatgagctit PAH 8.1.2 gtgacattqccatgagctit PAH 8.1.2 gtgacattqccatgagctit PAH 8.2.1 gtgacattqccatgagctit PAH 8.2.2 gtanamatcattectac PAH 8.2.3 gtanamatcattectac PAH 9.1.3 gtcaccattacoggaatt PAH 9.1.5 gtcaccattacoggaatt PAH 9.1.5 gtcaccattacoggaatt PAH 9.1.5 gtcaccattacoggaatt PAH 9.2.1 gtcaccattacoggaatt PAH 9.3.2 gtcaccattacoggaatt	PAH_7.8.1	ggacagtactcacggttcgg		indicated on the x-axis
PAH 7.8.4 genoagiactoaegittog path 7.8.4 genoagiactoaegittog genoagiactog genoagiactoaegittog genoagiactoaegittog genoagiactog ge	PAH_7.8.2	ggacagtactcacggttcgg		indicated on the x-axis
PAH.7.8.4 ggacaglacte-aggftegg gardjacte-aggftegg attigate-consignating-acadgate-acac-organ-cegtag indicated on the x-axis ind	PAH_7.8.3	ggacagtactcacggttcgg	gcgtgtttcattgtacccagtatattaggcatggttcaaaaccgatgtacacaccagaac	indicated on the x-axis
PAH. J. 8.5 gasacglatcheaggtigg attglacecagtattatageatgtticaaaccagtattacaccagaacetgtagta PAH. 8.1.1 gtgacatctgectagactgt PAH. 8.1.2 gtgacatctgectagactgt PAH. 8.1.2 gtgacatctgectagactgt PAH. 8.1.2 gtgacatctgectagactgt PAH. 8.1.3 gtgacatctgectagactgt PAH. 8.1.2 gtgacatctgectagactgt PAH. 8.1.2 gtgacatctgectagactgt PAH. 8.2.1 gtacatcgectagactgt PAH. 8.2.1 gtacatcgectagactgt PAH. 8.2.2 gtacatcgectagactgt PAH. 8.2.3 gtacatcgectagacagat PAH. 9.1.1 gttocccantacagaaat PAH. 9.1.2 gtacccantacagaaat PAH. 9.1.2 gtocccantacagaaat PAH. 9.1.2 gtocccantacagaaat PAH. 9.1.2 gtocccantacagaaat PAH. 9.1.3 gtoccccantacagaaat PAH. 9.1.4 gtocccantacagaaat PAH. 9.1.5 gtocccantacagaaat PAH. 9.1.5 gtocccantacagaaat PAH. 9.1.2 gtocccantacagaaat PAH. 9.1.2 gtocccantacagaaat PAH. 9.1.2 gtocccantacagaaat PAH. 9.1.3 gtocccantacagaaat PAH. 9.1.4 gtocccantacagaaat PAH. 9.2.2 ggaagaaagggactatctg PAH. 9.3.1 ggaagaaaggactatctg PAH. 9.3.2 gaccatcacccaggagagaagaagaagaactacaccagaagaagaagaagaagaagaagaagaagaagaag	PAH_7.8.4	ggacagtactcacggttcgg		indicated on the x-axis
PAH. 8.1.1 gigacatetyccatgagety pangagectategetyancagegagagectategetyancagegagagagagagagagagagagagagagagagagaga	PAH_7.8.5			indicated on the x-axis
PAH 8.1.3 gtgacatetgccatgagetts ganagacetategtpaceagtgcaegtgacegaagagetategeag indicated on the x-axis and the	PAH_7.8.6	ggacagtactcacggttcgg		indicated on the x-axis
PAH 8.1.3   glascatic/cactage/fgt PAH 8.2.1   glassaatace/tactore   PAH 8.2.2   glassaatace/tactore   PAH 8.2.3   glassaatace/tactore   PAH 9.1.1   gltccccantace/gasaat   PAH 9.1.2   gltccccantace/gasaat   PAH 9.1.3   gltccccantace/gasaat   PAH 9.1.5   gltccccantace/gasaat   PAH 9.1.5   gltccccantace/gasaat   PAH 9.1.5   gltccccantace/gasaat   PAH 9.1.5   gltccccantace/gasaat   PAH 9.1.1   gltccccantace/gasaat   PAH 9.1.2   gegangaangage/gasaat   PAH 9.1.2   gegangaangage/gasaat   PAH 9.1.3   gltccccantace/gasaat   PAH 9.1.3   gltccccantace/gasaat   PAH 9.1.3   gltccccantace/gasaat   PAH 9.3.1   gltccccantace/gasaat   PAH 9.3.2   gegangaangage/gastacty   PAH 9.3.3   gltccccantace/gasaat   PAH 9.3.3   gltcactoriace/gasaat   PAH 9.3.2   gegangaangage/gasaace/	PAH_8.1.1	gtgacatctgccatgagctgt	gaaggacctatcgctgaacagtggcacgtgaccgagaagctcatggc	indicated on the x-axis
PAH 8.2.1 gtanaanatceattectace pAH 8.2.2 gtanaanatceattectace pAH 8.2.3 gtanaanatceattectace pAH 9.1.1 gtoccocantacaggaat patteriotecacegate telegracegatectetegeacagtetectegeacagtetectageat indicated on the x-axis and pAH 9.1.2 gtoccocantacaggaat patteriotecacegate patteriotecacegategate patteriotecacegategate patteriotecacegategategategategategategategategategat	PAH_8.1.2	gtgacatctgccatgagctgt	gaaggacctatcgctgaacagtggcacgtgaccgagaagctcatggcag	indicated on the x-axis
PAH 8.2.2 ghanaanaccattectrace pAH 9.1.1 ghanaanaccattectrace path 9.1.2 gtteeceanthacagganat path 9.1.2 gtteeceanthacagganat path 9.1.2 gtteeceanthacagganat path 9.1.3 gtteeceanthacagganat path 9.1.5 gtteeceanthacagganat path 9.1.5 gtteeceanthacagganat path 9.1.5 gtteeceanthacagganat path 9.1.5 gtteeceanthacagganat path 9.1.2 gganganaggagactatety gganganaggagatetatety path 9.2.1 gganganaggagatetatety path 9.2.2 gganganaggagatetatety path 9.2.3 gganganaggagatetatety pacatacaccagganaggagatetatety pacatacaccagganaggagatetatety pacatacaccagganaggagatetatety pacatacaccagganaggagatetatety geacatacaccagganaggagatetatety gaccatacaccagganaggagatetatety gaccatacaccagganaggagatetatety gaccatacaccagganaggagatetatety gaccatacaccagganaggagatetatety gaccatacaccagganaggagatetatety gaccatacaccagganaggagatetatety gaccatacaccagganaggaggagatetatety gaccatacaccacagganaggagatetatety gaccatactacacacagganaggagatetatety gaccatacaccacagganaggagatetatety gaccatactacacacagganaggagatetatety gaccatacaccacagganaggagatetatety gaccatacaccacaggagatatety gaccatacaccacaggagatatety gaccatacaccacaggagatatety gaccatacacacaggagatatety gaccatacacacaggagatatety gaccatacacacaggagatatety gaccatacacacaggagatatactacacatagaaa tagcaggagatatactacacatagaaa tagcaggagatatactacacatagaaa tagcaggagatacatacacacatagaaa ta	PAH_8.1.3	gtgacatctgccatgagctgt	gaaggacctatcgctgaacagtggcacgtgaccgagaagctcatggcagat	indicated on the x-axis
PAH 9.1.1 gltececcantacaggaat pat disceccantacaggaat pat disceccantacaggaat pat disceccantacaggaat pat disceccantacaggaat pat pat pl. 1.1 gltececantacaggaat pat pat pl. 1.2 gltececantacaggaat pat pat pl. 1.3 gltececantacaggaat pat pat pl. 1.3 gltececantacaggaat pat pat pl. 1.3 gltececantacaggaat pat pat pl. 1.4 gltececantacaggaat pat pat pl. 1.5 gltececantacaggaat pat pat pl. 1.5 gltececantacaggaat pat pat pl. 1.6 gltececantacaggaat pat pat pl. 1.6 gltececantacaggaat pat pat pl. 1.6 gltececantacaggaat pat pl. 1.6 gltececantacaggaat pat pat pl. 2.1 gggagagagggatategt gggagagaggggatategt gggagagaggggatategt gggagagaggggatategt gggagacagaggggatategt gggagacacagaggggatategt gggagacacagagggggagaggaggaggggggggggg		gtaaaaaatccattccttacc	actgttcagcgataggtccttcgcacagttctctcaggtaaggaatgg	
PAH 9.1.1 gltecccantareagaard talatactegitegiteceagestegotaptate planting pAH 9.1.2 gltecccantareagaard talatactegitegiteceagestegotaptectignating indicated on the x-axis pAH 9.1.3 gltecccantareagaard tecccantareagaard tecccantareagaard tecccantareagaard gltecccantareagaard tecccantareagaard tecccantareagaard gltecccantareagaard tecccantareagaard gltecccantareagaard tectatareactegitegiteceagestegeageageageageageageageageageageageagea		gtaaaaaatccattccttacc	actgttcagcgataggtccttcgcacagttctctcaggtaaggaatgga	
PAH 9.1.3 gtroccocatatacaggaaat plane plan		-		
PAH 9.1.3 gtrocccaattacaggaaat tattatactgritegtgetcocagactgetcoetgatattggg indicated on the x-axis growth part 9.1.5 gtrocccaattacaggaaat trictatatactgetggtgetcocagactgetcoetgatatt gtrocccaattacaggaaat trictatatactgetggtgetcocagactgactgattggg indicated on the x-axis part 9.1.5 gtrocccaattacaggaaat trictatatactgetggtgetcocagactgactgattggg indicated on the x-axis indicated on the x-axis part 9.2.2 gggagaagagggatatattg gggagacacgaagggatatataggaaactgataggaaccagacaga				
PAH 9.1.5 gttccccaattacaggaaat teletatatactegtegtgetcecagectgecagaccgatetetgtaatt indicated on the x-axis pAH 9.1.5 gttccccaattacaggaaat teletatatactegtegtgetcecagettgecagaccgatetetgtattg indicated on the x-axis pah 9.2.1 gggagaagaaggacttactg teggagaccagaaggagatatataggaaacttactg teggagaccagaaggagatatataggaaacttgetaagtgagaaggagatatataggaaacttgetaagtgagaaggagatatataggaaacttgetacagtaagtagagaaggagatatataggaaacttgetacagtaaggaagaggagagagagagagagagagattataggaaactgataagagaaggagagaga				
PAH 9.1.6				
PAH 9.2.1 gggagagagggacttactg PAH 9.2.2 gggagagaggggacttactg PAH 9.2.3 gggagagaggggacttactg PAH 9.3.3 ggcactacaccagggagaga PAH 9.3.2 ggcacagagagggactactg PAH 9.3.2 ggcacagagagggactactg PAH 9.3.2 ggcacagagagggaggagggaggaggaggagagagagag				
PAH 9.2.1 gggagagagggacttactg gggagacaggagtatactg y gggagacagaggagtatactg y gggagacagaggagtatactg y gggagacagagggacttactg y gggagacagagggacttactg y gggagacagagggacttactg y gggagacagagggactactg y gggagacacagaggagtatataggagaacttgctacagtaagtccettct indicated on the x-axis indicated on the x-axis y and y a second conceagggagaga y gacactacaccagggagagag y gacactacaccagggagagag y gacactacaccagggagagag y gacactacaccagggagagag y gacagttatatggagagagattataggagaacttgctacagtaagtcetttettecetgggtg y gacagttatatggttattg y gacagttatataggagaacttgctacagtatagagagaacttgctacagtatagagagaactggagagaga				
PAH 9.2.1 gggagaagggacttactg gggagacaagggacttactg pAH 9.3.1 ggagacaagggacttactg ggagagaagggacttactg tgggagacaaggacaggagaaactgctacaagtaagtccettct indicated on the x-axis indicated on the x-axis accagacaggattatagagaaacttgctacagtaagtcetttetetectgggt accagacaggaggagaaggactgatatagagaaacttgctacagtaagtcetttetetectgggtg accagacacaggaggagaagaactgctacaggaagaactgctacaggaagga				
PAH 9.2.3 ggggagaagggacttactg pAH 9.3.1 gaccatccaccagggagaga gaccatcacccagggagaga gaccatcacccagggagaga gaccatcacccagggagaga gaccatcacccagggagaga gaccatcacccagggagaga gacatcacccagggagaga gacatcacccagggagaga gacatcacccagggagaga gacatcacccagggagaga gacatcacccagggagaga gacatcaccaccagggagaga gacatcaccaccagggagaga gacatcaccaccagggagaga gacatcaccaccagggagaga gacatcatcaccaggagagaga gacatcaccaccaggagagaga gacatcatcaccaggagagagagatgatatagagaaacttgctacagtatagtcttitctctcctgggtgga accagacagtatatagttatagtatacaccatcacaactagaaa tctctctttgacgcggttatatcagtatacaccatcagaaat ctctctttgacgcggttatatcagtataccactagaaat ctctctttgacggggtaaaccaatacatagaaa gtaggtttaatgtattag gtaggtttaatgtatacaccatctgataccaatcagaaat ctctctttgacggggttatatagtagacactagaaat ctctcttgacggggtgatacactatagaaat taagcagggtgataaccaatacagaaat taagcagggtgataaccaatacagaaat taagcagggtgatacgagattaagagaagag				
PAH 9.3.1 PAH 9.3.2 PAH 9.3.2 PAH 9.3.2 PAH 9.3.3 PAH 10.2.1 EvoPreQ1 PAH 10.2.2 EvoPreQ1 PAH 10.2.2 EvoPreQ1 PAH 10.3.3 EvoPreQ1 PAH 10.3.3 EvoPreQ1 PAH 11.1.1 EvoPreQ1 PAH 11.1.2 EvoPreQ1 PAH 11.1.2 EvoPreQ1 PAH 11.1.2 EvoPreQ1 PAH 11.2.2 EvoPreQ1 PAH 11.2.2 EvoPreQ1 PAH 11.2.2 EvoPreQ1 PAH 11.2.3 EvoPreQ1 PAH 11.2.2 EvoPreQ1 PAH 11.2.2 EvoPreQ1 PAH 11.2.3 EvoPreQ1 PAH 11.2.2 EvoPreQ1 PAH 11.3 EvoPreQ1 PAH 11.3 EvoPreQ1 PAH 11.4 EvoPreQ1				
PAH 9.3.2 PAH 9.3.3 PAH 9.3.3 PAH 10.2.1_EvoPreQ1 PAH 10.2.2_EvoPreQ1 PAH 10.2.2_EvoPreQ1 PAH 10.3.3_EvoPreQ1 PAH 10.3.3_EvoPreQ1 PAH 10.3.3_EvoPreQ1 PAH 10.3.3_EvoPreQ1 PAH 10.3.3_EvoPreQ1 PAH 11.3.2_EvoPreQ1 PAH 11.1.1_EvoPreQ1 PAH 11.1.2_EvoPreQ1 PAH 11.2.1_EvoPreQ1 PAH 11.2.2_EvoPreQ1 PAH 11.2_EvoPreQ1 PAH 11.2_EvoPreQ				
PAH_10.2.1_EvoPreQ1 gccagatttactggttactg PAH_10.2.2_EvoPreQ1 gccagatttactggttactg PAH_10.2.2_EvoPreQ1 gccagatttactggttactg PAH_10.2.3_EvoPreQ1 gccagatttactggttactg PAH_10.3.2_EvoPreQ1 gccagatttactggttactg PAH_10.3.1_EvoPreQ1 gtaattcacaaaggatgac PAH_10.3.2_EvoPreQ1 gtaattcacaaaggatgac PAH_10.3.2_EvoPreQ1 gtaattcacaaaggatgac PAH_10.3.3_EvoPreQ1 gtaattcacaaaggatgac PAH_10.3.3_EvoPreQ1 gtaattcacaaaggatgac PAH_11.1.1_EvoPreQ1 gaagccaaagattcaccaaggatgac PAH_11.1.1_EvoPreQ1 gaagccaaagattcaccacaagaaattcacaaagaattcaccaaaggatgac PAH_11.1.2_EvoPreQ1 gaagccaaagattcaccacaagaattcacaaagaattcaccaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcaccaaagaattcacaaagaaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcacaaagaattcaaagaattcaaagaattcaag				
PAH_10.2.1_EvoPreQ1 gccagatttactggtttactg PAH_10.2.3_EvoPreQ1 gccagatttactggtttactg PAH_10.2.3_EvoPreQ1 gccagatttactggttactg PAH_10.3.1_EvoPreQ1 gcagatttactggttactg PAH_10.3.1_EvoPreQ1 gtaattcacaaaggatgac PAH_10.3.2_EvoPreQ1 gtaattcacaaaggatgac PAH_10.3.2_EvoPreQ1 gtaattcacaaaggatgac PAH_10.3.3_EvoPreQ1 gtaattcacaaaggatgac PAH_11.1.1_EvoPreQ1 gaagccaaaaggttcccccc PAH_11.1.1_EvoPreQ1 gaagccaaaggttcccccc PAH_11.1.1_EvoPreQ1 gaagccaaaggttcccccc PAH_11.1.2_EvoPreQ1 gaagccaaaggttcccccc PAH_11.2.1_EvoPreQ1 gaagccaaaggttcccccc PAH_11.2.1_EvoPreQ1 gaagccaaagcttccccc PAH_11.2.1_EvoPreQ1 gaagccaaagcttcccccc PAH_11.2.2_EvoPreQ1 gaagccaaagcttccccctggage PAH_11.2.3_EvoPreQ1 gaagccaaagcttccccctggage PAH_11.2.3_EvoPreQ1 gaagccaaagcttccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.3_EvoPreQ1 gaagctccccctggage PAH_11.3_EvoPreQ1 gaagctccccctggage PAH_11.3_EvoPreQ1 gaagccaaagcttcccccttgage PAH_11.2.1_EvoPreQ1 gaagccaaagcttcccccttgage PAH_11.2.2_EvoPreQ1 gaagctccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.2.3_EvoPreQ1 gaagctccccctggage PAH_11.4.3_EvoPreQ1 gaactctccccttggage PAH_11.4.3_EvoPreQ1 gaactctccccttggage PAH_11.4.3_EvoPreQ1 gaactctccccttggage PAH_11.4.3_EvoPreQ1 gaactctccccttggage PAH_11.4.3_EvoPreQ1 gaactctccccttggage PAH_11.4.3_EvoPreQ1 gaactctccccttggage PAH_11.4.3_EvoPreQ1 gaactctctgccagtatag PAH_11.4.3_EvoPreQ1 gaactctctgccagtatag PAH_11.4.3_EvoPreQ1 gaactctctgccagtatag PAH_11.4.3_EvoPreQ1 gaactctctgccagtatag PAH_11.4.3_EvoPreQ1 gaactctctgccagtatag PAH_12.2.1_EvoPreQ1 gaactctctgccagtatag PAH_12.2.2_EvoPreQ1 gaactctctgccagtatag PAH_12.2.2_EvoPreQ1 gaactctctgccagtatag PAH_12.2.2_EvoPreQ1 gaactctctgccagtatag PAH_12.2.2_EvoPreQ1 gaactctctgccagtatag PAH_12.2.2_EvoPreQ1 gaactctctgccagtatag PAH_12.2.2_EvoPreQ1 gaactctctgccagtatagt PAH_12.2.2_EvoPreQ1 gaactctctgccagtatagt PAH_12.2.2_EvoPreQ1 gaactctctgccagtatagt PAH_12.	_			
PAH_10.2.2_EvoPreQ1 gcagatttactggtttactg cletctecttgaegeggtaaccagtaatacagaatacagtaatacaggattactggtttactg gtaggctttaatgctatcacctgetatacacaatcagaat cletctettgaegeggttaaccaatagaaa gaggctttaatggtatacaccatgaatacaggattaatacacatggattactggttaaccaataggatgactacacatggataaccaatagaaa tagcagggtgataaccaatagaaatacaggatgactatatagtatacacaaggatgactatatagtatacacaatggaatacacatagaaatacacatgaaatacacaaggatgactataagactatacacacatgaaatacacatgaaatacacacaaggatgactacacaaggatgacaaggtgataaccaacatagaaatacacacaaggatgacaaggtgataaccaacatagaaatacacacaggatgacaggttaaccaacatagaaatacacacac			gtaggett taatgetate accet getta caca at cega at tega eggtaa accag taaat	
PAH_10.3.1_EvoPreQ1 gtaattcaccaaggatgac gtaattcaccaaggatgac cittetettigacggttatatcagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttatactatagttateggttagattatagatagatagatagataga	PAH_10.2.2_EvoPreQ1	gccagatttactggtttactg	gtaggetttaatgetateaceetgettacacaateegaattegaeggtaaaceagtaaat	indicated on the x-axis
PAH_10.3.2_EvoPreQ1 gtaattcaccaaaggatgac tctttgacggttatactagttacggatgatgacatacaaaggatgac tctcttgacgggttatactagttacggatgatgacatactagaaa taagcaaggtgatagacataaaagcctacggagcaggtttgctctcatcttttggtgatct ctctcttgacgggttatactagttacggttaaccaactagaaa taagcagggtgatagcattaaaagactacggaagaagtttctctttgacggggttatactagttacggttaaaccaactagaaa taagcagggtgatagcattataagttcgagttgagaggagaagacttctctcttgacgggttatactagttacggttaaaccaactagaaa tgcactttatagttacggttaaaccaactagaaa tgcactttatagttacggttaaaccaactagaaa tgcacttatagttatgatttgaatttgagttgag	PAH_10.2.3_EvoPreQ1	gccagatttactggtttactg	gtaggett taatgetate accet getta cae aatee gaatte gae ggtaaace agtaaat	indicated on the x-axis
PAH_10.3.2_EvoPreQ1 gtaattcaccaaaggatgac taaagcaggtgatagcattaaagcatacgagaagaggatttgctctactctttggtgatc ctctttgacgcggttcatctagttacggttaaaccaactagaaa taagcagggtgatagcgttaaagcaactaggaagagattgttctcatctttgtgtgatc ctctttgacggggttatactagttacggttaaaccaactagaaa tgtcactgtaagttctgattgagttgag	PAH_10.3.1_EvoPreQ1	gtaattcaccaaaggatgac		indicated on the x-axis
PAH_11.1.1_EvoPreQ1 gaagccaaagcttctcccc tgtactgtatagttctgattgattgtgattgagatgaga	PAH_10.3.2_EvoPreQ1	gtaattcaccaaaggatgac	taag cagg g t g at ag cat taa ag c c tacgg ag cag g t t t g c t c t cat c c t t t g g t g at c t cat c c t t t g g t g at c t cat c c t t t g g t g at c t cat c c t t t g g t g at c t cat c c t t t g g t g at c t c at c c t t t g g t g at c c at c c t t t g g t g at c c at c c t t t g g t g at c c at c c at c c t t t g g t g at c c at c	indicated on the x-axis
PAH_11.1.2_EvoPreQ1 gaagccaaagcttctcccc tgagc tgtcactgtatagttctgattgtcggtttatctagttagggggagaagctttctctct tgacgcggttctatctagttaggttgtaatcggttagatggggagaagctttctctct tgacgcggttctatctagttaggttgtagttgggttgagggagaagctttctctct tgacgcggttctatctagttaggttgagttga	PAH_10.3.3_EvoPreQ1	gtaattcaccaaaggatgac		indicated on the x-axis
PAH_11.2.1_EvoPreQ1 gaaagcttctcccctggagc tgtcatctagttaggtctgagtggggagaagctttggtctctctttgaggtggggagaagctttggtctctcttgagggggttctatcta			acgcggttctatctagttacgcgttaaaccaactagaaa	
PAH_11.2.1_EvoPreQ1 gaaagettetececetggage tgteatetagttagttetgaattgeagtettttegagtteeaggggggtetetete		gaagecaaagetteteeee		indicated on the x-axis
PAH_11.2.2_EvoPreQ1 gaaagettetecectggage tgteactgtatagttetgaattgeagttetttegagtteeagggggagtetetete		gaagecaaagetteteeee		indicated on the x-axis
PAH_11.2.3_EvoPreQ1 gaaagettetecectggage tgteatetagtategegttaaaceaactagaaa tgteactgtatagttetgaattgeagttettetgagtteeagggggagaatetetete				
PAH_11.4.1_EvoPreQ1 gaactetetgecacgtaatag tgcaatteagaactatacagtgacagaattteaaccaactagaaa  PAH_11.4.2_EvoPreQ1 gaactetetgecacgtaatag tgcaatteagaactatacagtgacagaattteaaccaactagaaa  PAH_11.4.2_EvoPreQ1 gaactetetgecacgtaatag tgcaatteagaactatacagtgacagaattteaaccaattgattacgtggcagtetetetet tgacgcggttetatetagttacgcgttaaaccaactagaaa  PAH_11.4.3_EvoPreQ1 gaactetetgecacgtaatag tgcaatteagaactatacagtgacagaattteaaccaattgataacgaagaatteagaactatacagtgacagaattetacacaattgataacgaagaatteagaacaactagaaa  PAH_12.2.1_EvoPreQ1 gactttgetgecacaatacet ttegatgcgcgttetatetagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgetgecacaatacet ttegatgcggttetatetagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgetgecacaatacet ttegatgcgcgttetatetagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgetgecacaatacet ttegatgcgctgtataaggatcatateteacgctaaatggtettggtattgtggcagtet indicated on the x-axis ctettgacgcggttetatetagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgetgccacaatacet ttegatgcgctgtataaggatcatatetcacgctaaatggtettggtattgtggcagtet indicated on the x-axis ctettgacgcggttetatetagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgetgccacaatacet ttegatgcgctgtgataaggatcatatetcacgctaaatggtettggtattgtggcagtet indicated on the x-axis ctettgacgcggttaaaccaactagaaa		gaaagetteteeeetggage		indicated on the x-axis
PAH_11.4.2_EvoPreQ1 gaactetetgecacgtaatag tgcaatteagtacagtgacagaatttcaaccaactagaaa tgcaattcagacatacagtgacagaatttcaaccattgataacgtggcagtetetetet tgacgcggttctatctagttacgcgttaaaccaactagaaa  PAH_11.4.3_EvoPreQ1 gaactetetgecacgtaatag tgcaattcagaactatacagtgacagaatttcaaccattgatatacgtggcagagtetete indicated on the x-axis tettgacgcgtteatactatacagtgacagaatttcaaccattgatatacgtggcagagtetete tettgacgcggttctatctagttacgcgttaaaccaactagaaa  PAH_12.2.1_EvoPreQ1 gactttgetgcacaatacct ttegatgcgetgttataaggatcatateteagetaaacgaaatgetetggtattgtggetetet indicated on the x-axis cettgacgcggttctatctagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgetgcacaatacct ttegatgcgcgttaaaaggatcatatetcacgctaaatggtettggtattgtggcagtet indicated on the x-axis cettgacgcggttctatctagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgetgcacaatacct ttegatgcgctgtgtataaggatcatatetcacgctaaatggtettggtattgtggcagtet indicated on the x-axis cettgacgcggttcatctagttaaggatcatatetcacgctaaatggtettggtattgtggcagtet indicated on the x-axis cettgacgcggttcatactaggataaccaactagaaa	PAH_11.2.3_EvoPreQ1	gaaagetteteeeetggage		indicated on the x-axis
PAH_11.4.2_EvoPreQ1 gaactetetgecacgtaatag tgcaattcagacatatacagtgacagaatttcaaccattgtattacgtggcagtctetetet tgacgcggttctatctagttacgcgttaaaccaactagaaa tgcaattcagacatatacagtgacagaatttcaaccattgtattacgtggcagagtctete indicated on the x-axis tettgacgcgttaatcagaatttcaaccattgtattacgtggcagagtctete tettgacgcggttcatctagttacgcgttaaaccaactagaaa tettgaacgcggttcatcatcagttacacgcgtaaaccaactagaaa tettgacgcggtgtataaaggatcatatctcacgctaaatggtetggtattgtggcctete indicated on the x-axis cettgacgcggttcatctagttacgcgttaaaccaactagaaa tettgacgcggttcatctagttacgcgtaaaccaactagaaa pAH_12.2.2_EvoPreQ1 gactttgctgccacaatacct ttcgatgcgcgttcatctagttacgcgtaaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctacgctaaatggtcttggtattgtgggcaggtctctc indicated on the x-axis ctctgacgcggttcatctagttacgcgtgaaccaactagaaa ttcgacgcggttcatctagttacgcgtaaccaactagaaa ttcgacgcggttcatctagtacgcgaaccaactagaaa ttcgacgcggtcaacaaccactagaaa ttcgacgcggtcaacaacacactagaaa ttcgacgcggtcaacaacacacacacacacacacacacac			tg ca atteaga actata cagtga caga atttea accattg tatta cgtgget et e	
PAH_11.4.3_EvoPreQ1 gaacttctgccacgtaatag tgcaattcagacattacagtgacagaatttcaaccattgtattacgtggcagagtctcc indicated on the x-axis tcttgacgcggttctatctagttacgcgttaaaccaactagaaa  PAH_12.2.1_EvoPreQ1 gactttgctgccacaatacct ttcgatgcgctgtataaggatcatatctcacgctaaatggcttggtattgtggctctct indicated on the x-axis ctcttgacgcggttctatctagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgctgccacaatacct ttcgatgcgctgtgtataaggatcatatctcacgctaaatggtcttggtattgtggcagtct indicated on the x-axis ctcttgacgcggttctatctagttacgcgttaaaccaactagaaa  PAH_12.2.2_EvoPreQ1 gactttgctgccacaatacct ttcgatgcgctgtgtataaggatcatatctcacgctaaatggtcttggtattgtggcagtct indicated on the x-axis		gaactetetgeeaegtaatag	tg ca atteaga actata cagtga caga atttea accattgt atta cgtgg cag tetetetet	
ctettgaegeggttetatetagttaegegttaaaccaaetagaaa PAH_12.2.2_EvoPreQ1 gactttgetgecaeaatacet ttegatgegetgtgtataaggateatateteaegetaagtgtettggtattgtggeagtet indicated on the x-axis		gaactetetgeeaegtaatag	tgcaattcagaactatacagtgacagaatttcaaccattgtattacgtggcagagtctctc	
PAH_12.2.2_EvoPreQ1 gactttgctgccacaatacct ttcgatgcgctgtataaggatcatatctcacgctaaatggtcttggtattgtggcagtct indicated on the x-axis		gactttgctgccacaatacct	ttegatgegetgtgtataaggateatateteaegetaaatggtettggtattgtggetetet	indicated on the x-axis
	PAH_12.2.2_EvoPreQ1	gactttgctgccacaatacct	ttcgatgcgctgtgtataaggatcatatctcacgctaaatggtcttggtattgtggcagtct	indicated on the x-axis

PAH_12.2.3_EvoPreQ1	gactttgctgccacaatacct
PAH_12.3.1_EvoPreQ1	gctacgacccatacacccaa
PAH_12.3.2_EvoPreQ1	gctacgacccatacacccaa
PAH_12.3.3_EvoPreQ1	gctacgacccatacacccaa
PAH_12.4.1_EvoPreQ1	gcagccaaaatcttaagctgc
PAH_12.4.2_EvoPreQ1	gcagccaaaatcttaagctgc
PAH_12.4.3_EvoPreQ1	gcagccaaaatcttaagctgc
PAH_12.5.1_EvoPreQ1	gtgtaaattacttactgttaa
PAH_12.5.2_EvoPreQ1	gtgtaaattacttactgttaa
PAH 12.5.3 EvoPreO1	gtgtaaattacttactgttaa

ttcgatgcgctgtgtataaggatcatatctcacgctaaatggtcttggtattgtggcagctctctctcttgacgcggttctatctagttacgcgttaaaccaactagaaa acgcggttctatctagttacgcgttaaaccaactagaaagacgcggttctatctagttacgcgttaaaccaactagaaa ttgacgcggttctatctagttacgcgttaaaccaactagaaa tatgatcettatacacagegeategaagtgetegataacacteaacagettaagatttetetetettgaegeggttetatetagttaegegttaaaceaactagaaa tatgatccttatacacagcgcatcgaagtgctcgataacactcaacagcttaagatttagtctctctcttgacgcggttctatctagttacgcgttaaaccaactagaaatatgatccttatacacagcgcatcgaagtgctcgataacactcaacagcttaagatttag gtctctctcttgacgcggttctatctagttacgcgttaaaccaactagaaa gata a cactea a caatt gaag at cetege aga cag tatea a cag ta ag ta at ctetetetgacgcggttctatctagttacgcgttaaaccaactagaaa ttgacgcggttctatctagttacgcgttaaaccaactagaaagata a cact caa caatt gaag at cetege aga cag tat caa cag ta ag ta at ttat et ctetettgacgcggttetatetagttacgcgttaaaccaactagaaa

indicated on the x-axis indicated on the x-axis

# ED Figure 3- pegRNA screen in CCR5

ED Figure 5- pegRNA scree	
3' extension	3' extension
CCR5_A223a	gtcatcctgataaactgcaaa
CCR5_A223b	gtcatcctgataaactgcaaa
CCR5_A223c	gtcatcctgataaactgcaaa
CCR5_A260a	gtgacatctacctgctcaacc
CCR5_A260b	gtgacatctacctgctcaacc
CCR5 A260c	gtgacatctacctgctcaacc
CCR5 A325a	gctcactatgctgccgcccag
CCR5 A325b	gctcactatgctgccgcccag
CCR5 A325c	gctcactatgctgccgcccag
CCR5 A360a	gacaatgtgtcaactcttgac
CCR5 A360b	gacaatgtgtcaactcttgac
CCR5 A360c	gacaatgtgtcaactcttgac
CCR5 A506a	gacaagtgtgatcacttggg
CCR5 A506b	gacaagtgtgatcacttggg
CCR5 A506c	gacaagtgtgatcacttggg
CCR5_A509a	gaagtgtgatcacttgggtgg
CCR5_A509b	gaagtgtgatcacttgggtgg
CCR5_A509c	
CCR5_A509C	gaagtgtgatcacttgggtgg
CCR5_A531a CCR5_A531b	getgtgtttgegteteteee
_	gctgtgtttgcgtctctccc
CCR5_A531c	gctgtgtttgcgtctctccc
CCR5_B272a	gaaggaaaaacaggtcagaga
CCR5_B272b	gaaggaaaaacaggtcagaga
CCR5_B272e	gaaggaaaaacaggtcagaga
CCR5_B291a	gcccagaaggggacagtaaga
CCR5_B291b	gcccagaaggggacagtaaga
CCR5_B291c	gcccagaaggggacagtaaga
CCR5_B305a	ggcagcatagtgagcccaga
CCR5_B305b	ggcagcatagtgagcccaga
CCR5_B305c	ggcagcatagtgagcccaga
CCR5_B326a	gatttccaaagtcccactggg
CCR5_B326b	gatttccaaagtcccactggg
CCR5_B326c	gatttccaaagtcccactggg
CCR5_B330a	gttgtatttccaaagtcccac
CCR5_B330b	gttgtatttccaaagtcccac
CCR5_B330c	gttgtatttccaaagtcccac
CCR5 B414a	ggtacctatcgattgtcagg
CCR5 B414b	ggtacctatcgattgtcagg
CCR5 B414c	ggtacctatcgattgtcagg
CCR5_B535a	gatctggtaaagatgattcc
CCR5 B535b	gatctggtaaagatgattcc
CCR5 B535c	gatctggtaaagatgattcc
CCR5 B584a	gtatggaaaatgagagctgc
CCR5_B584b	gtatggaaaatgagagetge
CCR5_B584c	gtatggaaaatgagagetge
CCR5_B564c CCR5_B601a	
CCR5_B601b	gcagaattgatactgactgta gcagaattgatactgactgta
CCR5_B601c	
CCR3_B001C	gcagaattgatactgactgta

#### ED Figure 4 - pegRNA screen at AAVS1 pegRNA spacer sequence

AAVS1_A1077a	gcagagccaggaacccctgt
AAVS1_A1077b	gcagagccaggaacccctgt
AAVS1_A1077c	gcagagccaggaacccctgt

#### 3' extension

3' extension
atgateetgaegaeggagaeegeegtegtegaeaageegeagtttate
atgateetgaegaeggagaeegeegtegtegaeaageegeagtttateag
atgateetgaegaeggagaeegeegtegtegaeaageegeagtttateagg
atgateetgaegaeggagaeegeegtegtegaeaageetgageaggt
atgatectgaegaeggagaeegeegtegtegaeaageetgageaggtag
atgatcctgacgacggagaccgccgtcgtcgacaagcctgagcaggtagat
atgatcetgacgacggagaccgccgtcgtcgacaagccggcggcagc
atgateetgaegaeggagaeegeegtegtegaeaageeggeggeageat
atgatcetgacgacggagaccgccgtcgtcgacaagccggcggcagcatag
atgatcetgacgacggagaccgccgtcgtcgacaagccaagagttgac
atgatcetgacgacggagaccgccgtcgtcgacaagccaagagttgacac
atgatcctgacgacggagaccgccgtcgtcgacaagccaagagttgacaca
atgatectgacgacgagagaccgccgtegtegacaagccaagtgateac
atgatcctgacgacggagaccgccgtcgtcgacaagccaagtgatcacac
atgatcctgacgacgagagaccgccgtcgtcgacaagccaagtgatcacactt
atgatcctgacgacggagaccgccgtcgtcgacaagcccccaagtga
atgatcctgacgacggagaccgccgtcgtcgacaagcccccaagtgatc
atgatcctgacgacggagaccgccgtcgtcgacaagcccccaagtgatcac
atgatcctgacgacggagaccgccgtcgtcgacaagccagagacgca
atgatectgacgacggagaccgccgtegtegacaagccagagacgcaaa
atgatectgacgacgagagacgccgtegtegacaagccagagacgcaaaca
ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgacctg
ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgacctgt
ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgacctgttt
ggettgtcgacgacggcggtctccgtcgtcaggatcattactgtccc
ggettgtcgacgacggcggtctccgtcgtcaggatcattactgtcccct
ggettgtcgacgacggcggtctccgtcgtcaggatcattactgtccccttc
ggettgtegaegaeggeggteteegtegteaggateatgggeteaet
ggcttgtcgacgacggcggtctccgtcgtcaggatcatgggctcactat
ggettgtegaegaeggeggteteegtegteaggateatgggeteactatge
ggettgtegaegaeggeggteteegtegteaggateatagtgggaet
ggettgtegaegaeggeggteteegtegteaggateatagtgggaetttg
ggettgtegaegaeggeggteteegtegteaggateatagtgggaetttgg
ggettgtegaegaeggeggteteegtegteaggateatggaetttgg
ggettgtegaegaeggeggteteegtegteaggateatggaetttggaa
ggettgtegaegaeggeggteteegtegteaggateatggaetttggaaat
ggettgtegaegaeggeggteteegtegteaggateatgaeaatega
ggettgtegaegaeggeggteteegtegteaggateatgaeaategata
ggettgtegaegaeggeggteteegtegteaggateatgaeaategatagg
ggettgtegaegaeggeggteteegtegteaggateatateatettta
ggettgtegaegaeggeggteteegtegteaggateatateatetttaee
ggettgtegaegaeggeggteteegtegteaggateatateatetttaeeag
ggettgtegaegaeggeggteteegtegteaggateatgeteteatt
ggettgtegaegaeggeggteteegtegteaggateatgeteteatttte
ggettgtegaegaeggeggteteegtegteaggateatgeteteatttteea
ggettgtegaegaeggeggteteegtegteaggateatagteagtat
ggcttgtcgacgacggcggtctccgtcgtcaggatcatagtcagtatca
ggcttgtcgacgacggcggtctccgtcgtcaggatcatagtcagtatcaat

#### 3' extension

indicated on the x-axis indicated on the x-axis

## 3' extension

taccgtacaccactgagaccgcggtggttgaccagacaaacctggggttccttaccgtacaccactgagaccgcggtggttgaccagacaaacctggggttcctgg taccgtacaccactgagaccgcggtggttgaccagacaaacctggggttcctggct

#### Edits made by the specified pegRNA

indicated on the x-axis indicated on the x-axis indicated on the x-axis AAVS1 A1098a AAVS1 A1098b AAVS1 A1098c AAVS1\_A1246a AAVS1\_A1246b AAVS1 A1246c AAVS1 A1267a AAVS1\_A1267b AAVS1\_A1267c AAVS1 A1293a AAVS1\_A1293b AAVS1 A1293c AAVS1\_A1307a AAVS1\_A1307b AAVS1 A1307c AAVS1\_A1582a AAVS1 A1582b AAVS1\_A1582c AAVS1\_A1615a AAVS1\_A1615b AAVS1 A1615c AAVS1\_A1647a AAVS1\_A1647b AAVS1 A1647c AAVS1 A1810a AAVS1 A1810b AAVS1\_A1810c AAVS1 A1890a AAVS1 A1890b AAVS1\_A1890c AAVS1 A3786a AAVS1 A3786b AAVS1\_A3786c AAVS1\_A3835a AAVS1\_A3835b AAVS1 A3835c AAVS1 A3856a AAVS1\_A3856b AAVS1\_A3856c AAVS1 B1154a AAVS1\_B1154b AAVS1 B1154c AAVS1\_B1314a AAVS1\_B1314b AAVS1 B1314c AAVS1\_B1376a AAVS1 B1376b AAVS1 B1376c AAVS1\_B1640a AAVS1 B1640b AAVS1 B1640c AAVS1\_B1676a AAVS1 B1676b AAVS1 B1676c AAVS1 B1701a AAVS1 B1701b AAVS1\_B1701c AAVS1 B1705a AAVS1 B1705b AAVS1\_B1705c AAVS1 B1883a AAVS1 B1883b AAVS1 B1883c AAVS1 B1902a AAVS1 B1902b AAVS1 B1902c AAVS1 B1962a AAVS1 B1962b AAVS1 B1962c AAVS1 B3839a AAVS1 B3839b AAVS1 B3839c AAVS1 B3903a AAVS1 B3903b AAVS1 B3903c AAVS1\_B3930a AAVS1 B3930b AAVS1\_B3930c ggacttcccagtgtgcatcg

gggaaggggagagagcca gggaaggggcaggagagcca gggaaggggcaggagagcca gaatatgtcccagatagcac gaatatgtcccagatagcac gaatatgtcccagatagcac ggggactctttaaggaaaga ggggactctttaaggaaaga ggggactctttaaggaaaga gagaaagagaaagggagtag gagaaagagaaagggagtag gagaaagagaaagggagtag gagtagaggcggccacgacc gagtagaggcggccacgacc gagtagaggcggccacgacc gatcagtgaaacgcaccaga gatcagtgaaacgcaccaga gatcagtgaaacgcaccaga gcagctcaggttctgggaga gcagctcaggttctgggaga gcagctcaggttctgggaga gtggccactgagaaccgggc gtggccactgagaaccgggc gtggccactgagaaccgggc gaatctgcctaacaggaggt gaatctgcctaacaggaggt gaatctgcctaacaggaggt gtcaccaatcctgtccctag gtcaccaatcctgtccctag gtcaccaatcctgtccctag gctggcccccaccgcccca gctggcccccaccgcccca getggeececacegeecea gacgtcacggcgctgcccca gacgtcacggcgctgcccca gacgtcacggcgctgcccca ggtgtgctgggcaggtcgcg ggtgtgctgggcaggtcgcg ggtgtgctgggcaggtcgcg gtccttggcaagcccaggag gtccttggcaagcccaggag gtccttggcaagcccaggag gtgcgtcctaggtgttcacc gtgcgtcctaggtgttcaccgtgcgtcctaggtgttcacc gtcctggcagggctgtggtg gtcctggcagggctgtggtg gtcctggcagggctgtggtg gtgacctgcccggttctcag gtgacctgcccggttctcag gtgacctgcccggttctcag gagcttggcagggggtggga gagcttggcagggggtggga gagcttggcagggggtggga gagccagagaggatcctggg gagccagagaggatcctggg gagccagagaggatcctggg gatggagccagagaggatcc gatggagccagagaggatcc gatggagccagagaggatcc ggggccactagggacaggat ggggccactagggacaggat ggggccactagggacaggat gtccctccaccccacagtg gtccctccaccccacagtg gtccctccacccacagtg gggaccaccttatattccca gggaccaccttatattccca gggaccaccttatattccca gacctgcccagcacaccctg gacctgcccagcacaccctg gacctgcccagcacaccctg gcgactcctggaagtggcca gcgactcctggaagtggcca gcgactcctggaagtggcca ggacttcccagtgtgcatcg ggacttcccagtgtgcatcg

tacegtacaccactgagaccgcggtggttgaccagacaaacctctctcctgctaccgtacaccactgagaccgcggtggttgaccagacaaacctctctcctgccc tacegtacaccactgagaccgeggtggttgaccagacaaacctctctcctgccccttaccgtacaccactgagaccgcggtggttgaccagacaaacctctatctgggtaccgtacaccactgagaccgcggtggttgaccagacaaacctctatctgggactaccgtacaccactgagaccgcggtggttgaccagacaaacctctatctgggacat taccgtacaccactgagaccgcggtggttgaccagacaaacctttccttaaataccgtacaccactgagaccgcggtggttgaccagacaaacctttccttaaaga taccgtacaccactgagaccgcggtggttgaccagacaaacctttccttaaagagttaccgtacaccactgagaccgcggtggttgaccagacaaacctctccctttc taccgtacaccactgagaccgcggtggttgaccagacaaacctctccctttctctaccgtacaccactgagaccgcggtggttgaccagacaaacctctccctttctctttacegtacaccactgagaccgeggtggttgaccagacaaacctegtggcegetaccgtacaccactgagaccgcggtggttgaccagacaaacctcgtggccgccttaccgtacaccactgagaccgcggtggttgaccagacaaacctcgtggccgcctcttacegtacaccactgagaccgcggtggttgaccagacaaacctggtgcgttttaccgtacaccactgagaccgcggtggttgaccagacaaacctggtgcgtttca taccgtacaccactgagaccgcggtggttgaccagacaaacctggtgcgtttcacttaccgtacaccactgagaccgcggtggttgaccagacaaacctcccagaacc taccgtacaccactgagaccgcggtggttgaccagacaaacctcccagaacctgtaccgtacaccactgagaccgcggtggttgaccagacaaacctcccagaacctgagtaccgtacaccactgagaccgcggtggttgaccagacaaacctcggttctcataccgtacaccactgagaccgcggtggttgaccagacaaacctcggttctcagttaccgtacaccactgagaccgcggtggttgaccagacaaacctcggttctcagtggtaccgtacaccactgagaccgcggtggttgaccagacaaaccttcctgttag tacegtacaccactgagaccgeggtggttgaccagacaaaccttcctgttaggctaccgtacaccactgagaccgcggtggttgaccagacaaaccttcctgttaggcagtaccgtacaccactgagaccgcggtggttgaccagacaaacctgggacagga taccgtacaccactgagaccgcggtggttgaccagacaaacctgggacaggatttaccgtacaccactgagaccgcggtggttgaccagacaaacctgggacaggattggtaccgtacaccactgagaccgcggtggttgaccagacaaacctggcggtggg taccgtacaccactgagaccgcggtggttgaccagacaaacctggcggtgggg taccgtacaccactgagaccgcggtggttgaccagacaaacctggcagcgcctaccgtacaccactgagaccgcggtggttgaccagacaaacctggcagcgccgttaccgtacaccactgagaccgcggtggttgaccagacaaacctggcagcgcgtga taccgtacaccactgagaccgcggtggttgaccagacaaacctgacctgccctaccgtacaccactgagaccgcggtggttgaccagacaaacctgacctgcccagtaccgtacaccactgagaccgcggtggttgaccagacaaacctgacctgcccagcagtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgggcttg gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgggcttgcctotggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgggcttgccaagtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgaacaccta gtotggtcaaccaccgcggtctcagtggtgtacggtacaaacctgaacacctaggtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgaacacctaggacgtetggteaaceacegeggteteagtggtgtacggtacaaaceteacagecet gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctcacagccctgc tetggteaaceacegeggteteagtggtgtacggtacaaaceteacagecetgeca gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctagaaccggg gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctagaaccgggca totggtcaaccaccgcggtctcagtggtgtacggtacaaacctagaaccgggcagggtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctcacccctggtetggtcaaccaccgcggtctcagtggtgtacggtacaaacctcacccctgcc totggtcaaccaccgcggtctcagtggtgtacggtacaaacctcacccctgccaagtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctaggatcctcgtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctaggatcctctctctggtcaaccaccgcggtctcagtggtgtacggtacaaacctaggatcctctctggtetggteaaceacegeggteteagtggtgtaeggtaeaaacetteetetetg gtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttcctctctggc tctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttcctctctggctcgtetggteaaceacegeggteteagtggtgtaeggtaeaaacetetgteecta gtetggteaaceacegeggteteagtggtgtaeggtaeaaacetetgteeetagt totggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgtccctagtgggtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttgtggggtggtetggteaaceacegeggteteagtggtgtacggtacaaacettgtggggtgga tctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttgtggggtggagggtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgaatataaggtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgaatataaggttctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgaatataaggtgggtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctggtgtgctg gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctggtgtgctgggtotggt caaccaccg cggtct cagtggtgtacggtacaaacctggtgtgctgggcagtetggteaaceacegeggteteagtggtgtacggtacaaaceteeactteea gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctccacttccagg tctggtcaaccaccgcggtctcagtggtgtacggtacaaacctccacttccaggaggtetggteaaceacegeggteteagtggtgtacggtacaaacettgcacactggtctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttgcacactggg tctggtcaaccaccgcggtctcagtggtgtacggtacaaaccttgcacactgggaa

indicated on the x-axis indicated on the x-axis

ED Figure 5a - Comparis	on of twinPE- and PE3-med	diated attB insertion at CCR5 region 1	
pegRNA	spacer sequence	3' extension	Edits made by the
CCD5 +2251 WD			specified pegRNA
CCR5_A325b_attB CCR5_B414a_attB	geteactatgetgeegeecag ggtacetategattgteagg	atgatectgaegaeggagaeegeegtegtegaeaageeggeggeageat ggettgtegaegaeggegteteegtegteaggateatgaeaatega	indicated on the x-axis indicated on the x-axis
CCR5_B414_23	ggtacctatcgattgtcagg	tctgggctcactatgctgccgccggcttgtcgacgacggcggtctccgtcgtcaggat	indicated on the x-axis
CCR5_B414_29	ggtacctatcgattgtcagg	catgacaatega teceettetgggeteactatgetgeeggeetgtetegaegaeggeggteteegtegte	indicated on the x-axis
CCR5_B414_34	ggtacctatcgattgtcagg	aggatcatgacaatcga tactgtccccttctgggctcactatgctgccgcctggttgtcgacgacggcggtctccg	indicated on the x-axis
sgRNA	spacer sequence	tcgtcaggatcatgacaatcga	
PE3_CCR5_A1_sgRNA	gcatcctgataaactgcaaa		
PE3_CCR5_A2_sgRNA PE3_CCR5_A4_sgRNA	ggacatctacctgctcaacc gcaatgtgtcaactcttgac		
ED E' Fl. C		l'and application at CCR5 and a 2	
pegRNA	on of twinPE- and PES-med spacer sequence	diated attB insertion at CCR5 region 2 3' extension	Edits made by the
pegierni	spacer sequence	5 CATCHSION	specified pegRNA
CCR5 C2c attB	gaaaagacatcaagcacaga	atgateetgaegaeggagaeegeegtegtegaeaageegtgettgatgtett	indicated on the x-axis
CCR5 D2a attB	gtgaaagacagcctggagtc	ggcttgtcgacgacggcggtctccgtcgtcaggatcattccaggct	indicated on the x-axis
CCR5_D2_23	gtgaaagacagcctggagtc	accettgaaaagacatcaagcacggettgtegacgacggeggtetecgtegteaggat catteeagget	indicated on the x-axis
CCR5_D2_28	gtgaaagacagcctggagtc	gagaaacccttgaaaagacatcaagcacggettgtegacgacggcggtetecgtegt	indicated on the x-axis
CCR5_D2_34	gtgaaagacagcctggagtc	caggatcattccaggct agattggagaaacccttgaaaagacatcaagcacggcttgtcgacgacggcggtctc	indicated on the x-axis
DNIA		cgtcgtcaggatcattccaggct	
sgRNA	spacer sequence		
PE3_CCR5_C1_ sgRNA	gatgcagagtcagcagaact		
PE3_CCR5_C1.5_	ggaagtgagggtcagagagg		
sgRNA PE3_CCR5_C4_sgRNA	gatggattggtgtaaaagga		
ED Figure 6b UTC inner	tion numity		
ED Figure 6b - HTS junct pegRNA	spacer sequence	3' extension	Edits made by the
pegierni	spacer sequence	5 CATCHSION	specified pegRNA
CCR5 A325a	geteactatgetgeegeecag	atgatectgaegaeggagaeegeegtegtegaeaageeggeggeage	325/414
CCR5 B414b	ggtacctatcgattgtcagg	ggcttgtcgacgacggcggtctccgtcgtcaggatcatgacaatcgata	325/414
CCR5 A506c	gacaagtgtgatcacttggg	atgatectgaegaeggagaeegeegtegtegaeaagceaagtgateaeactt	506/584
CCR5 A509b	gaagtgtgatcacttgggtgg	atgatectgaegaegagaeegeegtegtegaeaageeeceaagtgate	509/584
CCR5 A531b	gctgtgtttgcgtctctccc	atgateetgaegaeggagaeegeegtegtegaeaageeagagaegeaaa	531/584
CCR5_B584b	gtatggaaaatgagagctgc	ggcttgtcgacgacggcggtctccgtcgtcaggatcatgctctcattttc	506/584, 509/584, 531/584
AAVS1 A1077c	gcagagccaggaacccctgt	taccgtacaccactgagaccgcggtggttgaccagacaaacctggggttcctggct	1077/1154
AAVS1 B1154c	gtccttggcaagcccaggag	tctggtcaaccaccgcggtctcagtggtgtacggtacaaacctctgggcttgccaa	1077/1154
AAVS1 A3786c	gctggcccccaccgccca	taccgtacaccactgagaccgcggtggttgaccagacaaacctggcggtgggggg	3786/3903, 3786/3930
AAVS1 B3903c	gcgactcctggaagtggcca	tctggtcaaccaccgcggtctcagtggtgtacggtacaaacctccacttccaggag	3786/3903
AAVS1_B3930c	ggacttcccagtgtgcatcg	tetggteaaceacegeggteteagtggtgtaeggtaeaaacettgeacactgggaa	3786/3930
ED Figure 6c - Multiplex	single transfection knock-in		
pegRNA	spacer sequence	3' extension	Edits made by the
AAVS1_A1077c	gcagagccaggaacccctgt	taccgtacaccactgagaccgcggtggttgaccagacaaacctggggttcctggct	specified pegRNA AAVS1 attP, all samples
AAVS1_B1154c	gtccttggcaagcccaggag	tetggteaaceacegeggteteagtggtgtaeggtacaaacetetgggettgeeaa	on x-axis AAVS1 attP, all samples
CCD5 A7 -4D 20	actatattt===t=t=*	22722727272727272727272727272727272727	on x-axis
CCR5_A7_attB_20	gctgtgtttgcgtctctccc	acgacggagaccgccgtcgtcgacaagccagagacgcaaa	CCR5 attB
CCR5_B8_attB_20 CCR5_A7_attB_GA_20	gtatggaaaatgagagctgc	acgacggcggtctccgtcgtcaggatcatgctctcattttc	CCR5 attB
CCR5_A7_attB_GA_20 CCR5_B8_attB_GA_20	gctgtgtttgcgtctctccc gtatggaaaatgagagctgc	acgacggagtccgccgtcgtcgacaagccagagacgcaaa acgacggcggactccgtcgtcaggatcatgctctcattttc	CCR5 attB-GA CCR5 attB-GA
CCR5_B6_attB_GA_20 CCR5_A7_attP_30	0 00 000	0 00 00 0 00 0	CCR5 attP
CCR5_A7_attr_30 CCR5_B8_attP_30	getgtgtttgegteteteee	egtacaceactgagacegeggtggttgaceagacaaaccaagagacgcaaa ggtcaaccacegeggtctcagtggtgtacggtacaaaccegctctcattttc	CCR5 attP
CCR5_B6_attr_50 CCR5_A7_attP_GA_30	gtatggaaaatgagagctgc	ggicaaccaccgcggicicagiggigacggiacaaacccgcicicaiiiic	CCR5 attP-GA
CCR5_B8_attP_GA_30	getgtgtttgegteteteee gtatggaaaatgagagetge	cgtacaccactgagtccgcggtggttgaccagacaaaccaagagacgcaaa ggtcaaccaccgcggactcagtggtgtacggtacaaacccgctctcattttc	CCR5 attP-GA
ED Figure 6d - Overlap r	eduction		
pegRNA	spacer sequence	3' extension	Edits made by the
-	- •		specified pegRNA
CCR5_A531b	getgtgtttgegtetetece	atgatectgaegaeggagaeegeegtegtegaeaageeagagaegeaaa	attB 38
CCR5_B584b	gtatggaaaatgagagctgc	ggettgtegaegaeggeggteteegtegteaggateatgeteteatttte	attB 38
CCR5_A7_attB_30	getgtgtttgegteteteee	tectgaegaeggagaeegeegtegtegaeaageeagagaegeaaa	attB 30
CCR5_B8_attB_30	gtatggaaaatgagagctgc	tgtcgacgacggcggtctccgtcgtcaggatcatgctctcattttc	attB 30
CCR5_A7_attB_20	gctgtgtttgcgtctctccc	acgacggagaccgccgtcgtcgacaagccagagacgcaaa	attB 20
CCR5 B8 attB 20	gtatggaaaatgagagctgc	acgacggcggtctccgtcgtcaggatcatgctctcattttc	attB 20

ED figure 7 - Factor 9 km pegRNA	ock-in spacer sequence	3' extension	Edits made by the
pegram	spacer sequence	CACHSION	specified pegRNA
CCR5_A7_attB_20	gctgtgtttgcgtctctccc	acgacggagaccgccgtcgtcgacaagccagagacgcaaa	CCR5 attB
CCR5_B8_attB_20	gtatggaaaatgagagctgc	acgacggcggtctccgtcgtcaggatcatgctctcattttc	CCR5 attB
CCR5_A277c CCR5_B358c	gactgaaacttcacagaata gatttatgagatcaacagcac	gaaacttcacagaggettgtcgacgacggcggtctccgtcgtcaggatcat ggettgtcgacgacggcggtctccgtcgtcaggatcatctgttgatctcat	ALB attB ALB attB
CCR5_B556C	gaittatgagatcaacagcac	ggenguegaeggeggieteegteaggateatetgtigateteat	ALD and
	b1 mediated inversion in the		***
pegRNA	spacer sequence	3' extension	Edits made by the specified pegRNA
AAVS1 A1077b	gcagagccaggaacccctgt	ggettgtegaegaeggeggteteegtegteaggateatggggtteetgg	twinPE-mediated
attB_rev			insertion of attB_rev in
			AAVS1 upstream of
4 4 VC1 D1154b	ataattaaaaaaaaaaaaaa	at ant ant and an	H2B_EGFP sequences twinPE-mediated
AAVS1_B1154b_ attB_fwd	gtccttggcaagcccaggag	atgateetgaegaeggagaeegeegtegtegaeaageeetgggettgee	insertion of attB rev in
			AAVS1 upstream of
			H2B_EGFP sequences
AAVS1_A3835b	gacgtcacggcgctgcccca	taccgtacaccactgagaccgcggtggttgaccagacaaacctggcagcgccgt	twinPE-mediated
			insertion of attP_fwd in AAVS1 downstream of
			H2B_EGFP sequences
AAVS1_B3903b	gcgactcctggaagtggcca	gtetggteaaceacegeggteteagtggtgtaeggtaeaaaceteeactteeagg	twinPE-mediated
			insertion of attP_fwd in
			AAVS1 downstream of H2B EGFP sequences
			_ 1
ED Figure 9c - IDS and II		3' extension	Edita mada by the
pegRNA	spacer sequence	5 extension	Edits made by the specified pegRNA
IDS2_A1_a_attP_rev	gacaccaaaaactgccacagg	taccgtacaccactgagaccgcggtggttgaccagacaaacctgtggcagtta	A1B2 (attP rev)
IDS2_A1_a_attP_fwd	gacaccaaaaactgccacagg	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgtggcagtta	A1B2 (attP fwd)
IDS2_A1_c_attP_rev	gacaccaaaaactgccacagg	taccgtacaccactgagaccgcggtggttgaccagacaaacctgtggcagtttta	A1B3 (attP rev); A1B4 (attP rev)
IDS2_A1_c_attP_fwd	gacaccaaaaactgccacagg	gtetggteaaceacegeggteteagtggtgtacggtacaaacetgtggcagtttta	A1B3 (attP fwd); A1B4
	8 8 86	0 00 0 00 0 00 0 00 0	(attP fwd)
IDS2_A4_b_attP_rev	gcactcatttcctccaagetc	taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa	A4B7 (attP rev)
IDS2_A4_b_attP_fwd IDS2_B2_a_attP_rev	gcactcatttcctccaagctc gtaggtacaggacagggcag	gtetggteaaceacegeggteteagtggtgtaceggtacaaacetettggaggaaa gtetggteaaceacegeggteteagtggtgtaceggtacaaacetecetgtee	A4B7 (attP fwd) A1B2 (attP rev)
IDS2_B2_a_attt_fev IDS2_B2_a_atttP_fwd	gtaggtacaggacagggcag	taccgtacaccactgagaccgcggtggttgaccagacaaacctccctgtcc	A1B2 (attl fev) A1B2 (attl fwd)
IDS2_B3_a_attP_rev	gagataggtaggtacaggaca	tetggteaaceacegeggteteagtggtgtaeggtaeaaaceteetgtaeet	A1B3 (attP rev)
IDS2_B3_a_attP_fwd	gagataggtaggtacaggaca	taccgtacaccactgagaccgcggtggttgaccagacaaacctcctgtacct	A1B3 (attP fwd)
IDS2_B4_b_attP_rev IDS2_B4_b_attP_fwd	gtgaaaagataggtaggtac gtgaaaagataggtaggtac	gtetggteaaceacegeggteteagtggtgtaceggtacaaacetectacetateta tacegtacaceactgagacegeggtggttgaceagacaaacetectacetateta	A1B4 (attP rev) A1B4 (attP fwd)
IDS2_B7_b_att1_twd IDS2_B7_b_att1_twd	gttatggtttactccatcta	gtetggteaaceacegeggteteagtggtgtaeggtaeaaacetatggagtaaacet	A4B7 (attl rwu)
IDS2_B7_b_attP_fwd	gttatggtttactccatcta	taccgtacaccactgagaccgcggtggttgaccagacaaacctatggagtaaacc	A4B7 (attP fwd)
IDS_C2_c_attB_rev	gttttggtttaccctatcta	atgateetgaegaeggagaeegeegtegtegaeaageeatagggtaaaeea	C2D2 (attB rev); C2D2
IDS C2 c attB fwd	attttaatttaaaatatata	ggettateggeggeggggggteteegteggggggggggg	(attB rev) C2D1 (attB fwd); C2D2
IDS_C2_C_attb_Iwt	gttttggtttaccctatcta	ggettgtegaegaeggegteteegtegteaggateatatagggtaaacea	(attB fwd)
IDS_D1_b_attB_rev	gctgtggaactgcaacacact	ggcttgtcgacgacggcggtctccgtcgtcaggatcatgtgttgcagt	C2D1 (attB rev)
IDS_D1_b_attB_fwd	gctgtggaactgcaacacact	at gate ctg acg acg acg accepteg teg acaa gccgtgttg cag t	C2D1 (attB fwd)
IDS_D2_c_attB_rev IDS_D2_c_attB_fwd	gtgccacctaacagtgagctg gtgccacctaacagtgagctg	ggettgtegaegaeggeggteteegtegteaggateateteaetgttaggt atgateetgaegaeggagaeegeegtegtegaeaageeeteaetgttaggt	C2D2 (attB rev) C2D2 (attB fwd)
IDS2 A1 a attP rev Ev	gacaccaaaaaactgccacagg	taccgtacaccactgagaccgcggtggttgaccagacaaacctgtggcagttaaattat	A1B2 (attP rev)
oPreQ1_motif	0 00	tccgcggttctatctagttacgcgttaaaccaactagaa	,
IDS2_A1_a_attP_fwd_Ev	gacaccaaaaactgccacagg	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgtggcagttaaaatt	A1B2 (attP fwd)
oPreQ1_motif IDS2_A1_c_attP_rev_Ev	gacaccaaaaactgccacagg	atgegeggttetatetagttaegegttaaaceaactagaa taeegtaeaceactgagaeegeggtggttgaeeagaeaaacetgtggeagttttataea	A1B3 (attP rev); A1B4
oPreQ1_motif	5 ded continua de la	tacacgeggttctatctagttacgegttaaaccaactagaa	(attP rev)
IDS2_A1_c_attP_fwd_Ev	gacaccaaaaactgccacagg	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctgtggcagttttaaaat	A1B3 (attP fwd); A1B4
oPreQ1_motif		atttcgcggttctatctagttacgcgttaaaccaactagaa	(attP fwd)
IDS2_A4_b_attP_rev_Ev oPreQ1 motif	geacteattteeteeaagete	taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaacata ataacgcggttctatctagttacgcgttaaaccaactagaa	A4B7 (attP rev)
IDS2 A4 b attP fwd Ev	geacteattteeteeaagete	gtetggteaaceacegeggteteagtggtgtaeggtacaaacetettggaggaaaaca	A4B7 (attP fwd)
oPreQ1_motif		taatacgcggttctatctagttacgcgttaaaccaactagaa	
IDS2_B2_a_attP_rev_Ev	gtaggtacaggacagggcag	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctccctgtccctcatag	A1B2 (attP rev)
oPreQ1_motif IDS2 B2 a attP fwd Ev	gtaggtacaggacagggcag	tegeggttetatetagttaegegttaaaceaactagaa taeegtaeaceactgagaeegeggtggttgaeeagaeaaaceteeetgteeataaatte	A1B2 (attP fwd)
oPreQ1_motif	0000005bvub	cgcggttctatctagttacgcgttaaaccaactagaa	(
IDS2_B3_a_attP_rev_Ev	gagataggtaggtacaggaca	gtetggteaaccaccgcggtetcagtggtgtacggtacaaacctcctgtaccttaaaga	A1B3 (attP rev)
oPreQ1_motif	angatagetagetage	ategeggttetatetagttaegeggtaaaceaactagaa	A 1D2 (64D 64)
IDS2_B3_a_attP_fwd_Ev oPreQ1_motif	gagataggtaggtacaggaca	taccgtacaccactgagaccgcggtggttgaccagacaaacctcctgtaccttgaaag aacgcggttctatctagttacgcgttaaaccaactagaa	A1B3 (attP fwd)
IDS2_B4_b_attP_rev_Ev	gtgaaaagataggtaggtac	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctcctaccta	A1B4 (attP rev)
oPreQ1_motif		atcccgcggttctatctagttacgcgttaaaccaactagaa	

IDS2_B4_b_attP_fwd_Ev	gtgaaaagataggtaggtac	taccgtacaccactgagaccgcggtggttgaccagacaaacctcctaccta	A1B4 (attP fwd)
oPreQ1_motif		atgccgcggttctatctagttacgcgttaaaccaactagaa	
IDS2_B7_b_attP_rev_Ev	gttatggtttactccatcta	gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacccc	A4B7 (attP rev)
oPreQ1_motif IDS2 B7 b attP fwd Ev	attataatttaataaatata	ctttgccgcggttctatctagttacgcgttaaaccaactagaa	A AD7 (attD fixed)
oPreQ1 motif	gttatggtttactccatcta	taccgtacaccactgagaccgcggtggttgaccagacaaacctatggagtaaacccc ctttctcgcggttctatctagttacgcgttaaaccaactagaa	A4B7 (attP fwd)
IDS C2 c attB rev Evo	gttttggtttaccctatcta	atgateetgacgacggagaccgccgtegtegacaagccatagggtaaaccacatttaa	C2D2 (attB rev); C2D2
PreQ1_motif	<i>c cc</i>	ccgcggttctatctagttacgcgttaaaccaactagaa	(attB rev)
IDS_C2_c_attB_fwd_Evo	gttttggtttaccctatcta	ggettgtegaegaeggeggteteegtegteaggateatatagggtaaaceatttaaaga	C2D1 (attB fwd); C2D2
PreQ1_motif		cgcggttctatctagttacgcgttaaaccaactagaa	(attB fwd)
IDS_D1_b_attB_rev_Evo PreQ1_motif	gctgtggaactgcaacacact	ggettgtegaegaeggeggteteegtegteaggateatgtgttgeagtagaaatttege ggttetatetagttaegegttaaaceaaetagaa	C2D1 (attB rev)
IDS_D1_b_attB_fwd_Ev	getgtggaaetgeaacacact	atgateetgaegaeggagaeegeegtegtegaeaageegtgttgeagtaattaat	C2D1 (attB fwd)
oPreQ1_motif	6 6 66 6	cggttctatctagttacgcgttaaaccaactagaa	,
IDS_D2_c_attB_rev_Evo	gtgccacctaacagtgagctg	ggettgtegaegaeggeggteteegtegteaggateateteaetgttaggtattaaatte	C2D2 (attB rev)
PreQ1_motif		gcggttctatctagttacgcgttaaaccaactagaa	CODO ( uD C 1)
IDS_D2_c_attB_fwd_Ev oPreQ1 motif	gtgccacctaacagtgagctg	atgateetgaegaeggagaeegeegtegtegaeaageeeteaetgttaggtaataaat eegeggttetatetagttaegegttaaaceaaetagaa	C2D2 (attB fwd)
or red_mom		cegeggiiciaiciagitaegegitaaaceaaciagaa	
ED Figure 10a - twinPE m	nediated attB insertion in Co	CR5 region 2	
pegRNA	spacer sequence	3' extension	Edits made by the
			specified pegRNA
CCR5_2_C1c	gatgcagagtcagcagaact	atgateetgaegaegagaeegeegtegtegaeaageetetgetgaetetg	indicated on the x-axis
CCR5_2_D1c	ggtgcttgatgtcttttcaa	ggettgtegaegaeggeggteteegtegteaggateataaaagaeateaage	indicated on the x-axis
CCR5_2_C2b	gaaaagacatcaagcacaga	atgateetgaegaeggagaeegeegtegtegaeaageegtgettgatgte	indicated on the x-axis
CCR5_2_D4c CCR5_2_C2c	gacccctcagtatttcagct	ggettgtegaegaeggegteteegtegteaggateattgaaataetgaggg atgateetgaegaeggagaeegeegtegtegaeaageegtgettgatgtett	indicated on the x-axis indicated on the x-axis
CCR5 2 D2a	gaaaagacatcaagcacaga gtgaaagacagcctggagtc	ggettgtegaegaeggeggteteegtegteaggateatteeagget	indicated on the x-axis
CCR5_ 2_D2a CCR5_ 2_C3b	ggtttaggtcaagaagaaga	atgatcetgaegaeggagaeegcetegteaggacaageetettettgaeeta	indicated on the x-axis
CCR5 2 D2b	gtgaaagacagcctggagtc	ggettgtegaegaeggeggteteegtegteaggateatteeaggetgt	indicated on the x-axis
CCR5 2 D4a	gacccctcagtatttcagct	ggettgtegaegaeggeggteteegtegteaggateattgaaataetg	indicated on the x-axis
CCR5 2 C5c	cacagteteacecagaetee	atgateetgaegaeggagaeegeegtegtegaeaageegtetgggtgagae	indicated on the x-axis
CCR5_2_D3b	gtatttcagctgggatggga	ggettgtegaegaeggeggteteegtegteaggateateateeaget	indicated on the x-axis
CCR5_ 2_D4b	gacccctcagtatttcagct	ggcttgtcgacgacggcggtctccgtcgtcaggatcattgaaatactgag	indicated on the x-axis
CCR5_2_C6c	gctagatttatgaatacacg	atgateetgaegaeggagaeegeegtegtegaeaageegtatteataaatet	indicated on the x-axis
CCR5_ 2_D5c	gaacccatgaaatgactact	ggettgtegaegaeggeggteteegtegteaggateatagteattteatggg	indicated on the x-axis
CCR5_2_C7c	gcacacatgagatctaggtg	atgateetgaegaeggagaeegeegtegtegaeaageeetagateteatgt	indicated on the x-axis
CCR5_2_D6b	gatgtgctaaatgctgcctg	ggettgtegaegaeggeggteteegtegteaggateatgeageatttag	indicated on the x-axis
ED Figure 10b twinDF is			
ED Figure 10b - twinPE in	multiple human cells		Edits made by the
ED Figure 10b - twinPE ir pegRNA		3' extension	Edits made by the specified pegRNA
	n multiple human cells spacer sequence	3' extension	Edits made by the specified pegRNA IDS2 (attP rev)
pegRNA	multiple human cells	3' extension taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa	specified pegRNA
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd	n multiple human cells spacer sequence gcactcatttcctccaagctc	3' extension	specified pegRNA IDS2 (attP rev)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd	n multiple human cells spacer sequence gcactcatttcctccaagctc gttatggtttactccatcta	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtetggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcgtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacgggagaccgccgtcgtcgacaagccctcactgttaggt	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-	multiple human cells spacer sequence gcactcatttcctccaagctc gttatggtttactccatcta gttttggtttaccctatcta	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtgtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt- insert	geacteattteeteeaagete gtataggttaeceateta gtttggtttaeceateta gtgeacetaacagtgagetg gaggetattetgeecatttg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacgcgggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagacggccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt	a multiple human cells spacer sequence geacteattteeteeaagete gtatggtttactecateta gttttggtttacectateta gtgccacetaacagtgagetg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtetggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcgtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacgggagaccgccgtcgtcgacaagccctcactgttaggt	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_ftwd IDS_D2_c_attB_ftwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert	gcactcatttcctccaagctc gttatggtttacccatcta gttttggtttacccatcta gtgcacctaacagtgagctg gaggctattctgcccatttg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga aacaccatcatcaccatcatttctggatcggggt	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) MYC (22-nt) MYC (22-nt)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt	geacteattteeteeaagete gtataggttaeceateta gtttggtttaeceateta gtgeacetaacagtgagetg gaggetattetgeecatttg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacgcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagacggccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2	gcactcatttcctccaagctc gttatggtttacccatcta gttttggtttacccatcta gtgcacctaacagtgagctg gaggctattctgcccatttg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga aacaccatcatcaccatcatttctggatcggggt	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) MYC (22-nt) MYC (22-nt)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert	geacteattteeteeaagete gtatggttaecetatcagtggggggggggggggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga aacaccatcatcactatttctggatcggggt ttcagagaagaagagagaagacagagaaaggctgg tgtcttccatctcttctct	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) MYC (22-nt) MYC (22-nt) TIMM44 (22-nt) TIMM44 (22-nt)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c	geacteattteeteeaagete gttatggtttaecetatea gtgeacetattetggttggggggggggggggggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtaccggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga aacaccatcatcactactttctggatcggggt ttcagagaagaga	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_ftwd IDS_D2_c attB_ftwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b	gcactcattcctccaagetc gtatggttacccatcta gttggtttacccatcta gtgcacctaacagtgagetg gaggctattctgccatttg gctttacccgatccagttc gctttacccgatccagttc gctggccagcctttctccag gtcctgtcct	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtaccggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcgggt ttcagagaagaagagaag	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS2 (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt) MYC (22-nt) TIMM44 (22-nt) CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_a (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c	geacteattteeteeaagete gtattggtttaecetatteg gaggeattettggttaecetattg gaggetattetgecatttg gaggetattetgecatttg gaggetattetgecatttg getttaeceegateegatte gettgeeageetteteeag gteetgeeageetteteeag gteetgeeageetteteeag gteetgeeageetteteeag gteetgeeageetgeeageetgeeagatteageegatteageegatteageagaagaaaga	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcgggt ttcagagaaggagagacagagaaaggctgg  tgtcttccatctcttctct	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS2 (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_ftwd IDS_D2_c attB_ftwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b	gcactcattcctccaagetc gtatggttacccatcta gttggtttacccatcta gtgcacctaacagtgagetg gaggctattctgccatttg gctttacccgatccagttc gctttacccgatccagttc gctggccagcctttctccag gtcctgtcct	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtaccggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcgggt ttcagagaagaagagaag	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS2 (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt) MYC (22-nt) TIMM44 (22-nt) CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_a (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a	geacteattteeteeaagete gtattggtttaecetatteg gaggeattettggttaecetattg gaggetattetgecatttg gaggetattetgecatttg gaggetattetgecatttg getttaeceegateegatte gettgeeageetteteeag gteetgeeageetteteeag gteetgeeageetteteeag gteetgeeageetteteeag gteetgeeageetgeeageetgeeagatteageegatteageegatteageagaagaaaga	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcggggt ttcagagaaggagagacagaagagaaaggctgg  tgtcttccatcttctctgaatggccccag atgatcctgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggcggtctccgtcgtcgacaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgttgatgtctt ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtgcttgatgtctt ggcttgtcgacgacgacggcggtctccgtcgtcaggatcattccaggct	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS2 (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c – Editing acceptable.	geacteattteeteeaagete gtatggttaecetateagteggaggetggaggetateetgeaggeeateg gettaecegateegttaegettaegettaegettaegttaeg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtetggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga aacaccatcatcaccatcatttctggatcggggt ttcagagaagaga	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a	geacteattteeteeaagete gtatggttaecetatteggggegggggggggggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcggggt ttcagagaaggagagacagaagagaaaggctgg  tgtcttccatcttctctgaatggccccag atgatcctgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggcggtctccgtcgtcgacaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgttgatgtctt ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtgcttgatgtctt ggcttgtcgacgacgacggcggtctccgtcgtcaggatcattccaggct	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_B4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt- insert MYC_pegRNA_R1_22nt -insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D3b CCR5_2_D2a  ED figure 10c – Editing acc pegRNA	geacteattteeteeaagete gtattggttaecetategtggggggggggggggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtacggtac	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c – Editing acceptable.	geacteattteeteeaagete gtatggttaecetateagteggaggetggaggetateetgeaggeeateg gettaecegateegttaegettaegettaegettaegttaeg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga aacaccatcatcaccatcatttctggatcgggt ttcagagaaggagagacagagaaaggctgg tgtcttccatctcttctct	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c – Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1	geacteattteeteeaagete gtattggtttaceetateagetggaggetattetgeeattteegggeeateg gaggetatteteeag gtettaceegateegtteegttaceegateegtteegatggagetggaggetattetgeeattteeag gtettaceegateeagtte gettggeeageettteteeag gteetgteet	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtgtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga aacaccatcatcaccatcatttctggatcgggt ttcagagaaggagaggaagacagagaaaggctgg  tgtcttccatcttctctgaatggcccag atgatcctgacgacggagaccgccgtcgtcgacaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtcttggtgtagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtcttgatgtctt ggcttgtcgacgacggcggtctccgtcgtcaagaatcatacccagct atgatcctgacgacggagaccgccgtcgtcgacaagccgtgcttgatgtctt ggcttgtcgacgacggcggtctccgtcgtcaggatcattccaggct -dead RT variant, and PE2  3' extension acgcggaatgcgagaccccccagaaagtctctactgctcaagagccggcaacggg tcggaggcgtctctctttgacgcggttctatctagttacgcgttaaaccaactagaaa	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd) Also used in Fig. 2c
pegRNA  IDS2_B4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt- insert MYC_pegRNA_R1_22nt -insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D3b CCR5_2_D2a  ED figure 10c – Editing acc pegRNA	geacteattteeteeaagete gtattggttaecetategtggggggggggggggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcgggt ttcagagaaggagagacagaagagaaaggctgg  tgtcttccatcttctctgaatggccccag atgatcctgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtcgttgatgtctt ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtgcttgatgtctt ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtgcttgatgtctt ggcttgtcgacgacggcggtctccgtcgtcgacaaagccgtgcttgatgtctt ggcttgtcgacgacggagacccccagaaagtctctactgccaagagccggcaacggg tcggaggcgtctctctctttgacgcggttctatctagttacgcgttaaaccaactagaaa gggctcttgagcagtagagaactttctgggggggtctcgattccgcgtgtttcattgcaca	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS2_C2_c_attB_fwd IDS_D2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D2a  ED figure 10c - Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1  PAH_E7.6_56_EvoPreQ1	geacteattteeteeaagete gtatggttaecetatteeteeaggegeateetteegggeeateg gaggetatteeteeaggeeteg geaggetatteeteeaggeeteggeggeeateegteegttaecetateegggeeateeggeetggeaggeeateeggeeateeggeeateeggeeateeggeeaggeeateeggeeaggeeateeggaaagaagaeateaaggeeaggaggagaaaagaeateaagcaeagagtgaaagaeageetggagteettivity of Cas9 nickase, PE2-spacer sequencegtetgatgteeggeeteggeeteggeeteggeeateggeggeeateggagteeteggagteeteggagteeteggagteeteggagteeteggagteeteggagteeteggagteeteggagteeteggagteeteggagteeggagteeteggagteeggaggaggaggaggaggaggaggaggaggaggaggagg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtacggtac	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c – Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1	geacteattteeteeaagete gtattggtttaceetateagetggaggetattetgeeattteegggeeateg gaggetatteteeag gtettaceegateegtteegttaceegateegtteegatggagetggaggetattetgeeattteeag gtettaceegateeagtte gettggeeageettteteeag gteetgteet	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcgggt ttcagagaaggagagacagaagagaaaggctgg  tgtcttccatcttctctgaatggcccag atgatcctgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtcgttgatgtctt ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtgcttgatgtctt ggcttgtcgacgacggagaccgccgtcgtcgacaaagccgtgcttgatgtctt ggcttgtcgacgacggcggtctccgtcgtcgacaaagccgtgcttgatgtctt ggcttgtcgacgacggagacccccagaaagtctctactgccaagagccggcaacggg tcggaggcgtctctctctttgacgcggttctatctagttacgcgttaaaccaactagaaa gggctcttgagcagtagagaactttctgggggggtctcgattccgcgtgtttcattgcaca	specified pegRNA IDS2 (attP rev) IDS2 (attP rev) IDS2 (attP rev) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd) CCR5_b (attB fwd) Also used in Fig. 2c
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS2_C2_c_attB_fwd IDS_D2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D2a  ED figure 10c - Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1 PAH_E7.6_56_EvoPreQ1 AAVS1_A3835a	geacteattteeteeaagete gtattggttaecetattegeagetegaggeatteetgggggeateg gaggeatteetgggggeateg gaggeatteetggggggggaggeateg gaggeatteetgggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtacggtac	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS2_C2_c_attB_fwd IDS_D2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c - Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1 PAH_E7.6_56_EvoPreQ1 AAVS1_A3835a AAVS1_B3930a CCR5_2_C2_c_attP fwd_pegRNA1	geacteattteeteeaagete gtattggttaecetatteggggeetggggggggtattetgggggeateg gaeageateagetegtatteagetgggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtgtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacggcggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggaga aacaccatcatcaccatcatttctggatcgggt ttcagagaaggaagacagaagaaaggctgg  tgtcttccatcttctctgaatggcccag atgatcctgacgacggagaccgccgtcgtcgacaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtctgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtcttgggtgagac ggcttgtcgacgacggagaccgccgtcgtcgacaagccgtcttgatgtctt ggcttgcgacgacggggtctccgtcgtcaaagccgtcttgatgtctt ggcttgtcgacgacggggtctccgtcgtcaagaaccgcgtcttgatgtctt ggcttgtcgacgacggcggtctccgtcgtcaagaacctgcgtttattcaggct  -dead RT variant, and PE2  3' extension acgcggaatgcgagaccccccagaaagtctctactgctcaagagccggcaacggg tcggaggcgtcttctctttgacgcggttctatctagttacgcgttaaaccaactagaaa gggctcttgagcagtagagactttctggggggtctcgattccggtgtttaattgcaca cagtacatctctctcttgacgcggttctatctagttacgcgttaaaccaactagaaa taccgtacaaccactgagaaccggcggtgtgaccagacaaacctggcagcgcc gtctggtcaaccaccgcggtctcagtgtgtacggtacaaaaccttgcaacact aggtttgtaccgtacaccactgagaccgcggttgttacaggtacaaaaccttgcaacact gagtttgtaccgtacacacactgagaccgcggttgttgaccagacaaaacctgcaacacct gagtttgtaccgtacacacactgagaccgcggttgttgaccagacaaaacctgcaacacct gagtttgtaccgtacacacactgagaccgcggttgttgaccagacaaaacctgcaacacct gtctt	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt -insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_D2a  ED figure 10c - Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1  PAH_E7.6_56_EvoPreQ1  AAVS1_A3835a AAVS1_B3930a CCR5_2_C2_c_attP fwd_pegRNA1 CCR5_2_D2_a_attP	geacteattteeteeaagete gtattggttaecetatteggggeetggggggggtattetgggggeateg gaeageateagetegtatteagetgggggggggg	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctatggagtaaacct ggcttgtcgacgacgggggtctccgtcgtcaggatcaatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcggggt  ttcagagaaggagagacagagaaaggctgg  tgtcttccatctcttctct	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS2_C2_c_attB_fwd IDS_D2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt- insert MYC_pegRNA_R1_22nt -insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c - Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1  AAVS1_A3835a AAVS1_B3930a CCR5_2_C2_c_attP fwd_pegRNA1 CCR5_2_C2_a_attP fwd_pegRNA1 CCR5_2_D2_a_attP rev_pegRNA2	gcactcatttcctccaagetc gtatggttacccattcta gttttggtttacccatcta gttttggtttacccatcta gtgcacctaacagtgagetg gaggctattctgccatttg gctttaccccgatccagttc gctggccagcctttctccag gtcctgtcct	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtacggtac	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd) CR5_b (attB fw
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS2_B7_b_attP_rev IDS_C2_c_attB_fwd IDS_D2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt-insert MYC_pegRNA_R1_22nt-insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c - Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1  AAVS1_A3835a AAVS1_B3930a CCR5_2_C2_c_attP fwd_pegRNA1 CCR5_2_D2_a_attP fwd_pegRNA2 PE3_CCR5_1_F414a_34	gcactcatttectecaagete gtatggttacectattecteagggcattetteggggcattegggggggttattetecaggggcatteggattettacectaggggcattettecagggcattettecagggcattettecagggcattettecagggcattettecagggcattettecagggcattettecagggcattettecagggcattetteagetggatteagagaagaagacatcaagaagagtgaaagacatcaagaagagtgaaagacagaagaagaagaagaagaagaagaagaagaaga	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtgacggtacaaacctatggagtaaacct ggcttgtcgacgacgggggtctccgtcgtcaggatcatatagggtaaacca atgatcctgacgacggagaccgccgtcgtcgacaagccctcactgttaggt aaatgatggtgatgatggtgttatgggcaga  aacaccatcatcaccatcatttctggatcggggt  ttcagagaaggagatggagacagacagagaaaggctgg  tgtcttccatctcttctct	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd)
pegRNA  IDS2_A4_b_attP_rev IDS2_B7_b_attP_rev IDS2_C2_c_attB_fwd IDS_D2_c_attB_fwd IDS_D2_c_attB_fwd MYC_pegRNA_F1_22nt- insert MYC_pegRNA_R1_22nt -insert TIMM44_pegRNA_F1_2 2nt-insert TIMM44_pegRNA_R1_2 2nt-insert CCR5_2_C5c CCR5_2_D3b CCR5_2_C2c CCR5_2_D2a  ED figure 10c - Editing acc pegRNA  PAH_E7.2_55_EvoPreQ1  AAVS1_A3835a AAVS1_B3930a CCR5_2_C2_c_attP fwd_pegRNA1 CCR5_2_C2_a_attP fwd_pegRNA1 CCR5_2_D2_a_attP rev_pegRNA2	gcactcatttcctccaagetc gtatggttacccattcta gttttggtttacccatcta gttttggtttacccatcta gtgcacctaacagtgagetg gaggctattctgccatttg gctttaccccgatccagttc gctggccagcctttctccag gtcctgtcct	3' extension  taccgtacaccactgagaccgcggtggttgaccagacaaacctcttggaggaaa gtctggtcaaccaccgcggtctcagtggtacggtac	specified pegRNA IDS2 (attP rev) IDS2 (attB rev) IDS (attB fwd) IDS (attB fwd) IDS (attB fwd) MYC (22-nt)  MYC (22-nt)  TIMM44 (22-nt)  CCR5_a (attB fwd) CCR5_a (attB fwd) CCR5_b (attB fwd) CR5_b (attB fw

PE3_CCR5_1_F414a_29 _FKBP108	ggtacctatcgattgtcagg	teccettetgggeteactatgetgeegecaaatttettteeatetteaageateeeggtgta gtgeaceaegeaggtetggeegegettgggggaaggtgegeeegteteetggggaga	Also used in ED Fig. 1a
IDS2_DF_A4_b_attP_fw d	geacteatttecteeaagete	tggtttccacctgeactccgacaatcga gtctggtcaaccaccgcggtctcagtggtgtacggtacaaacctcttggaggaaa	Also used in Fig. 4b
IDS2_DF_B7_b_attP_fw d	gttatggtttactccatcta	taccgtacaccactgagaccgcggtggttgaccagacaaacctatggagtaaacc	Also used in Fig. 4b
Supplementary Note 1 - TypegRNA	winPE PCR bias assessment spacer sequence	3' extension	Edits made by the
CCR5_A223c	gtcatcctgataaactgcaaa	atgatectgacgacggagaccgccgtcgtcgacaagccgcagtttatcagg	specified pegRNA A223c+B272a; A223c+B291b; A223c+B305a; A223c+B326b; A223c+B330b
CCR5_B272a CCR5_B291b CCR5_B305a CCR5_B326b CCR5_B330b	gaaggaaaaacaggtcagaga gcccagaaggggacagtaaga ggcagcatagtgagcccaga gatttccaaagtcccactggg	ggcttgtcgacgacggcggtctccgtcgtcaggatcatctgacctg ggcttgtcgacgacggcggtctccgtcgtcaggatcattactgtcccct ggcttgtcgacgacggcggtctccgtcgtcaggatcatagggctcact ggcttgtcgacgacggcggtctccgtcgtcaggatcatagtgggactttg ggcttgtcgacgacggcggtctccgtcgtcaggatcatggactttggaa	A223c+B272a A223c+B291b A223c+B305a A223c+B326b; A260c+B326b A223c+B330b
CCR5_A260c	gtgacatctacctgctcaacc	atgatectgaegaeggagaeegeegtegtegaeaageetgageaggtagat	A260c+B305c; A260c+B326b; A260c+B330c
CCR5_B305c CCR5_B330c CCR5_A325b CCR5_B414a	ggcagcatagtgagcccaga gttgtatttccaaagtcccac gctcactatgctgccgcccag ggtacctatcgattgtcagg	ggcttgtegaegaeggegteteegtegteaggateatgggeteactatge ggettgtegaegaeggegteteegtegteaggateatggaetttggaaat atgateetgaegaeggaegeegtegtegtegaeaageeggeggeageat ggettgtegaegaeggeggteteegtegteaggateatgaeaatega	A260c+B305c A260+B330c A325b+B414a A325b+B414a; A360b+B414a
CCR5_A360b CCR5_A506c CCR5_B584a CCR5_A509a	gacaatgtgtcaactcttgac gacaagtgtgatcacttggg gtatggaaaatgagagctgc gaagtgtgatcacttgggtgg	atgatectgaegaeggagaeegeegtegtegaeaageeaagattgaeae atgateetgaegaeggagaeegeegtegtegaeaageeaagtgateaeactt ggettgtegaegaeggeggteteegtegteaggateatgeteteatt atgateetgaegaeggagaeegeegtegtegaeaageeeceaagtga	A360b+B414a A360b+B414a A506c+B584a A506c+B584a A509a+B535c; A509a+B584a
CCR5_B535c CCR5_A531c CCR5_B584b CCR5_ 2_C2b	gatctggtaaagatgattcc gctgtgtttgcgtctctccc gtatggaaaatgagagctgc gaaaagacatcaagcacaga	ggcttgtcgacgacggcggtctccgtcgtcaggatcatatcatctttaccag atgatcctgacgacggagaccgccgtcgtcgacaagccagagacgcaaaca ggcttgtcgacgacggcggtctccgtcgtcaggatcatgctctcattttc atgatcctgacgacggagaccgccgtcgtcgacaagccgtgcttgatgtc	A509_B535c A531c+B584b A531c+B584b C2b+D4c
CCR5_ 2_D4c CCR5_ 2_C2c CCR5_ 2_D2a CCR5_ 2_C3b	gacccctcagtatttcagct gaaaagacatcaagcacaga gtgaaagacagcctggagtc ggtttaggtcaagaagaaga	ggcttgtegaegaeggegteteegtegteaggateattgaaataetgaggg atgateetgaegaeggagaeegeegtegtegaeaageegtgettgatgtett ggettgtegaegaeggegteteegtegteaggateatteeagget atgateetgaegaeggagaeegeegtegtegaeaageetettettgaeeta	C2b+D4c C2c+D2a C2c+D2a C3b+D2b; C3b+D4a
CCR5_ 2_D2b CCR5_ 2_D4a CCR5_2_C4b CCR5_2_D2a	gtgaaagacagcctggagtc gacccctcagtatttcagct gatggattggtgtaaaagga gtgaaagacagcctggagtc	ggcttgtcgacgacggcggtctccgtcgtcaggatcattccaggctgt ggcttgtcgacgacggcggtctccgtcgtcaggatcattgaaatactg atgatcctgacgacggagaccgccgtcgtcgacaagccttttacaccaatc ggcttgtcgacgacggcggtctccgtcgtcaggatcattccaggct	C3b+D2b C3b+D4a C4b+D2a C4b+D2a
CCR5_ 2_C5c CCR5_ 2_D3b CCR5_ 2_D4b HEK3_DF_A_SA_	cacagteteacceagactee gtattteagetgggatggga gaccecteagtattteaget ggcccagactgagcacgtga	atgatcctgacgacggagaccgccgtcgtcgacaagccgtctgggtgagac ggcttgtcgacgacggcgtctccgtcgtcaggatcatcatcccagct ggcttgtcgacgacggcgtctccgtcgtcaggatcattgaaatactgag tcctctgccatcacgtgctcagtctg	C5c+D3b; C5c+D4b C5c+D3b C5c+D4b SA (Δ 77nt)
del77nt HEK3_DF_B_SA_ del77nt	gtcaaccagtatcccggtgc	tgatggcagaggaccgggatactgg	SA (Δ 77nt)
HEK3_DF_A_SA_ del56nt	ggcccagactgagcacgtga	tggaggaagcagggcttcctttcctctgccatcacgtgctcagtctg	SA (Δ 56nt)
HEK3_DF_B_SA_ del56nt	gtcaaccagtatcccggtgc	tgatggcagaggaaaggaagccctgcttcctccaccgggatactgg	SA (Δ 56nt)
HEK3_DF_A_HA_ del64nt HEK3_DF_B_HA	ggcccagactgagcacgtga gtcaaccagtatcccggtgc	tgcaggagctgcatcctctgccatcacgtgctcagtctg tgatggcagaggatgcagctcctgcaccgggatactgg	HA (Δ 64nt) HA (Δ 64nt)
del64nt HEK3 DF A PD	ggcccagactgagcacgtga	geccagecaaacttgteaaccagtateceggegtgeteagtetg	PD (Δ 90nt)
del90nt HEK3_DF_B_PD_ del90nt	gtcaaccagtatcccggtgc	gggtcaatccttggggcccagactgagcacgccgggatactgg	PD (Δ 90nt)

# **Supplementary Table 2**. Sequences of primers used for mammalian cell genomic DNA amplification and HTS

#### Primers (All sequences are shown in 5' to 3' orientation) Figure 1 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNATGTGGGCTGCCTAGAAAGG HEK3\_fwd HEK3 rev TGGAGTTCAGACGTGTGCTCTTCCGATCTCCCAGCCAAACTTGTCAACC Figure 2 PAH AVA1686 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATCACCATTGGCTGGGAT PAH\_AVA1687 PAH\_AVA1696 TGGAGTTCAGACGTGTGCTCTTCCGATCTAGTGGAGGAGAGGCACTGAA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACCTAAAGGTCTCCTAGTGCCT PAH\_AVA1697 TGGAGTTCAGACGTGTGCTCTTCCGATCTCCAGCAATGAACCCAAACCTC HEK3 fwd ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNATGTGGGCTGCCTAGAAAGG HEK3 rev TGGAGTTCAGACGTGTGCTCTTCCGATCTCCCAGCCAAACTTGTCAACC DMD\_UMI fwd1 DMD UMI fwd2 TGGAGTTCAGACGTGTGCTCTTCCGATCTGGCTACTTTTGTTATTTGCATT DMD rev0 TGGAGTTCAGACGTGTGCTCTTCCGATCTCCAGAGCAGGGTCCCGCTTC AAVS1 AVA1713 AAVS1\_AVA1717 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACGGGGCTCAGTCTGAAGAG AAVS1\_AVA1651 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCCAAGGACTCAAACCCAGA AAVS1 AVA1652 TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCGTGCGTCAGTTTTACCT AAVS1 AVA1653 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAACTGCTTCTCCTCTTGGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTTGCCAGAACCTCTAAGGT AAVS1\_AVA1715 AAVS1 AVA1655 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNATCCTCTCTGGCTCCATCGTA AAVS1 AVA1656 TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCACTTCAGGACAGCATGTTT AAVS1\_AVA1707 ACACTCTTCCCTACACGACGCTCTTCCGATCTNNNNCGCCGGGAACTGCCGCTGGC AAVS1 AVA1710 TGGAGTTCAGACGTGTGCTCTTCCGATCTGAGGAGGCCCTCATCTGGCG CCR5\_AVA1678 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAATCAATGTGAAGCAAATCGCAGC CCR5\_AVA1679 CCR5\_AVA1680 TGGAGTTCAGACGTGTGCTCTTCCGATCTTCGATTGTCAGGAGGATGATGAA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTCCTTCTTACTGTCCCCTTCTGGGC CCR5\_AVA1681 TGGAGTTCAGACGTGTGCTCTTCCGATCTGCAAACACAGCATGGACGAC CCR5\_AVA1682 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC CCR5 AVA1683 TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT ALB\_AVA1760 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTTGGCATTTATTTCTAAAATGGCATA ALB\_AVA1759 Figure 4 IDS\_AVA1763 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG IDS\_AVA1764 TGGAGTTCAGACGTGTGCTCTTCCGATCTGTCTACTCCAGCTTAATGGAAGTGG IDS AVA1765 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC IDS AVA1766 TGGAGTTCAGACGTGTGCTCTTCCGATCTAATCAACATGAAGGGTTGTGTTGT ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGTTCCCACACATGCGTTCCTC IDS\_AVA1769 IDS AVA1770 TGGAGTTCAGACGTGTGCTCTTCCGATCTGGCATGAAGGGTTGTTTTTAATTGA IDS UMI junc1 fwd ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTTGACTCATGCCCTACGAGG IDS junc2 fwd IDS universal rev TGGAGTTCAGACGTGTGCTCTTCCGATCTCTCAAATTTACCCGTGGCAGC ED Figure 1 - Long tPE insertions at CCR5 CCR5\_AVA1682 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC CCR5\_AVA1683 TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT ED Figure 2 - pegRNAs screen at PAH ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTGTCCATGGAGGTTTAACAGGA PAH\_AVA1684 TGGAGTTCAGACGTGTGCTCTTCCGATCTACATGGAAGTTTGCTACGACAT PAH AVA1685 PAH AVA1686 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATCACCATTGGCTGGGAT PAH\_AVA1687 TGGAGTTCAGACGTGTGCTCTTCCGATCTAGTGGAGGAGAGGCACTGAA PAH AVA1689 PAH\_AVA1690 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGAGAGCCCCCATTCAAAGCA PAH\_AVA1691 TGGAGTTCAGACGTGTGCTCTTCCGATCTGCAGGACTCTTCATGCTGGT PAH AVA1696 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACCTAAAGGTCTCCTAGTGCCT PAH\_AVA1697 TGGAGTTCAGACGTGTGCTCTTCCGATCTCCAGCAATGAACCCAAACCTC PAH\_AVA1702 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGCCAAGTACTAGGTTGGTTCT PAH AVA1703 TGGAGTTCAGACGTGTGCTCTTCCGATCTTAACCTGGCTTCCAGGGGAGT PAH\_exon10 fwd ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGACACACCCCAAAATAATGC

### ED Figure 3 - pegRNA screen at CCR5 region 1

PAH exon10 rev

PAH exon11 fwd

PAH\_exon11\_rev PAH\_exon12\_fwd

PAH\_exon12\_rev

CCR5\_AVA1678 ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAATCAATGTGAAGCAAATCGCAGC

TGGAGTTCAGACGTGTGCTCTTCCGATCTTTGAAAGCACAATAATGGTTTT

TGGAGTTCAGACGTGTGCTCTTCCGATCTCGATGGTAGGGAAAGACAGT

ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCAGGGAATACTGATCCTGAT

ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGAGGTGTCCGTGTTCCTAA

CCR5 AVA1679	TGGAGTTCAGACGTGTGCTCTTCCGATCTTCGATTGTCAGGAGGATGATGAA
CCR5 AVA1680	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTCCTTCTTACTGTCCCCTTCTGGGC
CCR5 AVA1681	TGGAGTTCAGACGTGTGCTCTTCCGATCTGCAAACACAGCATGGACGAC
CCR5 AVA1682	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC
CCR5_AVA1683	TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT
ED Figure 4 - pegRNA sci	
AAVS1_AVA1713 AAVS1_AVA1717	TGGAGTTCAGACGTGTGCTCTTCCGATCTCCAGAGCAGGGTCCCGCTTC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACGGGGCTCAGTCTGAAGAG
AAVS1_AVA1/1/ AAVS1_AVA1651	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCCAAGGACTCAAACCCAGA
AAVS1 AVA1652	TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCGTGCGTCAGTTTTACCT
AAVS1 AVA1653	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAACTGCTTCTCCTCTTGGGAA
AAVS1_AVA1715	TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTTGCCAGAACCTCTAAGGT
AAVS1_AVA1655	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNATCCTCTCTGGCTCCATCGTA
AAVS1_AVA1656	TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCACTTCAGGACAGCATGTTT
AAVS1_AVA1707	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCGCCGGGAACTGCCGCTGGC
AAVS1_AVA1710	TGGAGTTCAGACGTGTGCTCTTCCGATCTGAGGAGGCCCTCATCTGGCG
ED Figure 5 - Comparison	n of twinPE- and PE3-mediated attB insertion at CCR5 region 1
CCR5 AVA1680	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTCCTTCTTACTGTCCCCTTCTGGGC
CCR5 AVA1681	TGGAGTTCAGACGTGTGCTCTTCCGATCTGCAAACACAGCATGGACGAC
CCR5-2_fwd2	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAGAGGAGTCAGAGAGAATCCC
CCR5-2_rev2	TGGAGTTCAGACGTGTGCTCTTCCGATCTTTCCTAGACCTCATACCTCGT
ED E	e n e
ED Figure 6b - HTS Junct	
CCR5_AVA1680 CCR5_AVA1682	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTCCTTCTTACTGTCCCCTTCTGGGC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC
AAVS1 AVA1717	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACGGGGCTCAGTCTGAAGAG
AAVS1 AVA1707	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCGCCGGGAACTGCCGCTGGC
Donor_CJP140	TGGAGTTCAGACGTGTGCTCTTCCGATCTGAACTTCAGGGTCAGCTTGC
_	
	ion Purity (the other donor-genome junction)
CCR5_AVA1681	TGGAGTTCAGACGTGTGCTCTTCCGATCTGCAAACACAGCATGGACGAC
CCR5_AVA1683	TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCCAGAGCAGGGTCCCGCTTC
AAVS1_AVA1713 AAVS1_AVA1710	TGGAGTTCAGACGTGTGCTCTTCCGATCTGAGGAGGCCCTCATCTGGCG
Donor_other_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGCAAGCTTACATCGAGATCC
ED Figure 6e - Overlap re	duction
CCR5_AVA1682	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC
CCR5_AVA1682 CCR5_AVA1683	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCGATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACATACA
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTGGAACACAAAAATCC
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAACTCTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCGATCTTCCTTC
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCCGATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACATACA
CCR5_AVA1682 CCR5_AVA1683 ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAACTCTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCGATCTTCCTTC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCGATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACATACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c Donor_CJP140 (with	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCCGATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACATACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd)	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACAACAACA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAAATCC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTTCCTTCC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCGATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCAAAAATCC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTACATCACATACAACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACAACACA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAAATCC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTTCCTTCC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACAACACA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAAATCC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTTCCTTCC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACAACACA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAAATCC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTTCCTTCC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACAACAACA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAAATCC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCTTCCTTCC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCGATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACATACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1765	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGCGATCTTAAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATTGCACTCCTACATACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1765 IDS_AVA1766	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCTACAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGTGGTGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAAGTC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTCATCATATTTTTGAAACAAAAGG  TGGAGTTCAGACGTGTGCTCTTCCGATCTCATCATATTTTTGAAACAAAAGG  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCAACTTCAGGGTCAGCTTGC  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG ACACTCTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAAGGTTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAAGGTTTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAAGGTTTGTTTGT
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1765 IDS_AVA1766 IDS_AVA1769	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCTACAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTCCTTCCGATCTNNNNGGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTCTCTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTCATTCATATTTTGAAACAAAAAGG  TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAACTTCAGGGTCAGCTTGC  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGATCCCACACATGCGTTCCTC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1765 IDS_AVA1766	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCTACAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGTGGTGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAAGTC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTCATCATATTTTTGAAACAAAAGG  TGGAGTTCAGACGTGTGCTCTTCCGATCTCATCATATTTTTGAAACAAAAGG  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCAACTTCAGGGTCAGCTTGC  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG ACACTCTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAAGGTTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAAGGTTTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAAGGTTTGTTTGT
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1766 IDS_AVA1766 IDS_AVA1769 IDS_AVA1769 IDS_AVA1770	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCTACAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTCTCTCCGATCTNNNNGGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTCTCTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTCATTCATATTTTGAAACAAAAAGG  TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAACTTCAGGGTCAGCTTGC  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGATCCCACACATGCGTTCCTC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1765 IDS_AVA1766 IDS_AVA1769	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCTACAAAGGAGAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTCTCTCCGATCTNNNNGGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTCTCTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTCATTCATATTTTGAAACAAAAAGG  TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAACTTCAGGGTCAGCTTGC  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCTGAAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAGAAGATGTGGAAATGCCTCAC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGATCCCACACATGCGTTCCTC
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1766 IDS_AVA1766 IDS_AVA1769 IDS_AVA1770  ED Figure 10 CCR5-2_Fwd1 CCR5-2_Rev1	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGATCTTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATCTGCACTCTACATACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1765 IDS_AVA1766 IDS_AVA1766 IDS_AVA1769 IDS_AVA1770  ED Figure 10 CCR5-2_Fwd1 CCR5-2_Fwd1 CCR5-2_Fwd2	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCCGATCTTAAAAGGAAGG
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT4_rev OT5_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1766 IDS_AVA1766 IDS_AVA1769 IDS_AVA1770  ED Figure 10 CCR5-2_Fwd1 CCR5-2_Fwd1 CCR5-2_Fwd2 CCR5-2_rev2	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGGCTGTC TGGAGTTCAGACGTGTGCTCTTCCGATCTACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTCCGATCTGCATCTGCACTCACATACAACA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTCCGATCTGCATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTCCGATCTNNNNGGAAAACCTTCACACACACACACACACACACACACACACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1766 IDS_AVA1766 IDS_AVA1769 IDS_AVA1769 IDS_AVA1769 IDS_AVA1770  ED Figure 10 CCR5-2_Fwd1 CCR5-2_Fwd1 CCR5-2_Fwd2 CCR5-2_Fwd3	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGCTGCTGCTGTCTGGAGTTCAGACGTGTGCTCTTCCGATCTACACGACCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTTNNNNGCATTGCACTCCTACATACAACA TGGAGTTCAGACGTGTGCTCTTCCGATCTCCATCTATATTTTGAAACAAAAGG  TGGAGTTCAGACGTGTGCTCTTCCGATCTCCATCTATATTTTGAAACAAAAGG  TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCATCTCATCATTCAGGGTCAGCTTGC  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCTGAAAACCTGAGCTTGGAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCATCTNNNNGAAAACCTGAGCTTGGAG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGAAAACTTCAGGGTCAGCTTGC  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGAGAAACTTGGAGTTGGAAG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGTTCCCACACATCGCTTCCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGTTCCCACACATCGCTTCCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGTTTCCACACATCGCTTCCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGTATTCGTGCAGCATATGAG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGGTATTCGTGCAGCATATGAG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNAGAGGATCAGACGAAGAATCCC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNAGAGGATCAGACGAAGAATCCC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNAGAGGAATCAACAAGAGAAACCC TCTTTCCCTACACGACGCTCTTCCGATCTNNNNAGAGGAATCACACGT ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAGACGAAGTCAAACCTCTT ACACTCTTCCCTACACGACGCTCTTCCGATCTNNNNAGACGAAGTCAAACCTCTTCTCAACCAACGACGCTCTTCCGATCTNNNNAGACGAATCCCTTTCCGATCTTNNNNAGACCTCATAACCTCCTT ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAGACCTCATACCTCCTT ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACACTGAATGCTTCTTCAACTCTCTT ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACACTGAATGCTTCTTCTTCTAACCTCTTCTTCCTAACCACGACGCTCTTCCGATCTNNNNACACTGAATCTCTCTTCTTCTAACCTCCTTTCCTT
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1766 IDS_AVA1766 IDS_AVA1769 IDS_AVA1770  ED Figure 10 CCR5-2_Fwd1 CCR5-2_Fwd1 CCR5-2_Fev1 CCR5-2_Fev2 CCR5-2_Fwd3 CCR5-2_Rev3	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGCTGCTGCTGCTGGAGTTCAGACGTGTGCTCTTCCGATCTTCCATCTNNNNGGAAATAAGTTATCACAATGGGAAAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTCGATCTTNNNNCATTCATATTTTGAAACAAAAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTTCCGATCTCCAATACAACA ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTGCATCTCCTACATACA
CCR5_AVA1682 CCR5_AVA1683  ED Figure 7b OT1_fwd OT1_rev OT2_fwd OT2_rev OT3_fwd OT3_rev OT4_fwd OT5_rev  ED Figure 7c Donor_CJP140 (with OT1_fwd or OT2_fwd) Donor_fwd_primer (with OT3_rev, or OT4_rev, or OT5_rev)  ED Figure 9 IDS_AVA1763 IDS_AVA1764 IDS_AVA1766 IDS_AVA1766 IDS_AVA1769 IDS_AVA1769 IDS_AVA1769 IDS_AVA1770  ED Figure 10 CCR5-2_Fwd1 CCR5-2_Fwd1 CCR5-2_Fwd2 CCR5-2_Fwd3	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNACAATCGATAGGTACCTGCTGCTGCTGCTGGAGTTCAGACGTGTGCTCTTCCGATCTCCAACCAGCCCCAAGATGACTAT  ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGGAAATAAGTTATCACAATGGGAAAT TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAGG TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNCCATTCATATTTTGAAACAAAAAGG TGGAGTTCAGACGTGTGCTCTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC TGGAGTTCAGACGTGTGCTCTTCCGATCTNNNNGCTGTGGTTATTCCCAGCTC ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGCAAAGCTTTGACAAGTGGAA TGGAGTTCAGACGTGTGCTCTTCCGATCTGCCTACTTGCCCTTCCTT

IDS_AVA1769	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNGTTCCCACACATGCGTTCCTC
IDS_AVA1770	TGGAGTTCAGACGTGTGCTCTTCCGATCTGGCATGAAGGGTTGTTTTTAATTGA
CCR5-2_fwd2	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAGAGGAGTCAGAGAGAATCCC
CCR5-2_rev2	TGGAGTTCAGACGTGTGCTCTTCCGATCTTTCCTAGACCTCATACCTCGT
MYC_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTTGCACTGGAACTTACAACAC
MYC_rev	TGGAGTTCAGACGTGTGCTCTTCCGATCTGGCAGAAATCTCGAAAGG
TIMM44_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNAGACCTGTACATTCGGGC
TIMM44 rev	TGGAGTTCAGACGTGTGCTCTTCCGATCTAAAAGCCCAGTGCTGCTC

## Supplementary Table 5 - TwinPE-mediated off-target genome editing

HEK3_OT1_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTCCCCTGTTGACCTGGAGAA
HEK3_OT1_rev	TGGAGTTCAGACGTGTGCTCTTCCGATCTCACTGTACTTGCCCTGACCA
HEK3_OT2_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTTGGTGTTGACAGGGAGCAA
HEK3_OT2_rev	TGGAGTTCAGACGTGTGCTCTTCCGATCTCTGAGATGTGGGCAGAAGGG
HEK3 OT3 fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTGAGAGGGAACAGAAGGGCT
HEK3 OT3 rev	TGGAGTTCAGACGTGTGCTCTTCCGATCTGTCCAAAGGCCCAAGAACCT
HEK3 OT4 fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNTCCTAGCACTTTGGAAGGTCG
HEK3 OT4 rev	TGGAGTTCAGACGTGTGCTCTTCCGATCTGCTCATCTTAATCTGCTCAGCC

# Supplementary Note 1 - Analysis of editing quantification bias

UMI_HEK3_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNNNNNNN
UMI_CCR5-2_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNNNNNNN
UMI_AVA1678_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNNNNNNN
	C
UMI_AVA1680_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNNNNNNN
	C
UMI_AVA1682_fwd	ACACTCTTTCCCTACACGACGCTCTTCCGATCTNNNNNNNNNN

5p constant primer C ACACTCTTTCCCTACACG

# Supplementary Table 3. Sequences of primers and probes used for ddPCR assays

Fig 3d				
Assay CCR5_B6 CCR5_B8_1	fwd catctctgacctgtttttcc gccaggacggtcacctt	rev teetegeeettgeteae teetegeeettgeteae	Probe /56-FAM/ACGACGGCG/ZEN/GTCTCAGTGGTG/3IABkFQ/ /56-FAM/ACGACGGCG/ZEN/GTCTCAGTGGTG/3IABkFQ/	Samples 325/414 507/584,
	tg			510/584, 532/584
AAVS1_1077 AAVS1_3786	ggaacggggctcagtct ggcaagcttacatcgag	tectegecettgeteae gaggaggeceteatetg	/56-FAM/ACCACCGCG/ZEN/GTCTCCGTCGT/3IABkFQ/ /56-FAM/ACGACGGCG/ZEN/GTCTCAGTGGTG/3IABkFQ/	1077/1154 3786/3903
ACTB	atec acactgtgcccatetac	gcg aatgtcacgcacgatttc	/5HEX/CGGGACCTG/ZEN/ACTGACTACCTCAT/3IABkFQ/	3786/3930 all
Fig 3e				
Assay CCR5_B8_2	fwd gccaggacggtcacctt tg	rev teetegeeettgeteae	Probe /56-FAM/CTCAGTGGT/ZEN/GTACGGTACAAACCC/3IABkFQ/	Samples all
ACTB	acactgtgcccatctac	aatgtcacgcacgatttc	/5HEX/CGGGACCTG/ZEN/ACTGACTACCTCAT/3IABkFQ/	all
Fig 3g				
Assay	fwd	rev	Probe	Samples
CCR5_B8_1	gccaggacggtcacctt tg	teetegeeettgeteae	/56-FAM/ACGACGGCG/ZEN/GTCTCAGTGGTG/3IABkFQ/	CCR5 samples
ALB	gtgactgtaattttcttttg	tectegeeettgeteae	/56-FAM/ACGACGGCG/ZEN/GTCTCAGTGGTG/3IABkFQ/	ALÂ
ACTB	cg acactgtgcccatctac	aatgtcacgcacgatttc	/5HEX/CGGGACCTG/ZEN/ACTGACTACCTCAT/31ABkFQ/	samples all
ED Fig 6a				
Assay CCR5_B8_2	fwd gccaggacggtcacctt tg	rev teetegeeettgeteae	Probe /56-FAM/CTCAGTGGT/ZEN/GTACGGTACAAACCC/3IABkFQ/	Samples all
ACTB	acactgtgcccatctac	aatgtcacgcacgatttc	/5HEX/CGGGACCTG/ZEN/ACTGACTACCTCAT/3IABkFQ/	all
ED Fig 6c				
Assay AAVS1 1077	fwd ggaacggggctcagtct	rev tectegecettgeteac	Probe /56-FAM/ACCACCGCG/ZEN/GTCTCCGTCGT/3IABkFQ/	Samples all
CCR5_B8_1	gccaggacggtcacctt tg	tectegecettgeteae	/56-FAM/ACGACGGCG/ZEN/GTCTCAGTGGTG/3IABkFQ/	attB
CCR5_B8_2	gccaggacggtcacctt tg	tectegeeettgeteae	/56-FAM/CTCAGTGGT/ZEN/GTACGGTACAAACCC/3IABkFQ/	attB-GA
CCR5_B8_3	gccaggacggtcacctt	tectegeeettgeteae	/56-FAM/ACCACCGCG/ZEN/GTCTCCGTCGT/3IABkFQ/	attP
CCR5_B8_4	tg gccaggacggtcacctt	tectegecettgeteac	/56-FAM/CTCCGTCGT/ZEN/CAGGATCATCCGT/3IABkFQ/	attP-GA
ACTB	tg acactgtgcccatctac	aatgtcacgcacgatttc	/5HEX/CGGGACCTG/ZEN/ACTGACTACCTCAT/3IABkFQ/	all

# **Supplementary Table 4**. Sequence of recoded exonic *PAH* sequences

Nucleotides labeled in red indicate positions where silent mutations were introduced.

Spacer 1	Spacer 2	Recoded allele product
2.1	2.2	GAAGACACTGCAATCAGAACGGCGCTATCTCTCTGATCTTCAGCCTGAAGGAAG
		GAAGGTATTGCGCTTATTTGAG
4.1	4.3	TTCTCTGTGTTTCAGTGCC <mark>G</mark> TGGTT <mark>T</mark> CCAC <mark>GG</mark> AC <mark>A</mark> ATTCA <mark>G</mark> GA <mark>A</mark> CTTGATAGGTTCGCTAATCA <mark>A</mark> ATCTTGT
		CCTACGGAGCCGAACTTGACGCTGATCATCCTGTGAGTCCATGGCCCG
4.1	4.4	TTCTCTGTGTTTCAGTGCC <mark>G</mark> TGGTT <mark>T</mark> CCAC <mark>GG</mark> AC <mark>A</mark> ATTCA <mark>G</mark> GA <mark>A</mark> CTTGATAGGTTCGCTAATCA <mark>A</mark> ATCTTGT
		CCTACGGAGCCGAACTTGACGCTGATCATCCTGTGAGTCCATGGCCCGTAG
4.2	4.3	CCCAAGAACCATTCAAGA <mark>A</mark> CT <mark>T</mark> GA <mark>T</mark> AGGTTCGCTAATCA <mark>A</mark> AT <mark>CTTGTC</mark> CTA <mark>C</mark> GGAGCCGAACTTGACGCTG
		ATCATCCTGTGAGTCCATGGCCCG
4.2	4.4	CCCAAGAACCATTCAAGA <mark>A</mark> CT <mark>T</mark> GA <mark>T</mark> AGGTTCGCTAATCA <mark>A</mark> AT <mark>CTTGTC</mark> CTA <mark>C</mark> GGAGCCGAACTTGACGCTG
		A <mark>TCATCCTGTGAGTCCATGGCCCGTAG</mark>
4.2	4.5	CCCAAGAACCATTCAAGA <mark>A</mark> CT <mark>T</mark> GA <mark>T</mark> AG <mark>GTTCGCT</mark> AATCA <mark>A</mark> AT <mark>CTTGTC</mark> CTA <mark>C</mark> GGAGCCGAACTTGACGCTG
		A <mark>TCATCCTGTGAGTCCATGGCCCGTAGGATGAGATTT</mark>
5.1	5.2	CAGGTGTCTCTTTTCTCCTAGGG <mark>C</mark> TT <mark>C</mark> AA <mark>G</mark> GACCCCGTTTATCGCGCCCGCCGTAAGCAATTCGCCGATATT
		GCATATAATTATCGCCAGTAAGTCTGCCTTGCTT
7.1	7.5	CTTTTCATCCCAGCTTGTACTGGCTTTCGACTCCGCCCCGTTGCCGGGCTCTTGAGCAGTAGAGACTTTCTGG
		GGGGTCTCGCCTTCCGAGTCTTCCACT
7.1	7.6	CTTTTCATCCCAGCTTGTACTGGCTTTCGACTCCGCCCCGTTGCCGGGCTCTTGAGCAGTAGAGACTTTCTGG
		GGGGTCTCGCATTCCGCGTGTTTCATTGCACACAGTACATCAGAC
7.2	7.5	TGGTTTCCGCCTCCGACC <mark>CGTT</mark> GCCGG <mark>G</mark> CT <mark>CTTGAGCAGTAGAGACTTTC</mark> TGGGGGGTCTCCGCCTTCCGAGT
		CTTCCACT
7.2	7.6	TGGTTTCCGCCTCCGACCCGTTGCCGGGCTCTTGAGCAGTAGAGACTTTCTGGGGGGGTCTCGCATTCCGCGT
		GTTTCATTGCACACAGTACATCAGAC
7.2	7.7	TGGTTTCCGCCTCCGACC <mark>CGTT</mark> GCCGG <mark>G</mark> CT <mark>CTTGAGCAGTAGAGACTTTC</mark> TGGGGGGTCTCGC <mark>A</mark> TTCCGCGT
		GTTTCATTGTACCCAGTATATTAGGCATGGTTCAAAACCGATGTACACACCAGAA
7.3	7.6	GGCTGGCCTGCTTTCCT <mark>GTAGAGACTTTC</mark> TGGG <mark>G</mark> GGTCTCGCATTCCG <mark>C</mark> GTGTTTCATTGCACACAGTACAT
		CAGAC
7.3	7.7	GGCTGGCCTGCTTTCCTGTAGAGACTTTCTGGGGGGGTCTCGCATTCCGCGTGTTTCATTGTACCCAGTATATT
		AGGCATGGTTCAAAACCGATGTACACACCAGAA
7.3	7.8	GGCTGGCCTGCTTTCCTGTAGAGACTTTCTGGGGGGGTCTCGCATTCCGCGTGTTTCATTGTACCCAGTATATT
	0.0	AGGCATGGTTCAAAACCGATGTACACACCAGAACCGTGAGTACTGTCC
9.1	9.2	TTCCCCCAATTACAGGAGATCGGTCTGGCAAGCCTGGGAGCACCAGACGAGTATATAGAGAAACTTGCTAC
0.1	0.2	AGTAAGTCCCTTCTCCC
9.1	9.3	TTCCCCCAATTACAGGAGATCGGTCTGGCAAGCCTGGGAGCACCAGACGAGTATATAGAGAAACTTGCTAC AGTAAGTCCCTTCTCCCTGGGTGGATGGT
10.2	10.3	CCAGATTTACTGGTTTACCGTCGAATTCGGATTGTGTAAGCAGGGTGATAGCATTAAAGCCTACGGAGCAG
10.2	10.3	GTTTGCTCTCATCCTTTGGTGAATTCGGATTGTGTAAGCAGGGTGATAGCATTAAAGCCTACGGAGCAG
11.1	11.4	GAAGCCAAAGCTTCTCCCACTCGAACTCGAAAAGACTGCAATTCAGAACTATACAGTGACAGAATTTCAAC
11.1	11.4	CATTGTATTACGTGGCAGAGAGTT
11.2	11.4	AAAGCTTCTCCCCCTGGAACTCGAAAAGACTGCAATTCAGAACTATACAGTGACAGAATTTCAACCATTGT
11.2	11.4	ATTACGTGGCAGAGAGTT
12.2	12.4	ACTTTGCTGCCACAATACCAAGACCATTTAGCGTGAGATATGATCCTTATACACAGCGCATCGAAGTGCTC
12.2	14.7	GATAACACTCAACAGCTTAAGATTTTGGCTG
12.3	12.5	GCTACGACCCATACACCCAGCGCATCGAAGTGCTCGATAACACTCAACAATTGAAGATCCTCGCAGACAGT
14.5	14.5	ATCAACAGTAAGTAATTTACAC
		ATOMERS IN THE ACT

# **Supplementary Table 5**. TwinPE-mediated off-target genome editing.

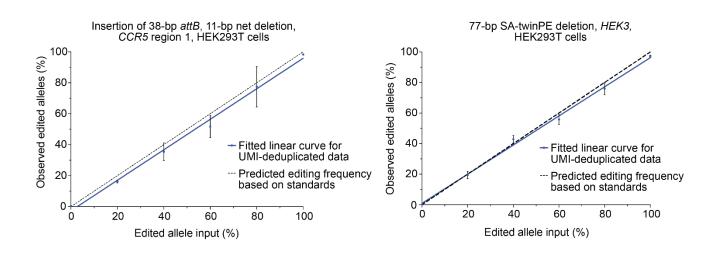
twinPE-mediated % editing at HEK3 on-target site and off-target sites

HEK3		standerd pegRNAs				enhanced pegRNAs			
	Untreated	SA (Δ77 nt)	SA (Δ56 nt)	HA (Δ64 nt)	PD (Δ90 nt)	SA (Δ77 nt)	SA (Δ56 nt)	HA (Δ64 nt)	PD (Δ90 nt)
on-target site	<0.1	14.8	18.8	11.7	40.4	29.6	28.5	29.5	59.5
off-target site 1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
off-target site 2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
off-target site 3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
off-target site 4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

# Supplementary Note 1. Analysis of editing quantification

To assess quantification bias, we applied unique molecular identifiers (UMIs) to index individual allele copies using linear amplification followed by bead-based purification, PCR amplification, and Illumina MiSeq amplicon sequencing (see method section for details) similar to the method used by Choi, et al<sup>1</sup> and Bolukbasi, et al<sup>2</sup>. Reads containing identical UMIs are first aligned and then collapsed (deduplicated) to a single consensus sequence. This workflow allows for quantification of allele frequencies based on UMI counts instead of total read counts, which may be subject to PCR amplification bias based on sequence composition or amplicon size differences between different allele products.

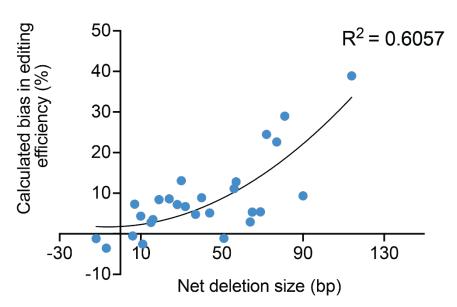
To ensure the UMI-sequencing protocol can faithfully quantify the editing efficiency, we mixed chemically synthesized gene fragments (IDT) replicating either an edited or wild-type allele for the given edits (insertion of *attB* at *CCR5* or 77-nt deletion at *HEK3*) to simulate 0%, 20%, 40%, 60%, 80%, and 100% editing efficiencies before diluting the mixed standards to 2000 genetic copies/µL, which is the estimated allele copy number amplified from our cell editing experiments. Diluted standards were then subjected to UMI barcoding, MiSeq analysis, and deduplication. We plotted the percentage of observed edited alleles from three independent biological replicates after sequencing and UMI deduplication against the expected edited allele percentage based on the input allele fraction.



Next, we prepared libraries of twinPE-edited samples from *CCR5* region 1 (15 samples), *CCR5* region 2 (7 samples), *HEK3* (4 samples), and *IDS* (1 sample). By comparing the editing efficiency calculated from total reads and the editing efficiency calculated from reads deduplicated based on UMIs, we estimated the bias in editing efficiency quantification

using the linear amplification with UMIs as the "true" editing efficiency. When plotting quantification bias vs. absolute size difference between the starting and edited alleles (net deletion size), we observed a positive correlation between bias and twinPE-induced deletion size. Although bias in this workflow could still exist at the linear amplification stage due to differences in sequence composition at the target DNA locus, this bias does not propagate over the course of repeated PCR cycles and should therefore more accurately represent the true editing efficiency in twinPE editing experiments analyzed by amplicon sequencing.

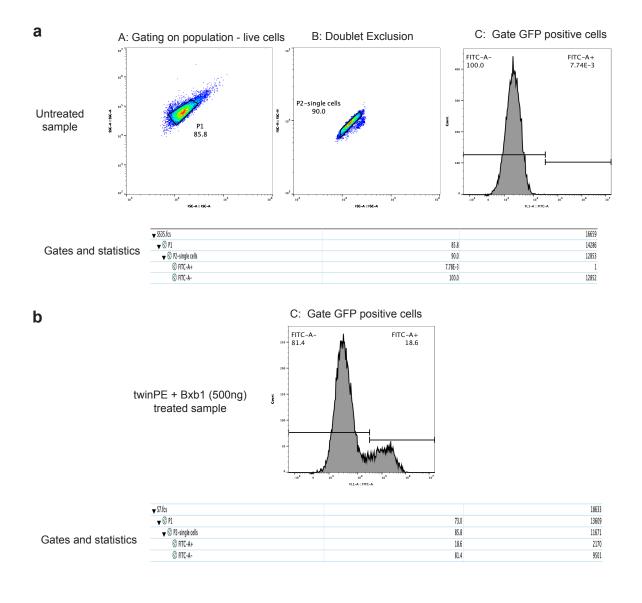




Each point in the above graph represents the mean value of bias calculated from three independent biological replicates. The percentage of bias in editing efficiency was defined by the following equation:  $100 \times (A - B) \div B$ , where "A" represents the editing efficiency calculated from total read counts without UMI-based deduplication, and "B" represents the editing efficiency calculated after UMI-based deduplication. For example, if the non-deduplicated editing efficiency is 60% and the deduplicated editing efficiency is 46%, the calculated bias is 30%, i.e., the deduplicated editing efficiency is 1.3-fold lower than the non-deduplicated editing efficiency. The bias in editing efficiency is plotted above as a function of the net deletion between the starting and edited alleles, which shows a positive correlation (a second-order polynomial trend line,  $R^2 = 0.6057$ ).

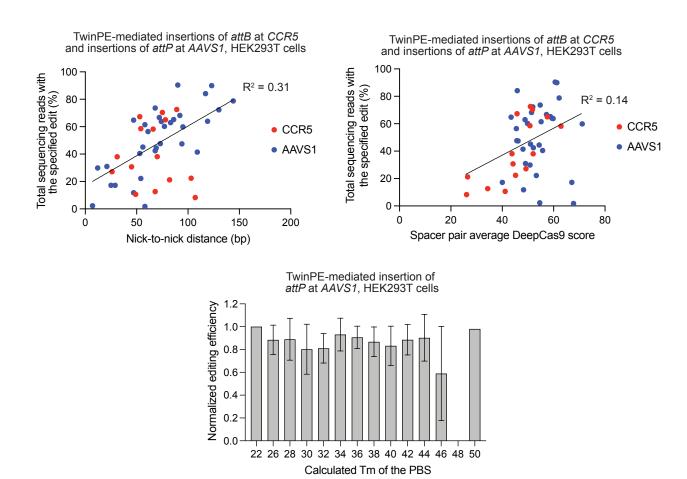
# Supplementary Note 2. Representative plot of FACS gating for GFP reporter assay

25,000 HEK293T stable GFP reporter cells were seeded into 48-well poly-D-lysine coated plates (Corning). 16-24 h post-seeding, cells were transfected with 1uL of Lipofectamine 2000 (Thermo Fisher Scientific) using the protocol described in the methods section and 750 ng of PE2, 250 ng AAVS1 targeting pegRNAs (62.5 ng each), and Bxb1 plasmid DNA (100 ng, 200 ng, 500 ng, or 1000 ng). The untreated and twinPE+Bxb1 treated cells were cultured for 72 hours, and then collected for flow cytometry analysis. HEK293T stable GFP reporter cells were first gated (Gate A) based on forward (FSC-A) and side scattering (SSC-A) to remove dead cells and other debris. A second gate (Gate B) was used to select singlets based on FSC-H and FSC-A. Finally, GFP positive and GFP negative cells were gated (Gate C) and analyzed via FITC channel.



# Supplementary Note 3. Analysis of twinPE design principles

To identify design principles that lead to efficient twinPE editing, we analyzed our dataset of attP insertions at AAVS1 and attB insertions at CCR5. For each spacer pair, we calculated nick-to-nick distances between predicted pegRNA-induced nick sites, the DeepCas9 score³ for each spacer, and the predicted  $T_m$  of the pegRNA primer binding sequence (PBS) for AAVS1. For comparing nick-to-nick distances and DeepCas9 scores, the highest efficiency pegRNA pair for each spacer pair was chosen for analysis (*i.e.*, the optimal individual pegRNAs were used). For analyzing the influence of predicted spacer activities, the average of the individual DeepCas9 scores for each spacer was used. For comparing predicted  $T_m$  values for PBS variants, the editing efficiency of each pegRNA was normalized to the maximum editing achieved within the spacer pair group. The editing efficiency for a given PBS variant was then averaged across the three paired pegRNA editing efficiencies (each experiment with the paired spacer).  $T_m$  was calculated according to the following formula⁴:  $T_m = 4N_{G-C} + 2N_{A-T}$ .



Although efficient targeting of both DNA protospacers is likely necessary for achieving efficient twinPE, we observed only weak correlations between *in silico* predictions of Cas9 spacer activity and observed twinPE editing efficiencies (top right panel). This poor correlation could arise from other determinants of twinPE efficiency beyond the protospacer, including RT template and PBS choice. While PBS optimization was important for high editing efficiency at many sites, we did not observe an optimal PBS melting temperature across the pegRNA designs in this study (bottom panel). A correlation between prime editing efficiency and the distance between pegRNA-induced nicks was observed (top left panel), which may suggest an optimal spacing of 50 to 100 bp, although many exceptions exist.

# Supplementary Note 4. Discussion of other targeted integration methods

TwinPE and Bxb1-mediated recombination offer advantages over other approaches. The serine integrase phiC31<sup>5</sup> and fusions of zinc fingers, TALEs, or dCas9 to the catalytic domain of Gin recombinase<sup>6-9</sup> have been used to integrate or excise DNA at endogenous pseudo-sites in the human genome, but the efficiency of these sequence manipulations has generally been low and, more importantly, the extensive sequence preferences inherent to these recombinases limit the number of targetable loci to a minute fraction of pseudo-sites in the genome. The programmable integration of attachment sites by twinPE overcomes this challenge by enabling insertion of cognate recombinase recognition sequences at any PEtargetable locus.

Compared to nuclease-based methods, the twinPE and recombinase approach avoids the generation of DSBs, which typically lead to uncontrolled mixtures of by products<sup>10</sup>, and can also lead to chromosomal rearrangements<sup>11</sup>, chromothripsis<sup>12</sup>, large deletions<sup>13-15</sup>, and p53 activation<sup>16-18</sup>. Integration orientation using twinPE and Bxb1 recombinase is strictly controlled by the directionality of the *attB* and *attP* sequences<sup>19</sup>, in contrast to uncontrolled integration orientation using homology-independent repair<sup>20</sup>. Methods that use HDR also enable control of sequence orientation, and can achieve efficiencies on the order of 5-10% without drug selection or suppression of NHEJ<sup>21-23</sup>, but HDR is less efficient than NHEJ in most cell types and typically requires DSBs<sup>24,25</sup>. Methods have also been developed for making targeted gene-sized insertions through paired nicking of the genome and a donor cassette<sup>26,27</sup>. These approaches do not require double strand breaks, but remain reliant on HDR and supportive cell types<sup>27</sup>.

# **Supplementary Sequences 1**. Sequences of plasmid donor DNA sequences harboring Bxb1 recombination sites

att site: highlighted in yellow

Promoter-less EGFP: highlighted in green

EF1a promoter: underlined PuroR: highlighted in red BFP: highlighted in blue KanR: highlighted in grey

### attB-Puro-GA donor DNA:

gatgccagctcattcctcccactcatgatctatagatcccccgggctgcaggaattctacccactctgtcgataccccaccgagacc ccattggggccaatacgcccgcgtttcttccttttccccacccccacccccaagttcgggtgaaggcccagggctcgcagccaacg tcggggcggcaagcttacatcgagatccc<mark>ggcttgtcgacgacggcggactccgtcgtcaggatcat</mark>cc<mark>gtgagcaagggcga</mark> ggagetgtteaceggggtggtgeceateetggtegagetggaeggegaegtaaaeggeeacaagtteagegtgteeggegagg gcgagggcgatgccacctacggcaagctgaccctgaagttcatctgcaccaccggcaagctgcccgtgccctggcccaccctc gtgaccaccctgacctacggcgtgcagtgcttcagccgctaccccgaccacatgaagcagcacgacttcttcaagtccgccatgc ccgaaggctacgtccaggagcgcaccatcttcttcaaggacgacggcaactacaagacccgcgcgaggtgaagttcgaggg cgacaccetggtgaaccgcatcgagetgaagggcatcgaettcaaggaggaeggcaacatcetggggcacaagetggagtac aactacaacagccacaacgtctatatcatggccgacaagcagaagaacggcatcaaggtgaacttcaagatccgccacaaca tcgaggacggcagcgtgcagctcgccgaccactaccagcagaacacccccatcggcgacggccccgtgctgctgcccgaca accactacctgagcacccagtccgccctgagcaaagaccccaacgagaagcgcgatcacatggtcctgctggagttcgtgacc gccgccgggatcactctcggcatggacgagctgtacaagagcggcctgaggagcagagcccaggcgagcaacagcgccgt gtcggcaattgaaccggtgcctagagaaggtggcgcggggtaaactgggaaagtgatgtcgtgtactggctccgcctttttcccga gggtgggggagaaccgtatataagtgcagtagtcgccgtgaacgttctttttcgcaacgggtttgccgccagaacacaggtaagtg ccqtqtqtqqttcccqcqqqcctqqccttttacqqqttatqqcccttqcqtqccttqaattacttccacctqqctqcaqtacqtqattctt gatcccgagcttcgggttggaagtggggagagttcgaggccttgcgcttaaggagccccttcgcctcgtgcttgagttgaggcc tggcctgggcgctggggcgcgcgcgtgcgaatctggtggcaccttcgcgcctgtctcgctgctttcgataagtctctagccatttaaa atttttgatgacctgctgcgacgctttttttctggcaagatagtcttgtaaatgcgggccaagatctgcacactggtatttcggtttttggg ccgcgggcgacggggcccgtgcgtcccagcgcacatgttcggcgaggcggggcctgcgagcgcggccaccgagaatc ggacggggtagtctcaagctggccggcctgctctggtgcctggcctcgcgccgcgtgtatcgccccgccctgggcggcaagg ctggcccggtcggcaccagttgcgtgagcggaaagatggccgcttcccggccctgctgcagggagctcaaaatggaggacgc ggcgctcgggagagcgggggggggggggtcacccacacaaaggaaaagggcctttccgtcctcagccgtcgcttcatgtgactcca gatggagtttccccacactgagtgggggagactgaagttaggccagcttggcacttgatgtaattctccttggaatttgccctttttga atttggatcttggttcattctcaagcctcagacagtggttcaaagtttttttcttccatttcaggtgtcgtgagctagcccaccatgaccga gtacaageceaeggtgegeetegeeaeeeggaegaegteeeeegggeegtaegeaeeetegeegeegttegeegaetaee ccgccacgcgccacaccgtcgacccggaccgccacatcgagcgggtcaccgagctgcaagaactcttcctcacgcgcgtcgg getegacateggeaaggtgtgggtegeggaegaeggegeeggtggeggtetggaceaegeeggagagegtegaageggg ggcggtgttcgccgagatcggcccgcgcatggccgagttgagcggttcccggctggccgcgcagcaacagatggaaggcctcc tggcgccgcaccggcccaaggagcccgcgtggttcctggccaccgtcggcgtctcgcccgaccaccagggcaagggtctggg cagegeegtegtgeteeceggagtggaggeggeegagegeeggggtgeeegeetteetggagaeeteegegeeeegeaac ctccccttctacgagcggctcggcttcaccgtcaccgccgacgtcgaggtgcccgaaggaccgcgcacctggtgcatgacccgc aagcccggtgccggatcgggagagggcagaggaagtctgctaacatgcggtgacgtcgaggagaatcctggcccaccggtcg ccaccagcgagctgattaaggagaacatgcacatgaagctgtacatggagggcaccgtggacaaccatcacttcaagtgcaca tccgagggcgaaggcaagccctacgagggcacccagaccatgagaatcaaggtggtcgagggcggccctctccccttcgcctt cgacatectggetactagettectetaeggeageaagacetteateaaceaeaceeagggeateceegaettetteaageagteett

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# attB-Puro donor DNA:

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# attP Factor IX donor (the vector backbone is pMC.BESPX-MCS1 from System Biosciences)

attP: highlighted in yellow

Factor IX intron 1: highlighted in grey

Factor IX exons 2-8 CDS: highlighted in green

Factor IX exon 8 3'UTR: <u>underlined</u> bGH poly(A) signal: <u>highlighted in cyan</u>

AGGTTTGTCTGGTCAACCACCGCGGTCTCAGTGGTGTACGGTACAAACCTTTTCTTAAG AGATGTAAAATTTTCATGATGTTTTCTTTTTTGCTAAAACTAAAGAATTATTCTTTTACATTT CAGTTTTTCTTGATCATGAAAACGCCAACAAAATTCTGAATCGGCCAAAGAGGTATAATT TGTAGTTTTGAAGAAGCACGAGAAGTTTTTGAAAACACTGAAAGAACAACTGAATTTTGG AAGCAGTATGTTGATGGAGATCAGTGTGAGTCCAATCCATGTTTAAATGGCGGCAGTTG CAAGGATGACATTAATTCCTATGAATGTTGGTGTCCCTTTGGATTTGAAGGAAAGAACTG TGAATTAGATGTAACATGTAACATTAAGAATGGCAGATGCGAGCAGTTTTGTAAAAATAG TGCTGATAACAAGGTGGTTTGCTCCTGTACTGAGGGATATCGACTTGCAGAAAACCAGA AGTCCTGTGAACCAGCAGTGCCATTTCCATGTGGAAGAGTTTCTGTTTCACAAACTTCTA AGCTCACCCGTGCTGAGACTGTTTTTCCTGATGTGGACTATGTAAATTCTACTGAAGCTG AAACCATTTTGGATAACATCACTCAAAGCACCCAATCATTTAATGACTTCACTCGGGTTGT TGGTGGAGAAGATGCCAAACCAGGTCAATTCCCTTGGCAGGTTGTTTTGAATGGTAAAG TTGATGCATTCTGTGGAGGCTCTATCGTTAATGAAAAATGGATTGTAACTGCTGCCCACT GTGTTGAAACTGGTGTTAAAATTACAGTTGTCGCAGGTGAACATAATATTGAGGAGACAG AACATACAGAGCAAAAGCGAAATGTGATTCGAATTATTCCTCACCACAACTACAATGCAG CTATTAATAAGTACAACCATGACATTGCCCTTCTGGAACTGGACGAACCCTTAGTGCTAA ACAGCTACGTTACACCTATTTGCATTGCTGACAAGGAATACACGAACATCTTCCTCAAAT TTGGATCTGGCTATGTAAGTGGCTGGGGAAGAGTCTTCCACAAAGGGAGATCAGCTTTA GTTCTTCAGTACCTTAGAGTTCCACTTGTTGACCGAGCCACATGTCTTCGATCTACAAAG TTCACCATCTATAACAACATGTTCTGTGCTGGCTTCCATGAAGGAGGTAGAGATTCATGT CAAGGAGATAGTGGGGGACCCCATGTTACTGAAGTGGAAGGGACCAGTTTCTTAACTGG AATTATTAGCTGGGGTGAAGAGTGTGCAATGAAAGGCAAATATGGAATATATACCAAGGT **ATCCCGGTATGTCAACTGGATTAAGGAAAAAACAAAGCTCACT**TAATGAAAGATGGATTT ATCTTTTGTTAGATTTGAATATACATTCTATGATCATTGCTTTTTCTCTTTACAGGGGAG AATTTCATATTTTACCTGAGCAAATTGATTAGAAAATGGAACCACTAGAGGAATATAATGT GTTAGGAAATTACAGTCATTTCTAAGGGCCCAGCCCTTGACAAAATTGTGAAGTTAAATT TTATTAGTTCTGTATACAGTACAGGATCTTTGGTCTACTCTATCACAAGGCCAGTACCAC ACTCATGAAGAAGAACACAGGAGTAGCTGAGAGGCTAAAACTCATCAAAAACACTACT CCTTTTCCTCTACCCTATTCCTCAATCTTTTACCTTTTCCAAATCCCAATCCCCAAATCAG TTTTTCTCTTTCTTACTCCCTCTCTCCCTTTTACCCTCCATGGTCGTTAAAGGAGAGATGG GGAGCATCATTCTGTTATACTTCTGTACACAGTTATACATGTCTATCAAACCCAGACTTGC TTCCGTAGTGGAGACTTGCTTTTCAGAACATAGGGATGAAGTAAGGTGCCTGAAAAGTTT ACACATATAATGGAAGCAATAAGCCATTCTAAGAGCTTGTATGGTTATGGAGGTCTGACT <u>AGGCATGATTTCACGAAGGCAAGATTGGCATATCATTGTAACTAAAAAAGCTGACATTGA</u> 

# Supplementary Sequence 2. Sequence of codon-optimized Bxb1 plasmid

CMV enhancer/promoter: highlighted in grey

SP6 promoter: underlined

Codon-optimized Bxb1: highlighted in green

SV40 poly(A): highlighted in cyan

CGTTACATAACTTACGGTAAATGGCCCGCCTGGCTGACCGCCCAACGACCCCCGCCCA TTGACGTCAATAATGACGTATGTTCCCATAGTAACGCCAATAGGGACTTTCCATTGACGT CAATGGGTGGAGTATTTACGGTAAACTGCCCACTTGGCAGTACATCAAGTGTATCATATG CCAAGTACGCCCCTATTGACGTCAATGACGGTAAATGGCCCGCCTGGCATTATGCCCA GTACATGACCTTATGGGACTTTCCTACTTGGCAGTACATCTACGTATTAGTCATCGCTAT TACCATGGTGATGCGGTTTTGGCAGTACATCAATGGGCGTGGATAGCGGTTTGACTCAC CAACGGGACTTTCCAAAATGTCGTAACAACTCCGCCCCATTGACGCAAATGGGCGGTAG GCGTGTACGGTGGGAGGTCTATATAAGCAGAGCTCGTTTAGTGAACCGTCAGATCGCCT GGAGGCGCCATCCACGCTGTTTTGACCTCCATAGAAGACACCGGGACCGATCCAGCCT CCGGACTCTAGCCTAGGCTTTTGCAAAAAGCTATTTAGGTGACACTATAGAAGGTACGC CTGCAGGTACCGGTCCGGAATTCGCCCTTATGATGCGGGCCCTGGTTGTGATTAGACTG TCCAGAGTGACCGACGCCACCACCTCACCTGAGAGACAGTTGGAGAGCTGCCAGCAGC TGTGCGCCCAGCGCGGCTGGGACGTGGTGGGCGTGGCCGAGGACCTGGACGTGTCCG CGAGGAACAGCCTTTCGATGTGATCGTGGCCTACAGAGTGGACCGGCTGACCAGAAGC ATCCGGCACCTGCAACAGCTGGTGCACTGGGCCGAGGATCACAAAAAGCTGGTGGTCT CTGCTACAGAGGCCCACTTCGACACAACCACACCTTTCGCCGCTGTGGTGATCGCCCTG ATGGGGACCGTGGCCCAGATGGAACTCGAGGCCATCAAGGAACGGAACAGATCTGCCG CCCACTTTAACATCAGAGCCGGCAAGTACAGAGGAAGCCTGCCACCTTGGGGCTACCT GATCCTGGAGGTGTACCACAGAGTGGTCGACAACCACGAGCCCCTGCATCTGGTGGCT CATGATCTGAATAGAAGGGGCGTGCTGAGCCCTAAAGACTACTTCGCTCAGCTGCAGG GCAGAGAACCCCAGGGCAGAGAGTGGAGCGCCCCCCCCCTGAAGAGAAGCATGATCA GCGAGGCCATGCTGGGATACGCCACCCTGAACGGCAAAACCGTGCGGGACGATGATG GAGCCCCTCTGGTGCGGGCAGAGCCTATCCTAACCCGCGAGCAGCTGGAAGCTCTGAG AGCCGAGCTGGTCAAGACATCTAGAGCCAAACCTGCTGTGTCCACCCCTAGCCTGCTG CTGCGGGTGCTGTTCTGTGCCGTGTGCGGTGAACCTGCTTATAAGTTCGCCGGCGGCG GCAGAAAGCACCCCAGATACCGGTGCAGATCTATGGGCTTCCCCAAGCACTGTGGCAA CGGCACCGTGGCCATGGCCGAGTGGGATGCTTTTTGCGAGGAACAAGTGCTGGACCTG GAACTGGCTGAAGTGAACGCCGAGCTGGTGGACCTCACCAGCCTCATCGGAAGCCCGG CCTACCGGGCCGGCTCTCCACAGAGAGAAGCCCTGGATGCCCGTATCGCCGCCCTGG CCGCTAGGCAGGAGGAACTGGAAGGCCTGGAAGCCAGACCAAGCGGCTGGGAGTGGA GAGAGACAGGACAGCGGTTCGGAGATTGGTGGCGGGAACAGGATACAGCCGCAAAGA ACACCTGGCTGAGAAGCATGAACGTGCGGCTGACATTCGACGTGAGAGGCGGACTGAC CAGAACAATCGACTTCGGCGACCTGCAGGAGTACGAGCAACACCTGAGACTGGGCAGC GTGGTCGAGCGGCTGCACACAGGCATGAGCTAGAAGGGCGAATTCCCGGGTCGACGA GCTCACTAGCTTGGGATCTTTGTGAAGGAACCTTACTTCTGTGGTGTGACATAATTGGAC AAACTACCTACAGAGATTTAAAGCTCTAAGGTAAATATAAAATTTTTAAGTGTATAATGTG TTAAACTAGCTGCATATGCTTGCTGCTTGAGAGTTTTGCTTACTGAGTATGATTTATGAAA ATATTATACACAGGAGCTAGTGATTCTAATTGTTTGTGTATTTTAGATTCACAGTCCCAAG

GCTCATTTCAGGCCCCTCAGTCCTCACAGTCTGTTCATGATCATAATCAGCCATACCACA
TTTGTAGAGGTTTTACTTGCTTTAAAAAACCTCCCACACCTCCCCCTGAACCTGAAACAT
AAAATGAATGCAATTGTTGTTTACTTTATTGCAGCTTATAATGGTTACAAATAAA
GCAATAGCATCACAAATTTCACAAATAAAGCATTTTTTTCACTGCATTCTAGTTGTGGTTT
GTCCAAACTCATCAATGTATCTTATCATGTCTGGATC

**Supplementary Sequence 3**. Sequence of the lentiviral GFP reporter vector (the vector bone is pLVX-EF1a-IRES-Puro from Takara Bio inc.).

LTR: in bold

EF1α promoter: underlined

AAVS1 target sequence: highlighted in yellow

Inverted H2B-EGFP coding sequence: highlighted in green

IRES: highlighted in grey

Puromycin resistance gene: highlighted in red

tagcagaactacaccagggccaggggtcagatatccactgacctttggatggtgctacaagctagtaccagttgag cccggagagagagagtttagagtggaggtttgacagccgcctagcatttcatcacgtggcccgagagctgcatccgg agtacttcaagaactgctgatatcgagcttgctacaagggactttccgctggggactttccagggaggcgtggcctggg cgggactggggagtggcgagccctcagatcctgcatataagcagctgctttttgcctgtactgggtctctctggttagac cagatetgageetgggagetetetggetaactagggaacceaetgettaageeteaataaagettgeettgagtgettea agtagtgtgtgcccgtctgttgtgtgactctggtaactagagatccctcagacccttttagtcagtgtggaaaatctctagc agtggcgcccgaacagggacttgaaagcgaaagggaaaccagaggagctctctcgacgcaggactcggcttgctgaagcgc ataaattaaaacatatagtatgggcaagcagggagctagaacgattcgcagttaatcctggcctgttagaaacatcagaaggctg tagacaaatactgggacagctacaaccatcccttcagacaggatcagaagaacttagatcattatataatacagtagcaaccctct attgtgtgcatcaaaggatagagataaaagacaccaaggaagctttagacaagatagaggaagagcaaaacaaaagtaaga ccaccgcacagcagcggccggccgctgatcttcagacctggaggaggagatatgagggacaattggagaagtgaattatata gcagtgggaataggagctttgttccttgggttcttgggagcagcaggaagcactatgggcgcagcgtcaatgacgctgacggtac aggccagacaattattgtctggtatagtgcagcagcagaacaatttgctgagggctattgaggcgcaacagcatctgttgcaactc acagtctggggcatcaagcagctccaggcaagaatcctggctgtggaaagatacctaaaggatcaacagctcctggggatttgg ggttgctctggaaaactcatttgcaccactgctgtgccttggaatgctagttggagtaataaatctctggaacagatttggaatcacac gacctggatggagtgggacagagaaattaacaattacacaagcttaatacactccttaattgaagaatcgcaaaaccagcaaga aaagaatgaacaagaattattggaattagataaatgggcaagtttgtggaattggtttaacataacaaattggctgtggtatataaa attattcataatgatagtaggaggcttggtaggtttaagaatagtttttgctgtactttctatagtgaatagagttaggcagggatattcac acagagacagatccattcgattagtgaacggatctcgacggtatcgcctttaaaagaaaaggggggattggggggtacagtgca ggggaaagaatagtagacataatagcaacagacatacaaactaaagaattacaaaaacaaattacaaaaatttcaaaattttcg ggtttattacagggacagcagagatccagtttatcgatgagtaattcatacaaaaggactcgccctgccttggggaatcccaggg ggagaagagcatgcgtgaggctccggtgcccgtcagtgggcagagcgcacatcgcccacagtccccgagaagttggggga ggggtcggcaattgaaccggtgcctagagaaggtggcgcggggtaaactgggaaagtgatgtcgtgtactggctccgcctttttcc cgagggtgggggagaaccgtatataagtgcagtagtcgccgtgaacgttctttttcgcaacgggtttgccgccagaacacaggta agtgccgtgtgtgtgttcccgcgggcctggcctctttacgggttatggcccttgcgtgccttgaattacttccacgcccctggctgcagta gttgaggcctggcttgggcctggggccgccgcgtgcgaatctggtggcaccttcgcgcctgtctcgctgctttcgataagtctctag ccatttaaaatttttgatgacctgctgcgacgctttttttctggcaagatagtcttgtaaatgcgggccaagatctgcacactggtatttcg <u>atttttggggccgcgggcgacggggcccgtgcgtcccagcgcacatgttcggcgaggcggggcctgcgagcgggccac</u> cgagaatcggacggggtagtctcaagctggccggcctgctctggtgcctggcctcgcgccgtgtatcgccccgcctgggc ggcaaggctggcccggtcggcaccagttgcgtgagcggaaagatggccgcttcccggccctgctgcagggagctcaaaatgg <u>aggacgcggcgctcgggagagcggggggggtgagtcacccacacaaaggaaaagggcctttccgtcctcag</u>ccgtcgcttcat

<u>gtgactccacggagtaccgggcgccgtccaggcacctcgattagttctcgagcttttggagtacgtcgtctttaggttgggggagg</u> ggttttatgcgatggagtttccccacactgagtgggtggagactgaagttaggccagcttggcacttgatgtaattctccttggaatttg <u>ccctttttgagtttggatcttggttcattctcaagcctcagacagtggttcaaagtttttttcttccatttcaggtgtcgtgagg</u>atctatttccg gtgaattcAACGGGGCTCAGTCTGAAGAGCAGAGCCAGGAACCCCTGTAGGGAAGGGGCA GGAGAGCCAGGGCATGAGATGGTGGACGAGGAAGGGGGACAGGGAAGCCTGAGCG CCTCTCCTGGGCTTGCCAAGGACTCAAACCCAGAAGCCCAGATTACTTGTACAGCTCGT CCATGCCGAGAGTGATCCCGGCGGCGGTCACGAACTCCAGCAGGACCATGTGATCGCG CTTCTCGTTGGGGTCTTTGCTCAGGGCGGACTGGGTGCTCAGGTAGTGGTTGTCGGGC AGCAGCACGGGGCCGTCGCCGATGGGGGTGTTCTGCTGGTAGTGGTCGGCGAGCTGC ACGCTGCCGTCCTCGATGTTGTGGCGGATCTTGAAGTTCACCTTGATGCCGTTCTTCTG CTTGTCGGCCATGATATAGACGTTGTGGCTGTTGTAGTTGTACTCCAGCTTGTGCCCCA GGATGTTGCCGTCCTCCTTGAAGTCGATGCCCTTCAGCTCGATGCGGTTCACCAGGGTG TCGCCCTCGAACTTCACCTCGGCGCGGGTCTTGTAGTTGCCGTCGTCCTTGAAGAAGAT GGTGCGCTCCTGGACGTAGCCTTCGGGCATGGCGGACTTGAAGAAGTCGTGCTGCTTC ATGTGGTCGGGGTAGCGGCTGAAGCACTGCACGCCGTAGGTCAGGGTGGTCACGAGG GTGGGCCAGGGCACGGCCTTGCCGGTGGTGCAGATGAACTTCAGGGTCAGCTTG CCGTAGGTGGCATCGCCCTCGCCCGGACACGCTGAACTTGTGGCCGTTTACGT CGCCGTCCAGCTCGACCAGGATGGGCACCACCCCGGTGAACAGCTCCTCGCCCTTGCT CCTCGGACACGGCGTGCTTGGCCAACTCCCCAGGCAGCAGCAGGCGCACGGCCGTCT GGATCTCCCTGGAGGTGATGGTCGAGCGCTTGTTGTAATGCGCCAGGCGGGAAGCCTC ACCTGCGATGCGCTCGAAAATGTCGTTCACAAAactATTCATGATGCCCATGGCCTTGGA CGAAATGCCGGTGTCAGGGTGGACCTGCTTCAGAACCTTGTACACATAGATGGAATAGC TTCTTGGAGCCCTTTTTCGGGGCGGGAGCAGACTTCGCTGGCTCTGGCATggtggcGGCC GTGCTGACGTCACGGCGCTGCCCCAGGGTGTGCTGGGCAGGTCGCGGGGAGCGCTGG GAAATGGAGTCCATTAGCAGAAGTGGCCCTTGGCCACTTCCAGGAGTCGCTGTGCCCC GATGCACACTGGGAAGTCCGCAGCggatcccgccctctccctcccccccctaacgttactggccgaagccg cttggaataaggccggtgtgcgtttgtctatatgttattttccaccatattgccgtcttttggcaatgtgagggcccggaaacctggccct ccaaaagccacgtgtataagatacacctgcaaaggcggcacaaccccagtgccacgttgtgagttggatagttgtggaaagagt caaatggctctcctcaagcgtattcaacaaggggctgaaggatgcccagaaggtaccccattgtatgggatctgatctggggcctc ggtgcacatgctttacatgtgtttagtcgaggttaaaaaaacgtctaggccccccgaaccacggggacgtggttttcctttgaaaaa cacgatgataagcttgccacaacccacaaggagacgaccttcc<mark>atgaccgagtacaagcccacggtgcgcctcgccacccgc</mark> gacgacgtcccccgggccgtacgcaccctcgccgccgcgttcgccgactaccccgccacgcgccacaccgtcgacccggacc gccacatcgagcgggtcaccgagctgcaagaactcttcctcacgcgcgtcgggctcgacatcggcaaggtgtgggtcgcggac gccgagttgagcggttcccggctggccgcgcagcaacagatggaaggcctcctggcgccgcaccggcccaaggagcccgcg tggttcctggccaccgtcggcgtctcgcccgaccaccagggcaagggtctgggcagcgccgtcgtgctccccggagtggaggc ggccgagcgcgccgggtgcccgccttcctggagacctccgcgccccgcaacctccccttctacgagcggctcggcttcaccg caccgccgacgtcgaggtgcccgaaggaccgcgcacctggtgcatgacccgcaagcccggtgcctagacgcgtctggaaca atcaacctctggattacaaaatttgtgaaagattgactggtattcttaactatgttgctccttttacgctatgtggatacgctgctttaatgc ctttgtatcatgctattgcttcccgtatggctttcattttctcctccttgtataaatcctggttgctgtctctttatgaggagttgtggcccgttgtc aggcaacgtggcgtggtgtgcactgtgtttgctgacgcaacccccactggttggggcattgccaccacctgtcagctcctttccggg ctgacaattccgtggtgttgtcggggaagctgacgtcctttccatggctgctcgcctgtgttgccacctggattctgcgcgggacgtcct 

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