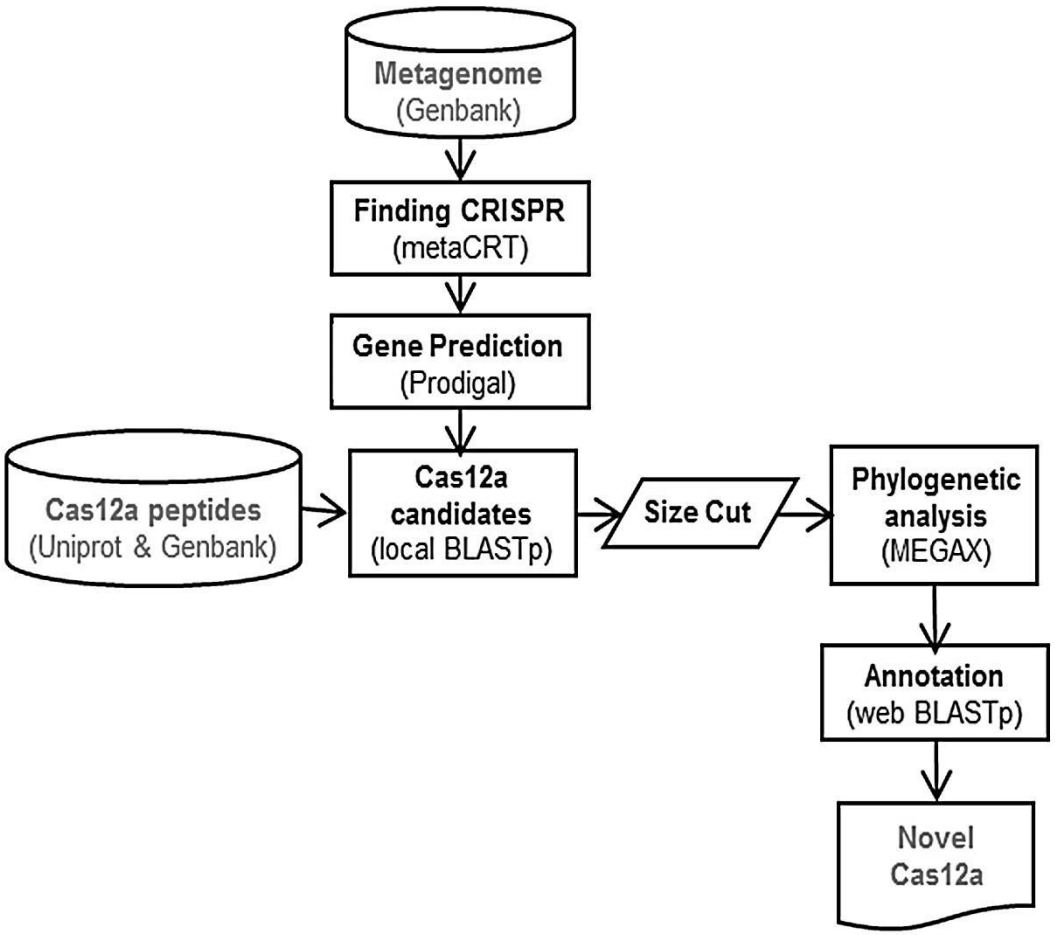
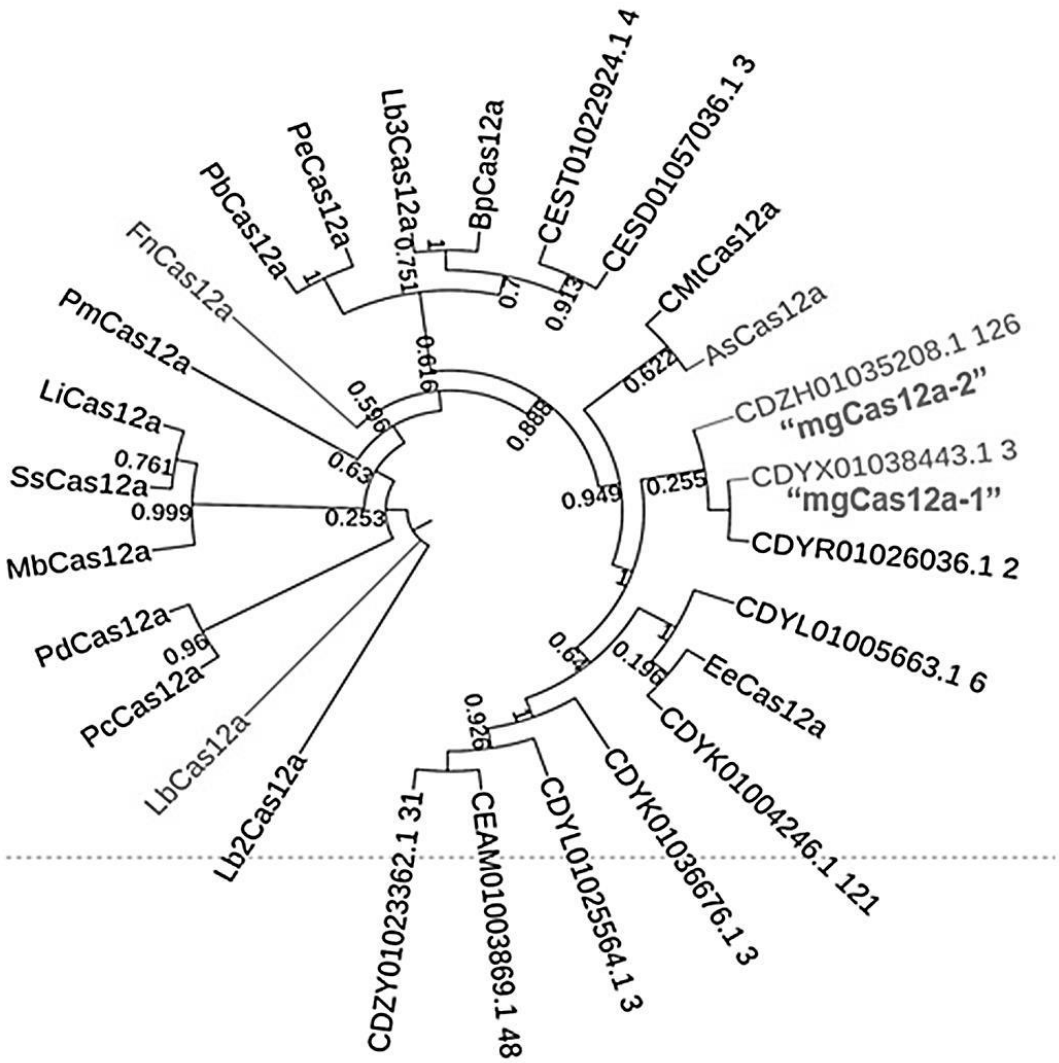
【Drawings】

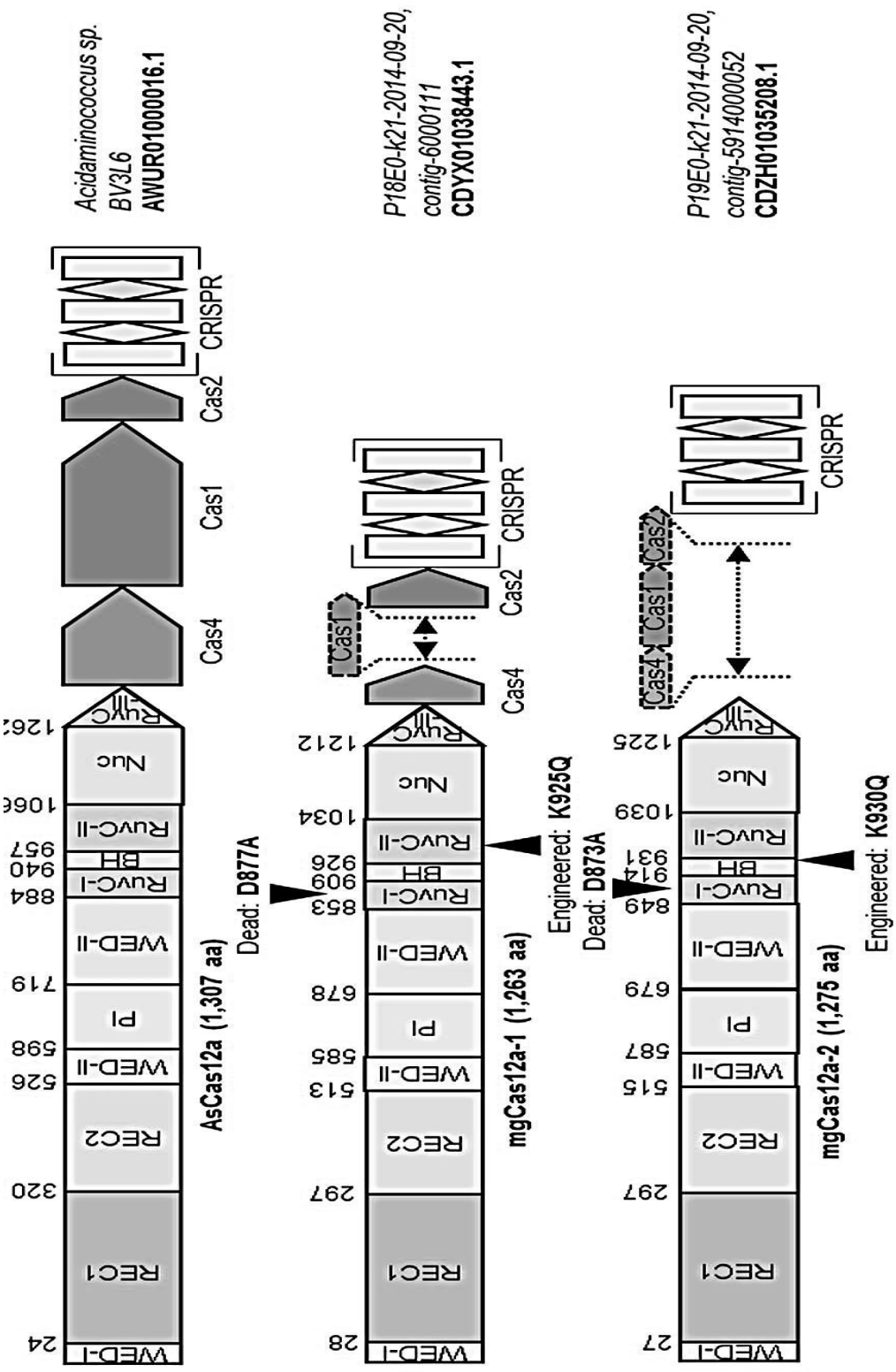
【FIG. 1】



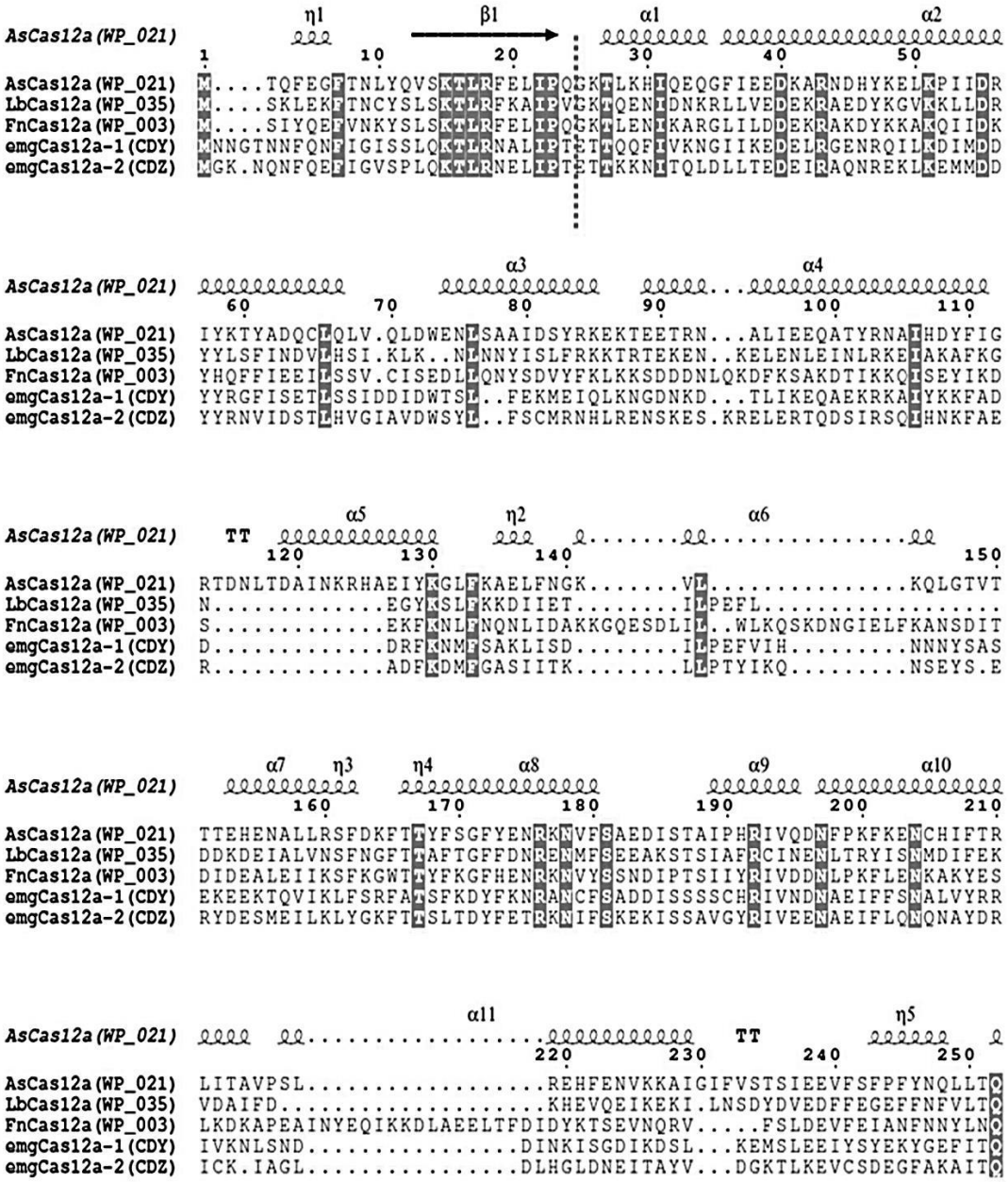
【FIG. 2A】


CEST01022924.1 4
CESD01057036.1 3
BpCas12a
Lb3Cas12a
PeCas12a
PbCas12a
FnCas12a
PmCas12a
LiCas12a
SsCas12a
MbCas12a
PdCas12a
PcCas12a
LbCas12a
Lb2Cas12a
CMICas12a
AsCas12a
CDZH01035208.1 126
"mgCas12a-2"
CDYX01038443.1 3
"mgCas12a-1"
CDYR01026036.1 2
CDYL01005663.1 6
EeCas12a
CDYK01004246.1 121
CDYK01036676.1 3
CDYL01025564.1 3
CEAM01003869.1 48
CDZY01023362.1 31
1
0.751
0.7
0.913
0.622
0.949
0.255
0.888
0.616
0.596
0.63
0.253
0.761
0.999
0.96
0.64
0.198
0.926

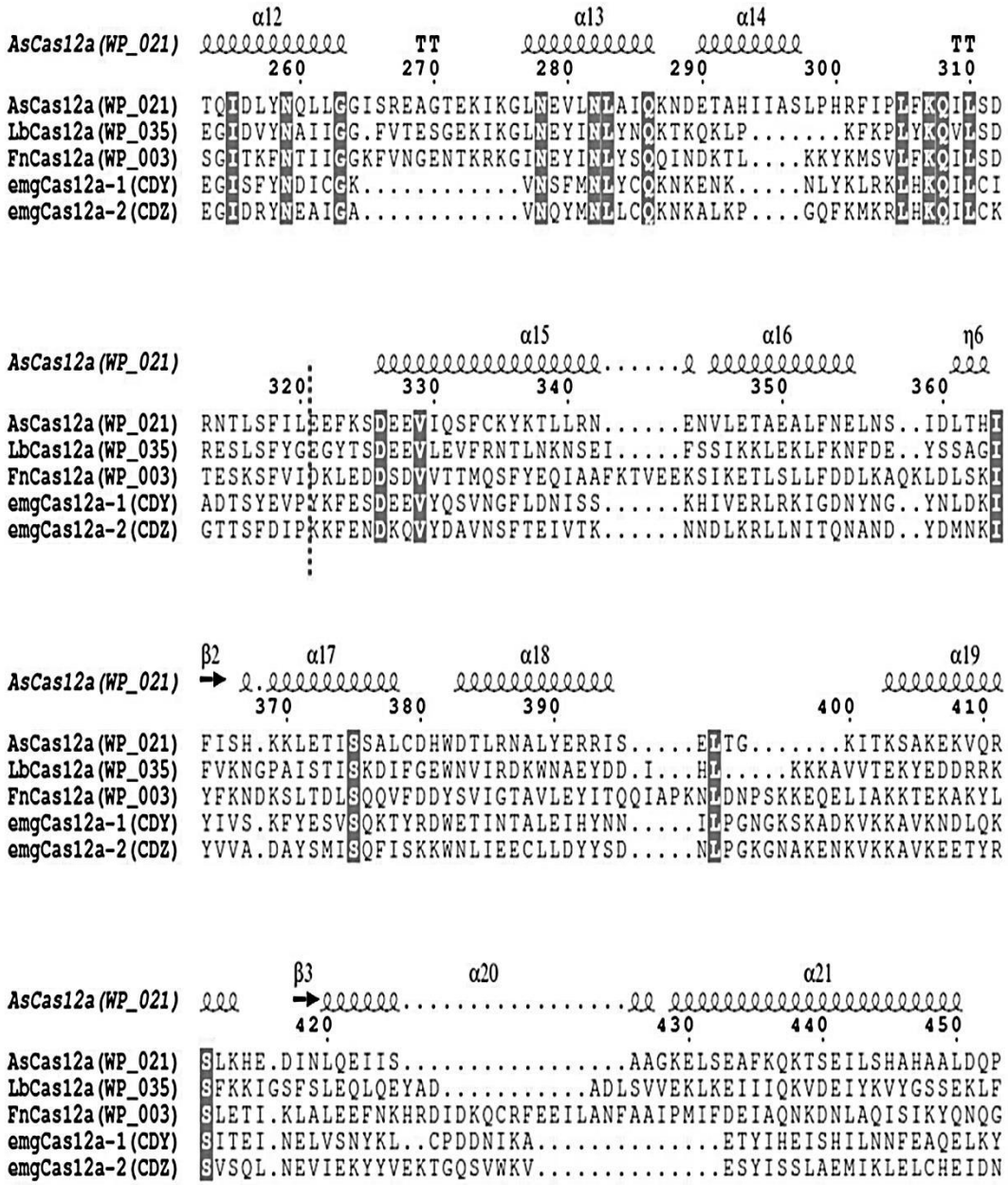
【FIG. 2B】


Acidaminococcus sp.
BV3L6
AWUR01000016.1
Cas4
Cas1
Cas2
CRISPR
WED-I
REC1
REC2
WED-II
PI
WED-III
RuvC-I
BH
RuvC-II
Nuc
RuvC-III
AsCas12a (1,307 aa)
Dead: D877A
P18E0-k21-2014-09-20,
contig-6000111
CDYX01038443.1
mgCas12a-1 (1,263 aa)
Engineered: K925Q
P19E0-k21-2014-09-20,
contig-5914000052
CDZH01035208.1
mgCas12a-2 (1,275 aa)
Dead: D873A
Engineered: K930Q

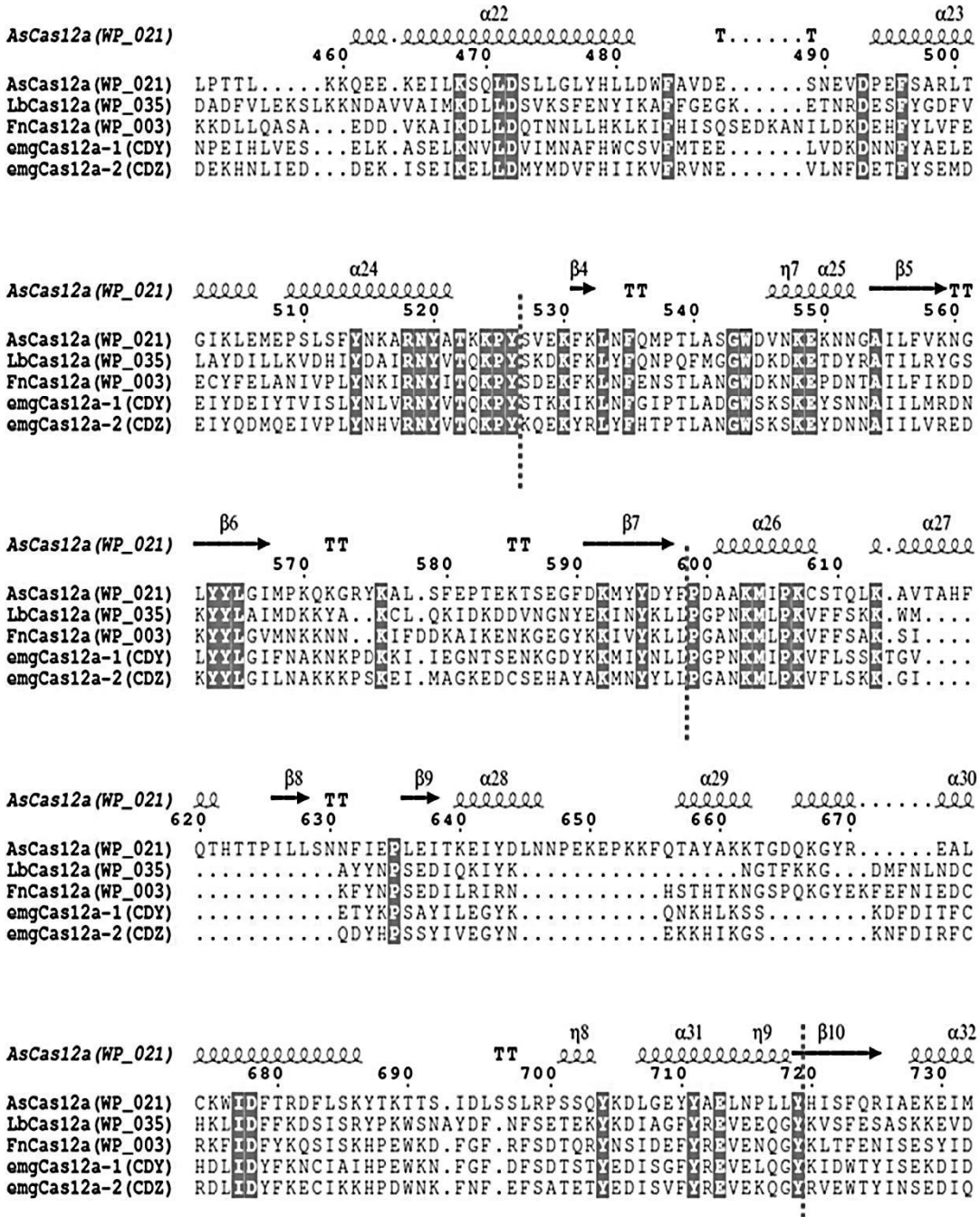
【FIG. 3】


AsCas12a (WP_021)
AsCas12a (WP_021)
LbCas12a (WP_035)
FnCas12a (WP_003)
emgCas12a-1 (CDY)
emgCas12a-2 (CDZ)

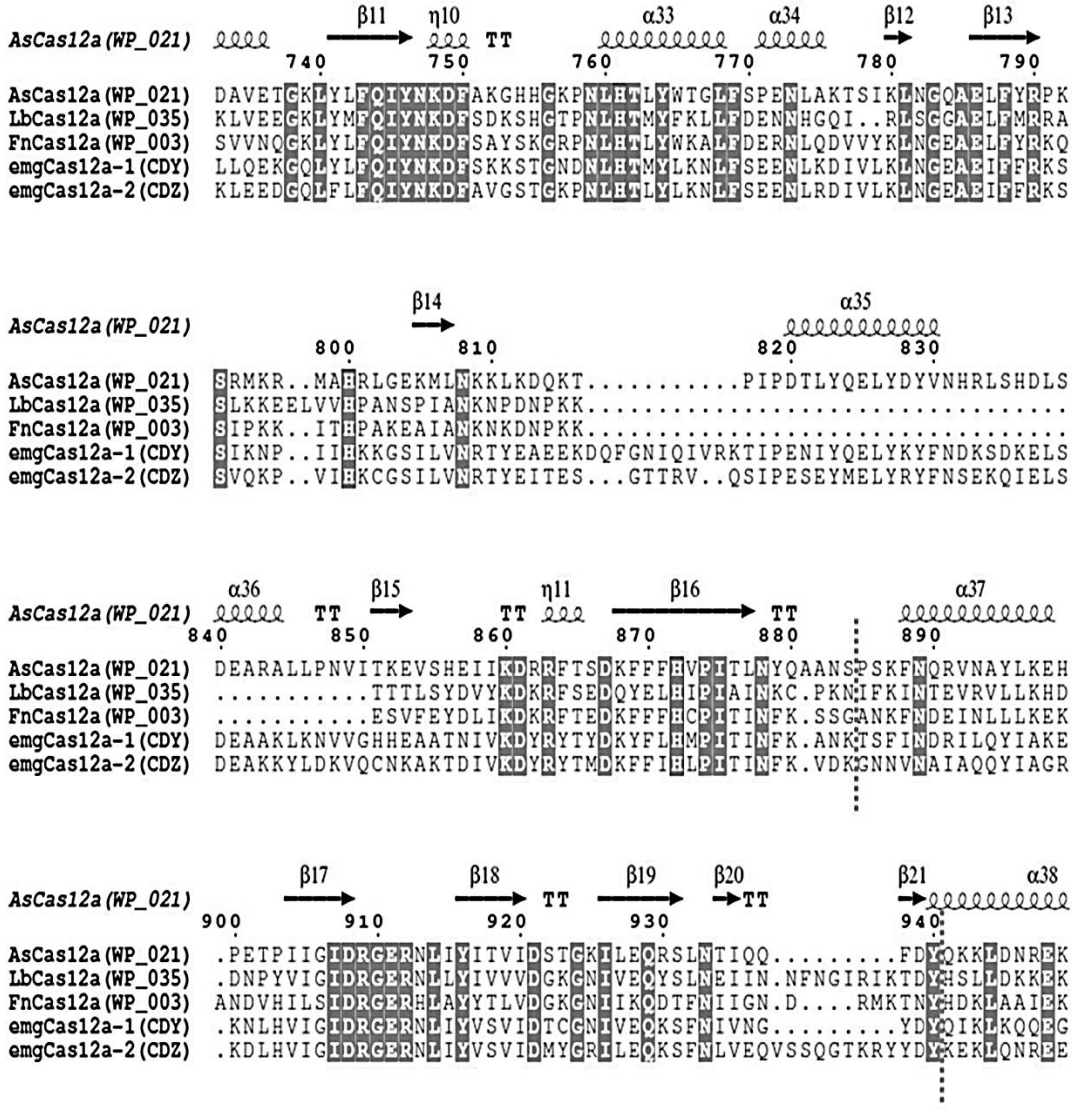
【FIG. 4】


α12
α13
α14
AsCas12a(WP_021)
TT
TT
260
270
280
290
300
310
AsCas12a(WP_021) TQIDLYNQLLGGISREAGTEKIKGLNEVLNLAIQKNDETAHIIASLPHRFIPLFKQILSD
LbCas12a(WP_035) EGIDVYNAIIGG.FVTESGEKIKGLNEYINLYNQKTKQKLP.....KFKPLYKQVLSD
FnCas12a(WP_003) SGITKFNTIIGGKFVNGENTKRKGINEYINLYSQQINDKTL....KKYKMSVLFKQILSD
emgCas12a-1(CDY) EGISFYNDICGK.....VNSFMNLYCQKNKENK.....NLYKLRKLHKQILCI
emgCas12a-2(CDZ) EGIDRYNEAIGA.....VNQYMNLLCQKNKALKP....GQFKMKRLHKQILCK
α15
α16
η6
AsCas12a(WP_021)
320
330
340
350
360
AsCas12a(WP_021) RNTLSFILEEFKSDEEVIQSFCKYKTLLRN.....ENVLETAEALFNELNS..IDLTHI
LbCas12a(WP_035) RESLSFYGEGYTSDEEVLEVFRNTLNKNSEI.....FSSIKKLEKLFKNFDE..YSSAGI
FnCas12a(WP_003) TESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKTVEEKSIKETLSLLFDDLKAQKLDLSKI
emgCas12a-1(CDY) ADTSYEVPYKFESDEEVYQSVNGFLDNISS.....KHIVERLRKIGDNYNG..YNLDKI
emgCas12a-2(CDZ) GTTSFDIPKKFENDKQVYDAVNSFTEIVTK.....NNDLKRLLNITQNAND..YDMNKI
β2
α17
α18
α19
AsCas12a(WP_021)
370
380
390
400
410
AsCas12a(WP_021) FISH.KKLETISSALCDHWDTLRNALYERRIS.....ELTG.....KITKSAKEKVQR
LbCas12a(WP_035) FVKNGPAISTISKDIFGEWNVIRDKWNAEYDD.I...HL.....KKKAVVTEKYEDDRRK
FnCas12a(WP_003) YFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKEQELIAKKTEKAKYL
emgCas12a-1(CDY) YIVS.KFYESVSQKTYRDWETINTALEIHYNN.....ILPGNGKSKADKVKKAVKNDLQK
emgCas12a-2(CDZ) YVVA.DAYSMISQFISKKWNLIEECLLDYYSD.....NLPGKGNAKENKVKKAVKEETYR
β3
α20
α21
AsCas12a(WP_021)
420
430
440
450
AsCas12a(WP_021) SLKHE.DINLQEIS.....AAGKELSEAFKQKTSEILSHAHAALDQP
LbCas12a(WP_035) SFKKIGSFSLEQLQEYAD.....ADLSVVEKLKEIIIQKVDEIYKVYGSSEKLF
FnCas12a(WP_003) SLETI.KLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
emgCas12a-1(CDY) SITEI.NELVSNYKL..CPDDNIKA.....ETYIHEISHILNNFEAQELKY
emgCas12a-2(CDZ) SVSQL.NEVIEKYYVEKTGQSVWKV.....ESYISSLAEMIKLELCHEIDN

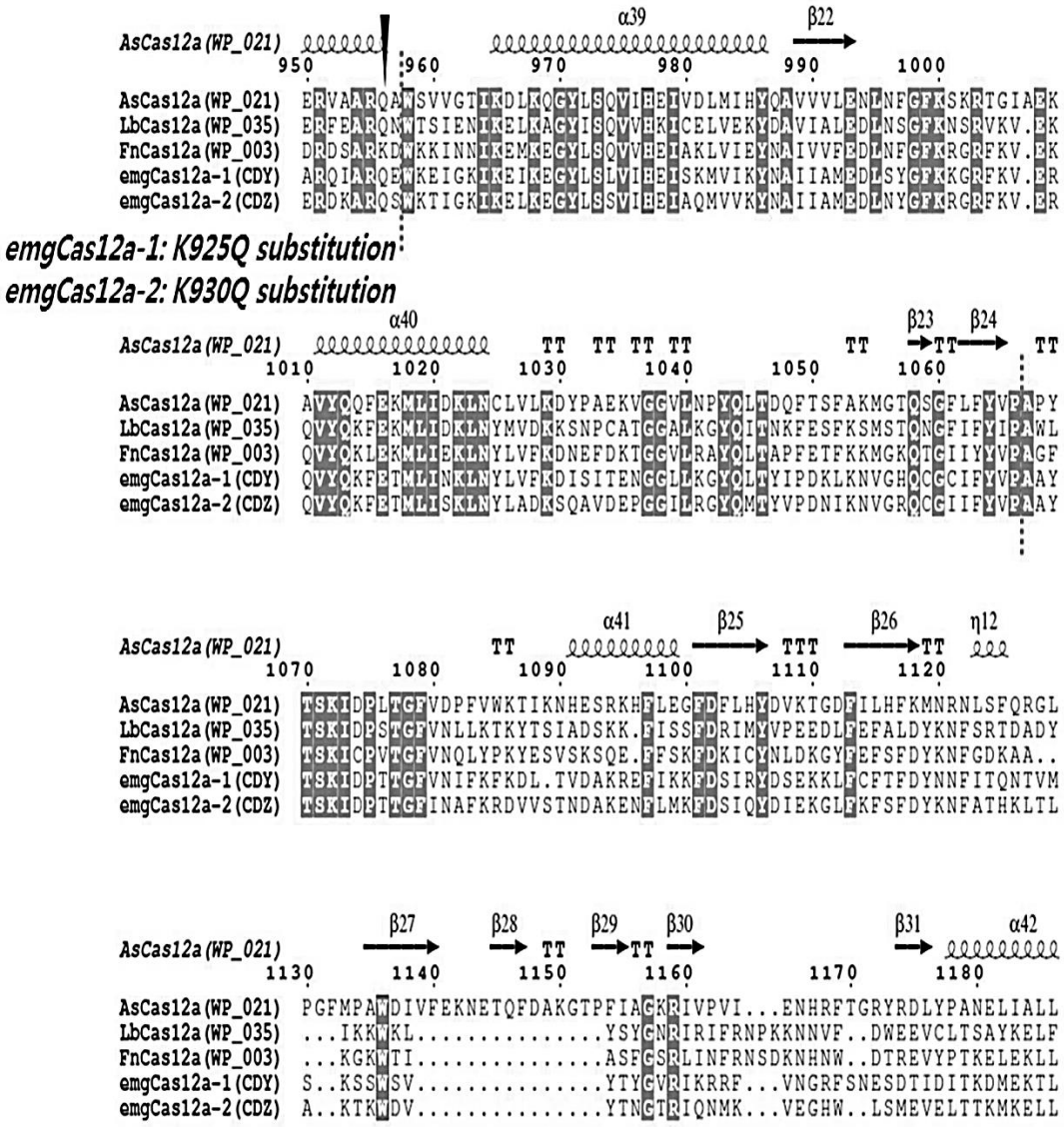
【FIG. 5】


AsCas12a(WP_021)
LbCas12a(WP_035)
FnCas12a(WP_003)
emgCas12a-1(CDY)
emgCas12a-2(CDZ)

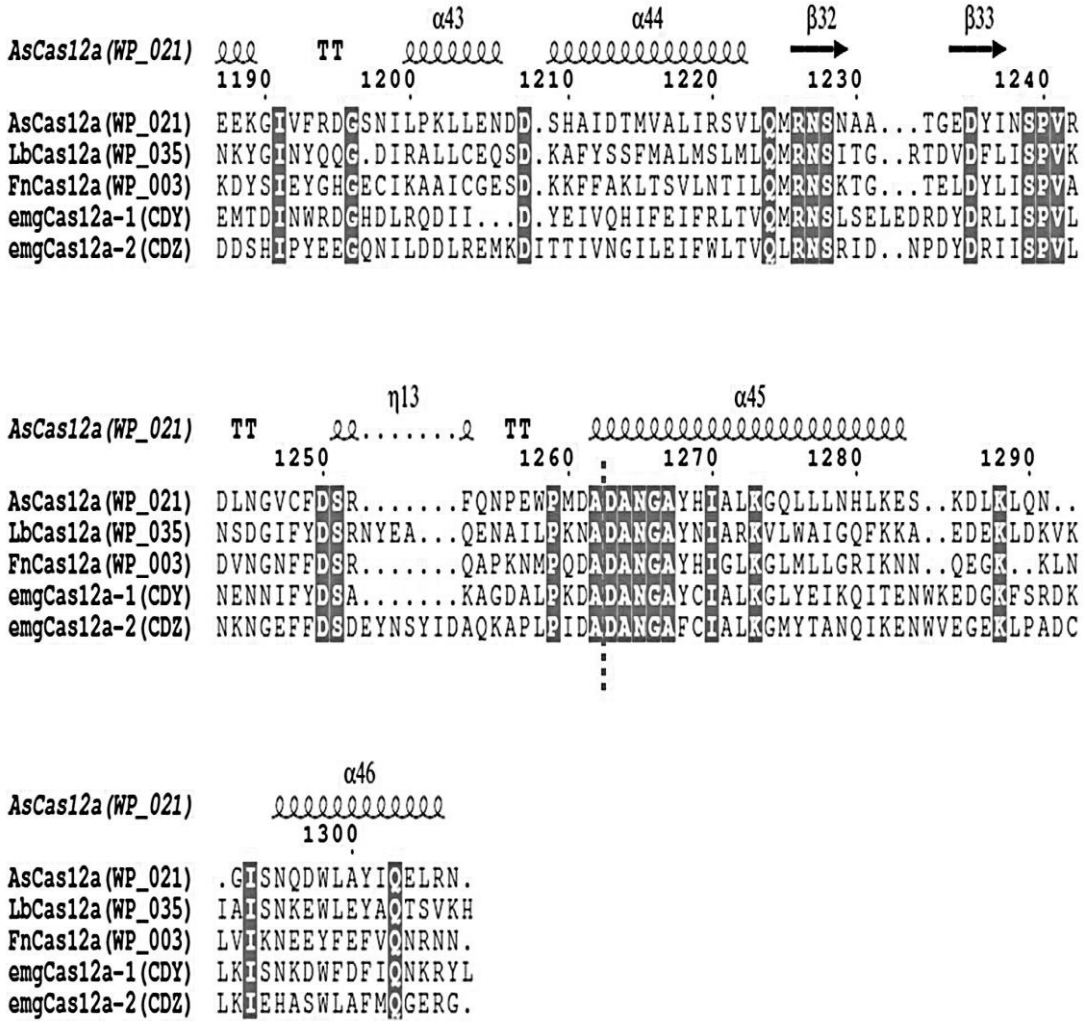
【FIG. 6】


AsCas12a(WP_021)
AsCas12a(WP_021) DAVETGKLYLFQIYNKDFAKGHHGKPNLHTLYWTGLFSPENLAKTSIKLNGQAELFYRPK
LbCas12a(WP_035) KLVEEGKLYMFQIYNKDFSDKSHGTPNLHTMYFKLLFDENNHGQI..RLSGGAELFMRRA
FnCas12a(WP_003) SVVNQGKLYLFQIYNKDFSAYSKGRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQ
emgCas12a-1(CDY) LLQEKGQLYLFQIYNKDFSKKSTGNDNLHTMYLKNLFSEENLKDIVLKLNGEAEIFFRKS
emgCas12a-2(CDZ) KLEEDGQLFLFQIYNKDFAVGSTGKPNLHTLYLKNLFSEENLRDIVLKLNGEAEIFFRKS
AsCas12a(WP_021) SRMKR..MAHRLGEKMLNKKLKDQKT..........PIPDTLYQELYDYVNHRLSHDLS
LbCas12a(WP_035) SLKKEELVVHPANSPIANKNPDNPKK..........
FnCas12a(WP_003) SIPKK..ITHPAKEAIANKNKDNPKK..........
emgCas12a-1(CDY) SIKNP..IIHKKGSILVNRTYEAEEKDQFGNIQIVRKTIPENIYQELYKYFNDKSDKELS
emgCas12a-2(CDZ) SVQKP..VIHKCGSILVNRTYEITES...GTTRV..QSIPESEYMELYRYFNSEKQIELS
AsCas12a(WP_021) DEARALLPNVITKEVSHEIIKDRRFTSDKFFFHVPITLNYQAANSPSKFNQRVNAYLKEH
LbCas12a(WP_035) ..........TTTLSYDVYKDKRFSEDQYELHIPIAINKC.PKNIFKINTEVRVLLKHD
FnCas12a(WP_003) ..........ESVFEYDLIKDKRFTEDKFFFHCPITINFK.SSGANKFNDEINLLLKEK
emgCas12a-1(CDY) DEAAKLKNVVGHHEAATNIVKDYRYTYDKYFLHMPITINFK.ANKTSFINDRILQYIAKE
emgCas12a-2(CDZ) DEAKKYLDKVQCNKAKTDIVKDYRYTMDKFFIHLPITINFK.VDKGNNVNAIAQQYIAGR
AsCas12a(WP_021) .PETPIIGIDRGERNLIYITVIDSTGKILEQRSLNTIQQ.....FDYQKKLDNREK
LbCas12a(WP_035) .DNPYVIGIDRGERNLLYIVVVDGKGNIVEQYSLNEIIN.NFNGIRIKTDYHSLLDKKEK
FnCas12a(WP_003) ANDVHILSIDRGERHLAYYTLVDGKGNIIKQDTFNIIGN.D....RMKTNYHDKLAAIEK
emgCas12a-1(CDY) .KNLHVIGIDRGERNLIYVSVIDTCGNIVEQKSFNIVNG.....YDYQIKLKQQEG
emgCas12a-2(CDZ) .KDLHVIGIDRGERNLIYVSVIDMYGRILEQKSFNLVEQVSSQGTKRYYDYKEKLQNREE

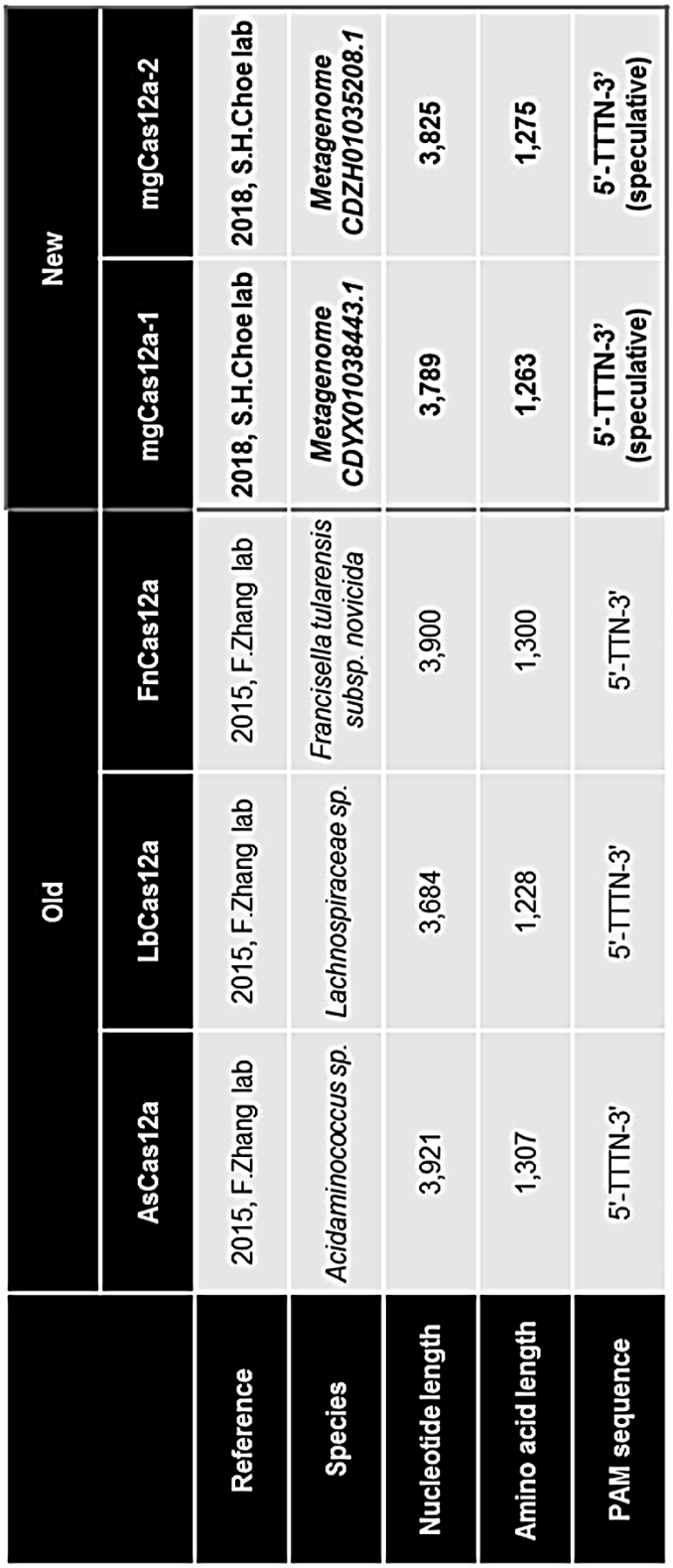
【FIG. 7】


AsCas12a(WP_021)
AsCas12a(WP_021) ERVAARQAWSVVGTIKDLKQGYLSQVIHEIVDLMIHYQAVVVLENLNFGFKSKRTGIAEK
LbCas12a(WP_035) ERFEARQNWTSIENIKELKAGYISQVVHKICELVEKYDAVIALEDLNSGFKNSRVKV.EK
FnCas12a(WP_003) DRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVFEDLNFGFKRGRFKV.EK
emgCas12a-1(CDY) ARQIARQEWKEIGKIKEIKEGYLSLVIHEISKMVIKYNAIIAMEDLSYGFKKGRFKV.ER
emgCas12a-2(CDZ) ERDKARQSWKTIGKIKELKEGYLSSVIHEIAQMVVKYNAIIAMEDLNYGFKRGRFKV.ER
emgCas12a-1: K925Q substitution
emgCas12a-2: K930Q substitution
AsCas12a(WP_021)
AsCas12a(WP_021) AVYQQFEKMLIDKLNCLVLKDYPAEKVGGVLNPYQLTDQFTSFAKMGTQSGFLFYVPAPY
LbCas12a(WP_035) QVYQKFEKMLIDKLNYMVDKKSNPCATGGALKGYQITNKFESFKSMSTQNGFIFYIPAWL
FnCas12a(WP_003) QVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGF
emgCas12a-1(CDY) QVYQKFETMLINKLNYLVFKDISITENGGLLKGYQLTYIPDKLKNVGHQCGCIFYVPAAY
emgCas12a-2(CDZ) QVYQKFETMLISKLNYLADKSQAVDEPGGILRGYQMTYVPDNIKNVGRQCGIIFYVPAAY
AsCas12a(WP_021)
AsCas12a(WP_021) TSKIDPLTGFVDPFVWKTIKNHESRKHFLEGFDFLHYDVKTGDFILHFKMNRNLSFQRGL
LbCas12a(WP_035) TSKIDPSTGFVNLLKTKYTSIADSKK.FISSFDRIMYVPEEDLFEFALDYKNFSRTDADY
FnCas12a(WP_003) TSKICPVTGFVNQLYPKYESVSKSQE.FFSKFDKICYNLDKGYFEFSFDYKNFGDKAA..
emgCas12a-1(CDY) TSKIDPTTGFVNIFKFKDL.TVDAKREFIKKFDSIRYDSEKKLFCFTFDYNNFITQNTVM
emgCas12a-2(CDZ) TSKIDPTTGFINAFKRDVVSTNDAKENFLMKFDSIQYDIEKGLFKFSFDYKNFATHKLTL
AsCas12a(WP_021)
AsCas12a(WP_021) PGFMPAWDIVFEKNETQFDAKGTPFIAGKRIVPVI...ENHRFTGRYRDLYPANELIALL
LbCas12a(WP_035) ...IKKWKL.....YSYGNRIRIFRNPKKNNVF..DWEEVCLTSAYKELF
FnCas12a(WP_003) ...KGKWTI.....ASFGSRLINFRNSDKNHNW..DTREVYPTKELEKLL
emgCas12a-1(CDY) S..KSSWSV.....YTYGVRIKRRF...VNGRFSNESDTIDITKDMEKTL
emgCas12a-2(CDZ) A..KTKWDV.....YTNGTRIQNMK...VEGHW..LSMEVELTTKMKELL

【FIG. 8】


AsCas12a(WP_021)
α43
α44
β32
β33
1190
1200
1210
1220
1230
1240
AsCas12a(WP_021) EEKGIVFRDGSNILPKLLENDD.SHAIDTMVALIRSVLQMRNSNAA...TGEDYINSPVR
LbCas12a(WP_035) NKYGINYQQG.DIRALLCEQSD.KAFYSSFMALMSLMLQMRNSITG..RTDVDFLISPVK
FnCas12a(WP_003) KDYSIEYGHGECIKAAICGESD.KKFFAKLTSVLNTILQMRNSKTG...TELDYLISPVA
emgCas12a-1(CDY) EMTDINWRDGHDLRQDII...D.YEIVQHIFEIFRLTVQMRNSLSELEDRDYDRLISPVL
emgCas12a-2(CDZ) DDSHIPYEEGQNILDDLREMKDITTIVNGILEIFWLTVQLRNSRID..NPDYDRIISPVL
AsCas12a(WP_021)
η13
α45
1250
1260
1270
1280
1290
AsCas12a(WP_021) DLNGVCFDSR.....FQNPEWPMDADANGAYHIALKGQLLLNHLKES..KDLKLQN..
LbCas12a(WP_035) NSDGIFYDSRNYEA...QENAILPKNADANGAYNIARKVLWAIGQFKKA..EDEKLDKVK
FnCas12a(WP_003) DVNGNFFDSR.....QAPKNMPQDADANGAYHIGLKGLMLLGRIKNN..QEGK..KLN
emgCas12a-1(CDY) NENNIFYDSA.....KAGDALPKDADANGAYCIALKGLYEIKQITENWKEDGKFSRDK
emgCas12a-2(CDZ) NKNGEFFDSDEYNSYIDAQKAPLPIDADANGAFCIALKGMYTANQIKENWVEGEKLPADC
AsCas12a(WP_021)
α46
1300
AsCas12a(WP_021) .GISNQDWLAYIQELRN.
LbCas12a(WP_035) IAISNKEWLEYAQTSVKH
FnCas12a(WP_003) LVIKNEEYFEFVQNRNN.
emgCas12a-1(CDY) LKISNKDWFDFIQNKRYL
emgCas12a-2(CDZ) LKIEHASWLAFMQGERG.

【FIG. 9A】

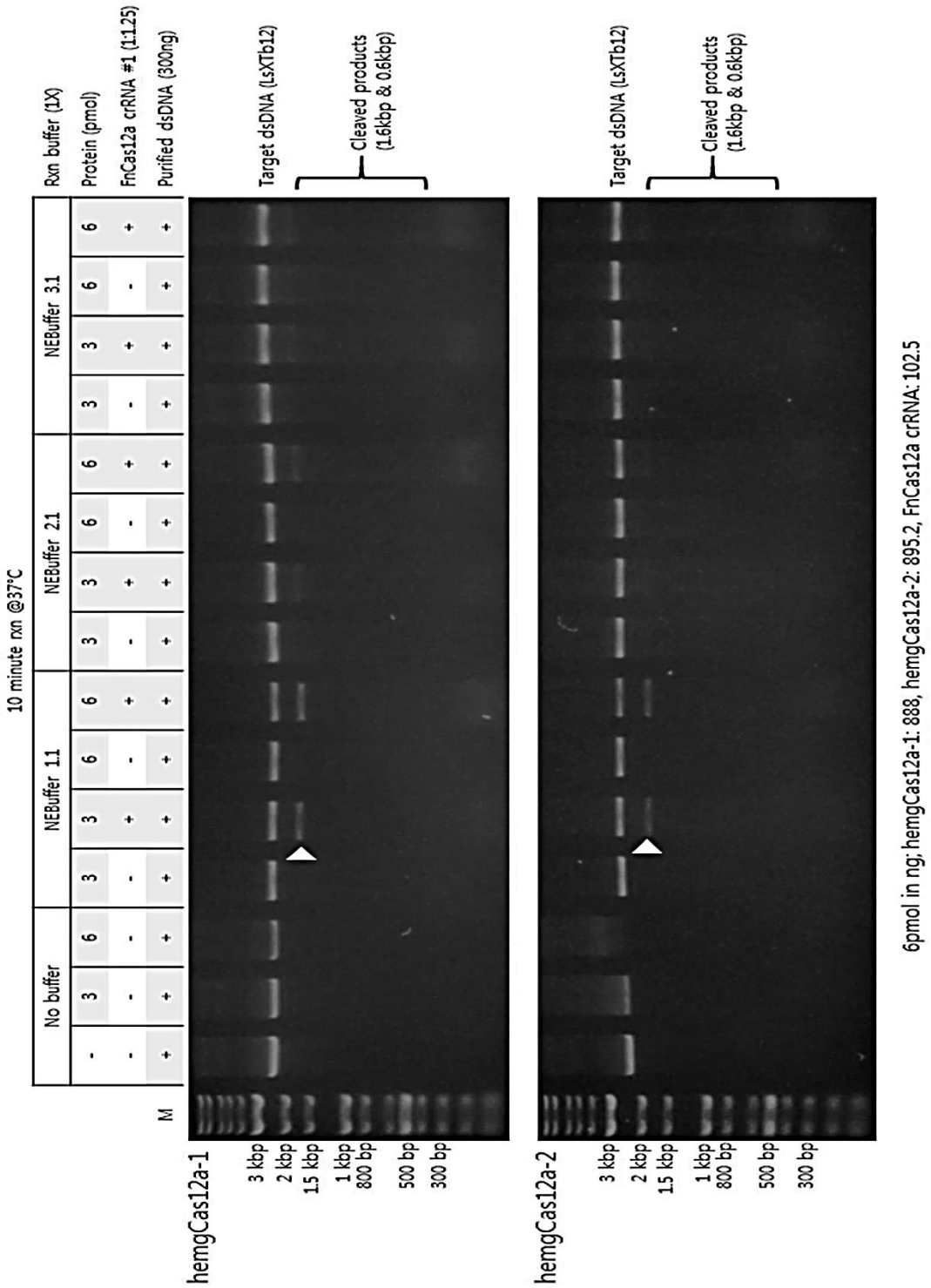


	Old			New	
	AsCas12a	LbCas12a	FnCas12a	mgCas12a-1	mgCas12a-2
Reference	2015, F.Zhang lab	2015, F.Zhang lab	2015, F.Zhang lab	2018, S.H.Choe lab	2018, S.H.Choe lab
Species	*Acidaminococcus sp.*	*Lachnospiraceae sp.*	*Francisella tularensis subsp. novicida*	*Metagenome CDYX01038443.1*	*Metagenome CDZH01035208.1*
Nucleotide length	3,921	3,684	3,900	3,789	3,825
Amino acid length	1,307	1,228	1,300	1,263	1,275
PAM sequence	5'-TTTN-3'	5'-TTTN-3'	5'-TTN-3'	5'-TTTN-3' (speculative)	5'-TTTN-3' (speculative)

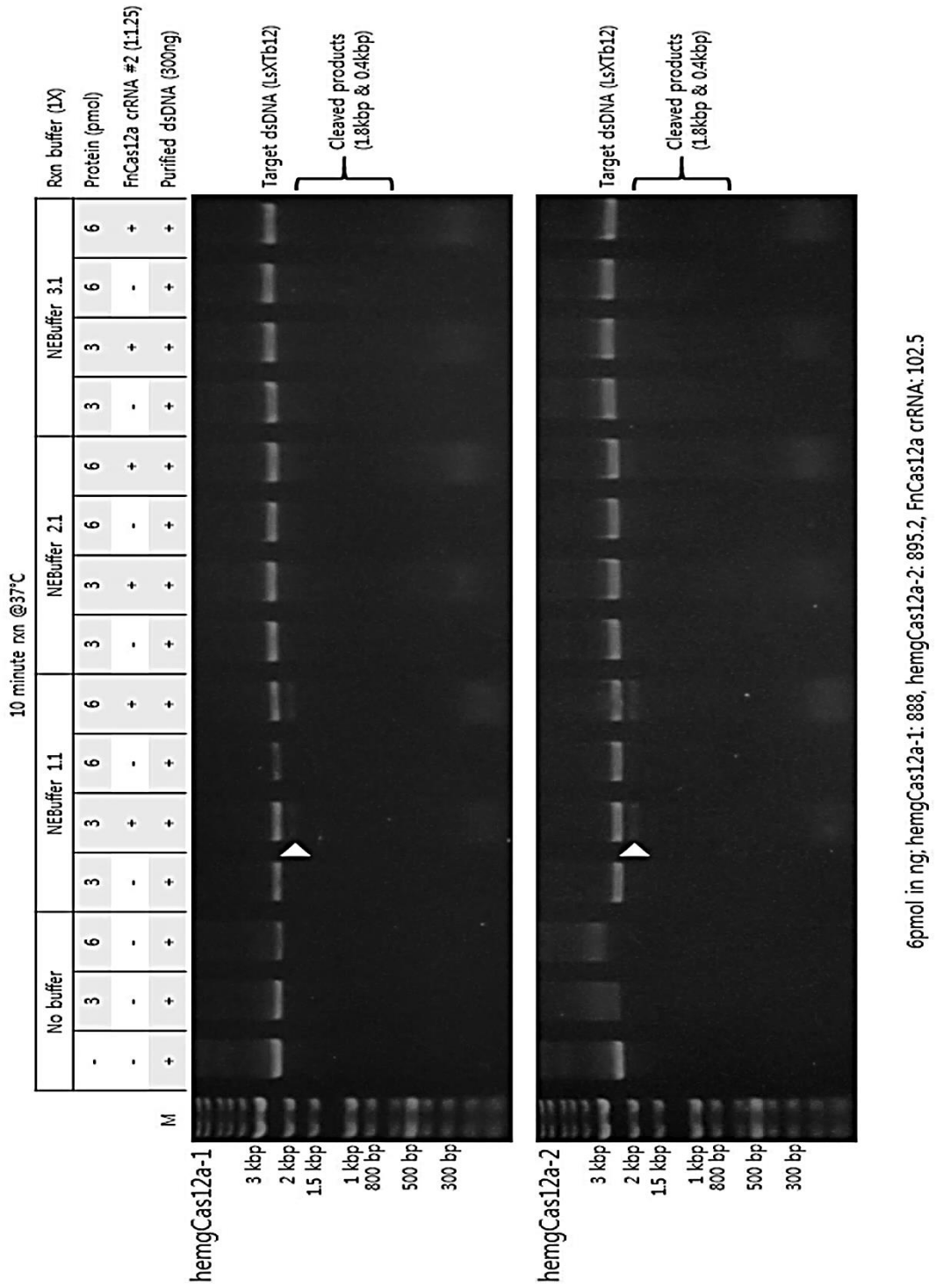
【FIG. 9B】

Cas12a	As	Lb	Fn	mg-1	mg-2
As					
Lb	33.4				
Fn	34.2	40.4			
mg-1	32.4	35.3	36.6		
mg-2	30.7	34.9	35.9	52.2	

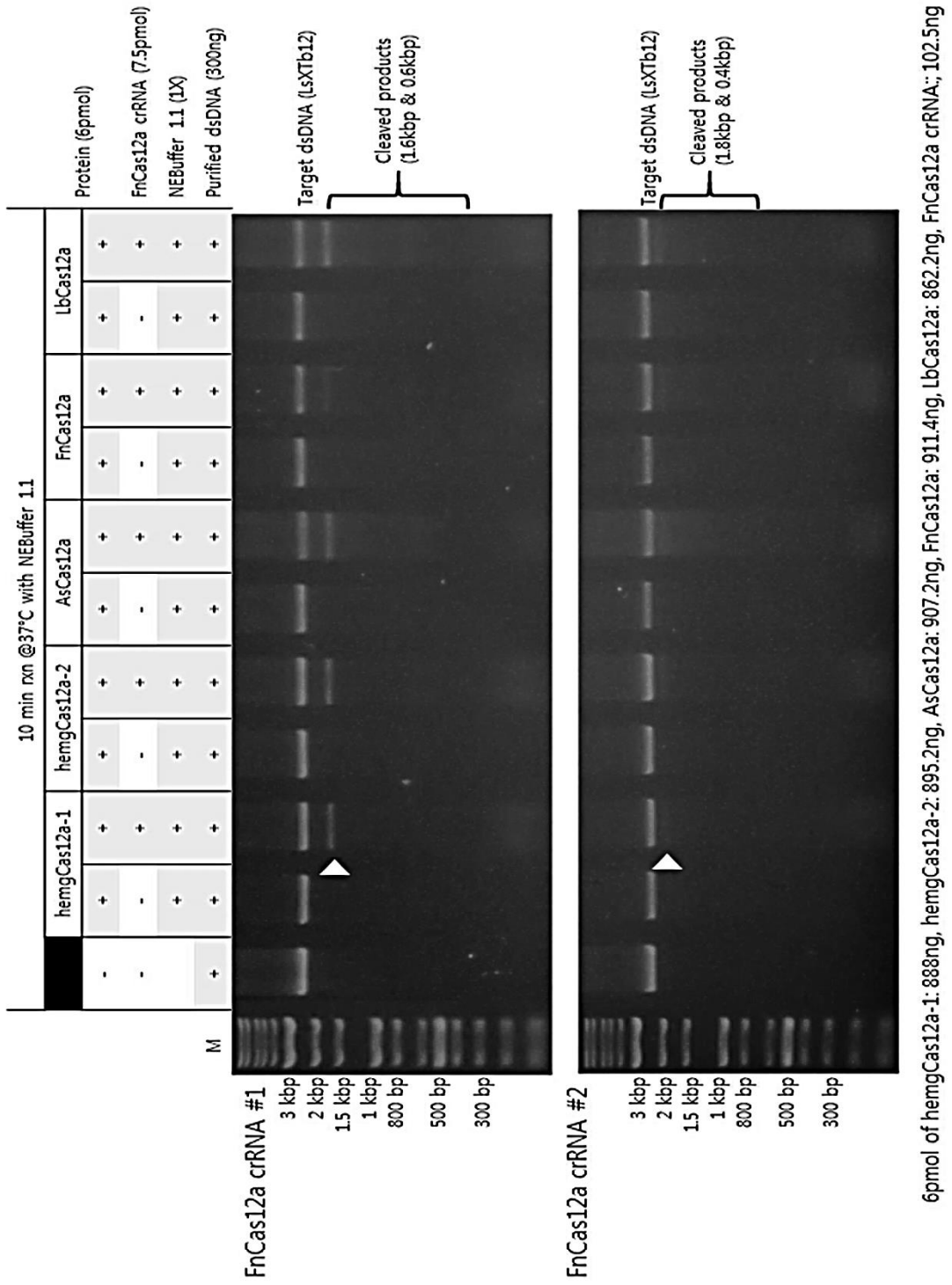
【FIG. 10】


10 minute rxn @37°C
No buffer
NEBuffer 1.1
NEBuffer 2.1
NEBuffer 3.1
Rxn buffer (1X)
Protein (pmol)
FnCas12a crRNA #1 (1:1.25)
Purified dsDNA (300ng)
M
hemgCas12a-1
hemgCas12a-2
Target dsDNA (LsXTb12)
Cleaved products (1.6kbp & 0.6kbp)
3 kbp
2 kbp
1.5 kbp
1 kbp
800 bp
500 bp
300 bp
6pmol in ng; hemgCas12a-1: 888, hemgCas12a-2: 895.2, FnCas12a crRNA: 102.5

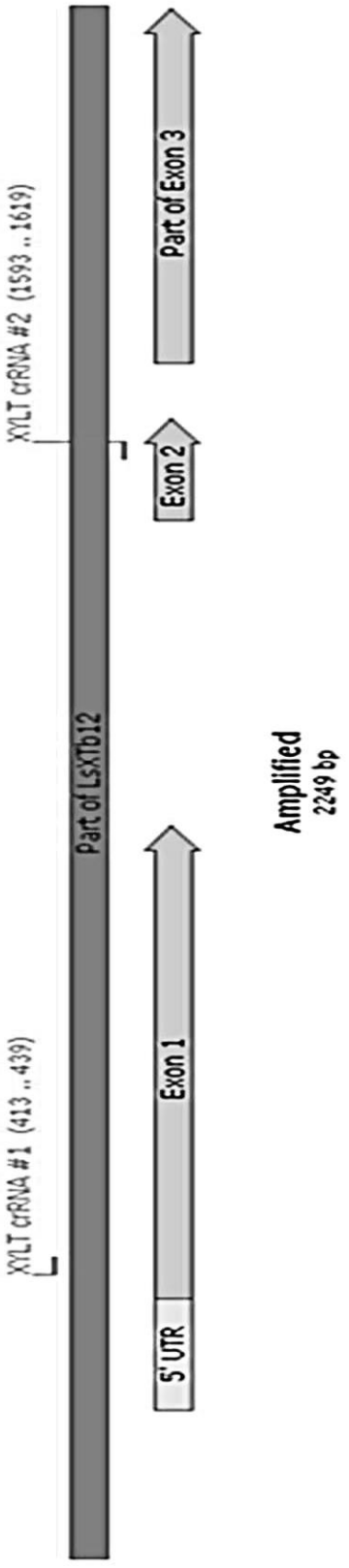
【FIG. 11】


10 minute rxn @37°C
No buffer
NEBuffer 1.1
NEBuffer 2.1
NEBuffer 3.1
Rxn buffer (1X)
Protein (pmol)
FnCas12a crRNA #2 (1:125)
Purified dsDNA (300ng)
M
hemgCas12a-1
hemgCas12a-2
Target dsDNA (LsXTb12)
Cleaved products (1.8kbp & 0.4kbp)
3 kbp
2 kbp
1.5 kbp
1 kbp
800 bp
500 bp
300 bp
6pmol in ng; hemgCas12a-1: 888, hemgCas12a-2: 895.2, FnCas12a crRNA: 102.5

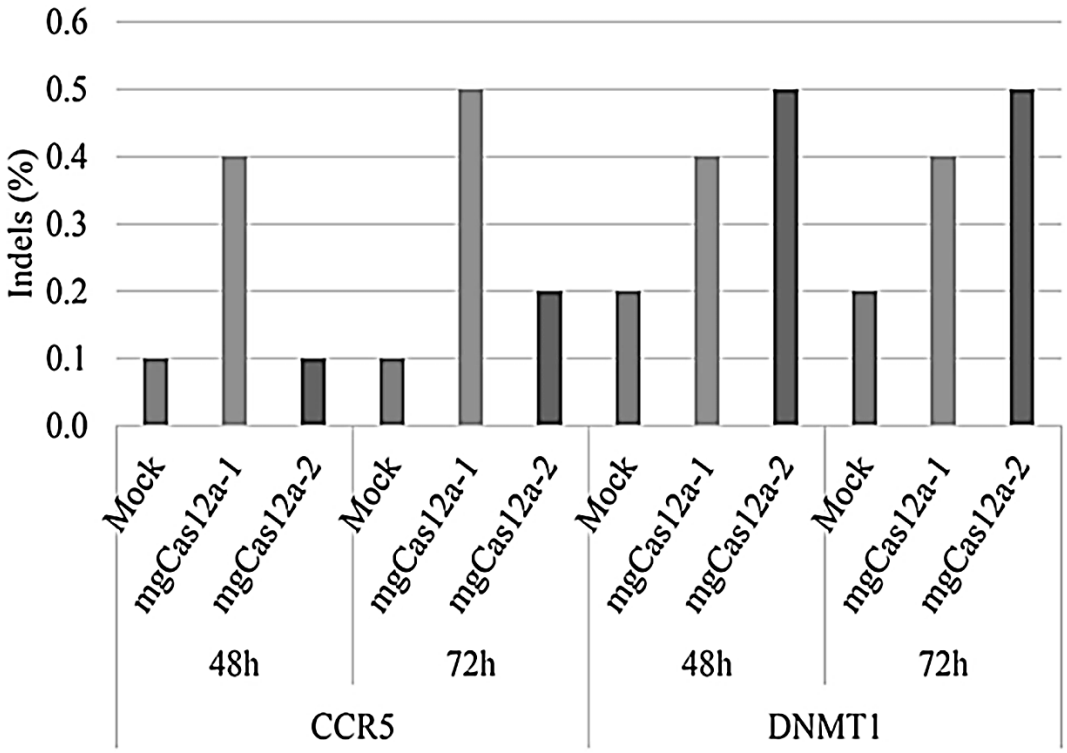
【FIG. 12】


10 min rxn @37°C with NEBuffer 1.1
hemgCas12a-1
hemgCas12a-2
AsCas12a
FnCas12a
LbCas12a
Protein (6pmol)
FnCas12a crRNA (7.5pmol)
NEBuffer 1.1 (1X)
Purified dsDNA (300ng)
M
Target dsDNA (LsXTb12)
Cleaved products (1.6kbp & 0.6kbp)
FnCas12a crRNA #1
3 kbp
2 kbp
15 kbp
1 kbp
800 bp
500 bp
300 bp
Target dsDNA (LsXTb12)
Cleaved products (1.8kbp & 0.4kbp)
FnCas12a crRNA #2
6pmol of hemgCas12a-1: 888ng, hemgCas12a-2: 895.2ng, AsCas12a: 907.2ng, FnCas12a: 911.4ng, LbCas12a: 862.2ng, FnCas12a crRNA:: 102.5ng

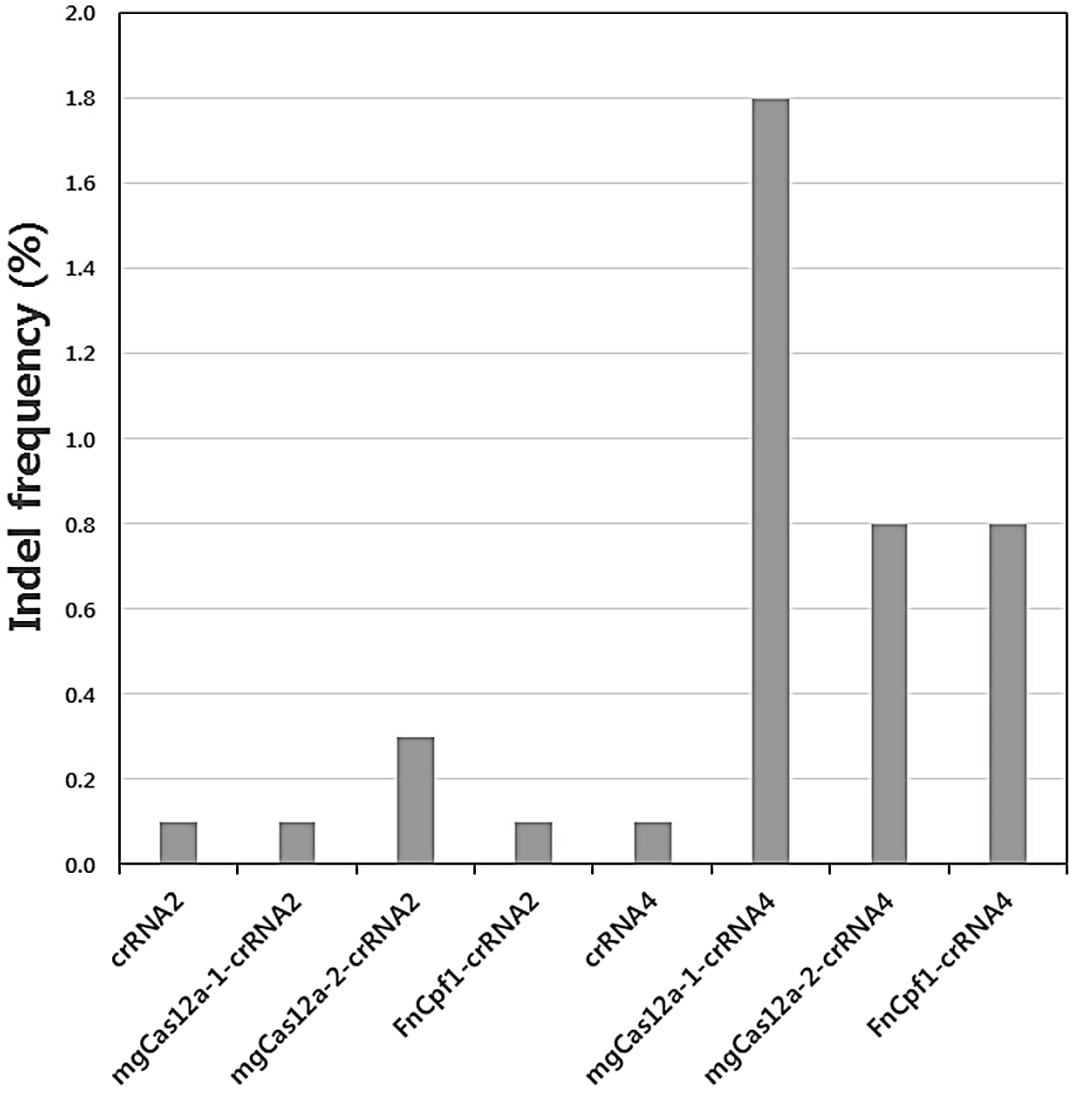
【FIG. 13】


XYLT crRNA #1 (413 .. 439)
XYLT crRNA #2 (1593 .. 1619)
5' UTR
Exon 1
Exon 2
Part of Exon 3
Part of LsXTb12
Amplified
2249 bp

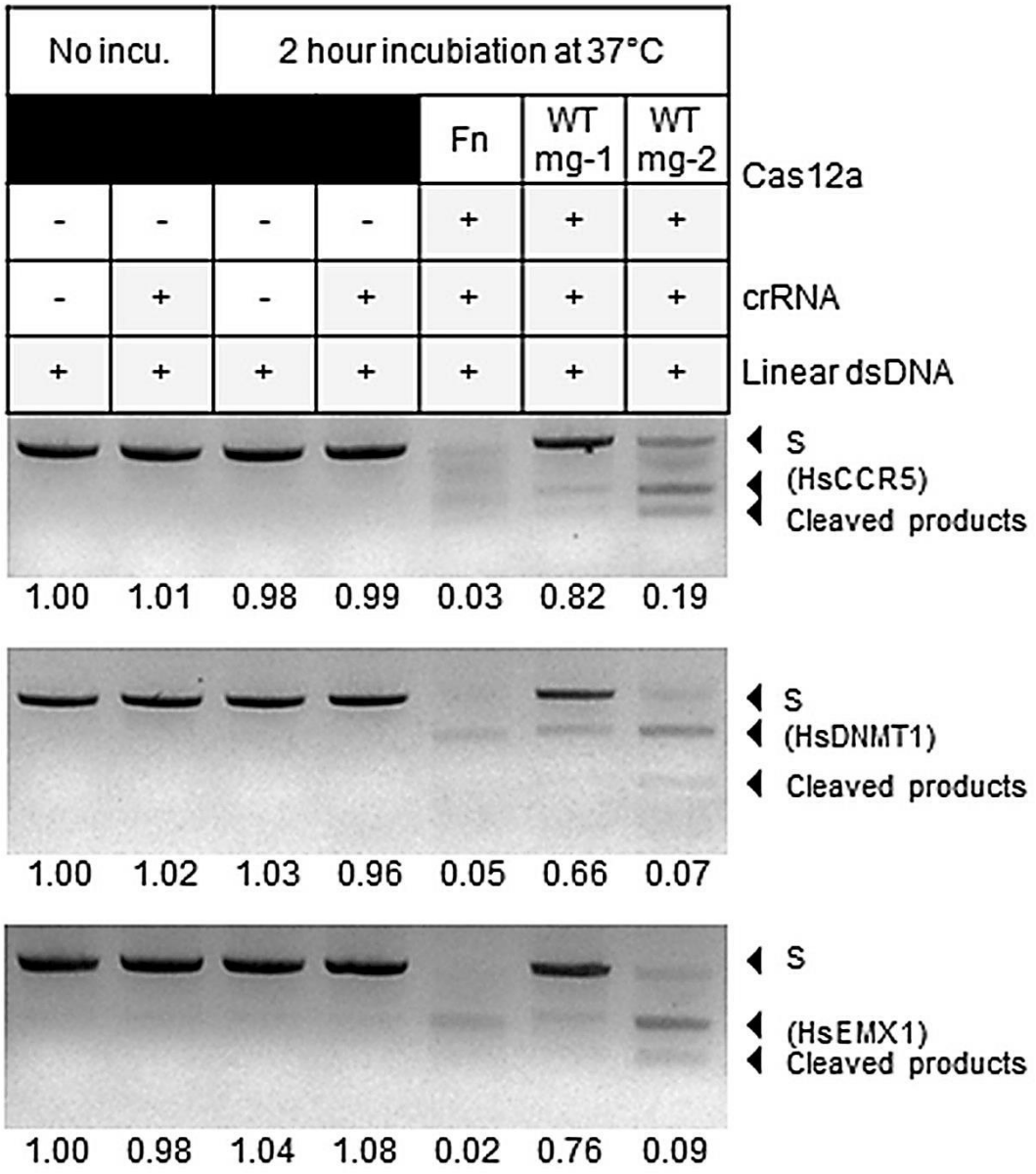
【FIG. 14】


0.6
0.5
0.4
0.3
0.2
0.1
0.0
Indels (%)
Mock
mgCas12a-1
mgCas12a-2
Mock
mgCas12a-1
mgCas12a-2
Mock
mgCas12a-1
mgCas12a-2
Mock
mgCas12a-1
mgCas12a-2
48h
72h
48h
72h
CCR5
DNMT1

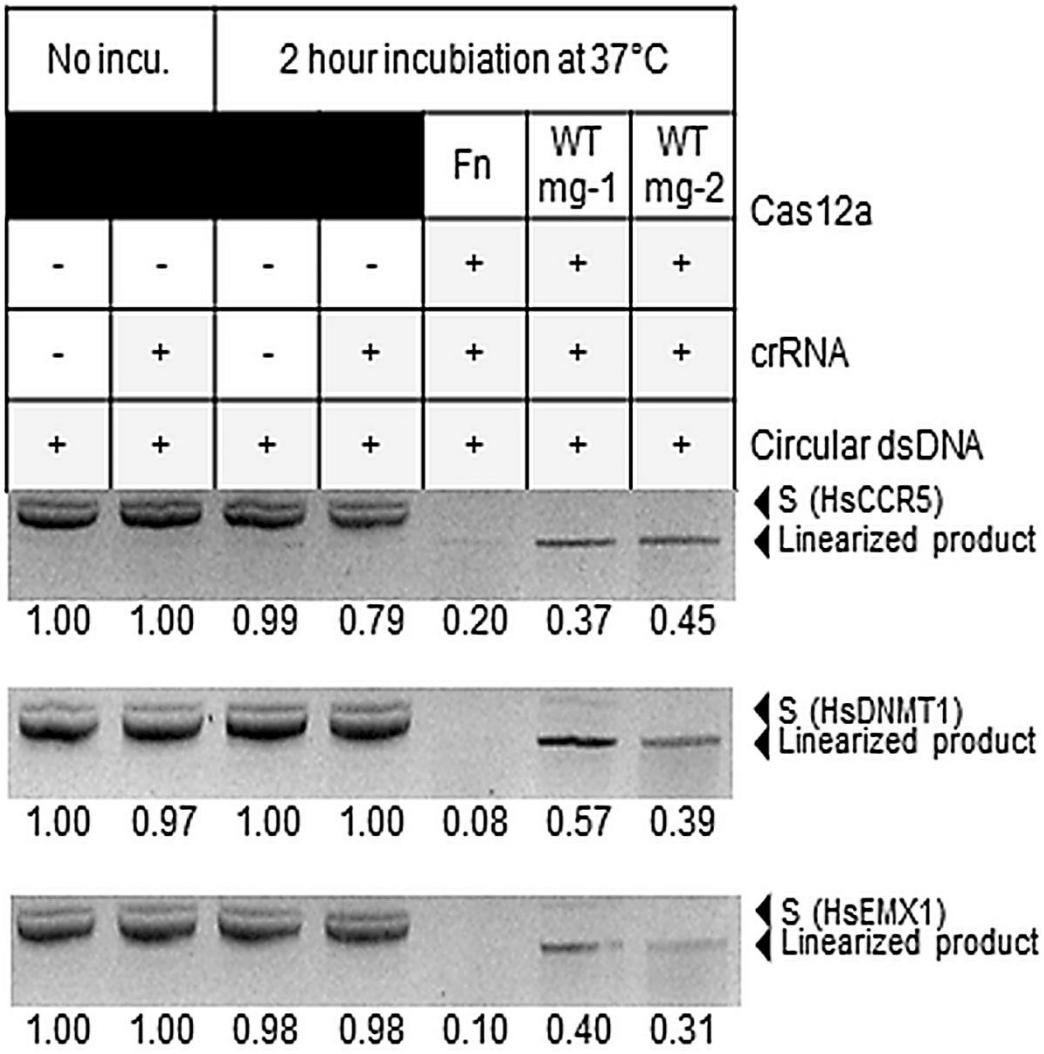
【FIG. 15】


Indel frequency (%)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
crRNA2
mgCas12a-1-crRNA2
mgCas12a-2-crRNA2
FnCpf1-crRNA2
crRNA4
mgCas12a-1-crRNA4
mgCas12a-2-crRNA4
FnCpf1-crRNA4

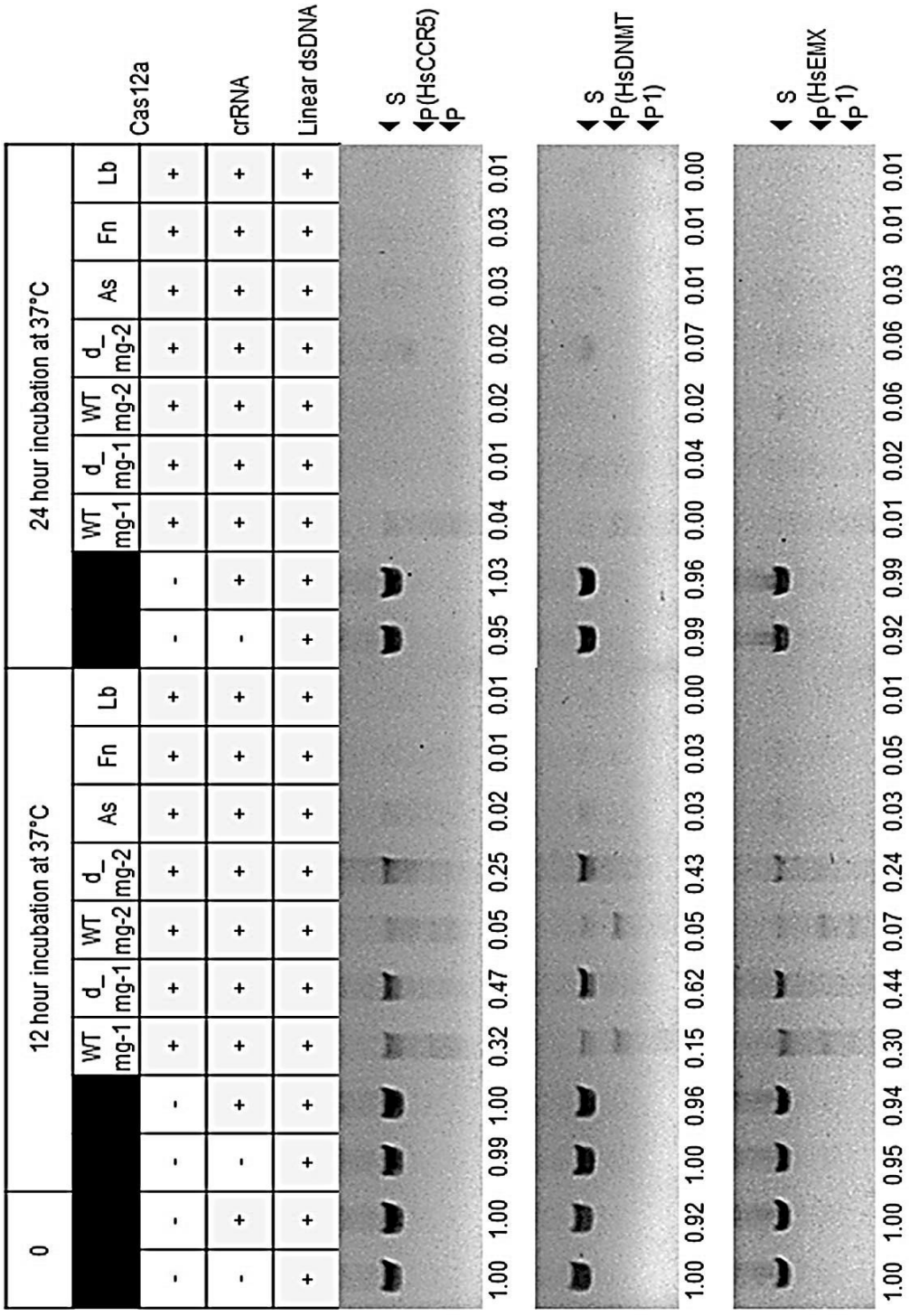
【FIG. 16A】


No incu.
2 hour incubiation at 37°C
Fn
WT mg-1
WT mg-2
Cas12a
crRNA
Linear dsDNA
S
(HsCCR5)
Cleaved products
1.00 1.01 0.98 0.99 0.03 0.82 0.19
S
(HsDNMT1)
Cleaved products
1.00 1.02 1.03 0.96 0.05 0.66 0.07
S
(HsEMX1)
Cleaved products
1.00 0.98 1.04 1.08 0.02 0.76 0.09

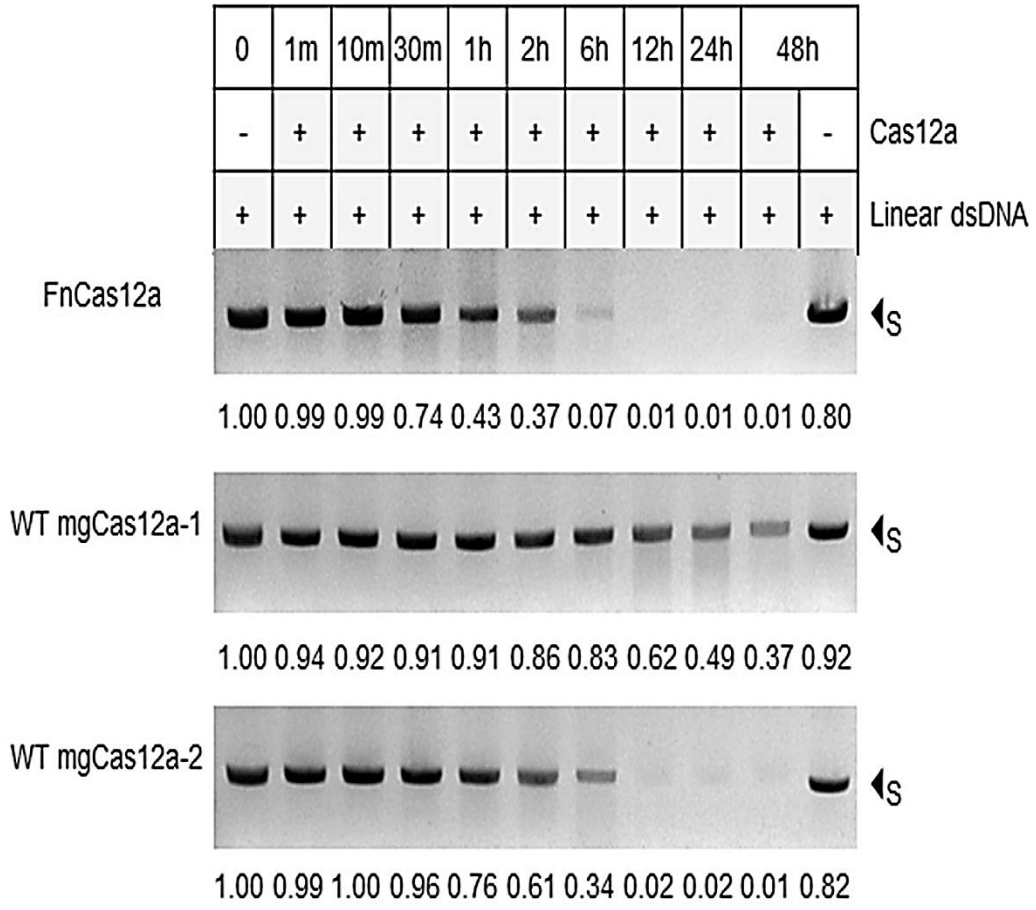
【FIG. 16B】


No incu.
2 hour incubiation at 37°C
Fn
WT mg-1
WT mg-2
Cas12a
crRNA
Circular dsDNA
S (HsCCR5)
Linearized product
1.00 1.00 0.99 0.79 0.20 0.37 0.45
S (HsDNMT1)
Linearized product
1.00 0.97 1.00 1.00 0.08 0.57 0.39
S (HsEMX1)
Linearized product
1.00 1.00 0.98 0.98 0.10 0.40 0.31

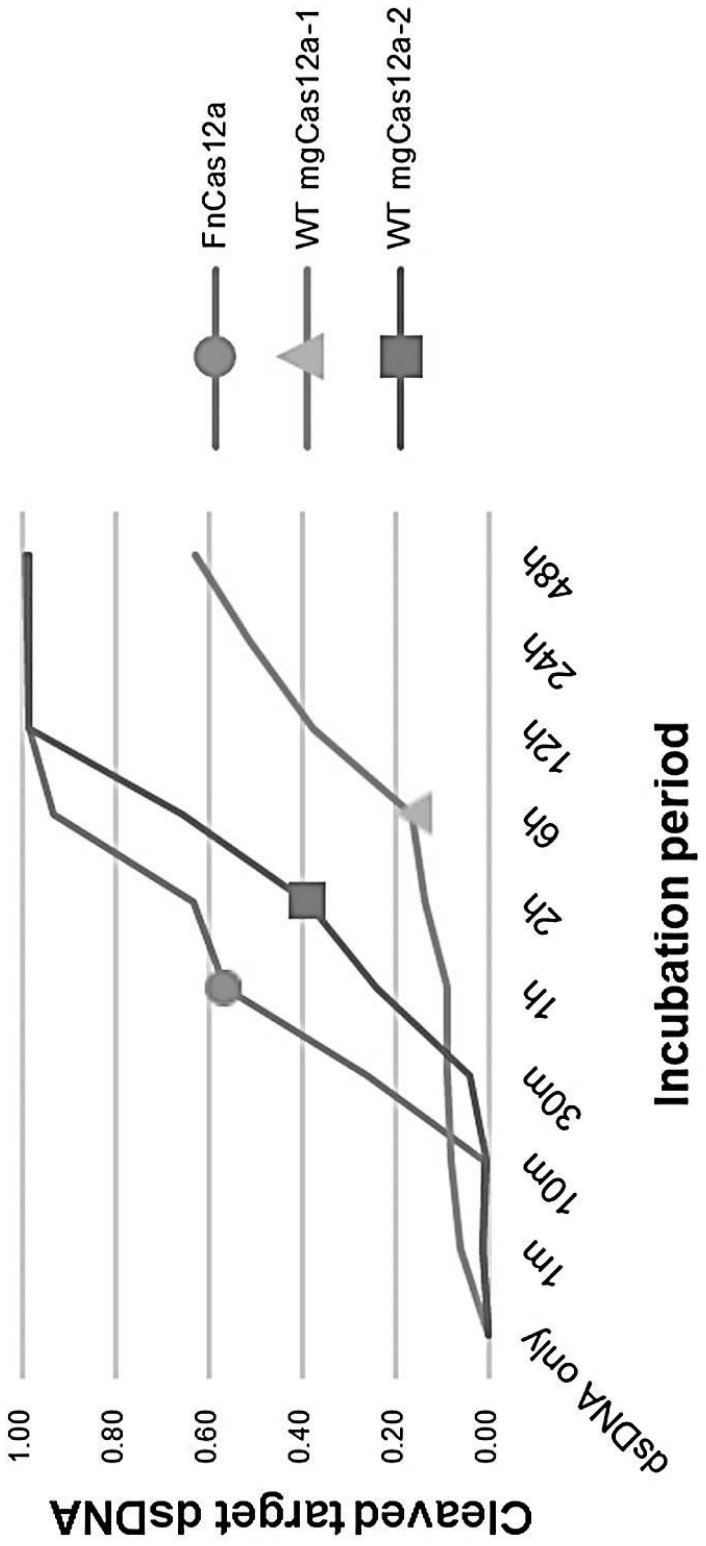
【FIG. 17】


0
12 hour incubation at 37°C
24 hour incubation at 37°C
WT mg-1
d_ mg-1
WT mg-2
d_ mg-2
As
Fn
Lb
Cas12a
crRNA
Linear dsDNA
S
P(HsCCR5) P
P(HsDNMT P1)
P(HsEMX P1)

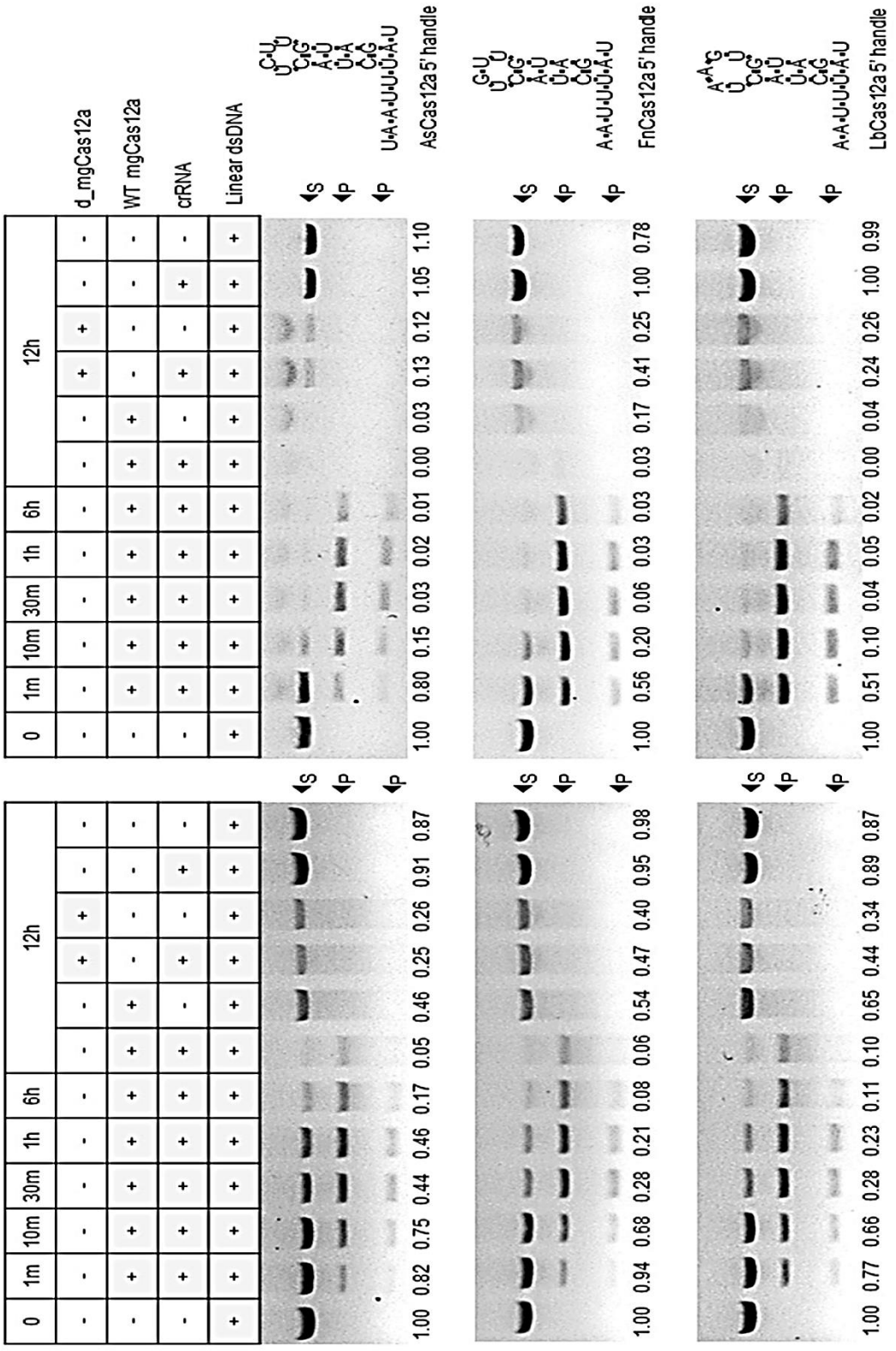
【FIG. 18A】


0 1m 10m 30m 1h 2h 6h 12h 24h 48h
- + + + + + + + + + -
Cas12a
+ + + + + + + + + + +
Linear dsDNA
FnCas12a
S
1.00 0.99 0.99 0.74 0.43 0.37 0.07 0.01 0.01 0.01 0.80
WT mgCas12a-1
S
1.00 0.94 0.92 0.91 0.91 0.86 0.83 0.62 0.49 0.37 0.92
WT mgCas12a-2
S
1.00 0.99 1.00 0.96 0.76 0.61 0.34 0.02 0.02 0.01 0.82

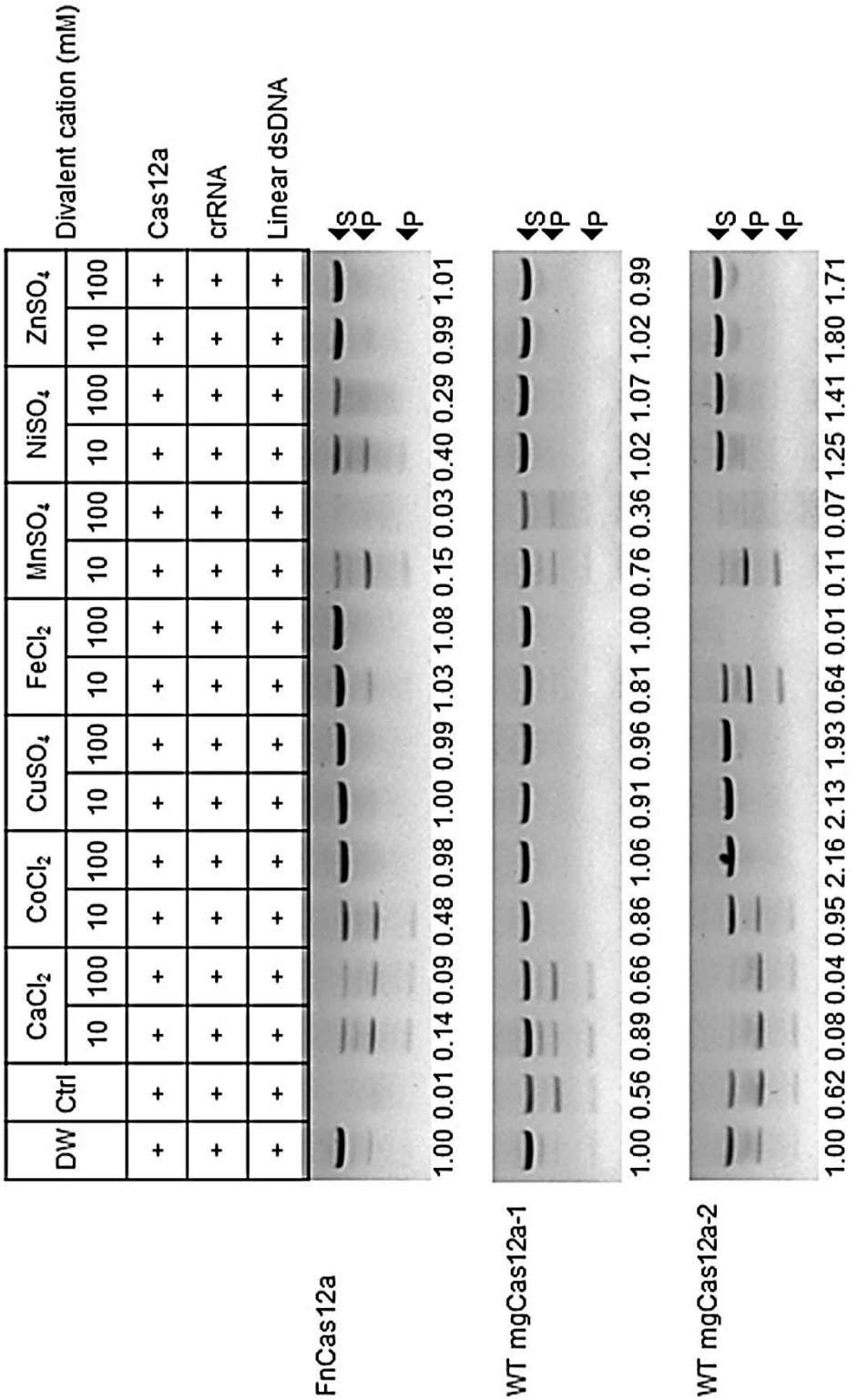
【FIG. 18B】


FnCas12a
WT mgCas12a-1
WT mgCas12a-2
Cleaved target dsDNA
1.00
0.80
0.60
0.40
0.20
0.00
dsDNA only
1m
10m
30m
1h
2h
6h
12h
24h
48h
Incubation period

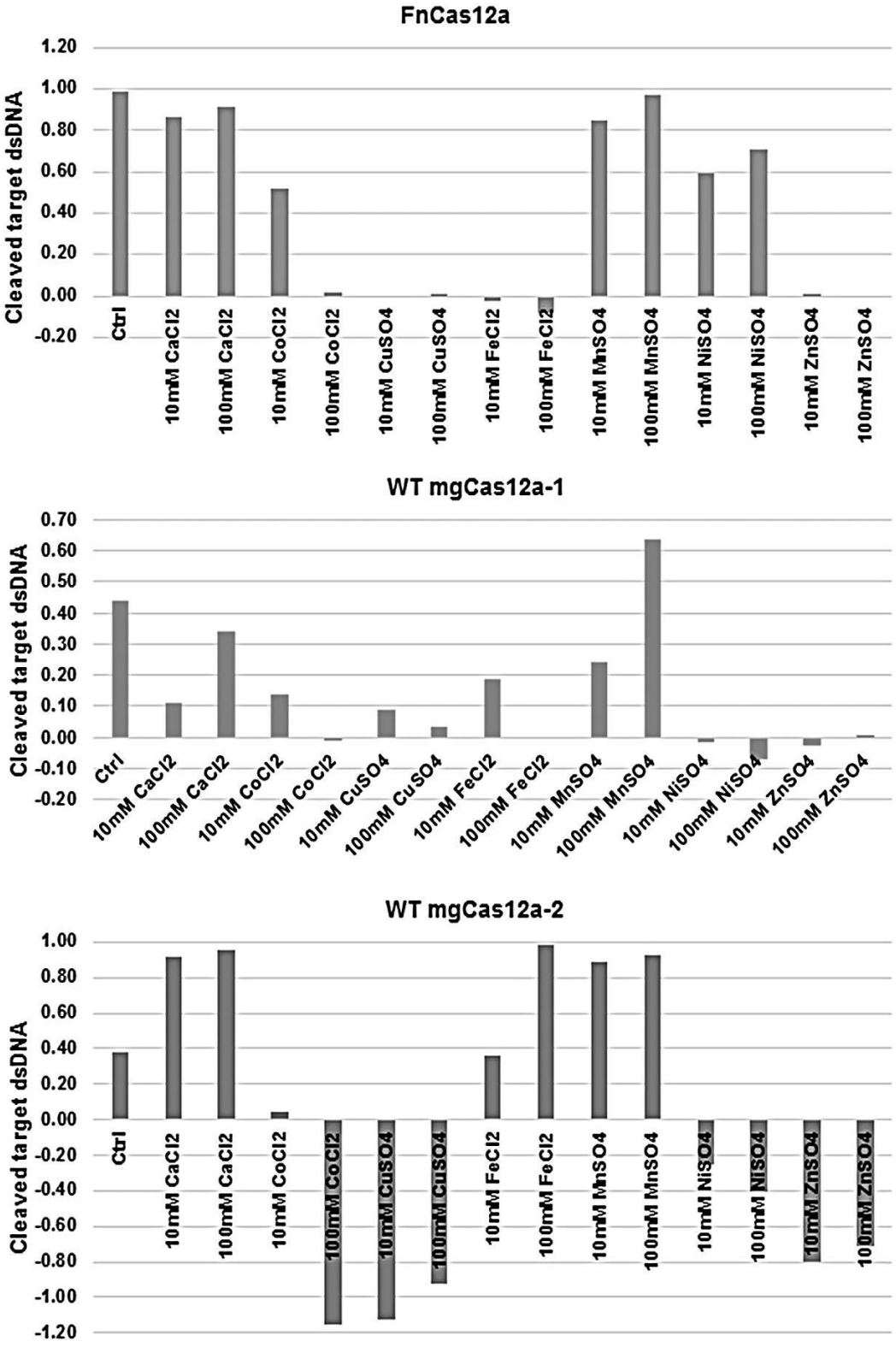
【FIG. 19】


0 1m 10m 30m 1h 6h 12h
d_mgCas12a
WT mgCas12a
crRNA
Linear dsDNA
S
P
1.00 0.82 0.75 0.44 0.46 0.17 0.05 0.46 0.25 0.26 0.91 0.87
1.00 0.94 0.68 0.28 0.21 0.08 0.06 0.54 0.47 0.40 0.95 0.98
1.00 0.77 0.66 0.28 0.23 0.11 0.10 0.65 0.44 0.34 0.89 0.87
1.00 0.80 0.15 0.03 0.02 0.01 0.00 0.03 0.13 0.12 1.05 1.10
1.00 0.56 0.20 0.06 0.03 0.03 0.03 0.17 0.41 0.25 1.00 0.78
1.00 0.51 0.10 0.04 0.05 0.02 0.00 0.04 0.24 0.26 1.00 0.99
AsCas12a 5' handle
FnCas12a 5' handle
LbCas12a 5' handle

【FIG. 20A】


Divalent cation (mM)
DW
Ctrl
CaCl2 10
CaCl2 100
CoCl2 10
CoCl2 100
CuSO4 10
CuSO4 100
FeCl2 10
FeCl2 100
MnSO4 10
MnSO4 100
NiSO4 10
NiSO4 100
ZnSO4 10
ZnSO4 100
Cas12a
crRNA
Linear dsDNA
FnCas12a
WT mgCas12a-1
WT mgCas12a-2
S
P
P
1.00 0.01 0.14 0.09 0.48 0.98 1.00 0.99 1.03 1.08 0.15 0.03 0.40 0.29 0.99 1.01
1.00 0.56 0.89 0.66 0.86 1.06 0.91 0.96 0.81 1.00 0.76 0.36 1.02 1.07 1.02 0.99
1.00 0.62 0.08 0.04 0.95 2.16 2.13 1.93 0.64 0.01 0.11 0.07 1.25 1.41 1.80 1.71

【FIG. 20B】


FnCas12a
Cleaved target dsDNA
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
Ctrl
10mM CaCl2
100mM CaCl2
10mM CoCl2
100mM CoCl2
10mM CuSO4
100mM CuSO4
10mM FeCl2
100mM FeCl2
10mM MnSO4
100mM MnSO4
10mM NiSO4
100mM NiSO4
10mM ZnSO4
100mM ZnSO4
WT mgCas12a-1
Cleaved target dsDNA
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
Ctrl
10mM CaCl2
100mM CaCl2
10mM CoCl2
100mM CoCl2
10mM CuSO4
100mM CuSO4
10mM FeCl2
100mM FeCl2
10mM MnSO4
100mM MnSO4
10mM NiSO4
100mM NiSO4
10mM ZnSO4
100mM ZnSO4
WT mgCas12a-2
Cleaved target dsDNA
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
Ctrl
10mM CaCl2
100mM CaCl2
10mM CoCl2
100mM CoCl2
10mM CuSO4
100mM CuSO4
10mM FeCl2
100mM FeCl2
10mM MnSO4
100mM MnSO4
10mM NiSO4
100mM NiSO4
10mM ZnSO4
100mM ZnSO4