Supplementary Information

The CENP-A centromere targeting domain facilitates H4K20 monomethylation in the nucleosome by structural polymorphism

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Supplementary Figure 1. Electron density maps around the H4 N-terminal tail in the H3.1 nucleosome, H3.1^{CATD} nucleosome, and H3.1^{CATD}(V^{76Q, K77D}) nucleosome. a-c, The electron density maps around the H4 N-terminal tails in the H3.1 nucleosome (a), H3.1^{CATD} nucleosome (b), and H3.1^{CATD}(V^{76Q, K77D}) nucleosome (c). The blue mesh shows the 2mFo-DFc map, which was calculated and contoured at the 1.0σ or 1.5σ level. The regions derived from H3.1, CENP-A, H4 N-terminal tail (amino acid residues 1-25), and H4 core region (amino acid residues 26-102) are colored blue, red, pink, and green, respectively.



Supplementary Figure 2. The omit map around the H4 N-terminal tail in the H3.1^{CATD} nucleosome.

Stereoviews of the electron density map around the H4 N-terminal tail in the H3.1^{CATD} nucleosome. The electron density map was calculated using the modified atomic coordinates, in which amino acid residues 1-25 of H4 were deleted from the H3.1^{CATD} nucleosome. The 2mFo-DFc map was contoured at the 1.0σ or 1.5σ level and shown by a blue mesh. The mFo-DFc map was contoured at the 2.0σ or 3.0σ level and shown by a green mesh. The regions derived from H4 N-terminal tail (amino acid residues 1-25), and H4 core region (amino acid residues 26-102) are colored pink, and green, respectively.



| b | |
|--|----------------------------|
| H3.1 nucleosome | e (5Y0C) |
| ion | B factor (Å ²) |
| Mn (H3.1D77-Mn ²⁺ -H ₂ O-H4L22) | 27.1 |
| O (H3.1D77-Mn ²⁺ -H ₂ O-H4L22) | 21.2 |
| O (H3.1Q76-H ₂ O-H4L22) | 25.4 |

Supplementary Figure 3. B factors of the H3.1, H3.1^{CATD}, and H4 molecules in the nucleosome structures.

a, The B factors of the C α atoms of the H4 molecule (ambiguous side) and the H3.1 or H3.1^{CATD} molecule in the crystal structures of the H3.1 nucleosome (5Y0C) and the H3.1^{CATD} nucleosome are plotted against the amino acid residues. Pink dots indicate the amino acid residues involved in the interaction between the H4 N-terminal tail and the H3 residues 76 and 77. **b**, The B factors of the Mn²⁺ ion and oxygen atoms of water molecules, which mediate the interaction between the H4 N-terminal tail and H3.1, are presented in the table. The corresponding Mn²⁺ ion and oxygen atoms are indicated in red.



Supplementary Figure 4. The EM density maps around the H4 N-terminal tail in the nucleosome structure, revealed by the previously reported cryo-EM studies. a, Structural comparison of the H4 N-terminal tails between the H3.1^{CATD} nucleosome and the H3.1 nucleosome (PDB ID: 5Y0C), viewed from the same angle as in Supplementary Figure 4b-e. **b and c,** The EM density maps around the H4 N-terminal tail in the H3.1 nucleosome (emd 8140 (b) and emd 6838 (c)). **d and e,** The EM density maps of the CENP-A nucleosome complexed with CENP-N (emd 7326 (d) and emd 7293 (e)) around the H4 N-terminal tail in the non-CENP-N binding side.



Supplementary Figure 5. Close-up views of the H4 N-terminal tails in the H3.1 nucleosome structure, revealed by the previously reported X-ray crystallography.

Comparison of the H4 N-terminal tail structures in the H3.1 nucleosomes. The H4 structures in the human H3.1 nucleosomes with PDB IDs 2CV5, 3AFA, and 5AV6 are colored pink, blue, and green, respectively. The H4 structures in the *Xenopus laevis* H3.1 nucleosomes with PDB IDs 3LJA and 1S32 are colored yellow and orange. The H4 structure in the *Drosophila melanogaster* H3.1 nucleosome, with PDB ID 2NQB, is colored red.



Supplementary Figure 6. Distances between the H4 Arg19 and H3 Gln76 residues or the nearest DNA backbone phosphate in the H3.1 and H3.1CATD^(V76Q, K77D) nucleosomes.

a, The black arrow indicates the distance between the H4 Arg19 and H3.1 Gln76 residues in the H3.1 nucleosome. **b**, The black arrow indicates the distance between the H4 Arg19 residue and the nearest DNA backbone phosphate in the H3.1 nucleosome. **c**, The black arrow indicates the distance between the H4 Arg19 and H3.1 Gln76 residues in the H3.1CATD^(V76Q, K77D) nucleosome. **d**, The black arrow indicates the distance between the H4 Arg19 residue and the nearest DNA backbone phosphate in the H3.1CATD^(V76Q, K77D) nucleosome. **d**, The black arrow indicates the distance between the H4 Arg19 residue and the nearest DNA backbone phosphate in the H3.1CATD^(V76Q, K77D) nucleosome. **d**, The black arrow indicates the distance between the H4 Arg19 residue and the nearest DNA backbone phosphate in the H3.1CATD^(V76Q, K77D) nucleosome. The gray spheres represent the oxygen atoms of water molecules. The blue mesh shows the 2mFo-DFc map, which was calculated and contoured at the 1.0 σ level.



Supplementary Figure 7. Purified nucleosomes and PR-Set7 used in the *in vitro* methyltransferase assay.

a, Purified nucleosomes were analyzed by native PAGE. Lane 1 indicates the 156 basepair Widom601 DNA. Lanes 2, 3, 4, and 5 indicate the nucleosomes containing H3.1, CENP-A, H3.1^{CATD}, and CENP-A^{QD}. **b**, Histone contents of purified nucleosomes were analyzed by SDS-PAGE. Lane 1 indicates molecular mass markers. Lanes 2, 3, 4, and 5 indicate the nucleosomes containing H3.1, CENP-A, H3.1^{CATD}, and CENP-A^{QD}. **c**, SDS-PAGE analysis of purified His₆-tagged PR-Set7. Lane 1 indicates molecular mass markers. Lane 2 indicates purified His₆-tagged PR-Set7.



Supplementary Figure 8. Replicated experiments of the *in vitro* methyltransferase assay.

The full images of the replicated experiments of the *in vitro* methyltransferase assays shown in Figure 3d, e, and f. **a**, Lanes 1-5 and 6-10 indicate results for the H3.1 and CENP-A nucleosomes, respectively. The nucleosomes (0.48 μ M) were incubated with 0.30 μ M His₆-tagged PR-Set7. **b**, Lanes 1-5 and 6-10 indicate results for the H3.1 and H3.1^{CATD} nucleosomes, respectively. The nucleosomes (0.48 μ M) were incubated with 0.30 μ M His₆-tagged PR-Set7. **c**, Lanes 1-5 and 6-10 indicate results for the CENP-A and CENP-A^{QD} nucleosomes, respectively. The nucleosomes (0.48 μ M) were incubated with 0.15 μ M His₆-tagged PR-Set7. **c**, Lanes 1-5 and 6-10 indicate results for the CENP-A and CENP-A^{QD} nucleosomes, respectively. The nucleosomes (0.48 μ M) were incubated with 0.15 μ M His₆-tagged PR-Set7. The red rectangles show the representative images used for Figure 3d, e, and f.



Supplementary Figure 9. Replicated experiments of Fig. 3g and h.

The PR-Set7 gel shift assay and the proteinase assay with trypsin were independently performed three times. **a**, The gel shift assay with His₆-tagged PR-Set7. Lanes 1-5 and 6-10 indicate results for the H3.1 and CENP-A nucleosomes, respectively. **b**, Proteinase assay. Lanes 1-5 and 6-10 indicate results for the H3.1 and CENP-A nucleosomes, respectively.



Supplementary Figure 10. CENP-A-deficient cells expressing either GFP-tagged CENP-A or CENP-A^{QD}.

a, Growth curves of CENP-A-deficient cell lines expressing either GFP-tagged CENP-A (GFP-CA_ Δ CA) or CENP-A^{QD} (GFP-CA^{QD}_ Δ CA). For GFP-CA^{QD}_ Δ CA, two independent cell lines (#2-5, #3-1) were used. **b**, Immunoblot analyses with anti-GFP (Upper panel), anti-H4K20me1 (Middle panel), and anti-H3 (Lower panel) antibodies, using the chromatin fraction prepared from CENP-A-deficient cells expressing either GFP-tagged CENP-A (GFP-CA_ Δ CA) or CENP-A^{QD} (GFP-CA^{QD}_ Δ CA: #2-5 and #3-1 lines). Dilution series (1.0, 0.5, 0.25, 0.125) of the protein samples from the GFP-CA^{QD}_ Δ CA cells (#2-5 and #3-1) were used to compare the expression level of each protein. An immunoblot with anti-H3 was used as a control (Lower panel). The expression level of GFP-tagged CENP-A^{QD} (CENP-A^{QD} in #2-5 cells was comparable to that of GFP-tagged CENP-A in GFP-CA_ Δ CA cells, while that of GFP-tagged CENP-A^{QD} was twice as high in #3-1 cells as compared to the GFP-CENP-A expression in GFP-CA_ Δ CA cells. The modification levels of H4K20me1 in bulk chromatin were similar in all cell lines.



Supplementary Figure 11 Full images of the western blots shown in Fig. 3g and Supplementary Figure 9b. The proteinase assay was independently performed three times. The red rectangles show the representative images used for Fig. 3g and Supplementary Figure 9b.



Supplementary Figure 12. Full image of the immunoblot shown in Fig. 4c. Immunoblot samples were prepared from cells expressing either GFP-tagged CENP-A (GFP-CA) or CENP- A^{QD} (GFP- CA^{QD}), before (-/F) and after (Δ) the endogenous CENP-A knockout. All samples were blotted on the same membrane. The membrane was then cut at the indicated dashed line and used for different antibodies. Expression of GFP-tagged CENP-A and CENP- A^{QD} and depletion of the endogenous CENP-A were confirmed by immunoblot analyses with an anti-GFP antibody (upper part of the membrane) and an anti-CENP-A antibody (lower part of the membrane), respectively. The asterisk indicates nonspecific bands. The regions enclosed by red rectangles were

used for Fig. 4c.



Supplementary Figure 13. Full image of the immunoblot shown in Supplementary Figure 10b.

Immunoblot samples were prepared from CENP-A-deficient cells expressing either GFPtagged CENP-A (GFP-CA_ Δ CA) or CENP-A^{QD} (GFP-CA^{QD}_ Δ CA, #2-5 and #3-1). The samples from GFP-CA_ Δ CA and the dilution series (1.0, 0.5, 0.25, 0.125) from GFP-CA^{QD}_ Δ CA (#2-5, #3-1) were blotted on the same membrane. The membrane was then cut, and the higher and lower molecular weight regions were used for immunoblot analyses with anti-GFP and anti-H4K20me1, respectively. For the immunoblot with the anti-H3 antibody, 10-fold reduced amounts of all samples were blotted on the same membrane, in the same order as for the immunoblots with anti-GFP or anti-H4K20me1. The membrane was then cut, and the lower molecular weight side was blotted. The areas enclosed by red rectangles were used for Supplementary Fig. 10b.

| | H3.1 ^{CATD} nucleosome | H3.1 ^{CATD(V76Q, K77D)} |
|------------------------------------|---------------------------------|----------------------------------|
| | | nucleosome |
| Data collection | | |
| Space group | $P2_{1}2_{1}2_{1}$ | $P2_{1}2_{1}2_{1}$ |
| Cell dimensions | | |
| <i>a</i> , <i>b</i> , <i>c</i> (Å) | 99.641, 100.745, 173.431 | 99.54, 109.00, 170.14 |
| α, β, γ (°) | 90.000, 90.000, 90.000 | 90.000, 90.000, 90.000 |
| Resolution (Å) | 50.00-2.71 (2.81-2.71) | 50-2.58 (2.73-2.58) |
| R _{merge} | 6.8 (46.6) | 14.5 (160.9) |
| $I/\sigma I$ | 19.3 (2.8) | 14.72 (1.68) |
| Completeness (%) | 96.5 (90.3) | 99.6 (98.3) |
| $CC_{1/2}$ in outer shell | 0.797 | 0.707 |
| Redundancy | 5.7 (4.8) | 13.2 (13.6) |
| Refinement | | |
| Resolution (Å) | 47.884 - 2.730 | 49.276 - 2.58 |
| No. reflections | 45284 | 58890 |
| $R_{\rm work} / R_{\rm free}$ | 20.29/26.14 | 21.33/24.93 |
| No. atoms | | |
| Protein | 6028 | 6024 |
| DNA | 5980 | 5980 |
| Water | 0 | 4 |
| Ion | 0 | 10 |
| B-factors | | |
| Protein | 58.1 | 56.1 |
| DNA | 108.0 | 86.5 |
| Water | - | 42.9 |
| Ion | - | 76.2 |
| R.m.s. deviations | | |
| Bond lengths (Å) | 0.010 | 0.008 |
| Bond angles (°) | 1.208 | 1.026 |
| | | |

Supplementary Table 1. X-ray crystallography data collection and refinement statistics

The crystal structures of the H3.1^{CATD} nucleosome and H3.1^{CATD}(V^{76Q, K77D}) nucleosome were determined from single crystals.
*Values in parentheses are for highest-resolution shell.

| Su | n | olement | tarv | Table | 2. | Primers | used | in | this | stud | v |
|----------------|---|---------|------|--------|----|----------------|------|-----|-------|------|---|
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| For pHCE-H3.1CATD amplification topCGTGAAATTTGCGTTAAATTTACGCGTG amplification totomFor pHCE-H3.1CATD amplification bottomCAGGGTTAACAGATACGCATCTTCAAACAGAT CCAGCGCCTGGTGGAAATTTGFor pHCE-H3.1CATD mutation 1 topCCAGCGCCTGGTGGAGAATTTGFor pHCE-H3.1CATD preparation, fixCCAACTTCACGCACCAGGCGCTGGmutation 1 bottomTCACTCGCTTAGCATGCAAGCGAGGGAFor pHCE-H3.1CATD preparation, fixTCACTCGCTTAGCATGCAGGGGGGGGGGGGAmutation 2 topTCACTCGCTTAGCATGCAGGGGTAACAGAFor pHCE-H3.1CATD preparation, fixTCACTCGCTTAGCATGCAGGGGGGGGGGGGGGGGGGGGG | amplification bottom | |
| amplification topFor pHCE-H3.1CATDCAGGGTTAACAGATACGCATCTTCAAACAGATmultification bottomCCAGGCCCTGGTGCGTGAAATTTGFor pHCE-H3.1CATD preparation, fixCCAGCGCCTGGTGCGTGAAATTTGmutation 1 bottomTCTGTTAACCCTGCATGCTAAGCGAGTGAfor pHCE-H3.1CATD preparation, fixTCTGTTAACCCTGCATGCTAAGCGAGTGAmutation 2 bottomTCACTCGCTTAGCATGCAGGGGTTAACAGAFor pHCE-H3.1CATD preparation, fixTCACTCGCTTAGCATGCAGGGGTAACAGAmutation 2 bottomTCACTCGCTTAGCATGCAGGGGTAACAGAFor pET15b-H2A.1SML.1SML.1SMLGCGCCGCGGTGTATATGGCGGCGGGGGCCTGGpreparation, L51M topFor pET15b-H2A.1SML.1SML.1SMLFor pET15b-H2A.1SML.1SML.1SMLGGGTGCTTGAGTACATGACCGCGCGGCGCpreparation, L51M bottomCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L51M bottomFor pET15b-H2A.1SML.1SML.1SMLFor pET15b-H2A.1SML.1SML.1SMLGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L53M topCCCCAAAAGTTTATCATCTCAAGCACCGFor pET15b-H2A.1SML.1SML.1SMLCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTACCCGCGGGGGGAATGAATAAACTTTGGGGFor pET15b-CENP-AQD preparation,CAAGACTTACCCGCGGCGCAAACGGCAGGAGGAGGAAGAATTTAACTGGCmutagenesis topAATGACGAGGCCCCATATGGCTAACGGCAGGCAGGAGGAGGAAGGA | For pHCE-H3.1 ^{CATD} preparation, CATD | CGTGAAATTTGCGTTAAATTTACGCGTG |
| For pHCE-H3.1 ^{CATD} preparation, CATD amplification bottom CAGGGTTAACAGATACGCATCTTCAAACAGAT CCAGCCCTGGTGCGTGAAATTTG mutation 1 top CCAGCGCCTGGTGCGTGAAATTTG For pHCE-H3.1 ^{CATD} preparation, fix CCAAATTTCACGCACCAGGCGCTGG mutation 1 bottom TCTGTTAACCCTGCATGCTAAGCGAGTGA For pHCE-H3.1 ^{CATD} preparation, fix TCACTCGCTTAGCATGCAGGGGTAACAGA mutation 2 bottom TCACTCGCTTAGCATGCAGGGGTGAACAGA For pHCE-H3.1 ^{CATD} preparation, fix TCACTCGCTTAGCATGCAGGGGGGGGGGGGGGGGGGGGG | amplification top | |
| amplification bottomFor pHCE-H3.1CATD preparation, fixCCAGCGCCTGGTGCGTGAAATTTGFor pHCE-H3.1CATD preparation, fixCCAAATTTCACGCACCAGGCGCTGGmutation 1 bottomFor pHCE-H3.1CATD preparation, fixFor pHCE-H3.1CATD preparation, fixTCTGTTAACCCTGCATGCTAGCGGGGTGAACAGGAmutation 2 topFor pHCE-H3.1CATD preparation, fixFor pHCE-H3.1CATD preparation, fixTCACTCGCTTAGCATGCAGGGGTGAACAGAmutation 2 bottomFor pET15b-H2A.1SIM.LS8M.193MFor pET15b-H2A.1SIM.LS8M.193MCCACCGCCGCGCCGCCATATACACCGGCGGCGpreparation, L51M bottomFor pET15b-H2A.1SIM.LS8M.193MFor pET15b-H2A.1SIM.LS8M.193MCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M bottomFor pET15b-H2A.1SIM.LS8M.193MFor pET15b-H2A.1SIM.LS8M.193MGGATCTCGGCGGGTCATGTACTCAAGCACCGpreparation, L58M bottomFor pET15b-H2A.1SIM.LS8M.193MFor pET15b-H2A.1SIM.LS8M.193MCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTATCCATCTCCTCGTCATTFor pET15b-H2A.1SIM.LS8M.193MCCACGGGGCGCCAGGCGGCGAGATTTAACTGGCAmutagenesis topAFor pET15b-CENP-A ^{QD} preparation,CAAGACTTTACCCGCGCGCGGGGCTAAACGGCAGmutagenesis topAFor pET15b-PRSet7 preparation, PRSet7GCAGCGGGACCCATATGGCTAGAGGCAGGAAGGAAGGAAG | For pHCE-H3.1 ^{CATD} preparation, CATD | CAGGGTTAACAGATACGCATCTTCAAACAGAT |
| For pHCE-H3.1CATD preparation, fix mutation 1 topCCAGCGCCTGGTGCGTGAAATTTG mutation 1 bottomFor pHCE-H3.1CATD preparation, fix mutation 1 bottomCAAATTTCACGCACCAGGCGCTGGFor pHCE-H3.1CATD preparation, fix mutation 2 bottomTCTGTTAACCCTGCATGCTAAGCGAGTGAFor pHCE-H3.1CATD preparation, fix mutation 2 bottomTCACTCGCTTAGCATGCAGGGGTAACAGAFor pET15b-H2A L51M, L58M, L93MGCGCGCCCGGTGTATATGGCGGCGGGGGGCGCGCpreparation, L51M bottomCAAGCACCGCCGCCCATATACACCGGCGCGCFor pET15b-H2A L51M, L58M, L93MCAAGCACCGCCGCCATATACACCGGCGCGCpreparation, L51M bottomCGGTGCTTGAGTACATGACCGCCGAGATCCFor pET15b-H2A L51M, L58M, L93MCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCGGTGCTTGAGTACATGACCAGCGCGGCGCGpreparation, L58M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M topFor pET15b-CENP-A ^{QD} preparation,For pET15b-CENP-A ^{QD} preparation,GCAAATTTCGCGCGCCAGGCGGCTAAACGGCAGmutagenesis topAFor pET15b-CENP-A ^{QD} preparation,GCAAATTTCGCGCGGCGCAGGCGCTGAACGGCAGGAAGmutagenesis bottomTTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAGFor pET15b-PRSet7 preparation, PRSet7TTCCAGGGGCCCCATATGGCTAGAGGCAGGAAGFor pET15b-PRSet7 preparation, PRSet7TAAGGATCCGGCTGCTAACAAAGCCmplification botomGCTTCAFor pET15b-PRSet7 preparation, PRSet7TAAGGATCCGGCTGCTAACAAAGCCmplification botomGCTTCAFor pET15b-PRSet7 preparation, | amplification bottom | |
| mutation 1 top For pHCE-H3.1CATD preparation, fix CAAATTTCACGCACCAGGCGCTGG mutation 1 bottom For pHCE-H3.1CATD preparation, fix TCTGTTAACCCTGCATGCTAAGCGAGGTGA mutation 2 top For pHCE-H3.1CATD preparation, fix TCACTCGCTTAGCATGCAGGGGTAACAGA For pHCE-H3.1CATD preparation, fix TCACTCGCTTAGCATGCAGGGGTGAACAGA For pET15b-H2A LSIM, LSBM, L93M GCGCGCCGGTGTATATGGCGGCGGGGGGGGGGGGGGGGG | For pHCE-H3.1 ^{CATD} preparation, fix | CCAGCGCCTGGTGCGTGAAATTTG |
| For pHCE-H3.1CATD preparation, fix mutation 1 bottom CAAATTTCACGCACCAGGCGCTGG For pHCE-H3.1CATD preparation, fix mutation 2 top TCTGTTAACCCTGCATGCTAAGCGAGTGA For pHCE-H3.1CATD preparation, fix TCACTCGCTTAGCATGCAGGGGTAACAGA mutation 2 bottom GCGCGCCGGTGTATATGGCGGCGGGGGGGGTGCTTG For pET15b-H2A LSIM. LSIM, | mutation 1 top | |
| Institution 1 bottom For phCE-H3.1 ^{CATD} preparation, fix TCTGTTAACCCTGCATGCTAAGCGAGTGA mutation 2 top For phCE-H3.1 ^{CATD} preparation, fix TCACTCGCTTAGCATGCAGGGGTAACAGA mutation 2 bottom For phCE-H3.1 ^{CATD} preparation, fix TCACTCGCTTAGCATGCAGGGGTAACAGA mutation 2 bottom For pET15b-H2A ^{LSIM, LSSM, L93M} preparation, L51M bottom For pET15b-H2A ^{LSIM, LSSM, L93M} CGGTGCTTGAGTACATGACCGCCGAGATCC preparation, L58M totom For pET15b-H2A ^{LSIM, LSSM, L93M} preparation, L58M totom For pET15b-H2A ^{LSIM, LSSM, L93M} preparation, L58M bottom For pET15b-H2A ^{LSIM, LSSM, L93M} preparation, L93M top For pET15b-H2A ^{LSIM, LSSM, L93M} preparation, L93M bottom For pET15b-H2A ^{LSIM, LSSM, L93M} preparation, L93M bottom For pET15b-H2A ^{LSIM, LSSM, L93M} preparation, L93M bottom For pET15b-CENP-A ^{OD} preparation, CAAATTTCCGCGCGCGCGCGGGGGGGGGGGCTAAACGGCAG mutagenesis botom TTT For pHCE-H3.1 ^{CATD(V760, K77D)} preparation, | For pHCE-H3.1 ^{CATD} preparation, fix | CAAATTTCACGCACCAGGCGCTGG |
| InstructInstructFor pHCE-H3.1CATD preparationTCTGTTAACCCTGCATGCTAAGCGAGTGAmutation 2 topTCACTCGCTTAGCATGCAAGCGAGTGAFor pHCE-H3.1CATD preparation, L51M topGCGCGCCGGTGTATATGGCGGCGGTGCTTGFor pET15b-H2A L51M, L58M, L93MGCGCGCCCGCCATATACACCGGCGCGCCpreparation, L51M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L51M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTATCATCTCCTCGGCAGTGAATTAACTGGCGFor pET15b-CENP-A ^{QD} preparation, mutagenesis bottomCAAGACTTTACCCGCGGCGCGAGATTTTAACTGGCAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis botomGCAAATTTCACGCGTGGTGTGGATTTTAACTGGCAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomGCAGCCGGATCCTTAATGGCTAGAGGCAGGAAGGAFor pHCE-H3.1CATD(V76Q, K77D) preparation, PREST7 preparation, PRSet7 | mutation 1 bottom | |
| Tot pictureTot pictureFor pHCE-H3.1CATDpreparation, fixTransformTCACTCGCTTAGCATGCAGGGGTAACAGAmutation 2 bottomGCGCGCCGGTGTATATGGCGGCGGGGGTGCTTGFor pET15b-H2A L51M, L58M, L93MGCGCGCCGCCGCCATATACACCGGCGGCGCCpreparation, L51M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTACCCGCGGCGTGGATTTTAACTGGCGpreparation, L93M bottomCCCCAAAAGTTTACCCGCGGCGGGGATTTAACTGGCCFor pET15b-CENP-A ^{QD} preparation,GCAAATTTCGCGGCGCCAGGCGGCGAAACGGCGCGGAGGGGCGCAAACGGCAGGGGGG | For pHCE-H3 1 ^{CATD} preparation fix | TCTGTTAACCCTGCATGCTAAGCGAGTGA |
| InstituteICACTDpreparation, fix mutation 2 bottomTCACTCGCTTAGCATGCAGGGGTTAACAGAFor pET15b-H2AL51M, L58M, L93MGCGCGCCGGTGTATATGGCGGCGGTGCTTGpreparation, L51M topFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2AL51M, L58M, L93MCAAGCACCGCCGCCATATACACCGGCGCGCpreparation, L51M bottomFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2AL51M, L58M, L93MCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2AL51M, L58M, L93MGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2AL51M, L58M, L93MCCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M bottomFor pET15b-H2AL51M, L58M, L93MFor pET15b-CENP-A0 ^D preparation,CCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M bottomCCCCCAAAAGTTTACCCGCGGGGGGATTTTAACTGGCFor pET15b-CENP-A0 ^D preparation,CCACAGCGGGGCCCAGGCGGGCTAAACGGCAGGmutagenesis botomTTTFor pHCE-H3.1CATD(V760, K77D) preparation,GCACATTTCACGCGTGGTGTGGATTTTAACTGGCAGGmutagenesis botomTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAGFor pET15b-PRSet7 preparation, PRSet7TTCCAGGGGGCCCCATATGGCTAGAGGCAGGAAGFor pET15b-PRSet7 preparation, PRSet7CCAGGCGGATCCTTAATGCTCAGCCACGGGTGGFor pET15b-PRSet7 preparation, PRSet7TAGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pE | mutation 2 ton | |
| Torpered bitspropagation, interferenceFor pET15b-H2ALSIM, LSIM, LSIM | For pHCF-H3 1 ^{CATD} preparation fix | |
| Initiation 2GCGCGCCGGTGTATATGGCGGCGGTGCTTGFor pET15b-H2A L51M, L58M, L93MGCGCGCCGCGCGCCATATACACCGGCGCGCGCpreparation, L51M bottomCAAGCACCGCCGCCATATACACCGGCGGCGCFor pET15b-H2A L51M, L58M, L93MCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MGGATCTCGGCGGGTCATGTACTCAAGCACCGpreparation, L58M bottomFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MGGATCTCGGCGGGCAGTGAATAAACTTTTGGGGpreparation, L93M topCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomCCCCCAAAAGTTTATCATCTCCTCGTCATTFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTACCCGCGGGGGGAACAGGCGCGGGAACAGGCGmutagenesis topCCCCCAAAAGTTTACCCGCGGGGGGGGATTTTAACTGGCMutagenesis bottomTTTFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomGCACAGGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomAGCTTCFor pET15b-PRSet7 preparation, PPSet7 amplification topATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification topGCACCGGGATCCTTAATGCTCAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCAmplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCC </td <td>mutation 2 bottom</td> <td></td> | mutation 2 bottom | |
| In preparation, L51M topGenerationFor pET15b-H2A L51M, L58M, L93MCAAGCACCGCCGCCATATACACCGGCGCGCGpreparation, L51M bottomCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomGGATCTCGGCGGTCATGTACTCAAGCACCGFor pET15b-H2A L51M, L58M, L93MAATGACGAGGAGAGAGAATAAACTTTGGGGpreparation, L93M topCCCCCAAAAGTTTATTCATCTCCTCGTCATTFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M bottomCCCCCAAAAGTTTATCCATCTCCTCGTCATTFor pET15b-CENP-A ^{QD} preparation, mutagenesis topCAAGACTTTACCCGCGGCGGGGGTAAACGGCAGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomGCATTTACGCGTGGGTGTGGATTTTAACTGGCAGGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTAGAACGGCAGGAAG AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTGCCAAFor pET15b-PRSet7 preparation, PRSet7 amplification topGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GAGCCCGGATCCTTAATGCTCAGAGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCC <td>For pFT15b-H2Δ L51M, L58M, L93M</td> <td>GCGCGCCGGTGTATATGGCGGCGGTGCTTG</td> | For pFT15b-H2Δ L51M, L58M, L93M | GCGCGCCGGTGTATATGGCGGCGGTGCTTG |
| Including (L2) TM tobyCAAGCACCGCCGCCATATACACCGGCGCGCFor pET15b-H2A L51M, L58M, L93MCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topCGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomGGATCTCGGCGGGTCATGTACTCAAGCACCGFor pET15b-H2A L51M, L58M, L93MGGATCTCGGCGGGGAGATGAATAAACTTTTGGGGGpreparation, L93M topCCCCAAAAGTTTATTCATCTCCTCGTCATTFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTACCCGCGGGGGGGATTTTAACTGGCFor pET15b-CENP-AQD preparation, mutagenesis topCAAGACTTTACCCGCGCGCGGGGGGATAAACGGCAGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomGACTTTACGCGTGGTGTGGATTTTAACTGGCAGGCFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomTTGCCAAGGGFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGGFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCC | preparation I 51M top | |
| Tot pict 150-12ACARGERCEGECECECCATATATECACCOCCCCCpreparation, L51M bottomCGGTGCTTGAGTACATGACCGCCGAGATCCFor pET15b-H2ACGGTGCTTGAGTACATGACCGCCGAGATCCpreparation, L58M topGGATCTCGGCGGTCATGTACTCAAGCACCGFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2AL51M, L58M, L93MFor pET15b-H2ACCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M topCCCCCAAAAGTTTATCATCTCCTCGTCATTFor pET15b-CENP-AQD preparation, mutagenesis bottomCAAGACTTTACCCGCGCGCGGGGGGTGAAACGGCAGAFor pET15b-CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCGCCAGGCGGCTAAACGGCAGGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification topTAGGGGCCCCTGGAACAGACCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | For pET15h H2A L51M, L58M, L93M | |
| preparation, L51M bitonCGGTGCTTGAGTACATGACCGCCGAGATCCFor pET15b-H2A L51M, L58M, L93MGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomGGATCTCGGCGGTCATGTACTCAAGCACCGFor pET15b-H2A L51M, L58M, L93MAATGACGAGGAGAGAGAATAAACTTTTGGGGGpreparation, L93M topFor pET15b-H2A L51M, L58M, L93MFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomFor pET15b-CENP-AQD preparation,For pET15b-CENP-AQD preparation,CAAGACTTTACCCGCGGCGCGGGGGTGGATTTTAACTGGCmutagenesis topAFor pET15b-CENP-AQD preparation,GCAAATTTCGCGCGCCCAGGCGGCGCAAACGGCAGGmutagenesis bottomTTTFor pHCE-H3.1CATD(V76Q, K77D) preparation,GACTTACGCGTGGTGTGGATTTTAACTGGCAGGmutagenesis topAFor pHCE-H3.1CATD(V76Q, K77D) preparation,TGCCAAGGmutagenesis bottomTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAGmutagenesis topAGCTTCFor pET15b-PRSet7 preparation, PRSet7TTCCAGGGGCCCCATATGGCTAGAGGCAGGAAGmulification topATGTCCAFor pET15b-PRSet7 preparation, PRSet7GCAGCCGGATCCTTAATGCTTCAGCCACGGGTGGmplification topTAAGGATCCGGCTGCTAACAAAGCCmplification topTAAGGATCCGGCTGCTAACAAAGCCmplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCmplification topTAGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCmulification topTAGGGGCCCCTGGAACAGAACTTCC | propagation I 51M bottom | CAAOCACCOCCATATACACCOCOCOC |
| For pET15b-H2ACOUTOCTTOAGTACATOACCOCCOAGATCCpreparation, L58M topGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomFor pET15b-H2AFor pET15b-H2AL51M, L58M, L93Mpreparation, L93M topCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTATCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTACCCGCGGCGGGGATTTTAACTGGCFor pET15b-CENP-AQD preparation, mutagenesis topCAAGACTTTACCCGCGCGCGGGGGTAAACGGCAGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomGACAATTTCACGCGTGGTGTGGATTTTAACTGGCAGGFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, pET15bAAGCTTCFor pET15b-PRSet7 preparation, pET15bAAGGATCCCGGCTGCTAACAAGCCFor pET15b-PRSet7 preparation, pET15bAAGGATCCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCC | For pET15h H2A L51M L58M L93M | CCCTCCTTCACTACATCACCCCCCACATCC |
| preparation, L35W topGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomFor pET15b-H2A L51M, L58M, L93MAATGACGAGGAGAGAGAATAAACTTTTGGGGFor pET15b-H2A L51M, L58M, L93MAATGACGAGGAGATGAATAAACTTTTGGGGFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomCCCCCAAAAGTTTACCCGCGGCGTGGATTTTAACTGGCFor pET15b-CENP-AQD preparation, mutagenesis topCAAGACTTTACCCGCGGCGCGGGGTAAACGGCAGFor pET15b-CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCGCCAGGCGGCTAAACGGCAGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomGACTTTACGCGTGGTGTGGGATTTTAACTGGCAGGCFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCC | ron pE 1150-H2A torn, from point | COOLOCITOAOTACATOACCOCCOAOATCC |
| For pE113b-H2A Disk DownGGATCTCGGCGGTCATGTACTCAAGCACCGpreparation, L58M bottomAATGACGAGGAGAGATGAATAAACTTTTGGGGFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomFor pET15b-CENP-AQD preparation, mutagenesis bottomCCCCAAAAGTTTACCCGCGGCGTGGATTTTAACTGGC AFor pET15b-CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCCAGGCGGGCTAAACGGCAG TTTFor pET15b-CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCGCGGGGGTAAACGGCAG CACAGGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomGACTTTACGCGTGGTGTGGATTTTAACTGGCAGG CACAGGFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCC | $E_{\text{regree}} = E_{\text{regree}} = E_{\text{regree}$ | |
| preparation, L58M bottomAATGACGAGGAGATGAATAAACTTTGGGGFor pET15b-H2A L51M, L58M, L93MCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTATTCATCTCCTCGTCATTFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATCCCGCGGCGTGGATTTTAACTGGCmutagenesis topAFor pET15b- CENP-A ^{QD} preparation, mutagenesis bottomGCAAATTTCGCGCGCGCCAGGCGGCTAAACGGCAGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomGACTTTACGCGTGGTGTGGATTTTAACTGGCAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCFor pET15b-PRSet7 preparation, PRSet7TTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG AGCTTCFor pET15b-PRSet7 preparation, PRSet7GCAGCCGGATCCTTAATGCTTCAGCCACGGGGGGGGGGG | FOR PETIJO-HZA ESTA, ESTA, ESTA | GGATCICGGCGGICAIGIACICAAGCACCG |
| For pE 1150-H2A L51M, L58M, L93MAATGACGAGGAGAGATGAATAAACTTTTGGGGGpreparation, L93M topCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomCCCCAAAAGTTTACCCGCGGGGGGGGAGATTTAACTGGCFor pET15b- CENP-AQD preparation, mutagenesis topCAAGACTTTACCCGCGGCGCGGGGGTAAACGGCAGFor pET15b- CENP-AQD preparation, mutagenesis bottomGCAAAATTTCGCGCGCGCGGGGGTAAACGGCAGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTGGCAGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | preparation, LS8M bottom | |
| preparation, L93M topFor pET15b-H2A L51M, L58M, L93MCCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomCAAGACTTTACCCGCGGCGTGGATTTTAACTGGCFor pET15b- CENP-AQD preparation, mutagenesis topCCAAGACTTTCGCCGCGCCAGGCGGCTAAACGGCAGFor pET15b- CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCCAGGCGGCTAAACGGCAGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGGFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCFor pHCE-H3.1CATD(V760, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCFor pET15b-PRSet7 preparation, PRSet7 amplification topAGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGGFor pET15b-PRSet7 preparation, pET15b amplification topTAGGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | For pE115b-H2A ESTIM, ESSIM | AATGACGAGGAGATGAATAAACTTTTGGGG |
| For pE115b-H2A L31M, L36M, L36MCCCCAAAAGTTTATTCATCTCCTCGTCATTpreparation, L93M bottomFor pET15b- CENP-A ^{QD} preparation, mutagenesis topCAAGACTTTACCCGCGGCGCGGGATTTTAACTGGC AFor pET15b- CENP-A ^{QD} preparation, mutagenesis bottomGCAAATTTCGCGCGCCCAGGCGGCTAAACGGCAG TTTFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGGCCCCTGGAACAGAACTTCC | preparation, L93M top | |
| preparation, L93M bottomFor pET15b- CENP-AQD preparation, mutagenesis topCAAGACTTTACCCGCGCGTGGATTTTAACTGGC AFor pET15b- CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCCAGGCGGCTAAACGGCAG TTTFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification bottomATGGGGCCCCTGGAACAGAACTTCC | For pE115b-H2A LSTM, LSTM, LSTM | CCCCAAAAGIIIAIICAICICCICGICAII |
| For pET15b- CENP-AQD preparation, mutagenesis topCAAGACTTTACCCGCGGCGTGGATTTTAACTGGC AFor pET15b- CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCGCCAGGCGGCTAAACGGCAG TTTFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomGACTTTACGCGTGGTGTGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | preparation, L93M bottom | |
| mutagenesis topAFor pET15b- CENP-AQD preparation, mutagenesis bottomGCAAATTTCGCGCGCCAGGCGGCTAAACGGCAG TTTFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGCC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | For pET15b- CENP-A ^{QD} preparation, | CAAGACTITACCCGCGGCGTGGATTTTAACTGGC |
| For pET15b- CENP-A ^{QD} preparation, mutagenesis bottomGCAAATTTCGCGCGCCAGGCGGCTAAACGGCAG TTTFor pHCE-H3.1 ^{CATD(V76Q, K77D)} preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1 ^{CATD(V76Q, K77D)} preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | mutagenesis top | A |
| mutagenesis bottomTTTFor pHCE-H3.1 ^{CATD(V76Q, K77D)} preparation, mutagenesis topGACTTTACGCGTGGTGTGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1 ^{CATD(V76Q, K77D)} preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | For pET15b- CENP-A ^{QD} preparation, | GCAAATTTCGCGCGCCAGGCGGCTAAACGGCAG |
| For pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis topGACTTTACGCGTGGTGTGGGATTTTAACTGGCAGG CACAGGFor pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | mutagenesis bottom | TTT |
| mutagenesis topCACAGGFor pHCE-H3.1 ^{CATD(V76Q, K77D)} preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGCCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | For pHCE-H3.1 ^{CATD(V76Q, K77D)} preparation, | GACTTTACGCGTGGTGTGGATTTTAACTGGCAGG |
| For pHCE-H3.1CATD(V76Q, K77D) preparation, mutagenesis bottomTTGGCAAATTTCACGCACCAGGCGCTGGAACGGC AGCTTCFor pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCC | mutagenesis top | CACAGG |
| mutagenesis bottomAGCTTCFor pET15b-PRSet7 preparation, PRSet7TTCCAGGGGGCCCCATATGGCTAGAGGCAGGAAGamplification topATGTCCAFor pET15b-PRSet7 preparation, PRSet7GCAGCCGGATCCTTAATGCTTCAGCCACGGGTGGamplification bottomGCTTCAFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15bATGGGGCCCCTGGAACAGAACTTCCamplification bottomATGGGGGCCCCTGGAACAGAACTTCC | For pHCE-H3.1 ^{CATD(V76Q, K77D)} preparation, | TTGGCAAATTTCACGCACCAGGCGCTGGAACGGC |
| For pET15b-PRSet7 preparation, PRSet7 amplification topTTCCAGGGGGCCCCATATGGCTAGAGGCAGGAAG ATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15b amplification topATGGGGGCCCCTGGAACAGAACTTCC | mutagenesis bottom | AGCTTC |
| amplification topATGTCCAFor pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification bottomATGGGGGCCCCTGGAACAGAACTTCC | For pET15b-PRSet7 preparation, PRSet7 | TTCCAGGGGCCCCATATGGCTAGAGGCAGGAAG |
| For pET15b-PRSet7 preparation, PRSet7 amplification bottomGCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG GCTTCAFor pET15b-PRSet7 preparation, pET15b amplification topTAAGGATCCGGCTGCTAACAAAGCCFor pET15b-PRSet7 preparation, pET15b amplification bottomATGGGGGCCCCTGGAACAGAACTTCC | amplification top | ATGTCCA |
| amplification bottomGCTTCAFor pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topTAGGGGCCCCTGGAACAGAACTTCCFor pET15b-PRSet7 preparation, pET15bATGGGGGCCCCTGGAACAGAACTTCCamplification bottomATGGGGGCCCCTGGAACAGAACTTCC | For pET15b-PRSet7 preparation, PRSet7 | GCAGCCGGATCCTTAATGCTTCAGCCACGGGTGG |
| For pET15b-PRSet7 preparation, pET15bTAAGGATCCGGCTGCTAACAAAGCCamplification topFor pET15b-PRSet7 preparation, pET15bFor pET15b-PRSet7 preparation, pET15bATGGGGGCCCCTGGAACAGAACTTCCamplification bottomATGGGGGCCCCTGGAACAGAACTTCC | amplification bottom | GCTTCA |
| amplification top For pET15b-PRSet7 preparation, pET15b ATGGGGCCCCTGGAACAGAACTTCC amplification bottom | For pET15b-PRSet7 preparation, pET15b | TAAGGATCCGGCTGCTAACAAAGCC |
| For pET15b-PRSet7 preparation, pET15b ATGGGGGCCCCTGGAACAGAACTTCC amplification bottom | amplification top | |
| amplification bottom | For pET15b-PRSet7 preparation, pET15b | ATGGGGCCCCTGGAACAGAACTTCC |
| | amplification bottom | |