**Supplementary Table 1. List of sgRNA Sequence and selected clones**

|  |  |  |  |
| --- | --- | --- | --- |
| **Genes** | **Targets** | **sgRNA Sequences (PAMs)** | **selected clones†** |
| ***Per1*** | Last exon | 5’-GCACCAGCTAGACTCCATTC (TGG) | *Per1Luc* KI - H1, H2, **H3**\*, H4, **H6a**, **H7a**, H8a, **H10**, H11, **H12a**, H13a, H14a, LH2, LH3a, **LH5** |
| ***Per2*** | Last exon | 5’-gACCCCTGCCCCACCTCAGCC (CGG) | *Per2Luc* KI - **H1**, **H2**, **H6**, H8, H9, **LH1**\*, LH3, LH4, LH5, LH6  |
| ***Cry1*** | Exon1 | 5’-GTTCGCCGGCTCCTCCAATG (TGG) | KO in *Per1Luc*- **2\***, 4, 5b, **6**, 7, 8, 9b, 10, 11, 13, 14, 15, 16 |
| KO in *Per2Luc*- **4**, 6, **7**\*, 9, **10**, 12b, 13, 14, 15, 16, 17, 19, 20, 21, **22**  |
| ***Cry2*** | Exon2 | 5’-gAGCCAGCCGACGTGTTCCCA (AGG) | KO in *Per1Luc*-1, 2, 3, 4, **5**, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19 |
| KO in *Per2Luc*- 2, 3, 4, 5, 6, 7, 8, **9**, 10, **11**, 12 |
| ***Cry1/2*** | Exon1/2 | --- | DKO in *Per1Luc*- **1**, 3, **4**, 5, **6**, 7, **8**, **10** |
| DKO in *Per2Luc*- **2**, **3b**, **4**, **5**, 6 |
| ***CK1*** | Exon4 | 5’-gCGTACCGCGCCGTCCCCGTG (AGG) | KO in *Per1Luc*- 1, 2\*, 4, 9, 10b, 12 |
| KO in *Per2Luc* -**1b**, 2b, 3b, 4b, 7, **9b**, **10**\*, 11, 12, 13 |
| ***CK1*** | Exon2 | 5’-GTTCCCCACACGTAGCTCCA (TGG) | KO in *Per2Luc*-21, **22**\*, 23, 24, **25**, 26, 27, 28, 29, 30, 31, 32, 33b, 36 |
| Exon8 | 5’-GCGGCGAGAACACGAACGCG (AGG) | KO in *Per2Luc*-2, 4, 5, 6, 7, **8**, 9, 10 |
| ***CK1*** | Exon4/8 | --- | DKO in *Per1Luc*- **1**, **2b** |
| DKO in *Per2Luc*- 1, **2**, **4** |

† selected clones were verified by immunoblotting initially. Clones in bold were further verified by sequencing. Immunoblotting with time course samples were performed for two clones each of *Per1Luc* H3 and H10, and *Per2Luc* H1 and LH1 clones. Two clones showed similar results for both reporters.

\* These *Per* reporter clones were used to generate mutations in other clock genes.

a These clones are homozygous KI.

b These clones have one in-frame indel allele and one out of frame allele, which was verified by immunoblotting and sequencing.

**Supplementary Table 2. List of T7E1 Assay Primers**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Genes** | **Targets** | **Forward Primers** | **Reverse Primers** | **PCR Products (bp)** |
| ***Per1*** | Exon 23 | 5’-CAAGCTCTCAGGACTTGGCTAT | 5’-GTTCTGCTCTCTGCTCCCTAAG | 284 |
| ***Per2*** | Exon 23 | 5’-TATTCCTTCTCTGGGACTCAGC | 5’-GCCCCTTCAGAAAACTATGTTG | 245 |
| ***Cry1*** | Exon1 | 5’-GAGCCTCCTTCCTTGAATTTCT | 5’-TTAAACACCCAAATCCATTTCC | 248 |
| ***Cry2*** | Exon2 | 5’-TGGACTCCACAGGTTCCTACTT | 5’-CTTTGCTCCCAACTTCTCTAGC | 265 |
| ***CK1δ*** | Exon4 | 5’-CAACCTGGTGTACATCATCGAC | 5’-AGGTCTGATGACACGCTTGC | 256 |
| ***CK1ε*** | Exon2 | 5’-GAGAATGCAGGTTTTCGAGTTC | 5’-TTCTGACTTCAGATCCCCAAAT | 289 |
| ***CK1ε*** | Exon8 | 5’-GTGTCTTTTCTTGCATCCCTG | 5’-CACCCTCAGAGTAGGCACAAAC | 290 |

**Supplementary Table 3. List of cloning primers for *Per* Repair Templates**

|  |  |  |
| --- | --- | --- |
| **Constructs** | **Names** | **Primer Sequences** |
| **Per1 repair template** | P1 F1 | 5’-TTCGAGCTCGGTACCCGGGGGCAAATACTTTGGCAGCATC |
| P1 R1 | 5’-ATGCTGCCAAAGTATTTGCccccgggtaccgagctcga |
| P1 F2 | 5’-CCTACAGCAGGAAACTGCACCAGCATGGAAGATGCCAAAAACATTAAG |
| P1 R2 | 5’-CTTAATGTTTTTGGCATCTTCCATGCTGGTGCAGTTTCCTGCTGTAGG |
| P1 F3 | 5’-GGCATGGACGAGCTGTACAAGTGAACTCCATTCTGGGACCATCTCCAG |
| P1 R3 | 5’-CTGGAGATGGTCCCAGAATGGAGTTCACTTGTACAGCTCGTCCATGCC |
| P1 F4 | 5’-AGGTGTGGAAGAATGGAGAATGCAGGCATGCAAGCTTGGC |
| P1 R4 | 5’-GCCAAGCTTGCATGCCTGCATTCTCCATTCTTCCACACCT |
| **Per2 repair template** | P2 F1 | 5’-TTCGAGCTCGGTACCCGGGGGCCATACACATCTGACCACC |
| P2 R1 | 5’-GGTGGTCAGATGTGTATGGCCCCCGGGTACCGAGCTCGAA |
| P2 F2 | 5’-AATCACAGGATCGAAGAGCAGACGATGGAAGATGCCAAAAACATTAAG |
| P2 R2 | 5’-CTTAATGTTTTTGGCATCTTCCATCGTCTGCTCTTCGATCCTGTGATT |
| P2 F3 | 5’-GGCATGGACGAGCTGTACAAGTGACCCCTGCCCCACCTCAGCCCGGCA |
| P2 R3 | 5’-TGCCGGGCTGAGGTGGGGCAGGGGTCACTTGTACAGCTCGTCCATGCC |
| P2 F4 | 5’-ATGATAAGGTAGCAGTCTGCTGCAGGCATGCAAGCTTGGC |
| P2 R4 | 5’-GCCAAGCTTGCATGCCTGCAGCAGACTGCTACCTTATCAT |
| **Per1 and Per2** | T2A F | 5’- CTTGAGGGCAGAGGAAGTCTGCTAACATGCGGTGACGTGGAGGAGAATCCCGGCCCTGCTAGCATGGTGTCTAAGGGCGAAGAGCTG |
| T2A R |  5’- GCTAGCAGGGCCGGGATTCTCCTCCACGTCACCGCATGTTAGCAGACTTCCTCTGCCCTCAAGCACGGCGATCTTGCCGCCCTTCTT |
| **Repair template PCR** | P1 F5 | 5’-CTGGCTCTGCCCTGGATAGGATAAAC |
|  | P1 R5 | 5’-AGATCACCTAAGGTCAGGAGTCCG |

**Supplementary Table 4. List of PCR primers for junction PCR in Fig.1D**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Names** | **Forward Sequences** | **Names** | **Reverse Sequences** | **PCR Products (kb)** |
| **P1-F** | 5’-CCTTCCTTTCAGAGGTAGTAGTGG | P1-R | 5’-AGCAAACTGCCTGCAGTGGTTCC | WT - 2.7KI - 3.9/5.1 |
| **Luc-F1** | 5’-GAAGGGCCCAGCGCCATTCTACCCA |  | --- |
| **P2-F** | 5’-GTTCAGATTCCTGCCAGCACTGTG | P2-R | 5’-GGCCTCACTTTTCCCCAAGTGTCC | WT - 2.6KI - 3.5/5 |
| **Luc-F2** | 5’-ACGCACATATCGAGGTGGAC |  | --- |

**Supplementary Table 5. List of sequencing primers for amplicons in Supplementary Table 4.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Names** | **Forward Sequences** | **Names** | **Reverse Sequences** |  |  |  | **PCR Products (kb)** |
| **P1 Sq F1** | 5’-GAGCTTCCTAAGGCCACTGGGAT | Luc Sq R | 5’-CGGTAGCTTCTTTTGCACGTTGAGGATC |  |  |  | 1.6 |
| **P1 Sq F2** | 5’-CAAGCTCTCAGGACTTGGCTAT | Ruby Sq R | 5’-TTTTCCTTGATCAGCTCTTCGCCC |  |  |  | 1.8 |
| **Luc Sq F** | 5’-GGTTACAACCGCCAAGAAGCTGC | P1-R | 5’-AGCAAACTGCCTGCAGTGGTTCC |  |  |  | 2.4 |
| **P2-F** | 5’-GTTCAGATTCCTGCCAGCACTGTG | Luc Sq R | 5’-CGGTAGCTTCTTTTGCACGTTGAGGATC |  |  |  | 1.9 |
| **P2 Sq F** | 5’-TATTCCTTCTCTGGGACTCAGC | Ruby Sq R | 5’-TTTTCCTTGATCAGCTCTTCGCCC |  |  |  | 1.8 |
| **Luc Sq F** | 5’-GGTTACAACCGCCAAGAAGCTGC | P2 Sq R | 5’-CTCCTTGCCTCTAAAGTCAGATC |  |  |  | 2.8 |

**Supplementary Fig 10. Full repair template sequence for Per1-Luc-T2A-mRuby3**

nnnn Introns in left homologous arm

NNNN Exon in left homologous arm

NNNN Luciferase

nnnn T2A

NNNNA mRuby3

nnnn right homologous arm

ctggctctgccctggataggataaacgtttctatctttcttcctgctccttggagccctgttactagttcctcccaggaggagagcaggtttcctggtcttggaagccttgacctcgcatagcactagtttaggggaggagcatgaggtgggaagctgtggtagaggaaggatgccagcttcatgggtcctggtccgggtcctggatcccagcctctgccttctgaaccccttcttgggcagGGACATGACCTCTGTGCTGAAGCAGGATCGGGAGCGGCTCCGAGCCATGCAGAAGCAGCAGCCTCGGTTTTCTGAGGACCAGCGGCGGGAACTGGGTGCTGTGCACTCCTGGGTCCGGAAGGGCCAACTGCCTCGGGCTCTTGATGTGATGgtgagagaagcctgggacggggagaaaaaagaattgagctcaagttcaagggggagaaaaagaattgagctcaagttcaagggggagaaaaaagaattgagctcaagttcaagggggagaaaaagaattgagctcaagttcaagggatcgaggccaagagctgatctccttgatgtccttggatcattaattctgaagaatgttgattccactaaatttgctgtggattatagaatattaagccgcgtgagtctttgcagaacttttcacagcctatcctatgctaatatgcattgtgactgtcctgtaacggcatctgggtagagggcacaaggcactgtccaaccttgttggaccgcaggtgcatctgtgtggactggtgcttcttgggagtacatttcgggaagcacagtgggctgggggtgggaagctgcgctggcaggttagcagtgagaaccctgtctgactctctcatgtccatttctctcaccaagGCCTGTGTGGACTGTGGGAGCAGCACCCAAGATCCTGGTCACCCTGATGACCCACTCTTCTCAGAGCTGGATGGACTGGGGCTGGAGCCCATGGAAGAGGGTGGAGGCGAGCAGGGCAGCAGCGGTGGCGGCAGTGGTGAGGGAGAGGGCTGCGAGGAGGCCCAAGGCGGGGCCAAGGCTTCAAGCTCTCAGGACTTGGCTATGGAGGAGGAGGAAGAAGGCAGGAGCTCATCCAGTCCAGCCTTACCTACAGCAGGAAACTGCACCAGCATGGAAGATGCCAAAAACATTAAGAAGGGCCCAGCGCCATTCTACCCACTCGAAGACGGGACCGCCGGCGAGCAGCTGCACAAAGCCATGAAGCGCTACGCCCTGGTGCCCGGCACCATCGCCTTTACCGACGCACATATCGAGGTGGACATTACCTACGCCGAGTACTTCGAGATGAGCGTTCGGCTGGCAGAAGCTATGAAGCGCTATGGGCTGAATACAAACCATCGGATCGTGGTGTGCAGCGAGAATAGCTTGCAGTTCTTCATGCCCGTGTTGGGTGCCCTGTTCATCGGTGTGGCTGTGGCCCCAGCTAACGACATCTACAACGAGCGCGAGCTGCTGAACAGCATGGGCATCAGCCAGCCCACCGTCGTATTCGTGAGCAAGAAAGGGCTGCAAAAGATCCTCAACGTGCAAAAGAAGCTACCGATCATACAAAAGATCATCATCATGGATAGCAAGACCGACTACCAGGGCTTCCAAAGCATGTACACCTTCGTGACTTCCCATTTGCCACCCGGCTTCAACGAGTACGACTTCGTGCCCGAGAGCTTCGACCGGGACAAAACCATCGCCCTGATCATGAACAGTAGTGGCAGTACCGGATTGCCCAAGGGCGTAGCCCTACCGCACCGCACCGCTTGTGTCCGATTCAGTCATGCCCGCGACCCCATCTTCGGCAACCAGATCATCCCCGACACCGCTATCCTCAGCGTGGTGCCATTTCACCACGGCTTCGGCATGTTCACCACGCTGGGCTACTTGATCTGCGGCTTTCGGGTCGTGCTCATGTACCGCTTCGAGGAGGAGCTATTCTTGCGCAGCTTGCAAGACTATAAGATTCAATCTGCCCTGCTGGTGCCCACACTATTTAGCTTCTTCGCTAAGAGCACTCTCATCGACAAGTACGACCTAAGCAACTTGCACGAGATCGCCAGCGGCGGGGCGCCGCTCAGCAAGGAGGTAGGTGAGGCCGTGGCCAAACGCTTCCACCTACCAGGCATCCGCCAGGGCTACGGCCTGACAGAAACAACCAGCGCCATTCTGATCACCCCCGAAGGGGACGACAAGCCTGGCGCAGTAGGCAAGGTGGTGCCCTTCTTCGAGGCTAAGGTGGTGGACTTGGACACCGGTAAGACACTGGGTGTGAACCAGCGCGGCGAGCTGTGCGTCCGTGGCCCCATGATCATGAGCGGCTACGTTAACAACCCCGAGGCTACAAACGCTCTCATCGACAAGGACGGCTGGCTGCACAGCGGCGACATCGCCTACTGGGACGAGGACGAGCACTTCTTCATCGTGGACCGGCTGAAGAGCCTGATCAAATACAAGGGCTACCAGGTAGCCCCAGCCGAACTGGAGAGCATCCTGCTGCAACACCCCAACATCTTCGACGCCGGGGTCGCCGGCCTGCCCGACGACGATGCCGGCGAGCTGCCCGCCGCAGTCGTCGTGCTGGAACACGGTAAAACCATGACCGAGAAGGAGATCGTGGACTATGTGGCCAGCCAGGTTACAACCGCCAAGAAGCTGCGCGGTGGTGTTGTGTTCGTGGACGAGGTGCCTAAAGGACTGACCGGCAAGTTGGACGCCCGCAAGATCCGCGAGATTCTCATTAAGGCCAAGAAGGGCGGCAAGATCGCCGTGcttgagggcagaggaagtctgctaacatgcggtgacgtggaggagaatcccggccctgctagcATGGTGTCTAAGGGCGAAGAGCTGATCAAGGAAAATATGCGTATGAAGGTGGTCATGGAAGGTTCGGTCAACGGCCACCAATTCAAATGCACAGGTGAAGGAGAAGGCAGACCGTACGAGGGAACTCAAACCATGAGGATCAAAGTCATCGAGGGAGGACCCCTGCCATTTGCCTTTGACATTCTTGCCACGTCGTTCATGTATGGCAGCCGTACTTTTATCAAGTACCCGGCCGACATCCCTGATTTCTTTAAACAGTCCTTTCCTGAGGGTTTTACTTGGGAAAGAGTTACGAGATACGAAGATGGTGGAGTCGTCACCGTCACGCAGGACACCAGCCTTGAGGATGGCGAGCTCGTCTACAACGTCAAGGTCAGAGGGGTAAACTTTCCCTCCAATGGTCCCGTGATGCAGAAGAAGACCAAGGGTTGGGAGCCTAATACAGAGATGATGTATCCAGCAGATGGTGGTCTGAGAGGATACACTGACATCGCACTGAAAGTTGATGGTGGTGGCCATCTGCACTGCAACTTCGTGACAACTTACAGGTCAAAAAAGACCGTCGGGAACATCAAGATGCCCGGTGTCCATGCCGTTGATCACCGCCTGGAAAGGATCGAGGAGAGTGACAATGAAACCTACGTAGTGCAACGCGAAGTGGCAGTTGCCAAATACAGCAACCTTGGTGGTGGCATGGACGAGCTGTACAAGTGAactccattctgggaccatctccaggagtccatgagaggctttcttctcctatgtcccaattctcagaactcagatgtggctagaccaaccagtgggaaactgccccagcttctcccaccatagggggccggacccccatcaccagcctaggatccaggggctgcctctggcctcttagggagcagagagcagaactccgcagcccagcccagaggagtgtcacctcccacctttggagaggaatccttccctcccctggacaaagttgctgacaagctgctgaagtggcctctccatattccagctgagcctgaatctgactcttgagggttggggctgcacttatttattgcggggagacagctctctctcccacctcctccccagatgggaggagagcctgaggcccaagcaggacccgggggttccagcccctagctgctctggagtgggggaggttggtggaccatggagtccctggtgctgcccctcaggtgggacccaggcgttctcagctgtaccctctgccgatggcatttgtgtttttgatatttgtgtctgttactacttttttaatacaaaaagataaaaacgcccaggactttgtggaatgaagtttggggttggggtgaagggagcatgtcaaggggagatgtggccctgcttttgggaaggttgtagtgagggtgtacagggccatctcctgacgacccccattcctcttttcccccatcctgtccaggtgagggccctgctgagcctgctacgtccacgtccagctcagactctgctgtcccctctagcatggcctcagctgggtttgccctgggaaggagagctgagaggtgcgtgtggccaagggcttgggtaagctccagcccgggtcacgggtggccaaggcagaggaaccctgcttaactccgtggtgccctgaggtattcgagggtgtttgtcttccttggcttccttttttttatttgagacggaatttcgctctgtcacccagctggagtgcaatggtgcaatctcggctcgctgcaacgtctgcctcccgggttcaagcgattctcctgcctcagcctcccgagtagctgggattataggtgcccaccaccgcgcccggctaattttgtatttttagtagcgatggggtttcaccatttttggtcaggctggtcgcggactcctgaccttaggtgatct

**Supplementary Fig 11. Full repair template sequence for Per2-Luc-T2A-mRuby3**

nnnn Introns in left homologous arm

NNNN Exon in left homologous arm

NNNN Luciferase

nnnn T2A

NNNNA mRuby3

nnnn right homologous arm

ggtacccgggggccatacacatctgaccacctatccacatcttctacctcatctcccatttttcctctccttccctcctctccagctacactggccccttggctgtttccccgactgccctggcaggcccctgccacaggatcttcgcacatgcccagccctttgcttggaatcctttttcctgaaatagacccgtggctcaccctggctgccttagagtctgttttccacccgctgctgcattagtaatctgctgctgcatggcagatggccccaacgcttagtgacttcaacaatgaacttgtattaccttgcacggtctctttgggtcaggaatttgagagcggcttagctgggtacttctagctcagggtcgttcctgatgttgacggtaagatactggtgggggcttctgtcacctgccagctggaggaccggcttccaggagcctcacttgcaggcctctcacacactgctggctcttggcagaggcctcacctccttgccatggggacctctccgtagggctgcctggatgtcctcacagtgtagcaggtgacttccccagagaggaaaagaggaagccaaggtgccttttaggacctagaatcagaagtcaggtactctttgttagaggcaaatgcctaagtccagccaaggtttaaggagaaaggaattaggccccaccttttgaggaaggagtggcaaagagtgtggacacgtttcaaaatcattgcgtcaccttttctttggcctgctgtgaatgtccagttgaaaatcacagatgtcctctatataccctatgcctctggagcccttcttagttattgtctctctctgctactagagtgccagctcctgggacagggattttggcctttgctgccagccacctcctggctgacacctggtcacctgcaccttactcagtttgaatgactttttatcttttgagacagagtctcactctgtcgcccaggctggagcacagtagcgtgatctccgctcactgcaagctctgcctccagggttcaagcgattcttctgcctcagcctcccaagtagctgggactacaggtgcctgccaccacgcccagctaattttttgtattattagtagagatgggatttcaccgtgttagccaggaaggtctcgatctcctgacgtcgtgatctgcccgcctcggcctcccaaagtgctgggattacaggcgtgagccaccgcgcccggccaatttgaatgacttttgtaacaactcagatctcaagtttgttactgatttctctttttttttcttttaagGAATGTGTTTACTGTGAAAACAAGGAAAAAGGTAATATTTGCATACCATATGAGGAAGATATTCCTTCTCTGGGACTCAGCGAAGTGTCGGACACCAAAGAAGACGAAAATGGATCCCCCTTGAATCACAGGATCGAAGAGCAGACGATGGAAGATGCCAAAAACATTAAGAAGGGCCCAGCGCCATTCTACCCACTCGAAGACGGGACCGCCGGCGAGCAGCTGCACAAAGCCATGAAGCGCTACGCCCTGGTGCCCGGCACCATCGCCTTTACCGACGCACATATCGAGGTGGACATTACCTACGCCGAGTACTTCGAGATGAGCGTTCGGCTGGCAGAAGCTATGAAGCGCTATGGGCTGAATACAAACCATCGGATCGTGGTGTGCAGCGAGAATAGCTTGCAGTTCTTCATGCCCGTGTTGGGTGCCCTGTTCATCGGTGTGGCTGTGGCCCCAGCTAACGACATCTACAACGAGCGCGAGCTGCTGAACAGCATGGGCATCAGCCAGCCCACCGTCGTATTCGTGAGCAAGAAAGGGCTGCAAAAGATCCTCAACGTGCAAAAGAAGCTACCGATCATACAAAAGATCATCATCATGGATAGCAAGACCGACTACCAGGGCTTCCAAAGCATGTACACCTTCGTGACTTCCCATTTGCCACCCGGCTTCAACGAGTACGACTTCGTGCCCGAGAGCTTCGACCGGGACAAAACCATCGCCCTGATCATGAACAGTAGTGGCAGTACCGGATTGCCCAAGGGCGTAGCCCTACCGCACCGCACCGCTTGTGTCCGATTCAGTCATGCCCGCGACCCCATCTTCGGCAACCAGATCATCCCCGACACCGCTATCCTCAGCGTGGTGCCATTTCACCACGGCTTCGGCATGTTCACCACGCTGGGCTACTTGATCTGCGGCTTTCGGGTCGTGCTCATGTACCGCTTCGAGGAGGAGCTATTCTTGCGCAGCTTGCAAGACTATAAGATTCAATCTGCCCTGCTGGTGCCCACACTATTTAGCTTCTTCGCTAAGAGCACTCTCATCGACAAGTACGACCTAAGCAACTTGCACGAGATCGCCAGCGGCGGGGCGCCGCTCAGCAAGGAGGTAGGTGAGGCCGTGGCCAAACGCTTCCACCTACCAGGCATCCGCCAGGGCTACGGCCTGACAGAAACAACCAGCGCCATTCTGATCACCCCCGAAGGGGACGACAAGCCTGGCGCAGTAGGCAAGGTGGTGCCCTTCTTCGAGGCTAAGGTGGTGGACTTGGACACCGGTAAGACACTGGGTGTGAACCAGCGCGGCGAGCTGTGCGTCCGTGGCCCCATGATCATGAGCGGCTACGTTAACAACCCCGAGGCTACAAACGCTCTCATCGACAAGGACGGCTGGCTGCACAGCGGCGACATCGCCTACTGGGACGAGGACGAGCACTTCTTCATCGTGGACCGGCTGAAGAGCCTGATCAAATACAAGGGCTACCAGGTAGCCCCAGCCGAACTGGAGAGCATCCTGCTGCAACACCCCAACATCTTCGACGCCGGGGTCGCCGGCCTGCCCGACGACGATGCCGGCGAGCTGCCCGCCGCAGTCGTCGTGCTGGAACACGGTAAAACCATGACCGAGAAGGAGATCGTGGACTATGTGGCCAGCCAGGTTACAACCGCCAAGAAGCTGCGCGGTGGTGTTGTGTTCGTGGACGAGGTGCCTAAAGGACTGACCGGCAAGTTGGACGCCCGCAAGATCCGCGAGATTCTCATTAAGGCCAAGAAGGGCGGCAAGATCGCCGTGcttgagggcagaggaagtctgctaacatgcggtgacgtggaggagaatcccggccctgctagcATGGTGTCTAAGGGCGAAGAGCTGATCAAGGAAAATATGCGTATGAAGGTGGTCATGGAAGGTTCGGTCAACGGCCACCAATTCAAATGCACAGGTGAAGGAGAAGGCAGACCGTACGAGGGAACTCAAACCATGAGGATCAAAGTCATCGAGGGAGGACCCCTGCCATTTGCCTTTGACATTCTTGCCACGTCGTTCATGTATGGCAGCCGTACTTTTATCAAGTACCCGGCCGACATCCCTGATTTCTTTAAACAGTCCTTTCCTGAGGGTTTTACTTGGGAAAGAGTTACGAGATACGAAGATGGTGGAGTCGTCACCGTCACGCAGGACACCAGCCTTGAGGATGGCGAGCTCGTCTACAACGTCAAGGTCAGAGGGGTAAACTTTCCCTCCAATGGTCCCGTGATGCAGAAGAAGACCAAGGGTTGGGAGCCTAATACAGAGATGATGTATCCAGCAGATGGTGGTCTGAGAGGATACACTGACATCGCACTGAAAGTTGATGGTGGTGGCCATCTGCACTGCAACTTCGTGACAACTTACAGGTCAAAAAAGACCGTCGGGAACATCAAGATGCCCGGTGTCCATGCCGTTGATCACCGCCTGGAAAGGATCGAGGAGAGTGACAATGAAACCTACGTAGTGCAACGCGAAGTGGCAGTTGCCAAATACAGCAACCTTGGTGGTGGCATGGACGAGCTGTACAAGTGAcccctgccccacctcagcccggcagccagcgaggtacaccaggtggtgcttggaagagatgaaagatcttcatggctgtttccactgaaatggacacatatgctcatgttgctttttttgttttagaaaaaaaaacaacatagttttctgaaggggcgacttaaaactgtggagagtggggagagttcggaaagaaatatgtttttatatataaaatatatatgtggagttttgtgggatggggaagagattttagttgttatttaacttgagaaagactaagcgcctcttagtgtcagggaagttgcctcagtgctcccagaagtcctgtgactgtgacgagacctctgtctgctgcaccagctggggactctggcttccagagctttcccagggtgtttggatcagatcaaattttgtcctctcttggggactgctttttatctgaattatcatttagtcaaggtagagtgtttttttatacataccaaatggagatagcagcctctcctagttttatttcaaaacgtttcacattaaatggtgtgaagcgttgtttggcaaaccaacagctttggcttctggtgtggtcaatatttcagtctgacataggttttgtttgtagtgaacaaagttgaaacatttgctctggactaaagaagcctagtggtttgtgtggccaactccatcggatgaatgcacacgcagacagaccctctgtatatttctgcattattcttgtctccttttcagaccatgatggccaatatggagattaaaatatgtcatcagtcatctctttatggtgacttccctttgcaaaccaggctgtgaccaacacatgtgagacccagtcctgtttggttttcttccgttggaaccacccagacatctgcttccacccagccaagcccacatcacatctcctggccgagagcagccactgccactcagtctgacagcttgcgactgcatctgtattttcaggggtgcagtgagctcacctctcccactgcaccctgggttgggtgcacagccctcattcttttcatgagcccgacctctctcggagcagcttcaggcctctgccagtgtccccagcacttttaggtcatttggacacttggggaaaagtgaggccagtctgcccggctttttacaaaacctcatgttgcattgtatattccaaagatggttcagaaaatttaatattggtccctggtggaaattcaaagttatcactgaagaacagttgacttaaaattggaccaagactatgaggcttaaaagggaccagggttttcttttttttttttttttttttttttttttagatggagtttctttttgcccaggctggagtgcagtggcgccatcttggctcactgcaacctctgcctcccaggttcaagcgattctcctgcctcagcctcctgagtagctgggaccacaggcgactgccaccacacccagctaattttttgtatttttagtagagacagggtttcaccatgttggccaggctggtctcgaactcctgacctcaagcgatccacccacctcggcctcccaaagtgctgggattacaggcgtgagccaccacgcccaactgggaccagggttttctgttttttgatggaggtgaaatctctttgtaatccactaggttttcatcgtaaaaccatcttatgcctgactattaaacctattcttcataaacacaagaacactttaatttttcgttaatttacaaagtaacatcagctgcctatgcctatgataaggtagcagtctgctgcaggcatgcaagctt

**Supplementary Figure 12. Cloning strategy for *Per* repair templates.**

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**Supplementary Figure 13. Location of primers used in Supplementary table 4 and 5.**

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