Table1. Basic information about HMMs of core proteins (Cas1-Cas10, Csf1 and Cpf1) of CRISPR-Cas systems.

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| **Protein** | **Model** | **Description** |
| Cas1 | PF01867 | Cas\_Cas1: CRISPR associated protein Cas1 |
| TIGR00287 | cas1: CRISPR-associated endonuclease Cas1 |
| TIGR03637 | cas1\_YPEST: CRISPR-associated endonuclease Cas1, subtype I-F/YPEST |
| TIGR03638 | cas1\_ECOLI: CRISPR-associated endonuclease Cas1, subtype I-E/ECOLI |
| TIGR03639 | cas1\_NMENI: CRISPR-associated endonuclease Cas1, subtype II/NMENI |
| TIGR03640 | cas1\_DVULG: CRISPR-associated endonuclease Cas1, subtype I-C/DVULG |
| TIGR03641 | cas1\_HMARI: CRISPR-associated endonuclease Cas1, subtype I-B/HMARI/TNEAP |
| TIGR03983 | cas1\_MYXAN: CRISPR-associated endonuclease Cas1, subtype MYXAN |
| TIGR04093 | cas1\_CYANO: CRISPR-associated endonuclease Cas1, subtype CYANO |
| TIGR04329 | cas1\_PREFRAN: CRISPR-associated endonuclease Cas1, subtype PREFRAN |
| Cas2 | PF09707 | Cas\_Cas2CT1978: CRISPR-associated protein (Cas\_Cas2CT1978) |
| PF09827 | CRISPR\_Cas2: CRISPR associated protein Cas2 |
| TIGR01573 | cas2: CRISPR-associated endonuclease Cas2 |
| TIGR01873 | cas\_CT1978: CRISPR-associated endoribonuclease Cas2, subtype I-E/ECOLI |
| Cas3 | TIGR01587 | cas3\_core: CRISPR-associated helicase Cas3 |
| TIGR01596 | cas3\_HD: CRISPR-associated endonuclease Cas3-HD |
| TIGR02562 | cas3\_yersinia: CRISPR-associated helicase Cas3, subtype I-F/YPEST |
| TIGR02621 | cas3\_GSU0051: CRISPR-associated helicase Cas3, subtype Dpsyc |
| TIGR03158 | cas3\_cyano: CRISPR-associated helicase Cas3, subtype CYANO |
| Cas4 | TIGR00372 | cas4: CRISPR-associated protein Cas4 |
| TIGR01896 | cas\_AF1879: CRISPR-associated protein Cas4/Csa1, subtype I-A/APERN |
| TIGR04328 | cas4\_PREFRAN: CRISPR-associated protein Cas4, subtype PREFRAN |
| Cas5 | PF09704 | Cas\_Cas5d: CRISPR-associated protein (Cas\_Cas5) |
| TIGR01868 | casD\_Cas5e: CRISPR-associated protein Cas5/CasD, subtype I-E/ECOLI |
| TIGR01874 | cas\_cas5a: CRISPR-associated protein Cas5, subtype I-A/APERN |
| TIGR01876 | cas\_Cas5d: CRISPR-associated protein Cas5, subtype I-C/DVULG |
| TIGR01895 | cas\_Cas5t: CRISPR-associated protein Cas5, subtype I-B/TNEAP |
| TIGR02586 | cas5\_cmx5\_devS: CRISPR-associated protein Cas5/DevS, subtype MYXAN |
| TIGR02592 | cas\_Cas5h: CRISPR-associated protein Cas5, subtype I-B/HMARI |
| TIGR02593 | CRISPR\_cas5: CRISPR-associated protein Cas5 |
| TIGR03488 | cas\_Cas5p: CRISPR-associated protein Cas5, subtype PGING |
| Cas6 | PF01881 | Cas\_Cas6: CRISPR associated protein Cas6 |
| TIGR01877 | cas\_cas6: CRISPR-associated endoribonuclease Cas6 |
| TIGR01907 | casE\_Cse3: CRISPR-associated protein Cas6/Cse3/CasE, subtype I-E/ECOLI |
| TIGR02563 | cas\_Csy4: CRISPR-associated endoribonuclease Cas6/Csy4, subtype I-F/YPEST |
| TIGR02807 | cas6\_cmx6: CRISPR-associated protein Cas6, subtype MYXAN |
| Cas7 | PF05107 | Cas\_Cas7: CRISPR-associated protein Cas7 |
| TIGR01869 | casC\_Cse4: CRISPR-associated protein Cas7/Cse4/CasC, subtype I-E/ECOLI |
| TIGR02583 | DevR\_archaea: CRISPR-associated protein Cas7/Csa2, subtype I-A/APERN |
| TIGR02585 | cas\_Cst2\_DevR: CRISPR-associated protein Cas7/Cst2/DevR, subtype I-B/TNEAP |
| TIGR02589 | cas\_Csd2: CRISPR-associated protein Cas7/Csd2, subtype I-C/DVULG |
| TIGR02590 | cas\_Csh2: CRISPR-associated protein Cas7/Csh2, subtype I-B/HMARI |
| TIGR03489 | cas\_csp1: CRISPR-associated protein Cas7/Csp1, subtype PGING |
| Cas8 | TIGR01863 | cas\_Csd1: CRISPR-associated protein Cas8c/Csd1, subtype I-C/DVULG |
| TIGR01908 | cas\_CXXC\_CXXC: CRISPR-associated protein Cas8b1/Cst1, subtype I-B/TNEAP |
| TIGR01914 | cas\_Csa4: CRISPR-associated protein Cas8a2/Csa4, subtype I-A/APERN |
| TIGR02591 | cas\_Csh1: CRISPR-associated protein Cas8b/Csh1, subtype I-B/HMARI |
| TIGR02670 | cas\_csx8: CRISPR-associated protein Cas8a1/Csx8, subtype I |
| TIGR02671 | cas\_csx9: CRISPR-associated protein Cas8a2/Csx9, subtype I-A/APERN |
| TIGR03485 | cas\_csx13\_N: CRISPR-associated protein Cas8a1/Csx13, MYXAN subtype |
| TIGR03486 | cas\_csx13\_C: CRISPR-associated protein Cas8a1/Csx13, MYXAN subtype, C-terminal region |
| TIGR03487 | cas\_csp2: CRISPR-associated protein Cas8c/Csp2, subtype PGING |
| Cas9 | PF16593 | Cas9-BH: Bridge helix of CRISPR-associated endonuclease Cas9 |
| PF16595 | Cas9\_PI: PAM-interacting domain of CRISPR-associated endonuclease Cas9 |
| PF16592 | Cas9\_REC: REC lobe of CRISPR-associated endonuclease Cas9 |
| TIGR01865 | cas\_Csn1: CRISPR subtype II RNA-guided endonuclease Cas9 |
| TIGR03031 | cas\_csx12: CRISPR system subtype II-B RNA-guided endonuclease Cas9/Csx12 |
| Cas10 | TIGR02577 | cas\_TM1794\_Cmr2: CRISPR-associated protein Cas10/Cmr2, subtype III-B |
| TIGR02578 | cas\_TM1811\_Csm1: CRISPR-associated protein Cas10/Csm1, subtype III-A/MTUBE |
| TIGR03174 | cas\_Csc3: CRISPR type I-D/CYANO-associated protein Csc3/Cas10d |
| Csf1 | TIGR03114 | cas8u\_csf1: CRISPR type AFERR-associated protein Csf1 |
| Cpf1 | TIGR04330 | cas\_Cpf1: CRISPR-associated protein Cpf1, subtype PREFRAN |