CLAIMS

1. A method of targeting one or more target RNA molecules, comprising:

contacting one or more target RNA molecules with a non-naturally occurring or engineered clustered regularly interspaced short palindromic repeats (CRISPR)-associated (Cas) system comprising:

at least one Cas13d protein comprising at least 95% sequence identity to SEQ ID NO: 212, or a nucleic acid molecule encoding the at least one Cas13d protein; and

at least one CRISPR-Cas system guide RNA (gRNA) comprising one or more direct repeat (DR) sequences and one or more spacer sequences, which hybridizes with the one or more target RNA molecules, or at least one nucleic acid molecule encoding the gRNA,

whereby the Cas13d protein forms a complex with the gRNA, wherein the gRNA directs the complex to the one or more target RNA molecules and targets the one or more target RNA molecules.

2. The method of claim 1, wherein contacting the one or more target RNA molecules with the non-naturally occurring or engineered CRISPR-Cas system comprises introducing into a cell containing the one or more target RNA molecules the non-naturally occurring or engineered CRISPR-Cas system.

3. The method of claim 1, wherein the one or more target RNA molecules are contacted with a complex comprising the at least one Cas13d protein and the at least one CRISPR-Cas system gRNA.

4. The method of claim 1, wherein the at least one Cas13d protein comprises at least 96% sequence identity to SEQ ID NO: 212.

5. The method of claim 1, wherein the one or more DR sequences comprises at least 95% sequence identity to SEQ ID NO: 213.

6. The method of claim 1, wherein targeting one or more target RNA molecules comprises one or more of cutting the one or more target RNA molecules, nicking the one or more target RNA molecules, increasing expression of the one or more target RNA molecules as compared to an amount of target RNA in a corresponding cell or sample not contacted with the at least one Cas13d protein, decreasing expression of the one or more target RNA molecules as compared to an amount of target RNA in a corresponding cell or sample not contacted with the at least one Cas13d protein, visualizing or detecting the one or more target RNA molecules, labeling the one or more target RNA molecules, binding the one or more target RNA molecules, enriching the one or more target RNA molecules, depleting the one or more target RNA molecules, editing the one or more target RNA molecules, trafficking the one or more target RNA molecules, splicing or perturbing the splicing of the one or more target RNA molecules, and masking the one or more target RNA molecules.

7. The method of claim 1, wherein the at least one Cas13d protein comprises

at least 96% sequence identity to SEQ ID NO: 212; and

one or more subcellular localization signals, effector domains, purification tags, affinity tags, or combinations thereof.

8. The method of claim 1, wherein the at least one Cas13d protein comprises at least 97% sequence identity to SEQ ID NO: 212.

9. The method of claim 1, wherein the at least one Cas13d protein comprises at least 98% sequence identity to SEQ ID NO: 212.

10. The method of claim 1, wherein the at least one Cas13d protein comprises at least 99% sequence identity to SEQ ID NO: 212.

11. The method of claim 1, wherein the at least one Cas13d protein comprises SEQ ID NO: 212.

12. The method of claim 1, wherein the at least one Cas13d protein further comprises one or more subcellular localization signals, effector domains, purification tags, affinity tags, or combinations thereof.

13. The method of claim 1, wherein the at least one gRNA comprises one or more DR sequences comprising at least 96% sequence identity to SEQ ID NO: 213.

14. The method of claim 1, wherein the at least one gRNA comprises one or more DR sequences comprising at least 97% sequence identity to SEQ ID NO: 213.

15. The method of claim 1, wherein the at least one gRNA comprises one or more DR sequences comprising at least 98% sequence identity to SEQ ID NO: 213.

16. The method of claim 1, wherein the at least one gRNA comprises one or more DR sequences comprising at least 99% sequence identity to SEQ ID NO: 213.

17. The method of claim 1, wherein the at least one gRNA comprises one or more DR sequences comprises SEQ ID NO: 213.

18. The method of claim 1, wherein the at least one gRNA comprises a nucleic acid aptamer.

19. The method of claim 18 wherein the nucleic acid aptamer inserted into the gRNA comprises MS2, PP7, or Qβ.

20. The method of claim 1, wherein the at least one gRNA comprises modified nucleotides.

21. The method of claim 2, wherein the cell is a eukaryotic cell.

22. The method of claim 21, wherein the eukaryotic cell is a mammalian cell.

23. The method of claim 21, wherein the eukaryotic cell is a plant cell.

24. The method of claim 2, wherein the cell is a bacterial cell.

25. The method of claim 1, wherein the at least one Cas13d protein further comprises a nuclear localization signal (NLS).

26. The method of claim 25, wherein the NLS comprises SEQ ID NO: 256.

27. The method of claim 25, wherein the NLS comprises SEQ ID NO: 258.

28. The method of claim 1, wherein the at least one Cas13d protein further comprises a nuclear export signal (NES).

29. The method of claim 28, wherein the NES comprises an adenovirus type 5 E1B nuclear export sequence, an HIV nuclear export sequence, a MAPK nuclear export sequence, or a PTK2 nuclear export sequence.

30. The method of claim 1, wherein the at least one Cas13d protein further comprises an effector domain that can cleave RNA, edit a nucleotide, edit a ribonucleotide, methylate RNA, or demethylate RNA.

31. The method of claim 1, wherein the at least one Cas13d protein is catalytically inactive for ribonuclease activity.

32. The method of claim 31, wherein the catalytically inactive Cas13d protein comprises one or more mutated HEPN domains.

33. The method of claim 31, wherein the catalytically inactive Cas13d protein comprises a mutated HEPN1 domain.

34. The method of claim 31, wherein the catalytically inactive Cas13d protein comprises a mutated HEPN2 domain.