CLAIMS

What is claimed is:

1. An engineered RNA polymerase, wherein said polymerase utilizes a cap or cap analog during transcription initiation, and wherein said engineered RNA polymerase comprises a polypeptide sequence having at least 95% sequence identity to SEQ ID NO: 4 and further comprises a mutation at position 664, wherein said position is numbered with reference to SEQ ID NO: 4.

2. The engineered RNA polymerase of Claim 1, wherein said RNA polymerase preferentially utilizes a cap or cap analog during transcription initiation.

3. The engineered RNA polymerase of Claim 1, wherein said RNA polymerase does not utilize a cap or cap analog during transcription elongation.

4. The engineered RNA polymerase of Claim 1, wherein said engineered RNA polymerase is an engineered T7 RNA polymerase.

5. The engineered RNA polymerase of Claim 1, wherein said polypeptide sequence further comprises a substitution set selected from 513/660/664, 513/635/664, 513/660/664, and 660/664, and/or any combination thereof, wherein the amino acid positions are numbered with reference to SEQ ID NO: 4.

6. The engineered RNA polymerase of Claim 1, wherein said polypeptide sequence further comprises at least one substitution or substitution set selected from 397, 397/513, 397/513/635, 397/513/635/656, 397/513/635/656/660, 397/513/635/656, 397/513/635/660, 397/513/635, 397/513/656/660, 397/513/660, 397/635, 397/635/656/660, 397/635/656, 397/635/660, 397/635, 397/6351850, 397/660, and/or any combinations thereof, wherein the amino acid positions are numbered with reference to SEQ ID NO:4.

7. The engineered RNA polymerase of Claim 1, wherein said engineered polymerase exhibits at least one improved property compared to wild-type T7 RNA polymerase.

8. The engineered RNA polymerase of Claim 7, wherein said at least one improved property comprises improved selectivity for cap analog relative to GTP during transcription initiation.

9. The engineered RNA polymerase of Claim 1, wherein the polymerase maintains RNA yield, transcription fidelity, thermostability, protein expression, stability at -20°C, or stability in reaction conditions equivalent to the wild-type T7 RNA polymerase

10. The engineered RNA polymerase of Claim 1, wherein said RNA polymerase generates greater than about 80%, 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more capped RNA transcripts relative to uncapped transcripts.

11. The engineered RNA polymerase of Claim 10, wherein said RNA polymerase generates greater than 90% capped RNA transcripts relative to uncapped transcripts.

12. The engineered RNA polymerase of Claim 1, wherein said engineered polymerase is purified.

13. A composition comprising at least one engineered RNA polymerase of Claim 1.

14. A method for producing capped RNA transcripts, comprising providing a composition comprising: i) at least one engineered RNA polymerase of Claim 1, a dinucleotide cap analog, and ii) a DNA template; exposing said DNA template to said composition under conditions such that said engineered RNA polymerase produces a capped RNA transcript.

15. The method of Claim 14, where the dinucleotide cap analog is alpha, gamma-bis(N7-methylguanosine) triphosphate (m7G(5')ppp(5')m7G) or an anti-reverse cap analog 3'-O-Me-m^7G(5')ppp(5')G.

16. The method of Claim 14, wherein the dinucleotide cap analog is alpha, gamma-bis(N7-methylguanosine) triphosphate.

17. The method of Claim 14, wherein said engineered RNA polymerase generates greater than about 80%, 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more capped RNA transcripts relative to uncapped transcripts.

18. The method of Claim 17, wherein said engineered RNA polymerase generates greater than 90% or more capped RNA transcripts relative to uncapped transcripts.

19. The method of Claim 18, wherein said engineered RNA polymerase generates greater than 95% or more capped RNA transcripts relative to uncapped transcripts.

20. The method of Claim 14, wherein said method comprises an in vitro transcription reaction.

21. The engineered RNA polymerase of Claim 1, wherein said polypeptide sequence further comprises at least one substitution or substitution set selected from 513, 513/635, 513/635/656, 513/635/660, 513/656, 513/660, 635, 635/656, 656/660, and 660, wherein the amino acid positions are numbered with reference to SEQ ID NO: 4.

22. The engineered RNA polymerase of Claim 9, wherein said at least one improved property further comprises at least one additional property selected from improved protein expression, improved stability in storage buffer, and improved stability under reaction conditions.