CLAIMS

1. A polypeptide that is distinguished from a wild-type *Ramazzottius varieornatus* X family DNA polymerase (RvPolX) by at least one amino acid substitution in the wild-type RvPolX amino acid sequence, wherein the at least one amino acid substitution is at a position corresponding to positions 281, 513 and/or 522 as set forth in SEQ ID NO: 1, wherein the polypeptide comprises an amino acid sequence having at least 70% sequence identity to an amino acid sequence as set forth in SEQ ID NO: 1, or a catalytic fragment thereof, and wherein the polypeptide is capable of template-independent nucleic acid synthesis.

2. The polypeptide of claim 1, wherein the polypeptide comprises an amino acid sequence having at least 70% sequence identity to an amino acid sequence of SEQ ID NO: 3.

3. The polypeptide of claim 1 or 2, wherein the amino acid substitution at the position corresponding to position 281, 513 and/or 522 is a substitution to a hydrophobic amino acid residue.

4. The polypeptide of any one of claims 1 to 3, wherein: a) the amino acid substitution at the position corresponding to position 281 is a substitution to A, F, I, L, V or Y; b) the amino acid substitution at the position corresponding to position 513 is a substitution to A or C; and/or c) the amino acid substitution at the position corresponding to position 522 is a substitution to I, M or V.

5. The polypeptide of claim 4, wherein the amino acid substitution at the position corresponding to position 281 is a substitution to L.

6. The polypeptide of any one of claims 1 to 5, wherein the polypeptide is distinguished from the wild-type RvPolX by at least two amino acid substitutions in the wild-type RvPolX amino acid sequence; optionally wherein the polypeptide is distinguished from the wild-type RvPolX by three amino acid substitutions at positions corresponding to positions 281, 513 and 522 as set forth in SEQ ID NO: 1.

7. The polypeptide of claim 6, wherein the polypeptide comprises an amino acid substitution of:
   i) G513A or G513C, and ii) R522I, R522M or R522V; or

i) E281L, ii) G513A or G513C, and iii) R522I, R522M or R522V.

8. The polypeptide of any one of claims 4 to 7, wherein the polypeptide comprises an amino acid sequence having at least 70% sequence identity to an amino acid sequence in SEQ ID NO: 4–26.

9. The polypeptide of claim 8, wherein the polypeptide is capable of nucleic acid synthesis at a salt concentration of about 100 mM to about 1500 mM.

10. A method of synthesizing a nucleic acid molecule, the method comprising contacting a nucleic acid primer with at least one nucleotide and a polypeptide of any one of claims 1 to 9 under conditions for the addition of the at least one nucleotide to the nucleic acid primer by the polypeptide.

11. The method of claim 10, wherein the nucleic acid primer is a single-stranded or double-stranded DNA molecule, and/or wherein the nucleotide is a deoxyribonucleotide (dNTP) or a 3'-O-NH_2 dNTP.

12. The method of claim 10 or 11, wherein the contacting is performed in the presence of Mn^{2+}, Mg^{2+} and/or Co^{2+}; optionally wherein the Mn^{2+} and/or Mg^{2+} is each present at a concentration of about 0.5 mM to about 20 mM, or the Co^{2+} is present at a concentration of about 0.5 mM to about 3 mM.

13. The method of any one of claims 10 to 12, wherein the contacting is performed at a salt concentration of at least about 100 mM; optionally wherein the salt concentration is about 400 mM to about 1500 mM.

14. The method of any one of claims 10 to 13, wherein the contacting is performed at a temperature of about 20°C to about 40°C, and/or at a pH of about 6 to about 10.

15. A kit for synthesizing a nucleic acid molecule, comprising a polypeptide of any one of claims 1 to 14 and at least one nucleotide; optionally wherein the nucleotide is a deoxyribonucleotide (dNTP) or a 3'-O-modified dNTP.