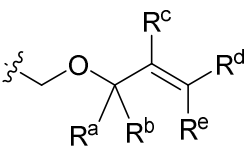


WHAT IS CLAIMED IS:

1. A method for determining sequences of a plurality of target polynucleotides, comprising:

(a) contacting a solid support with sequencing primers under hybridization conditions, wherein the solid support comprises a plurality of target polynucleotides immobilized thereon; and the sequencing primers are complementary to at least a portion of the target polynucleotides;

(b) contacting the solid support with a first aqueous solution comprising DNA polymerase and one or more of four different types of nucleotides under conditions suitable for DNA polymerase-mediated primer extension, wherein each of the nucleotides comprises a 3' blocking group having the

structure  attached to the 3' oxygen of the nucleotide;

(c) incorporating one type of nucleotides into the sequencing primers to produce extended copy polynucleotides;

(d) performing one or more fluorescent measurements of the extended copy polynucleotides; and

(e) removing the 3' blocking group of the incorporated nucleotides with a palladium catalyst;

wherein at least a portion of remaining palladium catalyst is inactivated by one or more palladium scavengers, wherein at least one palladium scavenger comprises one or more allyl moieties selected from the group consisting of -O-allyl, -S-allyl, -NR-allyl, and

-N⁺RR'-allyl and combinations thereof;

each of R^a, R^b, R^c, R^d and R^e is independently H, halogen, unsubstituted or substituted C₁-C₆ alkyl, or C₁-C₆ haloalkyl;

R is H, unsubstituted or substituted C₁-C₆ alkyl, unsubstituted or substituted C₂-C₆ alkenyl, unsubstituted or substituted C₂-C₆ alkynyl, unsubstituted or substituted C₆-C₁₀ aryl, unsubstituted or substituted 5 to 10 membered heteroaryl, unsubstituted or substituted C₃-C₁₀ carbocyclyl, or unsubstituted or substituted 5 to 10 membered heterocyclyl; and

R' is H, unsubstituted C₁-C₆ alkyl or substituted C₁-C₆ alkyl,

wherein at least one type of incorporated nucleotides comprise a detectable label, and wherein step (e) also removes the detectable label, wherein the detectable label comprises a fluorescent label.

2. The method of claim 1, further comprising: repeating steps (b) through (e) until sequences of at least a portion of the target polynucleotides are determined.

3. The method of claim 1, further comprising: (f) washing the solid support with a second aqueous solution after the removal of the 3' blocking group of the incorporated nucleotides.

4. The method of claim 3, further comprising: repeating steps (b) through (f) until sequences of at least a portion of the target polynucleotides are determined.

5. The method of claim 2 or 4, wherein steps (b) through (e) or (b) through (f) are repeated at least 50 times, at least 100 times, at least 150 times, at least 200 times, at least 250 times, or at least 300 times.

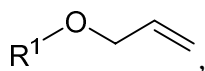
6. The method of any one of claims 1 to 5, wherein the palladium scavenger comprising one or more allyl moieties is in the first aqueous solution.

7. The method of claim 6, wherein the concentration of the palladium scavenger comprising one or more allyl moieties in the first aqueous solution is from 0.1 mM to 100 mM, from 0.5 mM to 50 mM, from 1 mM to 20 mM, or from 2 mM to 10 mM.

8. The method of any one of claims 3 to 6, wherein the palladium scavenger comprising one or more allyl moieties is in the second aqueous solution.

9. The method of claim 8, wherein the concentration of the palladium scavenger comprising one or more allyl moieties in the second aqueous solution is from 0.1 mM to 100 mM, from 0.5 mM to 50 mM, from 1 mM to 20 mM, or from 2 mM to 10 mM.

10. The method of any one of claims 1 to 9, wherein the palladium scavenger comprising one or more -O-allyl moieties has the structure:



wherein R¹ is C₁-C₁₂ alkyl optionally substituted with one or more Rˣ, C₂-C₁₂ alkenyl optionally substituted with one or more Rˣ, C₂-C₁₂ alkynyl optionally substituted

with one or more R^x , unsubstituted amino, substituted amino, C_6 - C_{10} aryl, (C_6 - C_{10} aryl) C_1 - C_6 alkyl, 5 to 10 membered heteroaryl, (5 to 10 membered heteroaryl) C_1 - C_6 alkyl, C_3 - C_{10} carbocyclyl, (C_3 - C_{10} carbocyclyl) C_1 - C_6 alkyl, 3 to 10 membered heterocyclyl, (3 to 10 membered heterocyclyl) C_1 - C_6 alkyl, a monosaccharide moiety, a disaccharide moiety, an oligosaccharide moiety, an amino acid moiety, $-C(=O)NR^{f1}R^{g1}$, $-P(=O)OR^{f1}OR^{g1}$,

$-C(=O)R^{h1}$, $-C(=O)OR^{h1}$ or $-S(=O)_2R^{i1}$, wherein each of C_6 - C_{10} aryl, 5 to 10 membered heteroaryl, C_3 - C_{10} carbocyclyl and 3 to 10 membered heterocyclyl is optionally substituted with one or more R^x ;

each of R^{f1} and R^{g1} is independently H, C_1 - C_6 alkyl optionally substituted with one or more R^x , C_6 - C_{10} aryl optionally substituted with one or more R^x , or 5 to 10 membered heteroaryl optionally substituted with one or more R^x ;

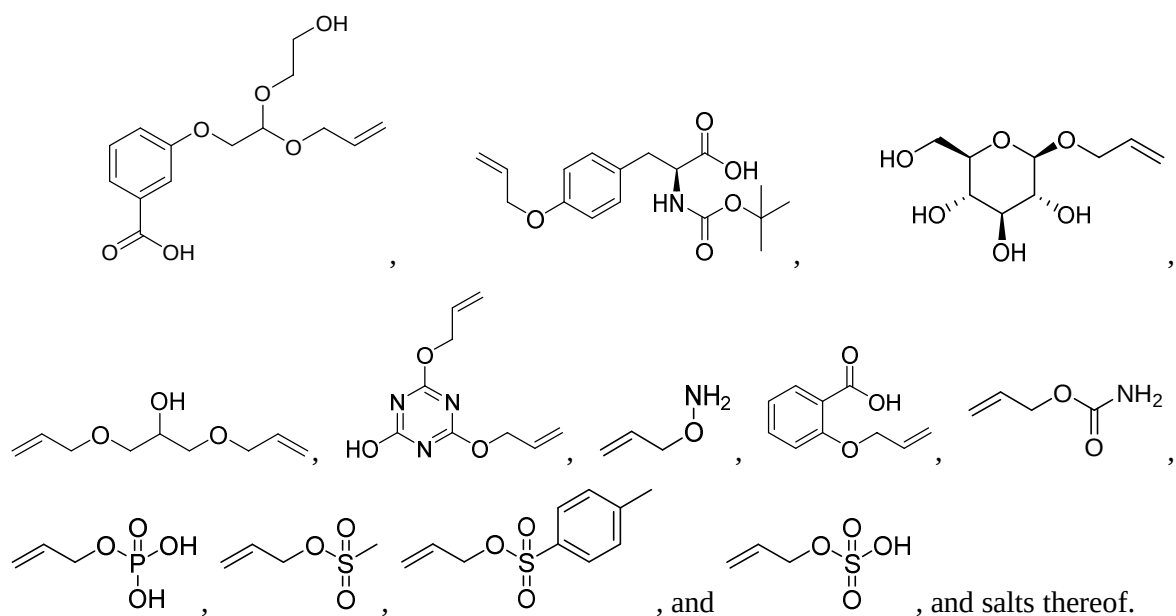
each R^{h1} is independently C_1 - C_6 alkyl optionally substituted with one or more R^x , C_6 - C_{10} aryl optionally substituted with one or more R^x , or 5 to 10 membered heteroaryl optionally substituted with one or more R^x ;

each R^{i1} is independently hydroxy, C_1 - C_6 alkyl optionally substituted with one or more R^x , C_6 - C_{10} aryl optionally substituted with one or more R^x , or 5 to 10 membered heteroaryl optionally substituted with one or more R^x ; and

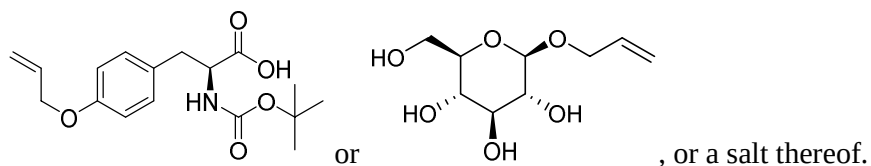
each R^x is independently amino, halo, hydroxy, carboxy, cyano, (C_1 - C_6 alkyl)amino,

C-amido, N-amido, unsubstituted and substituted C_1 - C_6 alkyl, C_1 - C_6 haloalkyl, unsubstituted and substituted C_1 - C_6 alkoxy, C_1 - C_6 haloalkoxy, unsubstituted and substituted C_6 - C_{10} aryloxy, sulfo, sulfonate, or $-O-CH_2-CH=CH_2$.

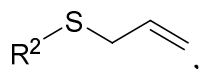
11. The method of claim 10, wherein the palladium scavenger comprising one or more $-O$ -allyl moieties is selected from the group consisting of:



12. The method of claim 11, wherein the palladium scavenger comprises



13. The method of any one of claims 1 to 9, wherein the palladium scavenger comprising one or more -S-allyl moieties has the structure:



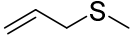
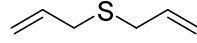
wherein R^2 is C_1 - C_{12} alkyl optionally substituted with one or more R^y , C_2 - C_{12} alkenyl optionally substituted with one or more R^y , C_2 - C_{12} alkynyl optionally substituted with one or more R^y , unsubstituted amino, substituted amino, C_6 - C_{10} aryl, (C_6 - C_{10} aryl) C_1 - C_6 alkyl, 5 to 10 membered heteroaryl, (5 to 10 membered heteroaryl) C_1 - C_6 alkyl, C_3 - C_{10} carbocyclyl, (C_3 - C_{10} carbocyclyl) C_1 - C_6 alkyl, 3 to 10 membered heterocyclyl, (3 to 10 membered heterocyclyl) C_1 - C_6 alkyl, a monosaccharide moiety, a disaccharide moiety, an oligosaccharide moiety, an amino acid moiety, $-C(=O)NR^{f2}R^{g2}$, $-P(=O)OR^{f2}OR^{g2}$, $-C(=O)R^{h2}$, $-C(=O)OR^{h2}$ or $-S(=O)_2R^{i2}$, wherein each of C_6 - C_{10} aryl, 5 to 10 membered heteroaryl, C_3 - C_{10} carbocyclyl and 3 to 10 membered heterocyclyl is optionally substituted with one or more R^y ;

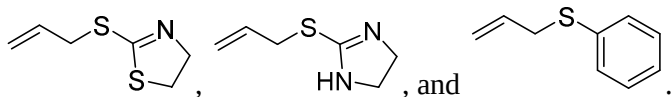
each of R^{f2} and R^{g2} is independently H, C_1 - C_6 alkyl optionally substituted with one or more R^y , C_6 - C_{10} aryl optionally substituted with one or more R^y , or 5 to 10 membered heteroaryl optionally substituted with one or more R^y ;

each R^{h2} is independently C_1 - C_6 alkyl optionally substituted with one or more R^y , C_6 - C_{10} aryl optionally substituted with one or more R^y , or 5 to 10 membered heteroaryl optionally substituted with one or more R^y ;

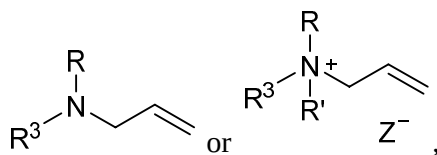
each R^{i2} is independently hydroxy, C_1 - C_6 alkyl optionally substituted with one or more R^y , C_6 - C_{10} aryl optionally substituted with one or more R^y , or 5 to 10 membered heteroaryl optionally substituted with one or more R^y ; and

each R^y is independently amino, halo, hydroxy, carboxy, cyano, (C_1 - C_6 alkyl)amino, C-amido, N-amido, unsubstituted and substituted C_1 - C_6 alkyl, C_1 - C_6 haloalkyl, unsubstituted and substituted C_1 - C_6 alkoxy, C_1 - C_6 haloalkoxy, unsubstituted and substituted C_6 - C_{10} aryloxy, sulfo, sulfonate, or $-S-CH_2-CH=CH_2$.

14. The method of claim 13, wherein the palladium scavenger comprising one or more $-S$ -allyl moieties is selected from the group consisting of: , ,



15. The method of any one of claims 1 to 9, wherein the palladium scavenger comprising one or more $-NR$ -allyl or $-N^+RR'$ -allyl moieties has the structure:



wherein Z is an anion;

each R^3 is independently C_1 - C_{12} alkyl optionally substituted with one or more R^z , C_2 - C_{12} alkenyl optionally substituted with one or more R^z , C_2 - C_{12} alkynyl optionally substituted with one or more R^z , unsubstituted amino, substituted amino, C_6 - C_{10} aryl, (C_6 - C_{10} aryl) C_1 - C_6 alkyl, 5 to 10 membered heteroaryl, (5 to 10 membered heteroaryl) C_1 - C_6 alkyl, C_3 - C_{10} carbocyclyl, (C_3 - C_{10} carbocyclyl) C_1 - C_6 alkyl, 3 to 10 membered heterocyclyl, (3 to 10 membered heterocyclyl) C_1 - C_6 alkyl, a monosaccharide moiety, a disaccharide moiety, an oligosaccharide moiety, an amino acid moiety, $-C(=O)NR^{f3}R^{g3}$, $-P(=O)OR^{f3}OR^{g3}$,

-C(=O)R^{h3}, -C(=O)OR^{h3} or -S(=O)₂R^{j3}, wherein each of C₆-C₁₀ aryl, 5 to 10 membered heteroaryl, C₃-C₁₀ carbocyclyl and 3 to 10 membered heterocyclyl is optionally substituted with one or more R^z;

each of R^{f3} and R^{g3} is independently H, C₁-C₆ alkyl optionally substituted with one or more R^z, C₆-C₁₀ aryl optionally substituted with one or more R^z, or 5 to 10 membered heteroaryl optionally substituted with one or more R^z;

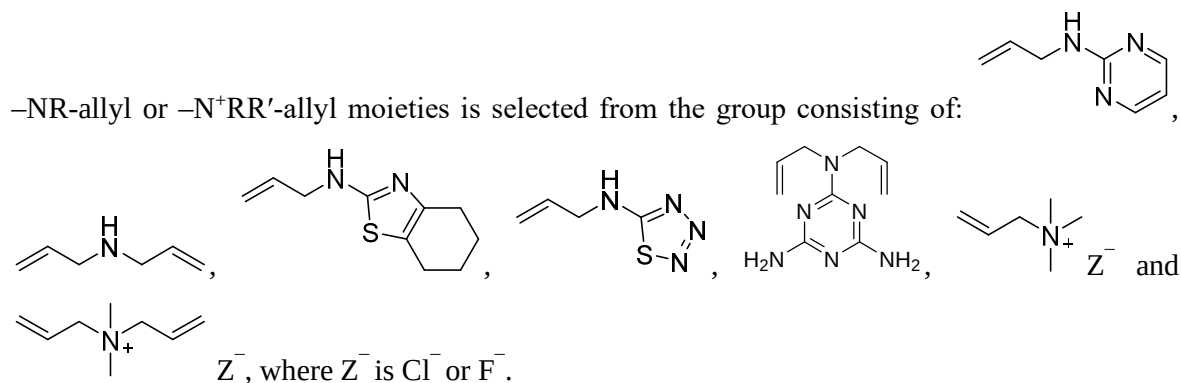
each R^{h3} is independently C₁-C₆ alkyl optionally substituted with one or more R^z, C₆-C₁₀ aryl optionally substituted with one or more R^z, or 5 to 10 membered heteroaryl optionally substituted with one or more R^z;

each R^{j3} is independently hydroxy, C₁-C₆ alkyl optionally substituted with one or more R^z, C₆-C₁₀ aryl optionally substituted with one or more R^z, or 5 to 10 membered heteroaryl optionally substituted with one or more R^z; and

each R^z is independently amino, halo, hydroxy, carboxy, cyano, (C₁-C₆ alkyl)amino,

C-amido, N-amido, unsubstituted and substituted C₁-C₆ alkyl, C₁-C₆ haloalkyl, unsubstituted and substituted C₁-C₆ alkoxy, C₁-C₆ haloalkoxy, unsubstituted and substituted C₆-C₁₀ aryloxy, sulfo, sulfonate, or -NH-CH₂-CH=CH₂.

16. The method of claim 15, wherein the palladium scavenger comprising one or more



17. The method of claim 16, wherein the palladium scavenger comprises

Cl^- .

18. The method of any one of claims 1 to 17, wherein the 3' blocking group having the structure attached to the 3' oxygen of the nucleotide.

19. The method of any one of claims 1 to 18, wherein the palladium catalyst is a Pd(0) catalyst generated *in situ* from a palladium complex and a water-soluble phosphine.

20. The method of claim 19, wherein the palladium complex comprises [Pd(Allyl)Cl]₂, Na₂PdCl₄, K₂PdCl₄, [Pd(Allyl)(THP)]Cl, [Pd(Allyl)(THP)₂]Cl, Pd(CH₃CN)₂Cl₂, Pd(OAc)₂, Pd(PPh₃)₄, Pd(dba)₂, Pd(Acac)₂, PdCl₂(COD), or Pd(TFA)₂, or combinations thereof.

21. The method of claim 20, wherein the palladium complex comprises [Pd(Allyl)Cl]₂ or Na₂PdCl₄.

22. The method of any one of claims 19 to 21, wherein the water-soluble phosphine comprises tris(hydroxypropyl)phosphine (THP), tris(hydroxymethyl)phosphine (THMP), 1,3,5-triaza-7-phosphaadamantane (PTA), bis(p-sulfonatophenyl)phenylphosphine dihydrate potassium salt, tris(carboxyethyl)phosphine (TCEP), or triphenylphosphine-3,3',3''-trisulfonic acid trisodium salt, or combinations thereof.

23. The method of any one of claims 1 to 22, wherein the molar ratio of the palladium catalyst to the palladium scavenger comprising one or more allyl moieties is 1:100, 1:50, 1:20, 1:10 or 1:5.

24. The method of any one of claims 1 to 23, wherein the one or more palladium scavengers further comprises at least one Pd(II) scavenger.

25. The method of claim 24, wherein the Pd(II) scavenger comprises an isocyanoacetate (ICNA) salt, ethyl isocyanoacetate, methyl isocyanoacetate, cysteine or a salt thereof, L-cysteine or a salt thereof, N-acetyl-L-cysteine, a thiosulfate salt, sodium thiosulfate, potassium thiosulfate, potassium ethylxanthogenate, potassium isopropyl xanthate, glutathione, ethylenediaminetetraacetic acid (EDTA), iminodiacetic acid, nitrilodiacetic acid, trimercapto-S-triazine, dimethyldithiocarbamate, dithiothreitol, mercaptoethanol, allyl alcohol, propargyl alcohol, thiol, tertiary amine and/or tertiary phosphine, or combinations thereof.

26. The method of claim 24 or 25, wherein the Pd(II) scavenger comprises L-cysteine or sodium thiosulfate.

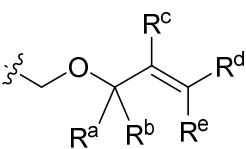
27. The method of any one of claims 24 to 26, wherein the Pd(II) scavenger is in the first aqueous solution or the second aqueous solution, or both.

28. The method of claim 27, wherein the concentration of the Pd(II) scavenger in the first or the second aqueous solution is from 0.1 mM to 100 mM, from 0.2 mM to 75 mM, from 0.5 mM to 50 mM, from 1 mM to 20 mM, or from 2 mM to 10 mM.

29. The method of any one of claims 1 to 28, wherein the solid support comprises an array of immobilized target polynucleotides.

30. A kit for use with a sequencing apparatus, comprising:

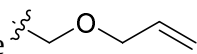
one or more of four different types of nucleotides, wherein each of the nucleotides comprises a 3' blocking group having the

structure  attached to the 3' oxygen of the nucleotide, wherein each of R^a, R^b, R^c, R^d and R^e is independently H, halogen, unsubstituted or substituted C₁-C₆ alkyl, or C₁-C₆ haloalkyl; and

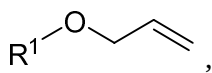
one or more palladium scavengers, wherein at least one palladium scavenger comprises one or more allyl moieties selected from the group consisting of -O-allyl, -S-allyl, -NR-allyl and -N⁺RR'-allyl, and combinations thereof,

wherein R is H, unsubstituted or substituted C₁-C₆ alkyl, unsubstituted or substituted C₂-C₆ alkenyl, unsubstituted or substituted C₂-C₆ alkynyl, unsubstituted or substituted C₆-C₁₀ aryl, or unsubstituted or substituted 5 to 10 membered heteroaryl, unsubstituted or substituted C₃-C₁₀ carbocyclyl, or unsubstituted or substituted 5 to 10 membered heterocyclyl; and

R' is H, unsubstituted C₁-C₆ alkyl or substituted C₁-C₆ alkyl.

31. The kit of claim 30, wherein the 3' blocking group has the structure  attached to the 3' oxygen of the nucleotide.

32. The kit of claim 30 or 31, wherein the palladium scavenger comprising one or more

-O-allyl moieties has the structure: ,

wherein R¹ is C₁-C₁₂ alkyl optionally substituted with one or more R^x, C₂-C₁₂ alkenyl optionally substituted with one or more R^x, C₂-C₁₂ alkynyl optionally substituted with one or more R^x, unsubstituted amino, substituted amino, C₆-C₁₀ aryl, (C₆-C₁₀ aryl)C₁-C₆ alkyl, 5 to 10 membered heteroaryl, (5 to 10 membered heteroaryl)C₁-C₆

alkyl, C₃-C₁₀ carbocyclyl, (C₃-C₁₀ carbocyclyl)C₁-C₆ alkyl, 3 to 10 membered heterocyclyl, (3 to 10 membered heterocyclyl)C₁-C₆ alkyl, a monosaccharide moiety, a disaccharide moiety, an oligosaccharide moiety, an amino acid moiety, -C(=O)NR^{f1}R^{g1}, -P(=O)OR^{f1}OR^{g1}, -C(=O)R^{h1}, -C(=O)OR^{h1} or -S(=O)₂R^{j1}, wherein each of C₆-C₁₀ aryl, 5 to 10 membered heteroaryl, C₃-C₁₀ carbocyclyl and 3 to 10 membered heterocyclyl is optionally substituted with one or more R^x;

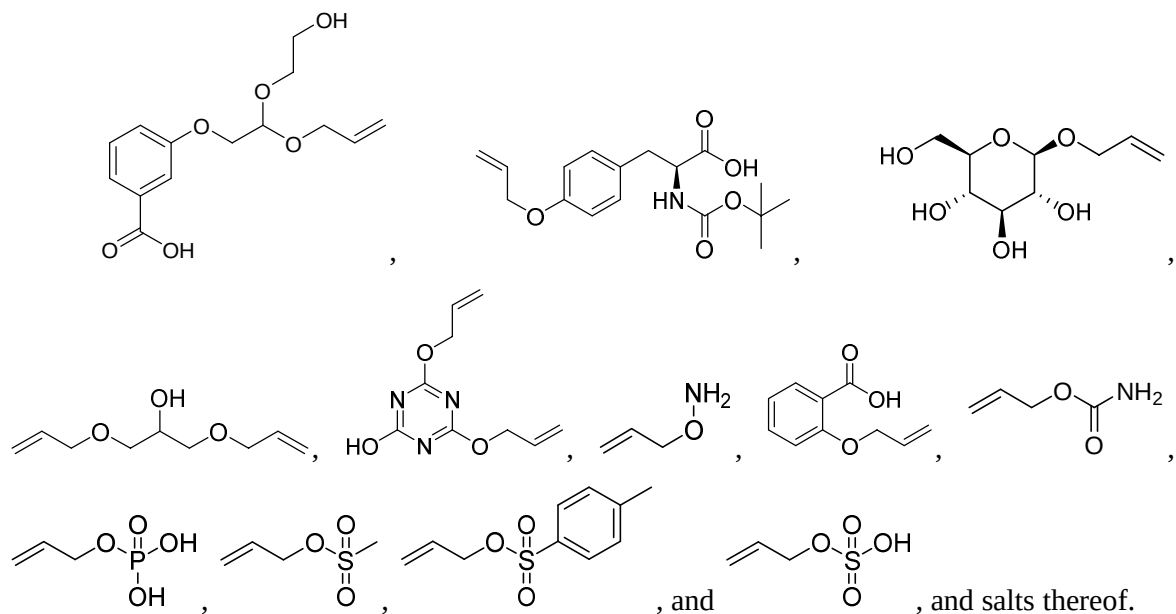
each of R^{f1} and R^{g1} is independently H, C₁-C₆ alkyl optionally substituted with one or more R^x, C₆-C₁₀ aryl optionally substituted with one or more R^x, or 5 to 10 membered heteroaryl optionally substituted with one or more R^x;

each R^{h1} is independently C₁-C₆ alkyl optionally substituted with one or more R^x, C₆-C₁₀ aryl optionally substituted with one or more R^x, or 5 to 10 membered heteroaryl optionally substituted with one or more R^x;

each R^{j1} is independently hydroxy, C₁-C₆ alkyl optionally substituted with one or more R^x, C₆-C₁₀ aryl optionally substituted with one or more R^x, or 5 to 10 membered heteroaryl optionally substituted with one or more R^x; and

each R^x is independently amino, halo, hydroxy, carboxy, cyano, (C₁-C₆ alkyl)amino, C-amido, N-amido, unsubstituted and substituted C₁-C₆ alkyl, C₁-C₆ haloalkyl, unsubstituted and substituted C₁-C₆ alkoxy, C₁-C₆ haloalkoxy, unsubstituted and substituted C₆-C₁₀ aryloxy, sulfo, sulfonate, or -O-CH₂-CH=CH₂.

33. The kit of claim 32, wherein the palladium scavenger comprising one or more -O-allyl moieties is selected from the group consisting of:



34. The kit of claim 30 or 31, wherein the palladium scavenger comprising one or more

-S-allyl moieties has the structure: $R^2-S-CH_2-CH=CH_2$,

wherein R^2 is C_1 - C_{12} alkyl optionally substituted with one or more R^y , C_2 - C_{12} alkenyl optionally substituted with one or more R^y , C_2 - C_{12} alkynyl optionally substituted with one or more R^y , unsubstituted amino, substituted amino, C_6 - C_{10} aryl, (C_6 - C_{10} aryl) C_1 - C_6 alkyl, 5 to 10 membered heteroaryl, (5 to 10 membered heteroaryl) C_1 - C_6 alkyl, C_3 - C_{10} carbocyclyl, (C_3 - C_{10} carbocyclyl) C_1 - C_6 alkyl, 3 to 10 membered heterocyclyl, (3 to 10 membered heterocyclyl) C_1 - C_6 alkyl, a monosaccharide moiety, a disaccharide moiety, an oligosaccharide moiety, an amino acid moiety, $-C(=O)NR^{f2}R^{g2}$, $-P(=O)OR^{f2}OR^{g2}$,

$-C(=O)R^{h2}$, $-C(=O)OR^{h2}$ or $-S(=O)_2R^{i2}$, wherein each of C_6 - C_{10} aryl, 5 to 10 membered heteroaryl, C_3 - C_{10} carbocyclyl and 3 to 10 membered heterocyclyl is optionally substituted with one or more R^y ;

each of R^{f2} and R^{g2} is independently H, C_1 - C_6 alkyl optionally substituted with one or more R^y , C_6 - C_{10} aryl optionally substituted with one or more R^y , or 5 to 10 membered heteroaryl optionally substituted with one or more R^y ;

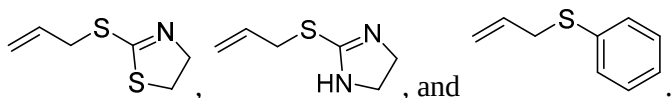
each R^{h2} is independently C_1 - C_6 alkyl optionally substituted with one or more R^y , C_6 - C_{10} aryl optionally substituted with one or more R^y , or 5 to 10 membered heteroaryl optionally substituted with one or more R^y ;

each R^{i2} is independently hydroxy, C_1 - C_6 alkyl optionally substituted with one or more R^y , C_6 - C_{10} aryl optionally substituted with one or more R^y , or 5 to 10 membered heteroaryl optionally substituted with one or more R^y ; and

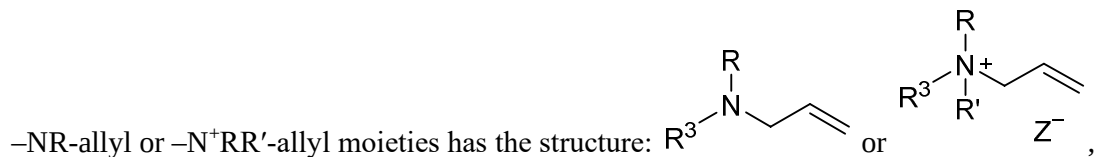
each R^y is independently amino, halo, hydroxy, carboxy, cyano, (C_1 - C_6 alkyl)amino,

C-amido, N-amido, unsubstituted and substituted C_1 - C_6 alkyl, C_1 - C_6 haloalkyl, unsubstituted and substituted C_1 - C_6 alkoxy, C_1 - C_6 haloalkoxy, unsubstituted and substituted C_6 - C_{10} aryloxy, sulfo, sulfonate, or $-S-CH_2-CH=CH_2$.

35. The kit of claim 34, wherein the palladium scavenger comprising one or more -S-allyl moieties is selected from the group consisting of: $CH_2=CH-CH_2-S-$, $CH_2=CH-CH_2-S-CH_2-CH=CH_2$,



36. The kit of claim 30 or 31, wherein the palladium scavenger comprising one or more



wherein Z is an anion;

R³ is C₁-C₁₂ alkyl optionally substituted with one or more R^z, C₂-C₁₂ alkenyl optionally substituted with one or more R^z, C₂-C₁₂ alkynyl optionally substituted with one or more R^z, unsubstituted amino, substituted amino, C₆-C₁₀ aryl, (C₆-C₁₀ aryl)C₁-C₆ alkyl, 5 to 10 membered heteroaryl, (5 to 10 membered heteroaryl)C₁-C₆ alkyl, C₃-C₁₀ carbocyclyl, (C₃-C₁₀ carbocyclyl)C₁-C₆ alkyl, 3 to 10 membered heterocyclyl, (3 to 10 membered heterocyclyl)C₁-C₆ alkyl, a monosaccharide moiety, a disaccharide moiety, an oligosaccharide moiety, an amino acid moiety, -C(=O)NR^{f3}R^{g3}, -P(=O)OR^{f3}OR^{g3}, -C(=O)R^{h3}, -C(=O)OR^{h3} or -S(=O)₂R^{j3}, wherein each of C₆-C₁₀ aryl, 5 to 10 membered heteroaryl, C₃-C₁₀ carbocyclyl and 3 to 10 membered heterocyclyl is optionally substituted with one or more R^z;

each of R^{f3} and R^{g3} is independently H, C₁-C₆ alkyl optionally substituted with one or more R^z, C₆-C₁₀ aryl optionally substituted with one or more R^z, or 5 to 10 membered heteroaryl optionally substituted with one or more R^z;

each R^{h3} is independently C₁-C₆ alkyl optionally substituted with one or more R^z, C₆-C₁₀ aryl optionally substituted with one or more R^z, or 5 to 10 membered heteroaryl optionally substituted with one or more R^z;

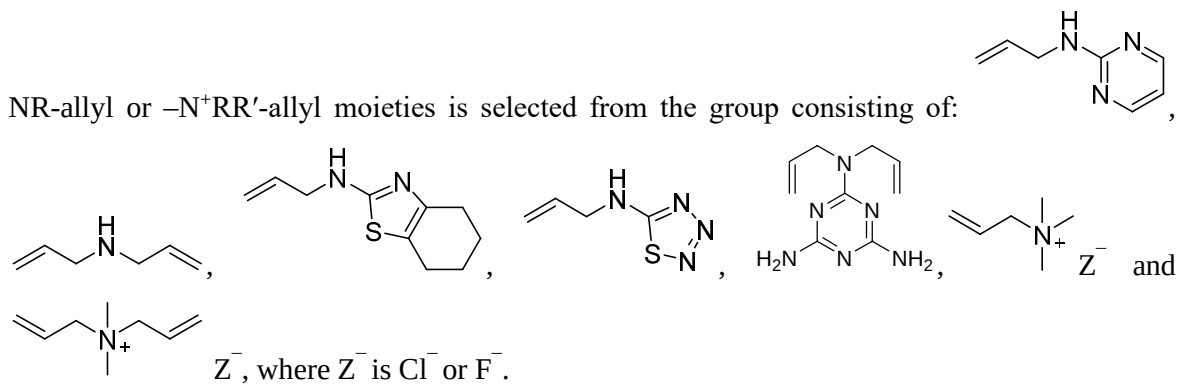
each R^{j3} is independently hydroxy, C₁-C₆ alkyl optionally substituted with one or more R^z, C₆-C₁₀ aryl optionally substituted with one or more R^z, or 5 to 10 membered heteroaryl optionally substituted with one or more R^z; and

each R^z is independently amino, halo, hydroxy, carboxy, cyano, (C₁-C₆ alkyl)amino,

C-amido, N-amido, unsubstituted and substituted C₁-C₆ alkyl, C₁-C₆ haloalkyl, unsubstituted and substituted C₁-C₆ alkoxy, C₁-C₆ haloalkoxy, unsubstituted and substituted C₆-C₁₀ aryloxy, sulfo, sulfonate, or –NH-CH₂-CH=CH₂.

37. The kit of claim 36, wherein the palladium scavenger comprising one or more –

NR-allyl or $-N^+RR'$ -allyl moieties is selected from the group consisting of:



38. The kit of any one of claims 30 to 37, further comprising a DNA polymerase and one or more buffer compositions.