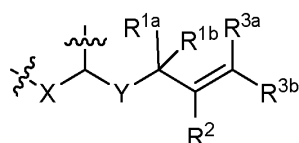


WHAT IS CLAIMED IS:

1. A nucleoside or nucleotide comprising a nucleobase attached to a detectable label via a cleavable linker, wherein the nucleoside or nucleotide comprises a ribose or 2' deoxyribose moiety and a 3'-OH blocking group, and wherein the cleavable linker comprises a moiety of the structure:

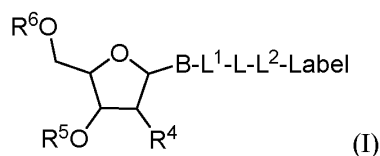


wherein

each of X and Y is independently O or S; and

each of R^{1a}, R^{1b}, R², R^{3a} and R^{3b} is independently H, halogen, unsubstituted or substituted C₁-C₆ alkyl, or C₁-C₆ haloalkyl.

2. The nucleoside or nucleotide of claim 1, comprising the structure of Formula (I):



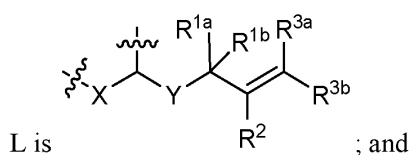
wherein B is the nucleobase;

R⁴ is H or OH;

R⁵ is the 3'-OH blocking group;

R⁶ is H, monophosphate, diphosphate, triphosphate, thiophosphate, a phosphate ester analog, a reactive phosphorous containing group, or a hydroxy protecting group;

the detectable label is a fluorescent dye;



each of L¹ and L² is independently an optionally present linker moiety.

3. The nucleoside or nucleotide of claim 1 or 2, wherein each of X and Y is O.

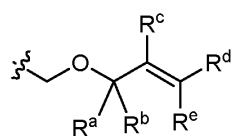
4. The nucleoside or nucleotide of any one of claim 1 to 3, wherein each of R^{1a}, R^{1b}, R², R^{3a} and R^{3b} is H.

5. The nucleoside or nucleotide of any one of claims 1 to 3, wherein at least one of R^{1a} , R^{1b} , R^2 , R^{3a} and R^{3b} is halogen or unsubstituted C_1 - C_6 alkyl.

6. The nucleoside or nucleotide of claim 5, wherein each of R^{1a} and R^{1b} is H and one of R^2 , R^{3a} and R^{3b} is unsubstituted C_1 - C_6 alkyl.

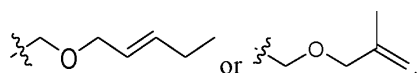
7. The nucleoside or nucleotide of any one of claims 2 to 6, wherein B is a purine, a deaza purine, or a pyrimidine.

8. The nucleoside or nucleotide of any one of claims 2 to 7, wherein R^5 is

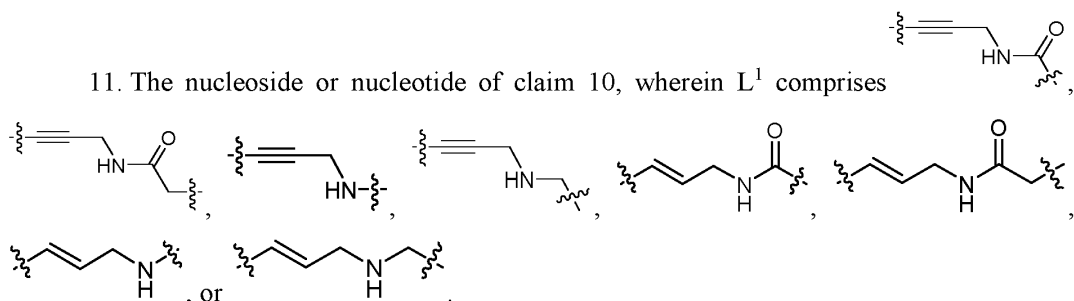


, and wherein each of R^a , R^b , R^c , R^d and R^e is independently H, halogen, unsubstituted or substituted C_1 - C_6 alkyl, or C_1 - C_6 haloalkyl.

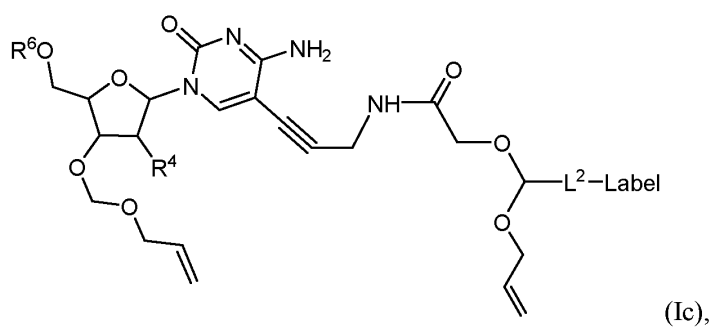
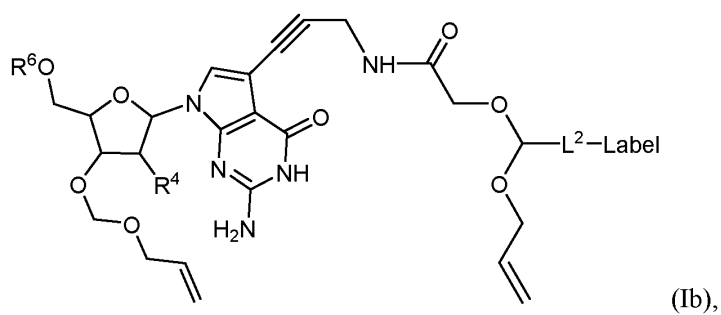
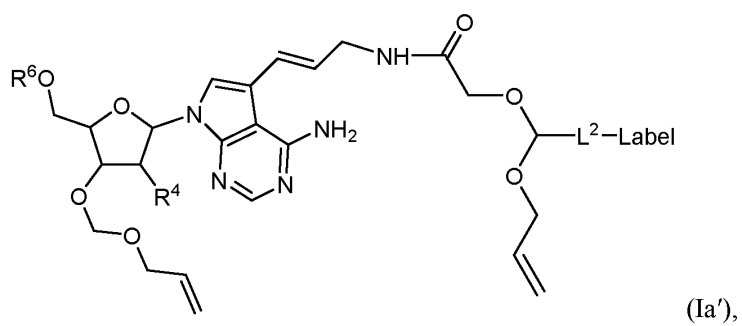
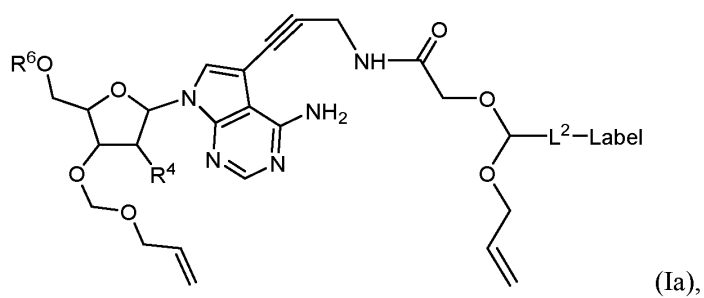
9. The nucleoside or nucleotide of claim 8, wherein R^5 is

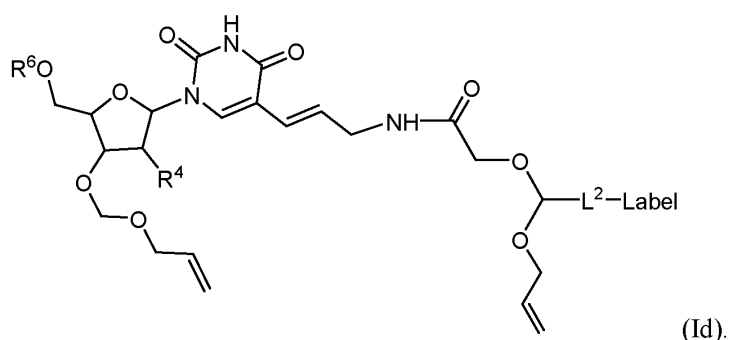
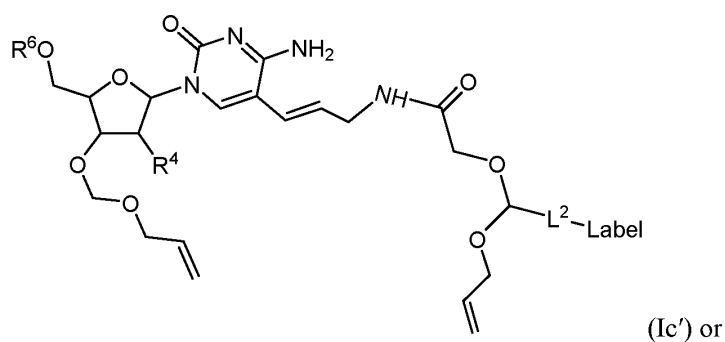


10. The nucleoside or nucleotide of any one of claims 2 to 9, wherein L^1 is present, and L^1 comprises a moiety selected from the group consisting of a propargylamine, a propargylamide, an allylamine, an allylamide, and optionally substituted variants thereof.

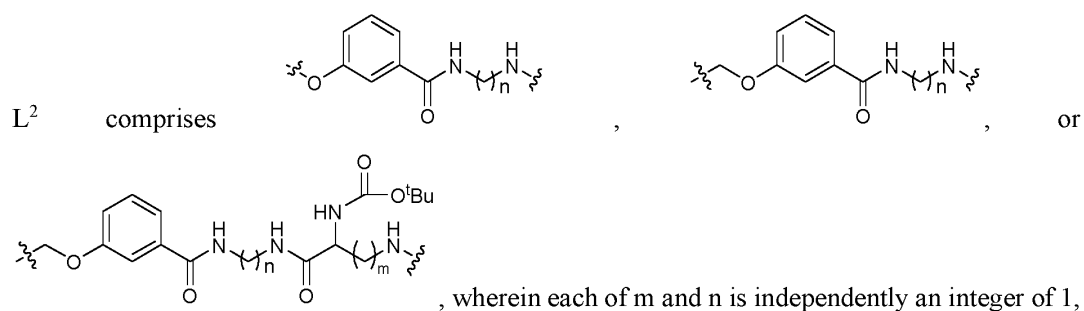


12. The nucleoside or nucleotide of claim 11, comprising the structure of Formula (Ia), (Ia'), (Ib), (Ic), (Ic') or (Id):





13. The nucleoside or nucleotide of any one of claims 2 to 12, wherein L^2 is present, and



2, 3, 4, 5, 6, 7, 8, 9 or 10, and the phenyl moiety is optionally substituted.

14. The nucleoside or nucleotide of claim 13, wherein n is 5.

15. The nucleoside or nucleotide of claim 13 or 14, wherein m is 4.

16. The nucleoside or nucleotide of any one of claims 1 to 14, wherein the nucleotide is a nucleotide triphosphate comprising 2' deoxyribose moiety.

17. An oligonucleotide or polynucleotide comprising a nucleotide of any one of claims 1 to 16.

18. The oligonucleotide or polynucleotide of claim 17, wherein the oligonucleotide or polynucleotide is hybridized to a template polynucleotide.

19. The oligonucleotide or polynucleotide of claim 18, wherein the template polynucleotide is immobilized on a solid support.

20. The oligonucleotide or polynucleotide of claim 19, wherein the solid support comprises an array of a plurality of immobilized template polynucleotides.

21. A method of preparing a growing polynucleotide complementary to a target single-stranded polynucleotide in a sequencing reaction, comprising incorporating a nucleotide of any one of claims 1 to 16 into a growing complementary polynucleotide, wherein the incorporation of the nucleotide prevents the introduction of any subsequent nucleotide into the growing complementary polynucleotide.

22. The method of claim 21, wherein the incorporation of the nucleotide is accomplished by a polymerase, a terminal deoxynucleotidyl transferase, or a reverse transcriptase.

23. A method of determining the sequence of a target single-stranded polynucleotide, comprising:

(a) incorporating a nucleotide of any one of claims 1 to 16 into a copy polynucleotide strand complementary to at least a portion of the target polynucleotide strand;

(b) detecting the identity of the nucleotide incorporated into the copy polynucleotide strand; and

(c) chemically removing the detectable label and the 3'-OH blocking group from the nucleotide incorporated into the copy polynucleotide strand.

24. The method of claim 23, further comprising (d) using a post-cleavage washing solution to wash the chemically removed label and the 3'-OH blocking group away from the copy polynucleotide strand.

25. The method of claim 24, further comprising repeating steps (a) to (d) until a sequence of at least a portion of the target polynucleotide strand is determined.

26. The method of claim 25, wherein the steps (a) to (d) is repeated at least 50 times, at least 100 times, or at least 150 times.

27. The method of any one of claims 23 to 26, wherein step (c) comprises contacting the incorporated nucleotide with a cleavage solution comprising a palladium catalyst.

28. The method of claim 27, wherein the palladium catalyst is a palladium (0) catalyst generated *in situ* from a palladium complex and a water-soluble phosphine.

29. The method of claim 28, wherein the palladium complex comprises $[\text{Pd}(\text{Allyl})\text{Cl}]_2$, Na_2PdCl_4 , $[\text{Pd}(\text{Allyl})(\text{THP})]\text{Cl}$, $[\text{Pd}(\text{Allyl})(\text{THP})_2]\text{Cl}$, $\text{Pd}(\text{CH}_3\text{CN})_2\text{Cl}_2$, $\text{Pd}(\text{OAc})_2$, $\text{Pd}(\text{PPh}_3)_4$, $\text{Pd}(\text{dba})_2$, $\text{Pd}(\text{Acac})_2$, $\text{PdCl}_2(\text{COD})$, or $\text{Pd}(\text{TFA})_2$, or combinations thereof.

30. The method of claim 29, wherein the palladium complex comprises $[\text{Pd}(\text{Allyl})\text{Cl}]_2$ or Na_2PdCl_4 .

31. The method of any one of claims 27 to 30, wherein the detectable label and the 3'-OH blocking group from the nucleotide incorporated into the copy polynucleotide strand are removed in a single chemical reaction.

32. The method of any one of claims 27 to 31, wherein the cleavage solution further comprises one or more buffer reagents selected from the group consisting of a primary amine, a secondary amine, a tertiary amine, a carbonate salt, a phosphate salt, and a borate salt, and combinations thereof.

33. The method of claim 32, wherein the buffer reagents in the cleavage solution are selected from the group consisting of ethanolamine (EA), tris(hydroxymethyl)aminomethane (Tris), glycine, a carbonate salt, a phosphate salt, a borate salt, dimethylethanolamine (DMEA), diethylethanolamine (DEEA), N,N,N',N'-tetramethylethylenediamine (TEMED), and N,N,N',N'-tetraethylethylenediamine (TEEDA), 2-piperidine ethanol, and combinations thereof.

34. The method of any one of claims 27 to 33, wherein step (a) comprises contacting the nucleotide with the copy polynucleotide strand in an incorporation solution comprising a polymerase, at least one palladium scavenger, and one or more buffering agents.

35. The method of claim 34, wherein the buffering agents in the incorporation solution comprise a primary amine, a secondary amine, a tertiary amine, a natural amino acid, or a non-natural amino acid, or combinations thereof.

36. The method of claim 35, wherein the buffering agents in the incorporation solution comprise ethanolamine or glycine, or a combination thereof.

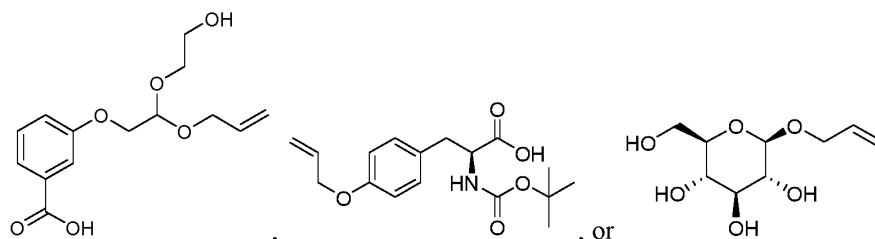
37. The method of any one of claims 34 to 36, wherein the palladium scavenger in the incorporation solution comprises one or more allyl moieties independently selected from the group consisting of -O-allyl, -S-allyl, -NR-allyl, and -N⁺RR'-allyl,

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, 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.

38. The method of claim 37, wherein the palladium scavenger in the incorporation solution is:



39. The method of any one of claims 27 to 38, wherein the post-cleavage washing solution comprises one or more palladium scavengers.

40. The method of claim 39, wherein the one or more palladium scavengers in the post cleavage solution comprises an isocyanoacetate (ICNA) salt, ethyl isocyanoacetate, methyl isocyanoacetate, cysteine or a salt thereof, L-cysteine or a salt thereof, *N*-acetyl-L-cysteine, potassium ethylxanthogenate, potassium isopropyl xanthate, glutathione, lipoic acid, 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.

41. The method of any one of claims 23 to 40, wherein the target single-stranded polynucleotide is formed by chemically cleaving a complementary strand from a double stranded polynucleotide.

42. The method of claim 41, wherein the chemically cleavage of the complementary strand is performed under the same reaction condition as chemically removing the detectable label and the 3'-OH blocking group from the nucleotide incorporated into the copy polynucleotide strand.

43. A kit comprising one or more nucleosides or nucleotides of any one of claims 1 to 16.

44. The kit of claim 43, further comprising an enzyme, at least one Pd(0) scavenger, and one or more buffering agents.

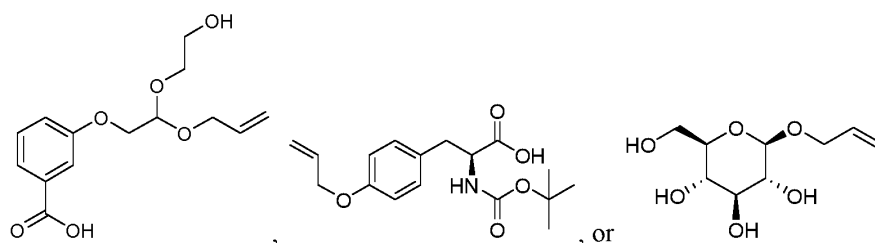
45. The kit of claim 44, wherein the enzyme is a DNA polymerase, a terminal deoxynucleotidyl transferase, or a reverse transcriptase.

46. The kit of claim 44, wherein the Pd(0) scavenger comprises one or more allyl moieties each independently selected from the group consisting of $-O$ -allyl, $-S$ -allyl, $-NR$ -allyl, and $-N^+RR'$ -allyl,

wherein R is H, unsubstituted or substituted C_1 - C_6 alkyl, unsubstituted or substituted C_2 - C_6 alkenyl, unsubstituted or substituted C_2 - C_6 alkynyl, unsubstituted or substituted C_6 - C_{10} aryl, unsubstituted or substituted 5 to 10 membered heteroaryl, unsubstituted or substituted C_3 - C_{10} carbocyclyl, or unsubstituted or substituted 5 to 10 membered heterocyclyl; and

R' is H, unsubstituted C_1 - C_6 alkyl or substituted C_1 - C_6 alkyl.

47. The kit of claim 46, wherein the palladium scavenger is:



48. The kit of any one of claims 43 to 47, further comprising a palladium catalyst.

49. The kit of claim 48, wherein the palladium catalyst is a Pd(0) catalyst generated *in situ* from a Pd(II) complex and one or more water soluble phosphines.

50. The kit of claim 49, wherein the Pd(II) complex is $[Pd(Allyl)Cl]_2$ or Na_2PdCl_4 .

51. The kit of claim 49 or 50, further comprising one or more Pd(II) scavengers, 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, potassium ethylxanthogenate, potassium isopropyl xanthate, glutathione, lipoic acid, 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.

52. The kit of claim 51, wherein the Pd(II) scavenger is L-cysteine or a salt thereof.