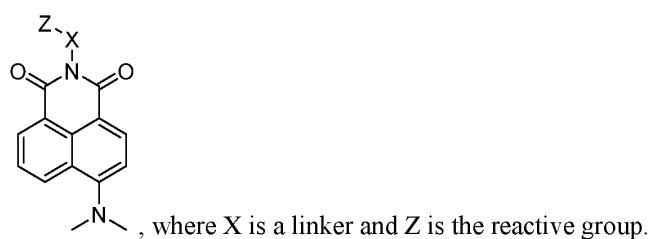
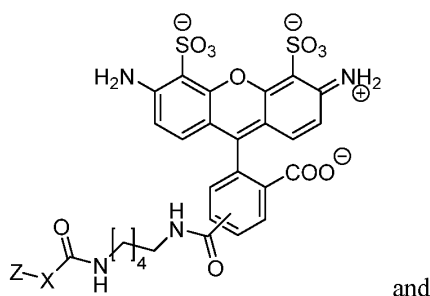


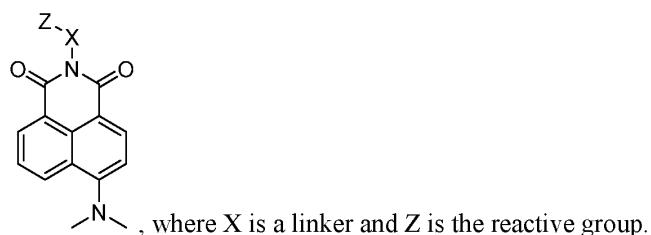
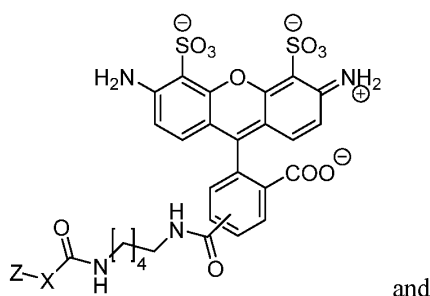
## WHAT IS CLAIMED IS:

1. A method for detecting an abasic site, the method comprising:  
flowing a solution over a substrate having a plurality of oligonucleotides coupled thereto,  
at least one of the oligonucleotides comprising an abasic site,  
the solution comprising a fluorophore coupled to a reactive group;  
reacting the reactive group with the abasic site to couple the fluorophore to the abasic site; and  
detecting the abasic site using fluorescence from the fluorophore.
2. The method of claim 1, wherein the abasic site is generated by damage to the oligonucleotide.
3. The method of claim 1 or claim 2, wherein nucleotide bases adjacent to the abasic site inhibit non-radiative energy dissipation from the respective fluorophore coupled to the abasic site.
4. The method of any one of claims 1 to 3, wherein the fluorophore comprises a molecular rotor dye comprising  $\pi$ -conjugated components separated by a rotatable C-C bond.
5. The method of claim 4, wherein nucleotide bases adjacent to the abasic site restrict rotation of the C-C bond and align the  $\pi$ -conjugated components with one another.
6. The method of claim 4 or claim 5, wherein the molecular rotor dye coupled to the reactive group is selected from the group consisting of 9-(2-carboxy-2-cyanovinyl)-julolidine (CCVJ1), (Z)-4-(3,5-difluoro-4-hydroxybenzylidene)-1,2-dimethyl-1-H-imidazol-5(4H)-one (DFHBI), and 1-methyl-4-[(3-methyl-2(3H)-benzothiazolylidene)methyl]quidolimium (thiazole orange).
7. The method of any one of claims 1 to 3, wherein the fluorophore coupled to the reactive group is selected from the group consisting of:



8. The method of any one of claims 1 to 7, wherein the abasic site comprises an aldehyde.
9. The method of any one of claims 1 to 8, wherein the reactive group comprises a hydroxylamine group.
10. The method of any one of claims 1 to 8, wherein the reactive group comprises a hydrazine group.
11. The method of any one of claims 1 to 10, wherein reacting the reactive group with the abasic site forms an oxime linkage.
12. A composition comprising:
  - a substrate having a plurality of oligonucleotides coupled thereto,
  - at least one of the oligonucleotides comprising an abasic site; and
  - a fluorophore coupled to the abasic site, the abasic site being detectable using fluorescence from the fluorophore.
13. The composition of claim 12, wherein the abasic site is generated by damage to the oligonucleotide.

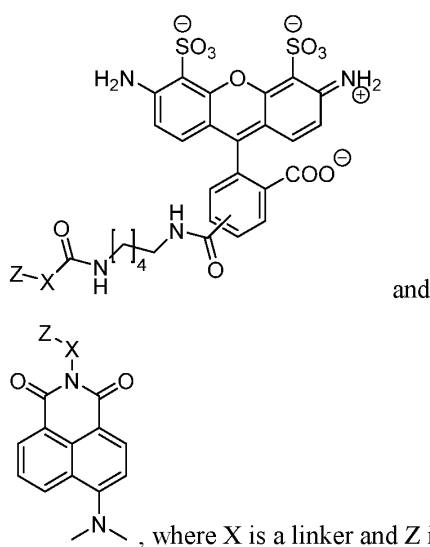
14. The composition of claim 12 or claim 13, wherein nucleotide bases adjacent to the abasic site inhibit non-radiative energy dissipation from the respective fluorophore coupled to the abasic site.
15. The composition of any one of claims 12 to 14, wherein the fluorophore comprises a molecular rotor dye comprising  $\pi$ -conjugated components separated by a rotatable C-C bond.
16. The composition of claim 15, wherein nucleotide bases adjacent to the abasic site restrict rotation of the C-C bond and align the  $\pi$ -conjugated components with one another.
17. The composition of claim 15 or claim 16, wherein the molecular rotor dye coupled to the reactive group is selected from the group consisting of 9-(2-carboxy-2-cyanovinyl)-julolidine (CCVJ1), (Z)-4-(3,5-difluoro-4-hydroxybenzylidene)-1,2-dimethyl-1-H-imidazol-5(4H)-one (DFHBI), and 1-methyl-4-[(3-methyl-2(3H)-benzothiazolylidene)methyl]quidolimium (thiazole orange).
18. The composition of any one of claims 12 to 14, wherein the fluorophore coupled to the reactive group is selected from the group consisting of:



19. The composition of any one of claims 13 to 18, wherein the abasic site comprises an aldehyde.
20. The composition of any one of claims 13 to 19, wherein the reactive group comprises a hydroxylamine group.
21. The composition of any one of claims 13 to 19, wherein the reactive group comprises a hydrazine group.
22. The composition of any one of claims 13 to 21, wherein reacting the reactive group with the abasic site forms an oxime linkage.
23. A method, comprising:  
preparing a solution comprising (i) glycosylases, (ii) oligonucleotides, and (iii) fluorophores coupled to reactive groups;  
generating, using the glycosylases, abasic sites in the oligonucleotides in the solution;  
reacting the reactive groups with the abasic sites to couple the fluorophores to the abasic sites;  
measuring activity of the glycosylases using fluorescence from the fluorophores coupled to the abasic sites; and  
using the glycosylases in a sequencing-by-synthesis operation.
24. The method of claim 23, wherein nucleotide bases adjacent to the abasic site inhibit non-radiative energy dissipation from the respective fluorophore coupled to the abasic site.
25. The method of claim 23 or claim 24, wherein the fluorophore comprises a molecular rotor dye comprising  $\pi$ -conjugated components separated by a rotatable C-C bond.
26. The method of claim 25, wherein nucleotide bases adjacent to the abasic site restrict rotation of the C-C bond and align the  $\pi$ -conjugated components with one another.
27. The method of claim 25 or claim 26, wherein the molecular rotor dye coupled to the reactive group is selected from the group consisting of 9-(2-carboxy-2-cyanovinyl)-julolidine (CCVJ1), (Z)-4-(3,5-difluoro-4-hydroxybenzylidene)-1,2-dimethyl-1-H-imidazol-5(4H)-one

(DFHBI), and 1-methyl-4-[(3-methyl-2(3*H*)-benzothiazolylidene)methyl]quidolimium (thiazole orange).

28. The method of claim 23 or claim 24, wherein the fluorophore coupled to the reactive group is selected from the group consisting of:



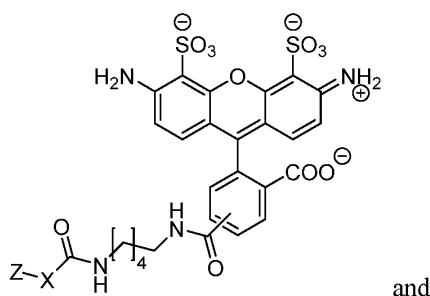
29. The method of any one of claims 23 to 28, wherein the abasic site comprises an aldehyde.

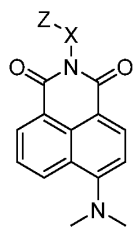
30. The method of any one of claims 23 to 29, wherein the reactive group comprises a hydroxylamine group.

31. The method of any one of claims 23 to 29, wherein the reactive group comprises a hydrazine group.

32. The method of any one of claims 23 to 31, wherein reacting the reactive group with the abasic site forms an oxime linkage.

33. A solution for measuring glycosylase activity, the solution comprising:  
 (i) glycosylases, (ii) oligonucleotides, and (iii) fluorophores coupled to reactive groups,  
 the oligonucleotides comprising abasic sites generated by the glycosylases in the solution,  
 the fluorophores being coupled to the abasic sites, and  
 the abasic sites being detectable using fluorescence from the fluorophores.
34. The solution of claim 33, wherein nucleotide bases adjacent to the abasic site inhibit non-radiative energy dissipation from the respective fluorophore coupled to the abasic site.
35. The solution of claim 33 or claim 34, wherein the fluorophore comprises a molecular rotor dye comprising  $\pi$ -conjugated components separated by a rotatable C-C bond.
36. The solution of claim 35, wherein nucleotide bases adjacent to the abasic site restrict rotation of the C-C bond and align the  $\pi$ -conjugated components with one another.
37. The solution of claim 35 or claim 36, wherein the molecular rotor dye coupled to the reactive group is selected from the group consisting of 9-(2-carboxy-2-cyanovinyl)-julolidine (CCVJ1), (Z)-4-(3,5-difluoro-4-hydroxybenzylidene)-1,2-dimethyl-1-H-imidazol-5(4H)-one (DFHBI), and 1-methyl-4-[(3-methyl-2(3*H*)-benzothiazolydene)methyl]quidolimium (thiazole orange).
38. The solution of claim 33 or claim 34, wherein the fluorophore coupled to the reactive group is selected from the group consisting of:





, where X is a linker and Z is the reactive group.

39. The solution of any one of claims 33 to 38, wherein the abasic site comprises an aldehyde.
40. The solution of any one of claims 33 to 39, wherein the reactive group comprises a hydroxylamine group.
41. The solution of any one of claims 33 to 39, wherein the reactive group comprises a hydrazine group.
42. The solution of any one of claims 33 to 41, wherein reacting the reactive group with the abasic site forms an oxime linkage.