The present invention also provides any one of the embodiments disclosed below and indicated with the numbers 1 to 42.

1. A controllable and reversible nanoparticle assembly comprising, nanoparticles encapsulated with non-complementary DNA and/or RNA, the non-complementary DNA and/or RNA bound by a nucleotide binding protein to form a nanoparticle assembly.

2. The controllable and reversible nanoparticle assembly according to claim 1, wherein the nanoparticle assembly is disassembled by further combining the nanoparticle assembly with DNA and/or RNA complementary to the non-complementary DNA and/or RNA.

3. The controllable and reversible nanoparticle assembly according to claim 1, wherein the nanoparticle is a metal.

4. The controllable and reversible nanoparticle assembly according to claim 3, wherein the metal is selected from the group consisting of gold, silver, and platinum.

5. The controllable and reversible nanoparticle assembly according to claim 4, wherein the metal is gold.

6. The controllable and reversible nanoparticle assembly according to claim 1, wherein the nanoparticle is a semiconductor.

7. The controllable and reversible nanoparticle assembly according to claim 6, wherein the semiconductor is selected from the group consisting of cadmium selenide, cadmium sulfide, zinc sulfide, and gallium arsenide.

8. The controllable and reversible nanoparticle assembly according to claim 1, wherein the nanoparticle is magnetic.

9. The controllable and reversible nanoparticle assembly according to claim 8, wherein the nanoparticle is iron oxide.

10. The controllable and reversible nanoparticle assembly according to claim 1, wherein the DNA and/or RNA are single stranded.

11. The controllable and reversible nanoparticle assembly according to claim 1, wherein the DNA and/or RNA are double stranded.

12. The controllable and reversible nanoparticle assembly according to claim 1, wherein the nucleotide binding protein is g5p.

13. A controllable nanoparticle assembly and disassembly process comprising,
encapsulating nanoparticles with DNA and/or RNA;
combining the encapsulated nanoparticles with a nucleotide binding protein; and
binding the DNA and/or RNA to the nucleotide binding protein, thereby forming an assembly of nanoparticles.

14. The controllable nanoparticle assembly and disassembly process according to claim 13, wherein the assembly of nanoparticles is disassembled by further combining the nanoparticle assembly with nucleotides complementary to the non-complementary DNA and/or RNA.

15. The controllable nanoparticle assembly and disassembly process according to claim 13, wherein the nanoparticle is a metal.

16. The controllable nanoparticle assembly and disassembly process according to claim 15, wherein the metal is selected from the group consisting of gold, silver, and platinum.

17. The controllable nanoparticle assembly and disassembly process according to claim 16, wherein the nanoparticle is gold.

18. The controllable nanoparticle assembly and disassembly process according to claim 13, wherein the nanoparticle is a semiconductor.

19. The controllable nanoparticle assembly and disassembly process according to claim 18, wherein the semiconductor is selected from the group consisting of cadmium selenide, cadmium sulfide, zinc sulfide, and gallium arsenide.

20. The controllable nanoparticle assembly and disassembly process according to claim 13, wherein the nanoparticle is magnetic.

21. The controllable nanoparticle assembly and disassembly process according to claim 20, wherein the nanoparticle is iron oxide.

22. The controllable nanoparticle assembly and disassembly process according to claim 13, wherein the DNA and/or RNA is single stranded.

23. The controllable nanoparticle assembly and disassembly process according to claim 13, wherein the DNA and/or RNA is double stranded.

24. The controllable nanoparticle assembly and disassembly process according to claim 13, wherein the nucleotide binding protein is g5p.

25. A method for assembling nanoparticles comprising,
functionalizing a plurality of nanoparticles with a nucleotide binding protein;
incubating the functionalized nanoparticles with non-complementary DNA and/or RNA; and
linking at least two strands of the DNA and/or RNA with the nucleotide binding protein, thereby forming an assembly of nanoparticles.

26. The method according to claim 25, wherein the nanoparticles are metal.

27. The method according to claim 26, wherein the metals are selected from the group consisting of gold, silver, and platinum.

28. The method according to claim 27, wherein the nanoparticles are gold.

29. The method according to claim 25, wherein the nanoparticles are semiconductors.

30. The method according to claim 29, wherein the semiconductors are selected from the group consisting of cadmium selenide, cadmium sulfide, zinc sulfide, and gallium arsenide.

31. The method according to claim 25, wherein the nanoparticles are magnetic.

32. The method according to claim 31, wherein the nanoparticles are iron oxide.

33. A molecular switch comprising, a fluorescent quenched off position and a fluorescent emission on position, wherein
the fluorescent quenched off position comprises a first ssDNA bound to fluorescein at the 5' end forming a fluorescein-ssDNA strand, a second ssDNA bound to DABCYL at the 3' end to form a ssDNA-DABCYL strand, the fluorescein-ssDNA strand and the ssDNA-DABCYL strand bound together with g5p; and
the fluorescent emission on position further comprises a complementary ssDNA or ssRNA hybridized to either the fluorescein-ssDNA strand or the ssDNA-DABCYL strand, whereby removing the fluorescein quencher and enabling fluorescence detection.

34. A molecular switch comprising:
a segment of dsDNA;
a first strand of ssDNA bound to one of the two strands of the dsDNA and to DABCYL at respective ends;
a second strand of ssDNA bound to the other of the two strands of the dsDNA and to fluorescein at respective ends, the two strands of ssDNA non-complementary each to the other; and
g5p attached to at least one pair of DABCYL-tipped and fluorescein-tipped ssDNA strands, such that fluorescence from the fluorescein is quenched during attachment via g5p.

35. A g5p-mediated DNA assemblage comprising, non-complementary DNA or RNA strands, the non-complementary DNA or RNA strands bound to a nucleotide binding protein, thereby forming an assemblage.

36. The g5p-mediated DNA assemblage according to claim 35, wherein the DNA or RNA is single stranded.

37. The g5p-mediated DNA assemblage according to claim 35, wherein the nucleotide binding protein is g5p.

38. A method for assembling nanoparticles, the method comprising
functionalizing a plurality of nanoparticles with non-complementary ssDNA;
exposing the functionalized nanoparticles to gene 5 protein ; and
linking at least two strands of the ssDNA with the g5p, thereby forming an assembly of nanoparticles.

39. A multi-dimensional structure of DNA and nanoparticle-functionalized g5p comprising, a DNA structure having multiple branches of ssDNA, a peptide conjugated to g5p, wherein the g5p is bound to the ssDNA, and nanoparticles bound specifically to the peptide, thereby forming a complex structure of DNA and nanoparticle-functionalized g5p.

40. A multi-dimensional DNA scaffold comprising:
first and second strands of ssDNA mutually bound by sequences of C-ssDNA at a first locus;
third and fourth strands of ssDNA mutually bound by sequences of C-ssDNA at a second locus;
the second and third strands of ssDNA mutually bound by sequences of C-ssDNA at the second locus; and
g5p bound to at least two of the strands of ssDNA at one or more points between the bound loci.

41. The scaffold of claim 40, further comprising at least one nanoparticle bound to at least one of the g5p.

42. The scaffold of claim 41, further comprising at least one nanoparticle bound to at least one region of DNA.