What is claimed is:

1. A targeted templated assembly reactant comprising:

a) at least one nucleic acid recognition moiety that binds a target nucleic acid sequence;

b) at least one effector partial moiety; and

c) at least one selectively-reactive moiety; wherein the reactant is capable of binding a corresponding templated assembly reactant to produce an active effector structure.

2. The reactant of claim 1, wherein the nucleic acid recognition moiety is a nucleic acid-binding oligomer.

3. The reactant of claim 1, wherein the nucleic acid recognition moiety is a nucleic acid oligomer that hybridizes to the target nucleic acid sequence.

4. The reactant of claim 1, wherein the selectively-reactive moiety is biologically inert.

5. The reactant of claim 1, wherein the selectively-reactive moiety is linked to the nucleic acid recognition moiety.

6. The reactant of claim 1, wherein the selectively-reactive moiety is a bio-orthogonal reactive molecule.

7. The reactant of claim 1, wherein the active effector structure regulates at least one of enzyme activity, gene/protein expression, molecular signaling, and molecular interaction.

8. The reactant of claim 1, wherein the active effector structure possesses targeted activity as compared to an activity of the effector partial moiety.

9. The reactant of claim 1 further comprising a chemical linker between any of the nucleic acid recognition moiety and the selectively-reactive moiety, and the selectively-reactive moiety and the effector partial moiety.

10. The reactant of claim 9, wherein the chemical linker improves at least one of solubility, hydrophobicity, charge, cell-permeability, toxicity, bio-distribution, and stability of the targeted templated assembly reactant.

11. The reactant of claim 9, wherein the chemical linker is at least one of a flexible moiety, cleavage site, and chemical modification site.

12. The reactant of claim 1, wherein the target nucleic acid sequence is selected from a cancer-specific nucleic acid sequence, a viral nucleic acid sequence, a microbial-specific nucleic acid sequence, a differentially expressed gene, a disease-specific nucleic acid sequence, and a fragment, portion or a nucleic acid gene product thereof.

13. A targeted templated assembly reactant comprising:

a) at least one nucleic acid recognition moiety;

b) at least one bio-orthogonal moiety; and

c) at least one effector partial moiety.

14. The reactant of claim 13, wherein the nucleic acid recognition moiety is an oligomer selected from the group consisting of DNA nucleotides, RNA nucleotides, phosphorothioate-modified nucleotides, 2-O-alkylated RNA nucleotides, halogenated nucleotides, locked nucleic acid nucleotides (LNA), peptide nucleic acids (PNA), morpholino nucleic acid analogues (morpholinos), pseudouridine nucleotides, xanthine nucleotides, hypoxanthine nucleotides, 2-deoxyinosine nucleotides, other nucleic acid analogues capable of base-pair formation, and combinations thereof.

15. The reactant of claim 13, wherein the nucleic acid recognition moiety binds a target nucleic acid sequence selected from the group consisting of an oncogene, a mutant gene, an oncoviral gene, a viral nucleic acid sequence, a microbial nucleic acid sequence, a differentially expressed gene, and a fragment, portion or a nucleic acid gene product thereof.

16. The reactant of claim 13, wherein the bio-orthogonal moiety is selected from the group consisting of an azide, a cyclooctyne, a nitrone, a norbornene, an oxanorbornadiene, a phosphine, a dialkyl phosphine, a trialkyl phosphine, a phosphinothiol, a phosphinophenol, a cyclooctene, a nitrile oxide, a thioester, a tetrazine, an isonitrile, a tetrazole, a quadricyclane, and derivatives thereof.

17. The reactant of claim 13, wherein the effector partial moiety is selected from the group consisting of a peptide, a non-active portion of a peptidomimetic structure, a non-active portion of a drug, and other bioactive compound.

18. The reactant of claim 13, wherein the effector partial moiety is less than 20kDa.

19. The reactant of claim 13, wherein one or more of the nucleic acid recognition moiety, the bio-orthogonal moiety, and the effector partial moiety is functionalized with a chemical linker.

20. The reactant of claim 13 further comprising a chemical linker between any of the nucleic acid recognition moiety and the bio-orthogonal moiety, and the bio-orthogonal moiety and the effector partial moiety.

21. The reactant of claim 20, wherein the chemical linker is selected from the group consisting of an alkyl group, an alkenyl group, an amide, an ester, a thioester, a ketone, an ether, a thioether, a disulfide, an ethylene glycol, a cycloalkyl group, a benzyl group, a heterocyclic group, a maleimidyl group, a hydrazone, a urethane, azoles, an imine, a haloalkyl, a carbamate, and combination thereof.

22. A method of synthesizing a templated assembly reactant, said method comprising:

generating at least one nucleic acid recognition moiety that is capable of binding a target nucleic acid sequence;

generating at least one selectively-reactive moiety that is capable of binding a corresponding selectively-reactive moiety; and

generating at least one effector partial moiety that is capable of binding a corresponding effector partial moiety to produce an active effector structure.

23. The method of claim 22 further comprising the step of determining competency of the nucleic acid recognition moiety, selectively-reactive moiety, and the effector partial moiety to produce the active effector structure.

24. A method of synthesizing an active effector structure, said method comprising:

generating at least two templated assembly reactants, wherein said reactants comprise:

at least one nucleic acid recognition moiety that binds a target nucleic acid sequence within a target sample,

at least one selectively-reactive moiety, and

at least one effector partial moiety;

contacting the targeted templated assembly reactants to a target nucleic acid sequence; and

producing an active effector structure.

25. The method of claim 24, wherein the active effector structure possesses targeted activity as compared to an activity of the effector partial moiety.

26. A method of delivering at least two targeted templated assembly reactants to a pathogenic cell, said method comprising:

administering a therapeutically effective amount of the targeted templated assembly reactants to the pathogenic cell, wherein said reactants are each comprised of:

at least one nucleic acid recognition moiety that binds a target nucleic acid sequence within the target pathogenic cell,

at least one selectively-reactive moiety, and

at least one effector partial moiety; and

producing at least one active effector structure in the pathogenic cell.

27. The method of claim 26, wherein the method comprising the step of detecting the presence or absence of the target nucleic acid sequence prior to administering the targeted templated assembly reactants.

28. The method of claim 26 further comprising inducing at least one of programmed cell death of the pathogenic cell, apoptosis of the pathogenic cell, non-specific or programmed necrosis of the pathogenic cell, lysis of the pathogenic cell, and growth inhibition of the pathogenic cell.

29. The method of claim 26, wherein the templated assembly reactants are comprised of two or more sets of nucleic acid recognition moieties that are capable of binding two or more target nucleic acid sequences, where the two or more target nucleic acid sequences are found within the same gene transcript, or different gene transcripts.

30. The method of claim 26, wherein the templated assembly reactants are comprised of two or more sets effector partial moieties capable of producing two or more active effector structures.

31. The method of claim 30 further comprising inducing two or more effector activities.

32. The method of claim 26, wherein the pathogenic cell is selected from the group consisting of a virus infected cell, a tumor cell, a cell infected with a microbe, and a cell that produces a disease-inducing or disease modulating molecule that may cause inflammation, allergy or autoimmune pathology.

33. The method of claim 26, wherein the pathogenic cell is a virus infected cell and the method further comprising inducing at least one of programmed cell death of the virus infected cell, apoptosis of the virus infected cell, non-specific or programmed necrosis of the virus infected cell, lysis of the virus infected cell, inhibition of viral infection, and inhibition of viral replication.

34. The method of claim 26, wherein the pathogenic cell is a tumor cell and the method further comprising inducing at least one of programmed cell death of the tumor cell, apoptosis of the tumor cell, non-specific or programmed necrosis of the tumor cell, lysis of the tumor cell, inhibition of the tumor cell growth, inhibition of oncogene expression in the tumor cell, and modification of gene expression in the tumor cell.

35. The method of claim 26, wherein the pathogenic cell is a microbe-infected cell and the method further comprising inducing at least one of programmed cell death of the microbe-infected cell, apoptosis of the microbe-infected cell, non-specific or programmed necrosis of the microbe-infected cell, lysis of the microbe-infected cell, inhibition of microbial infection, and inhibition of microbe replication.

36. An active effector structure formed from a targeted templated assembly product comprising a product of a reaction of:

a) at least two selectively-reactive moieties; and

b) at least one effector partial moiety bound to one of the selectively-reactive moieties.

37. The effector structure of claim 36 further comprising at least one nucleic acid recognition moiety bound to the reaction product.

38. The effector structure of claim 36, wherein an activity of the effector structure modulates expression of a target gene.

39. The effector structure of claim 36, wherein an activity of the effector structure induces at least one of an immune response, programmed cell death, apoptosis, non-specific or programmed necrosis, lysis, growth inhibition, inhibition of viral infection, inhibition of viral replication, inhibition of oncogene expression, modification of gene expression, inhibition of microbial infection, and inhibition of microbe replication.

40. The effector structure of claim 36 is a ligand for an antibody.

CLAIMS

1. A targeted templated assembly reactant comprising:

a) at least one nucleic acid recognition moiety that binds a target nucleic acid sequence;

wherein the target nucleic acid sequence is selected from a cancer-specific nucleic acid sequence, a viral nucleic acid sequence, a microbial-specific nucleic acid sequence, a differentially expressed gene, a disease-specific nucleic acid sequence;

b) at least one effector partial moiety, wherein the molecular size of the effector partial moiety is less than about 20 kDA; and

c) at least one selectively-reactive moiety, wherein the selectively-reactive moiety is a bio-orthogonal moiety selected from the group consisting of an azide, a cyclooctyne, a nitrone, a norbornene, an oxanorbornadiene, a phosphine, a dialkyl phosphine, a trialkyl phosphine, a phosphinothiol, a phosphinophenol, a cyclooctene, a nitrile oxide, a thioester, a tetrazine, an isonitrile, a tetrazole, and a quadricyclane;

wherein the reactant is capable of reacting with a different corresponding templated assembly reactant to produce an active effector structure.

2. The reactant of claim 1, wherein the nucleic acid recognition moiety is a nucleic acid-binding oligomer or a nucleic acid oligomer that hybridizes to the target nucleic acid sequence.

3. The reactant of claim 1, wherein the active effector structure regulates at least one of enzyme activity, gene/protein expression, molecular signaling, and molecular interaction or possesses targeted activity as compared to an activity of the effector partial moiety.

4. The reactant of claim 1 further comprising a chemical linker between any of the nucleic acid recognition moiety and the selectively-reactive moiety, and the selectively-reactive moiety and the effector partial moiety, wherein the chemical linker is at least one of a flexible moiety, cleavage site, and chemical modification site.

5. The reactant of claim 1, wherein the nucleic acid recognition moiety is an oligomer selected from the group consisting of DNA nucleotides, RNA nucleotides, phosphorothioate-modified nucleotides, 2-O-alkylated RNA nucleotides, halogenated nucleotides, locked nucleic acid nucleotides (LNA), peptide nucleic acids (PNA), morpholino nucleic acid analogues (morpholinos), pseudouridine nucleotides, xanthine nucleotides, hypoxanthine nucleotides, 2-deoxyinosine nucleotides, other nucleic acid analogues capable of base-pair formation, and combinations thereof; and wherein the effector partial moiety is selected from the group consisting of a peptide, a non-active portion of a peptidomimetic structure, a non-active portion of a drug, and other bioactive compound.

6. A method of synthesizing the templated assembly reactant of claim 1, said method comprising:

generating at least one nucleic acid recognition moiety that is capable of binding a target nucleic acid sequence;

generating at least one selectively-reactive moiety that is capable of binding a corresponding selectively-reactive moiety;

generating at least one effector partial moiety that is capable of reacting with a corresponding effector partial moiety to produce an active effector structure; and

determining competency of the nucleic acid recognition moiety, selectively-reactive moiety, and the effector partial moiety to produce the active effector structure.

7. A method of synthesizing an active effector structure, said method comprising:

generating at least two templated assembly reactants according to claim 1;

contacting the targeted templated assembly reactants to a target nucleic acid sequence; and

producing an active effector structure.

8. A method of delivering at least two targeted templated assembly reactants to a pathogenic cell, said method comprising:

providing a therapeutically effective amount of the targeted templated assembly reactants according to claim 1 to be administered to the pathogenic cell, wherein:

at least one nucleic acid recognition moiety binds a target nucleic acid sequence within the target pathogenic cell; and

producing at least one active effector structure in the pathogenic cell;

wherein the method further comprises the step of detecting the presence or absence of the target nucleic acid sequence prior to the administration of the targeted templated assembly reactants.

9. The method of claim 8, wherein the templated assembly reactants are comprised of two or more sets of nucleic acid recognition moieties that are capable of binding two or more target nucleic acid sequences, where the two or more target nucleic acid sequences are found within the same gene transcript, or different gene transcripts or wherein the templated assembly reactants are comprised of two or more sets effector partial moieties capable of producing two or more active effector structures.

10. The method of claim 8, wherein the pathogenic cell is selected from the group consisting of a virus infected cell, a tumor cell, a cell infected with a microbe, and a cell that produces a disease-inducing or disease modulating molecule that may cause inflammation, allergy or autoimmune pathology.