CLAIMS

1. A multivalent assembly, comprising:

a first single-stranded oligonucleotide probe complementary to a first region of a target nucleic acid;

a second single-stranded oligonucleotide probe complementary to a second region of the target nucleic acid; and

a third single-stranded oligonucleotide probe complementary to a third region of the target nucleic acid, and wherein melting temperatures of the first single-stranded oligonucleotide probe, the second single-stranded oligonucleotide probe, and the third single-stranded oligonucleotide probe from the target nucleic acid are all within a 20 degrees Celsius range.

2. The multivalent assembly of claim 1, wherein the first single-stranded oligonucleotide probe, the second single-stranded oligonucleotide probe, and the third single-stranded oligonucleotide probe are 20-30 nucleotides in length.

3. The multivalent assembly of claim 1, wherein the first single-stranded oligonucleotide probe, the second single-stranded oligonucleotide probe, and the third single-stranded oligonucleotide probe are immobilized on a surface via respective linkers.

4. The multivalent assembly of claim 3, wherein the respective linkers comprise a universal adapter sequence.

5. The multivalent assembly of claim 3, wherein the surface comprises a bead surface or a planar surface.

6. The multivalent assembly of claim 5, wherein the bead surface comprises multiple copies of the first single-stranded oligonucleotide probe, the second single-stranded oligonucleotide probe, and the third single-stranded oligonucleotide probe.

7. The multivalent assembly of claim 1, wherein the first single-stranded oligonucleotide probe, the second single-stranded oligonucleotide probe, and the third single-stranded oligonucleotide probe are coupled to a polypeptide.

8. The multivalent assembly of claim 1, wherein the first single-stranded oligonucleotide probe, the second single-stranded oligonucleotide probe, and the third single-stranded oligonucleotide probe are coupled to a nucleic acid tile.

9. The multivalent assembly of claim 1, wherein the first region, the second region, and the third region of the target nucleic acid are contiguous.

10. The multivalent assembly of claim 1, wherein the first region and the second region of the target nucleic acid are separated by 5 or fewer nucleotides.

11. The multivalent assembly of claim 10, wherein the second region and the third region of the target nucleic acid are separated by 5 or fewer nucleotides.

12. The multivalent assembly of claim 1, comprising a fourth single-stranded oligonucleotide probe comprising a fourth probe capture region complementary to a fourth region of the target nucleic acid, wherein a melting temperature of the fourth single-stranded oligonucleotide probe from the target nucleic acid is within the 20 degrees Celsius range.

13. The multivalent assembly of claim 12, comprising a fifth single-stranded oligonucleotide probe comprising a fifth probe capture region complementary to a fifth region of the target nucleic acid, wherein a melting temperature of the fifth single-stranded oligonucleotide probe from the target nucleic acid is within the 20 degrees Celsius range.

14. The multivalent assembly of claim 1, wherein the first single-stranded oligonucleotide probe, the second single-stranded oligonucleotide probe, and the third single-stranded oligonucleotide probe are different lengths relative to one another

15. A multivalent bead assembly, comprising:

a bead surface;

first single-stranded oligonucleotide probes comprising a first hybridization sequence complementary to a first region of a target nucleic acid;

second single-stranded oligonucleotide probes comprising a second hybridization sequence complementary to a second region of the target nucleic acid; and

third single-stranded oligonucleotide probes comprising a third hybridization sequence complementary to a third region of the target nucleic acid, wherein the first single-stranded oligonucleotide probes, the second single-stranded oligonucleotide probes, and the third single-stranded oligonucleotide probes are immobilized randomly on the bead surface, and wherein the first hybridization sequence, the second hybridization sequence, and the third hybridization sequence are different from one another.

16. The multivalent bead assembly of claim 15, wherein the first single-stranded oligonucleotide probes, the second single-stranded oligonucleotide probes, and the third single-stranded oligonucleotide probes are 20-30 nucleotides in length.

17. The multivalent bead assembly of claim 15, wherein the first single-stranded oligonucleotide probes, the second single-stranded oligonucleotide probes, and the third single-stranded oligonucleotide probes are immobilized on the bead surface via respective linkers.

18. The multivalent bead assembly of claim 15, wherein the respective linkers comprise universal linkers.

19. The multivalent bead assembly of claim 15, wherein the first region, the second region, and the third region of the target nucleic acid are contiguous.

20. The multivalent bead assembly of claim 15, wherein the first region and the second region of the target nucleic acid are separated by 5 or fewer nucleotides or wherein the

second region and the third region of the target nucleic acid are separated by 5 or fewer nucleotides.

21. The multivalent bead assembly of claim 15, wherein oligonucleotide probes to different target nucleic acids are not immobilized on the bead surface.

22. The multivalent bead assembly of claim 15, wherein a subset of the first single-stranded oligonucleotide probes, the second single-stranded oligonucleotide probes, and the third single-stranded oligonucleotide probes are arranged on the bead surface such that the target nucleic acid hybridizes to an individual first single-stranded oligonucleotide probe, an individual second single-stranded oligonucleotide probe, and an individual third single-stranded oligonucleotide probe.

23. The multivalent bead assembly of claim 15, comprising the target nucleic acid, wherein the target nucelic acid is an RNA molecule.

24. The multivalent bead assembly of claim 15, wherein the first single-stranded oligonucleotide probes, the second single-stranded oligonucleotide probes, and the third single-stranded oligonucleotide probes are randomers.

25. The multivalent bead assembly of claim 15, wherein the first single-stranded oligonucleotide probes are a different length than one or both of the second single-stranded oligonucleotide probes and the third single-stranded oligonucleotide probes.

26. A hybridization kit, comprising:

a first bead comprising:

a first plurality of single-stranded oligonucleotide probes randomly immobilized on a surface of the first bead, wherein a first subset of the first plurality are complementary to a first region of a first target nucleic acid, a second subset of the first plurality are complementary to a second region of the first target

nucleic acid, and a third subset are complementary to a third region of the first target nucleic acid; and

a second bead comprising:

a second plurality of single-stranded oligonucleotide probes randomly immobilized on a surface of the second bead, wherein a first subset of the second plurality are complementary to a first region of a second target nucleic acid, a second subset of the second plurality are complementary to a second region of the second target nucleic acid, and a third subset of the second plurality are complementary to a third region of the second target nucleic acid.

27. A method of target enrichment, comprising:

contacting nucleic acid fragments with a plurality of multivalent assemblies to form multivalent assembly-target nucleic acid complexes, wherein the multivalent assemblies comprise individual probe sets specific for respective target nucleic acids, an individual probe set comprising:

a first oligonucleotide probe complementary to a first subregion of a target nucleic acid;

a second oligonucleotide probe complementary to a second subregion of the target nucleic acid; and

a third oligonucleotide probe complementary to a third subregion of the target nucleic acid, wherein the first oligonucleotide probe, the second oligonucleotide probe, and the third oligonucleotide probe have sequences that are distinguishable from one another; and

separating the multivalent assembly-target nucleic acid complexes from unhybridized nucleic acid fragments of the nucleic acid fragments to generate separated nucleic acid fragments.

28. A method of cDNA synthesis, comprising:

contacting an RNA sample with a multivalent assembly to capture an RNA molecule, the multivalent assembly comprising a probe set immobilized on a surface of a bead, wherein the probe set comprises:

a first oligonucleotide probe complementary to a first subregion of the RNA molecule;

a second oligonucleotide probe complementary to a second subregion of the RNA molecule; and

a third oligonucleotide probe complementary to a third subregion of the RNA molecule, wherein the first oligonucleotide probe, the second oligonucleotide probe, and the third oligonucleotide probe have sequences that are distinguishable from one another; and

extending the first oligonucleotide probe using a reverse transcriptase to generate a cDNA complementary to at least a portion of the RNA molecule.