CLAIMS

What is claimed is:

1. A method of linking functional single cell information with genomic, transcriptomic, and/or proteomic single cell information, the method comprising:

(a) performing a functional assay on a single cell located in a cavity of a nanovial, wherein the functional assay is associated with a first barcode or a first label;

(b) performing a genomic, transcriptomic, and/or proteomic assay on the single cell in the nanovial, wherein the genomic, transcriptomic, and/or proteomic assay is associated with a second barcode or a second label; and

(c) linking functional single cell information with genomic, transcriptomic, and/or proteomic single cell information by associating the first barcode or first label with the second barcode or second label.

2. The method of claim 1, further comprising, prior to (b), sorting the nanovial based on a signal generated by the functional assay.

3. The method of claim 1 or 2, wherein the functional assay is an antibody secretion screening assay

4. The method of claim 1 or 2, wherein the functional assay is an antibody affinity assay.

5. The method of claim 1 or 2, wherein the functional assay is an antibody specificity assay.

6. The method of claim 1 or 2, wherein the genomic assay is a single cell RNA sequencing assay.

7. The method of any one of claims 1-6, wherein the nanovial is associated with a unique oligonucleotide tag.

8. The method of claim 7, wherein the unique oligonucleotide tag comprises a poly-dT capture region.

9. The method of any one of claims 1-8, wherein the first barcode or first label comprises an oligonucleotide with a poly-A-region.

10. A method of identifying an antibody or fragment thereof that binds to an antigen of interest, the method comprising:

(a) providing or obtaining a nanovial comprising a cavity formed therein and an affinity agent immobilized thereto;

(b) loading an antibody-producing cell into the cavity of the nanovial;

(c) incubating the nanovial such that one or more antibody or fragment thereof is secreted from the antibody-producing cell and binds to the affinity agent;

(d) adding a detection agent to the cavity of the nanovial such that the detection agent binds to the one or more antibody or fragment thereof;

(e) detecting one or more signals related to binding of the detection agent to the one or more antibody or fragment thereof;

(f) performing a sequencing assay on nucleic acids derived from the antibody-producing cell, thereby generating a sequence of the one or more antibody or fragment thereof;

(g) associating the sequence of the one or more antibody or fragment thereof with the one or more signals related to the binding of the detection agent to the one or more antibody or fragment thereof; and

(h) identifying the one or more antibody or fragment thereof that binds to the antigen of interest based on the associating of (g).

11. The method of claim 10, wherein the cavity of the nanovial further comprises one or more cell capture agents immobilized thereto.

12. The method of claim 10 or 11, wherein the affinity agent is an antigen- presenting cell expressing the antigen of interest on a surface thereof.

13. The method of any one of claims 10-12, wherein the detection agent is directly or indirectly labeled with a detectable label.

14. The method of claim 13, wherein the detectable label is selected from the group consisting of: a fluorescent label, a protein affinity tag, an oligonucleotide tag, and a magnetic particle.

15. The method of claim 14, wherein the detectable label is an oligonucleotide tag.

16. The method of any one of the claims 10-15, wherein the cavity of the nanovial comprises an opening to the surface of the nanovial.

17. The method of claim 16, further comprising, prior to (c), adding one or more blocking particles to block or reduce a size of the opening.

18. The method of any one of claims 1-17, wherein the nanovial comprises a cross-linked hydrogel.

19. The method of claim 18, wherein the cross-linked hydrogel is a PEG-based cross-linked hydrogel.

20. The method of any one of claims 1-19, wherein the cavity of the nanovial comprises an aqueous fluid disposed therein.

21. The method of any one of claims 1-20, wherein, at any step prior to (c) of claim 1, or at any step prior to (g) of claim 10, the nanovial is suspended in an oil phase and/or the nanovial comprises one or more blocking particles to reduce or prevent transport out of the cavity of the nanovial.

22. The method of any one of claims 1-21, wherein the cavity of the nanovial has a volume from about 100 fL to about 10 nL.

23. A nanovial having a size, a shape, a surface chemistry, a density, or any combination thereof, configured to be compatible with and used in a plurality of different types of instruments designed to analyze particles and/or cells.

24. The nanovial of claim 23, wherein the plurality of different types of instruments designed to analyze particles and/or cells is selected from the group consisting of: flow cytometers, fluorescence activated cell sorters, imaging flow cytometers, image activated cell sorters, Coulter counters, particle counters, microfluidic droplet generators, microwell arrays, microfluidic chips with microvalves, microfluidic SlipChips, optofluidic microdevices, microfluidic droplet generators, and microfluidic channels.

25. The nanovial of claim 23 or 24, wherein the size of the nanovial is less than about 100 μm in diameter and comprises capped reactive functional groups.

26. The nanovial of any one of claims 23-25, wherein the nanovial is configured to be used with a first instrument designed to analyze particles and/or cells and subsequently a second instrument designed to analyze particles and/or cells.

27. The nanovial of claim 26, wherein the nanovial is configured to be sorted by a fluorescence activated cell sorter, image activated cell sorter, or optofluidic microdevice and subsequently introduced into a microfluidic droplet generator.