

CLAIMS**WHAT IS CLAIMED IS:**

1. A method for processing a nucleic acid molecule of a biological particle, comprising:
 - (a) providing (1) a plurality of partitions, wherein a partition of said plurality of partitions comprises (i) a particle comprising a plurality of nucleic acid barcode molecules, wherein a nucleic acid barcode molecule of said plurality of nucleic acid barcode molecules comprises a barcode sequence, and (ii) a biological particle comprising said nucleic acid molecule, and (2) a first data set comprising data indicative of one or more physical properties of said biological particle stored in computer memory, which data is generated upon sensing said biological particle;
 - (b) using said nucleic acid barcode molecule of said plurality of nucleic acid barcode molecules and said nucleic acid molecule of said biological particle to generate a barcoded nucleic acid molecule;
 - (c) generating a second data set comprising data identifying a nucleic acid sequence of said barcoded nucleic acid molecule or a derivative thereof; and
 - (d) using said first data set and said second data set to associate said one or more physical properties of said biological particle with said nucleic acid sequence.
2. The method of claim 1, wherein said one or more physical properties of said biological particle includes a size of said biological particle, a shape of said biological particle, a surface marker on said biological particle, an inclusion in said biological particle, a structure of an organelle in said biological particle, a number of organelles in said biological particle, a secretion or excretion with respect to said biological particle, or a localization of an organelle in said biological particle.
3. The method of claim 1, wherein said biological particle comprises a plurality of nucleic acid molecules.
4. The method of claim 3, wherein said plurality of nucleic acid molecules comprises a plurality of ribonucleic acid molecules.
5. The method of claim 3, wherein said plurality of nucleic acid molecules comprises a plurality of deoxyribonucleic acid molecules.
6. The method of claim 1, wherein said nucleic acid molecule is a ribonucleic acid molecule.

7. The method of claim 1, wherein said nucleic acid molecule is a deoxyribonucleic acid molecule.
8. The method of claim 1, wherein said one or more physical properties comprises phenotypic information of said biological particle.
9. The method of claim 1, further comprising optically detecting said particle to generate a third data set comprising data indicative of one or more physical properties of said particle or said plurality of nucleic acid barcode molecules.
10. The method of claim 9, wherein said one or more physical properties of said particle comprises an optical property of said particle.
11. The method of claim 9, wherein said physical property of said particle comprises a size, a shape, a circularity, a hardness, or a symmetry of said particle or a component thereof.
12. The method of claim 10, wherein said optical property of said particle comprises an absorbance, a birefringence, a color, a fluorescence characteristic, a luminosity, a photosensitivity, a reflectivity, a refractive index, a scattering, or a transmittance of said particle or a component thereof.
13. The method of claim 1, wherein nucleic acid barcode molecules of said plurality of nucleic acid barcode molecules comprise barcode sequences, which barcode sequences are identical.
14. The method of claim 1, wherein said plurality of partitions is a plurality of droplets.
15. The method of claim 1, wherein said plurality of partitions is a plurality of wells.
16. The method of claim 1, wherein said particle comprises one or more optical barcodes.
17. The method of claim 16, wherein said plurality of nucleic acid barcode molecules of said particle comprise said one or more optical barcodes.
18. The method of claim 16, wherein said one or more optical barcodes comprises a fluorescent dye, a nanoparticle, a microparticle, or any combination thereof.
19. The method of claim 16, wherein said one or more optical barcodes has an associated optical intensity or frequency that is distinct with respect to other optical barcodes of said plurality of partitions.
20. The method of claim 16, wherein (a)-(d) are repeated for an additional partition among said plurality of partitions, wherein said additional partition comprises (i) an additional particle comprising an additional plurality of nucleic acid barcode molecules, wherein a nucleic acid barcode molecule of said additional plurality of nucleic acid barcode molecules comprises an additional barcode sequence different than said barcode

sequence, and (ii) an additional biological particle comprising an additional nucleic acid molecule, wherein said partition and said additional partition yield optical signals at different intensities or frequencies upon sensing.

21. The method of claim 18, wherein said nanoparticle comprises a quantum dot.
22. The method of claim 18, wherein said nanoparticle comprise a Janus particle.
23. The method of claim 1, wherein said plurality of nucleic acid barcode molecules is configured in a geometric structure.
24. The method of claim 23, wherein said geometric structure is a nucleic acid origami.
25. The method of claim 1, wherein said one or more physical properties of said biological particle are identified by imaging said partition using (i) bright field microscopy, (ii) fluorescence microscopy, (iii) phase contrast microscopy, (iv) multispectral microscopy, or (v) polarization microscopy.
26. The method of claim 1, wherein said particle is a bead.
27. The method of claim 26, wherein said bead is a gel bead.
28. The method of claim 27, wherein said plurality of nucleic acid barcode molecules is releasably attached to said gel bead.
29. The method of claim 27, wherein said gel bead comprises a polyacrylamide polymer.
30. The method of claim 1, wherein said one or more physical properties are one or more optical properties.
31. The method of claim 30, further comprising, subsequent to (a), imaging said partition to optically detect said biological particle, thereby identifying said one or more optical properties of said biological particle.
32. The method of claim 30, further comprising, prior to (a), imaging said biological particle to identify said one or more optical properties of said biological particle.
33. The method of claim 32, wherein said biological particle is imaged prior to providing said biological particle in said partition.
34. The method of claim 1, wherein said particle is coupled to another particle comprising one or more optical barcodes.
35. The method of claim 1, wherein (a)-(d) are repeated for additional partitions among said plurality of partitions, wherein said additional partitions each comprise (i) an additional plurality of nucleic acid barcode molecules, wherein a nucleic acid barcode molecule of said additional plurality of nucleic acid barcode molecules comprises an additional barcode sequence different than said barcode sequence, and (ii) an additional biological

- particle comprising an additional nucleic acid molecule, and wherein said partition and said additional partitions comprise a combination of particles comprising molecular barcodes and particles comprising optical barcodes, which combination is different across said partition and said additional partitions.
36. The method of claim 1, wherein (a)-(d) are repeated for additional partitions among said plurality of partitions, wherein said additional partitions each comprise (i) an additional plurality of nucleic acid barcode molecules, wherein a nucleic acid barcode molecule of said additional plurality of nucleic acid barcode molecules comprises an additional barcode sequence different than said barcode sequence, and (ii) an additional biological particle comprising an additional nucleic acid molecule, which additional partitions comprises at least 1,000 partitions.
37. The method of claim 36, wherein said additional partitions comprise at least 10,000 partitions.
38. The method of claim 37, wherein said additional partitions comprise at least 100,000 partitions.
39. The method of claim 36, wherein said additional partitions comprise a plurality of particles comprising nucleic acid barcode molecules comprising at least 1,000 barcode sequences, which at least 1,000 barcode sequences are different across said partition and said additional partitions.
40. The method of claim 39, wherein said additional partitions comprises a plurality of particles comprising nucleic acid barcode molecules comprising at least 10,000 barcode sequences, which at least 10,000 barcode sequences are different across said partition and said additional partitions.
41. The method of claim 40, wherein said additional partitions comprises a plurality of particles comprising nucleic acid barcode molecules comprising at least 100,000 barcode sequences, which at least 100,000 barcode sequences are different across said partition and said additional partitions.
42. The method of claim 1, wherein said biological particle is a cell.
43. The method of claim 1, wherein said biological particle comprises a cell, or one or more components thereof, in a matrix.
44. The method of claim 43, wherein said matrix is a polymeric matrix.
45. The method of claim 43, wherein said matrix is a gel matrix.

46. The method of claim 1, further comprising associating a protein of said biological particle with said one or more physical properties of said biological particle with said nucleic acid sequence.
47. The method of claim 47, wherein said protein is a cell surface protein.
48. The method of claim 1, further comprising associating one or more ribonucleic acid sequences or one or more deoxyribonucleic acid (DNA) sequences of said biological particle with said one or more physical properties.
49. The method of claim 48, wherein said one or more DNA sequences comprise epigenetic information.
50. The method of claim 48, wherein said one or more DNA sequences comprise chromatin information.
51. A kit comprising a plurality of particles, which plurality of particles comprise (i) a plurality of nucleic acid barcode molecules coupled thereto, wherein said plurality of barcode molecules comprise a plurality of barcode sequences, and (ii) a plurality of optical barcodes, wherein said plurality of optical barcodes comprise a plurality of optical codes,
wherein each particle of said plurality of particles comprises (i) a subset of said plurality of nucleic acid barcode molecules coupled thereto and (ii) a subset of said plurality of optical barcodes,
wherein barcode sequences of subsets of said plurality of nucleic acid barcode molecules differ across particles of said plurality of particles, and wherein optical codes of subsets of said plurality of optical barcodes differ across said particles.
52. The kit of claim 51, wherein each subset of said subsets of said plurality of optical barcodes comprise a single optical barcode.
53. The kit of claim 51, wherein each subset of said subsets of said plurality of optical barcodes comprise two or more optical barcodes.
54. The kit of claim 51, wherein said plurality of optical barcodes confers optical properties to said plurality of particles.
55. The kit of claim 54, wherein said optical properties are selected from the group consisting of an absorbance, a birefringence, a color, a fluorescence characteristic, a luminosity, a photosensitivity, a reflectivity, a refractive index, a scattering, or a transmittance of said particle or a component thereof.

56. The kit of claim 51, wherein said plurality of optical barcodes comprise one or more fluorescent dyes, nanoparticles, microparticles, or any combination thereof.
57. The kit of claim 56, wherein said plurality of optical barcodes comprise a plurality of nanoparticles.
58. The kit of claim 57, wherein said plurality of optical barcodes comprise a plurality of quantum dots.
59. The kit of claim 57, wherein said plurality of optical barcodes comprise a plurality of Janus particles.
60. The kit of claim 56, wherein said plurality of optical barcodes comprises a plurality of fluorescent dyes.
61. The kit of claim 60, wherein said plurality of fluorescent dyes comprises between 2-10 fluorescent dyes.
62. The kit of claim 60, wherein said plurality of fluorescent dyes comprises a plurality of fluorescent dyes having the same emission wavelength and different intensities.
63. The kit of claim 62, wherein said plurality of fluorescent dyes comprises at least 20 different intensities.
64. The kit of claim 51, wherein each subset of said subsets of said plurality of optical barcodes comprises different optical codes.
65. The kit of claim 53, wherein each subset of said subsets of said plurality of optical barcodes comprises a different combination of optical codes.
66. The kit of claim 51, wherein said plurality of optical barcodes have associated optical intensities or frequencies that are distinct with respect to one another.
67. The kit of claim 51, wherein said plurality of optical barcodes comprises at least 1,000 different optical codes.
68. The kit of claim 67, wherein said plurality of optical barcodes comprises at least 10,000 different optical codes.
69. The kit of claim 68, wherein said plurality of optical barcodes comprises at least 100,000 different optical codes.
70. The kit of claim 51, wherein nucleic acid barcode molecules within a given subset of said subsets of said plurality of nucleic acid barcode molecules comprise identical barcode sequences.
71. The kit of claim 51, wherein said plurality of barcode sequences comprises at least 1,000 different barcode sequences.

72. The kit of claim 71, wherein said plurality of barcode sequences comprises at least 10,000 different barcode sequences.
73. The kit of claim 72, wherein said plurality of barcode sequences comprises at least 100,000 different barcode sequences.
74. The kit of claim 51, wherein said plurality of particles comprises at least 10,000 particles.
75. The kit of claim 74, wherein said plurality of partitions comprises at least 100,000 particles.
76. The kit of claim 51, wherein said plurality of nucleic acid barcode molecules comprise a plurality of functional sequences, which plurality of functional sequences are configured to interact with a plurality of target molecules.
77. The kit of claim 76, wherein said plurality of target molecules comprise a plurality of deoxyribonucleic acid molecules.
78. The kit of claim 76, wherein said plurality of target molecules comprise a plurality of ribonucleic acid molecules.
79. The kit of claim 76, wherein said plurality of functional sequences are configured to capture said plurality of target molecules.
80. The kit of claim 51, wherein said plurality of particles comprises a plurality of beads.
81. The kit of claim 80, wherein said plurality of particles comprises a plurality of gel beads.
82. The kit of claim 81, wherein said plurality of nucleic acid barcode molecules is releasably coupled to said plurality of gel beads.
83. The kit of claim 81, wherein said plurality of gel beads comprises a polyacrylamide polymer.
84. The kit of claim 51, wherein said plurality of optical barcodes are included on surfaces of said plurality of particles.
85. The kit of claim 51, wherein said plurality of optical barcodes are included within said plurality of particles.
86. The kit of claim 51, wherein first particles of said plurality of particles are coupled to second particles of said plurality of particles, wherein said first particles comprise nucleic acid barcode molecules of said plurality of nucleic acid barcode molecules and said second particles comprise optical barcodes of said plurality of optical barcodes.