~~WHAT IS CLAIMED IS:~~CLAIMS

~~1. A system for non-volatile storage comprising:~~

~~a processor and a memory;~~

~~a module interface;~~

~~a removable storage device for receipt in the module interface, the removable storage device comprising:~~

~~a case adapted to couple with the module interface and fix the removable storage device at a static position, and~~

~~a flow cell positioned within the case, the flow cell comprising a plurality of wells with open sides accessible from a first surface of the flow cell, wherein the wells are adapted to contain polynucleotides storing machine written data;~~

~~a fluidics device to provide one or more reagents to the removable storage device; and~~

~~a sequencing device to analyze polynucleotides within the removable storage device and determine nucleotides within the polynucleotides;~~

~~wherein the processor is to perform a data read process to:~~

~~determine a set of sequencing data indicative of nucleotides of a polynucleotide in a well of the plurality of wells, and~~

~~determine a set of machine written binary data based upon the set of sequencing data.~~

~~2. The system of claim 1, wherein the processor, when performing the data read process:~~

~~identifies the well of the plurality of wells from which data is to be read,~~

~~operates the fluidics device and the sequencing device to perform sequencing-by-synthesis on the polynucleotide in the well,~~

captures the set of sequencing data from the sequencing device during sequencing-by-synthesis, and

converts the set of sequencing data into the set of binary data based upon an encoding scheme.

3. The system of claim 2, wherein the encoding scheme comprises a set of encoding rules usable by the processor to convert data between a binary format having base 2, and a polynucleotide format having a base of greater than 2.

4. The system of claim 3, wherein the base of the polynucleotide format is base 4.

5. The system of claim 1, wherein the flow cell is sealed within the case, the removable storage device further comprising:

a sequencing interface positioned on the case and to transmit light from the sequencing device to the well when the removable storage device is at the static position, and

a fluidic interface positioned on the case and to transmit fluid from the fluidic device to the well when the removable storage device is at the static position.

6. The system of claim 5, wherein the sequencing interface comprises a glass substrate, and wherein the fluidic interface comprises a passive manifold.

7. The system of claim 1, further comprising a synthesis device to provide nucleotides and create polynucleotides within the removable storage device, wherein the processor further, when performing a data write process:

receives a set of input data,

determines a set of input sequencing data based upon the set of input data, and

operates the synthesis device to create an input polynucleotide in a target well of the plurality of wells based on the set of input sequencing data.

8. The system of claim 7, wherein the processor further:

stores a set of index data describing the contents of each well of the plurality of wells,

identifies the well of the plurality of wells from which data is to be read based upon the set of index data,

determines the target well based upon the set of index data, and

updates the set of index data after creating the input polynucleotide in the target well.

9. The system of claim 8, the removable storage device further comprising a device memory, wherein the processor further stores the set of index data for the removable storage device on the device memory for that removable storage device.

10. The system of claim 9, wherein the device memory is to receive the set of index data wirelessly.

11. The system of claim 1, the removable storage device further comprising an electrical interface positioned on the case and to exchange electrical signals with the sequencing device when the removable storage device is at the static position.

12. The system of claim 11, the removable storage device further comprising an integrated circuit positioned on a second surface of the flow cell, wherein the electrical interface is to provide power and instructions to operate the integrated circuit, wherein the second surface is opposite the first surface.

13. The system of claim 12, wherein the integrated circuit is to selectively, based on signals received from the sequencing device:

emit light into each well of the plurality of wells,

detect fluorescence of the light emitted from a label associated with a nucleotide in each well of the plurality of wells, and

provide a set of fluorescence data to the sequencing device, wherein the set of fluorescence data is usable to determine the set of sequencing data.

14. The system of claim 1, the system further comprising a conditioning device, wherein the processor further:

receives a signal indicating that the removable storage device has been coupled with the module interface,

operates the fluidics device to provide a preparation fluid to the flow cell, wherein the preparation fluid is adapted to remove a preservative coating on the flow cell to enable the flow cell for read and write operations, and

operates the conditioning device to bring the flow cell to a predetermined temperature.

15. The system of claim 1, the system further comprising a conditioning device, wherein the conditioning device is to effect preservation of polynucleotides in the plurality of wells.

16. The system of claim 15, wherein the conditioning device is to freeze dry the flow cell to preserve polynucleotides in the plurality of wells.

17. The system of claim 15, wherein the conditioning device comprises a feature of the fluidics device that dispenses a preservative fluid to the flow cell to thereby apply a preservative coating on the flow cell to preserve and protect polynucleotides in the plurality of wells.

18. The system of claim 15, wherein the processor further:

receives a signal indicating that the removable storage device is to be dismounted from the module interface, and

~~activate the conditioning device in response to the signal indicating that the removable storage device is to be dismounted from the module interface.~~

~~19. The system of claim 1, wherein the processor further:~~

~~receives a signal indicating that the removable storage device has been dismounted from the module interface, and~~

~~provide a notification to a user that the removable storage device is dismounted in response to the signal indicating that the removable storage device has been dismounted from the module interface.~~

~~20~~1. A method for non-volatile storage comprising:

~~placing~~ receiving a signal indicating that a removable storage device ~~in~~ has been coupled with a module interface of a storage instrument, the removable storage device comprising a flow cell, wherein the module interface is adapted to fix the removable storage device in a static position;

in response to receiving the signal indicating that the removable storage device has been coupled with the module interface, enabling the flow cell for synthesis and sequencing of polynucleotides;

operating a sequencing device comprising one or more illuminators and one or more optical sensors to perform sequencing-by-synthesis on a polynucleotide within a well of a plurality of wells of the flow cell to determine a set of sequencing data that describes nucleotides of the polynucleotide;

operating a fluidics device to provide ~~one or more~~ fluid ~~types~~ to the flow cell for sequencing-by-synthesis with the sequencing device; ~~and~~

~~determine~~ determining, using a processor, a set of binary data based upon the set of sequencing data and an encoding scheme, wherein the encoding scheme describes a set of rules to convert

information ~~from~~ between a binary format ~~to~~ and a non-binary format associated with the set of sequencing data;

after operating the sequencing device to perform sequencing-by-synthesis on the polynucleotide within the well of the plurality of wells of the flow cell, receiving a signal indicating that the removable storage device is to be dismounted from the module interface;

in response to receiving the signal indicating that the removable storage device is to be dismounted from the module interface, dispensing a preservative fluid to the flow cell wherein the preservative fluid is adapted provide a preservative coating on the flow cell to preserve and protect polynucleotides in the plurality of wells, and wherein the preservative fluid is selected from a group consisting of a desiccant, an antioxidant, a polymer coating, and combinations of the foregoing; and

after receiving the signal indicating that the removable storage device is to be dismounted from the module interface, removing the removable storage device from the module interface.

2~~1~~. The method of claim ~~20~~1, further comprising:

receiving a set of input data in the binary format;

determining a set of input sequencing data in the non-binary format based upon the set of input data and the encoding scheme; and

~~operating a synthesis device~~ introducing a nucleotide carrier fluid to the flow cell to create an input polynucleotide in a target well of the plurality of wells based on the set of input sequencing data.

~~22. The method of claim 20, further comprising receiving a signal indicating that the removable storage device has been coupled with the module interface.~~

~~2~~3. The method of claim ~~22~~1~~, further comprising~~ wherein enabling the flow cell for synthesis and sequencing of polynucleotides comprises operating the fluidics device to provide a preparation fluid to the flow cell ~~in response to the signal indicating that the removable storage device has been coupled with the module interface~~, wherein the preparation fluid is adapted to remove a preservative coating on the flow cell ~~to enable the flow cell for read and write operations~~.

4. The method of claim 1, wherein enabling the flow cell for synthesis and sequencing of polynucleotides comprises operating a temperature control device, wherein the temperature control device raises a temperature of the flow cell relative to the temperature of the flow cell when the signal indicating that the removable storage device had been coupled with the module interface was received.

5. The method of claim 4, wherein raising the temperature of the flow cell relative to the temperature of the flow cell when the signal indicating that the removable storage device had been coupled with the module interface was received comprises raising the temperature of the flow cell to a predetermined temperature.

6. The method of claim 5, wherein the predetermined temperature is a temperature for sequencing and synthesizing polynucleotides.

7. The method of claim 6, wherein the predetermined temperature is between 59° C and 95° C.

8. A method for non-volatile storage comprising:

receiving a signal indicating that a removable storage device has been coupled with a module interface of a storage instrument, the removable storage device comprising a flow cell, wherein the module interface is adapted to fix the removable storage device in a static position;

in response to receiving the signal indicating that the removable storage device has been coupled with the module interface,

enabling the flow cell for synthesis and sequencing of polynucleotides;

operating a sequencing device comprising one or more illuminators and one or more optical sensors to perform sequencing-by-synthesis on a polynucleotide within a well of a plurality of wells of the flow cell to determine a set of sequencing data that describes nucleotides of the polynucleotide;

operating a fluidics device to provide fluid to the flow cell for sequencing-by-synthesis with the sequencing device;

determining, using a processor, a set of binary data based upon the set of sequencing data and an encoding scheme, wherein the encoding scheme describes a set of rules to convert information between a binary format to and a non-binary format associated with the set of sequencing data;

after operating the sequencing device to perform sequencing-by-synthesis on the polynucleotide within the well of the plurality of wells of the flow cell, receiving a signal indicating that the removable storage device is to be dismounted from the module interface;

in response to receiving the signal indicating that the removable storage device is to be dismounted from the module interface freeze drying the flow cell to preserve polynucleotides in the plurality of wells; and

after receiving the signal indicating that the removable storage device is to be dismounted from the module interface, removing the removable storage device from the module interface.

9. The method of claim 8, wherein:

the method comprises removing the removable storage device from the module interface;

receiving the signal indicating that the removable storage device is to be dismounted from the module interface takes place after operating the sequencing device to perform sequencing-by-

synthesis on the polynucleotide within the well of the plurality of wells of the flow cell; and

removing the removable storage device from the mobile interface takes place after receiving the signal indicating that the removable storage device is to be dismounted from the module interface.

~~24. The method of claim 22, further comprising operating a conditioning device in response to the signal indicating that the removable storage device has been coupled with the module interface, wherein the conditioning device brings the flow cell to a predetermined temperature required for read and write operations.~~

~~25. The method of claim 20, further comprising receiving a signal indicating that the removable storage device is to be dismounted from the module interface.~~

~~26. The method of claim 25, further comprising activating a conditioning device in response to the signal indicating that the removable storage device is to be dismounted from the module interface.~~

~~27. The method of claim 26, wherein the activated conditioning device dispenses a preservative fluid to the flow cell to thereby apply a preservative coating on the flow cell to preserve and protect polynucleotides in the plurality of wells.~~

~~28. The method of claim 26, wherein the activated conditioning device freeze dries the flow cell to preserve polynucleotides in the plurality of wells.~~

~~29. The method of claim 20, further comprising:~~

~~receiving a signal indicating that the removable storage device has been dismounted from the module interface; and~~

~~providing a notification to a user that the removable storage device is dismounted in response to the signal indicating that the removable storage device has been dismounted from the module interface.~~

30. A removable storage device for non-volatile storage comprising:

a case adapted to couple with a module interface of a storage instrument and fix the removable storage device at a static position;

a flow cell sealed within the case, the flow cell comprising a plurality of wells with open sides accessible from a first surface of the flow cell, the wells being adapted to contain polynucleotides storing machine-written data;

a sequencing interface positioned proximately to the flow cell and adapted to transmit light to the well when the removable storage device is at the static position; and

a fluidic interface positioned on the case and adapted to transmit fluid from a fluidic device of the storage instrument to the well when the removable storage device is at the static position.

31. The removable storage device of claim 30, further comprising an electrical interface positioned on the case to exchange electrical signals with the storage instrument when the removable storage device is at the static position.

32. The removable storage device of claim 31, further comprising an integrated circuit positioned on a second surface of the flow cell, the electrical interface to provide power and instructions to operate an integrated circuit.

33. The removable storage device of claim 32, wherein the second surface is opposite the first surface, and wherein the integrated circuit selectively, based on signals received from the storage instrument:

emits light into each well of the plurality of wells via the sequencing interface,

detect fluorescence of light emitted from a label associated with a nucleotide in each well of the plurality of wells, and

provide a set of fluorescence data to the storage instrument, wherein the set of fluorescence data is usable to

determine a set of sequencing data that describes the nucleotides of a polynucleotide in each well of the plurality of wells.

34. The removable storage device of claim 30, wherein the removable storage device comprises:

a power connection to couple the removable storage device with a power source, and

a set of sensors to detect one or more characteristics of the flow cell and provide an indication when a detected characteristic exceeds a predetermined threshold, wherein the set of sensors comprises one or more sensors selected from the group consisting of: a temperature sensor, a humidity sensor, a light sensor, and a radiation sensor.

35. The removable storage device of claim 30, further comprising at least one sensor, the at least one sensor to indicate whether one or more environmental conditions fall outside a predetermined range, the one or more environmental conditions including one or more of humidity, temperature, light, or radiation.

36. The removable storage device of claim 30, the flow cell comprising a substrate with a plurality of openings formed through bottom regions of the wells.

37. The removable storage device of claim 36, the flow cell further comprising an electrically conductive material in the openings formed through the bottom regions of the wells.

38. The removable storage device of claim 37, the electrically conductive material comprising indium tin oxide.

39. The removable storage device of claim 37, further comprising transparent anisotropic material in the openings formed through the bottom regions of the wells.

40. The removable storage device of claim 30, the flow cell including an underside with one or more pads to contact an integrated circuit chip positioned under the flow cell.

41. The removable storage device of claim 30, the flow cell comprising glass.

42. The removable storage device of claim 30, further comprising a thin film medium to transfer polynucleotides to a corresponding sequencing surface in the flow cell.

43. The removable storage device of claim 42, wherein the polynucleotides are transferred to the corresponding sequencing surface in the flow cell electrophoretically.

44. The removable storage device of claim 42, wherein the polynucleotides are transferred to the corresponding sequencing surface in the flow cell via blotting.

45. A method comprising:

- receiving a read request, wherein the read request is associated with a particular location in a storage device;
- creating a copy of a polynucleotide located at the particular location in the storage device;
- transferring the copy of the polynucleotide to a read location; and
- reading the copy of the polynucleotide at the read location.

46. The method of claim 45, wherein:

- the storage device comprises a set of one or more write locations;
- the particular location is comprised by the set of one or more write locations;

the read location is not comprised by the set of one or more write locations; and

the storage device is to, whenever it receives a write request, only write data to locations comprised by the set of one or more write locations.

47. The method of claim 46, wherein:

the storage device comprises a flow cell;

each write location from the one or more write locations is disposed on a first surface of the flow cell; and

the read location is disposed on a second surface of the flow cell.

48. The method of claim 47, wherein the first surface and the second surface are opposed to each other.

49. The method of claim 47, wherein:

the first surface is a bottom surface of the flow cell; and

the second surface is a top surface of the flow cell.

50. The method of claim 46, wherein each write location from the set of one or more write locations has a corresponding set of electrodes to encode data using nucleotides in that write location.

51. The method of claim 50, wherein:

the storage device comprises a dedicated integrated circuit; and

the dedicated integrated circuit is to, for each write location from the set of one or more write locations, drive the set of electrodes corresponding to that location to thereby encode data using nucleotides in that write location.

52. The method of claim 51, wherein the storage device comprises a second integrated circuit, wherein the second integrated circuit is to read data from nucleotides at the read location.

53. The method of claim 52, wherein the dedicated integrated circuit and the second integrated circuit are both complementary-metal-oxide-semiconductor (CMOS) chips.

54. The method of claim 46, wherein:

- each write location from the set of one or more write locations is addressable; and
- the storage device does not comprise any addressable locations to store data in the form of polynucleotides other than the set of one or more write locations.

55. The method of claim 46, wherein:

- the storage device stores a set of one or more logical data groupings;
- the method comprises creating an index specifying, for each logical data grouping from the set of one or more logical data groupings, an associated set of one or more locations; and
- for each logical data grouping from the set of one or more logical data groupings, each location from that logical data grouping's associated set of one or more locations is a write location comprised by the set of one or more write locations.

56. The method of claim 55, wherein the method comprises:

- receiving a request to retrieve a particular logical data grouping from the set of one or more logical data groupings;
- retrieving, from the index, the particular logical data grouping's associated set of one or more locations; and

determining the particular location in the storage device based on the particular logical data grouping's associated set of one or more locations.

57. The method of claim 55, wherein, for each logical data grouping from the set of one or more logical data groupings, that logical data grouping's associated set of one or more locations comprises a starting location and an ending location.

58. The method of claim 55, wherein, for each logical data grouping from the set of one or more logical data groupings, each location from that logical data grouping's associated set of one or more locations is a location in a two-dimensional grid.

59. The method of claim 55, wherein the method comprises:

storing the index in a non-nucleotide memory; and

storing the index using nucleotides on a bead.

60. The method of claim 45, wherein transferring the copy of the polynucleotide to the read location comprises:

fixing the copy of the polynucleotide to a bead at the particular location; and

transferring the bead from the particular location to the read location.

61. The method of claim 45, wherein the particular location is on the surface of a bead.

62. The method of claim 45, wherein transferring the copy of the polynucleotide to the read location is performed using a technique selected from the group consisting of:

electrophoresis;

dielectrophoresis; and

laminar fluid flow.

63. A system comprising one or more non-transitory computer readable media storing instructions to perform a method comprising:

receiving a read request, wherein the read request is associated with a particular location in a storage device;

creating a copy of a polynucleotide located at the particular location in the storage device;

transferring the copy of the polynucleotide to a read location; and

reading the copy of the polynucleotide at the read location.

64. The system of claim 63, wherein:

the storage device comprises a set of one or more write locations;

the particular location is comprised by the set of one or more write locations;

the read location is not comprised by the set of one or more write locations; and

the storage device is to, whenever it receives a write request, only write data to locations comprised by the set of one or more write locations.

65. The system of claim 64, wherein:

the storage device comprises a flow cell;

each write location from the one or more write locations is disposed on a first surface of the flow cell; and

the read location is disposed on a second surface of the flow cell.

66. The system of claim 65, wherein the first surface and the second surface are opposed to each other.

67. The system of claim 65, wherein:

the first surface is a bottom surface of the flow cell; and

the second surface is a top surface of the flow cell.

68. The system of claim 64, wherein each write location from the set of one or more write locations has a corresponding set of electrodes to encode data using nucleotides in that write location.

69. The system of claim 68, wherein:

the storage device comprises a dedicated integrated circuit; and

the dedicated integrated circuit is to, for each write location from the set of one or more write locations, drive the set of electrodes corresponding to that location to thereby encode data using nucleotides in that write location.

70. The system of claim 69, wherein the storage device comprises a second integrated circuit, wherein the second integrated circuit is to read data from nucleotides at the read location.

71. The system of claim 70, wherein the dedicated integrated circuit and the second integrated circuit are both CMOS chips.

72. The system of claim 64, wherein:

each write location from the set of one or more write locations is addressable; and

the storage device does not comprise any addressable locations to store data in the form of polynucleotides other than the set of one or more write locations.

73. The system of claim 64, wherein:

the storage device stores a set of one or more logical data groupings;

the method comprises creating an index specifying, for each logical data grouping from the set of one or more logical data groupings, an associated set of one or more locations; and

for each logical data grouping from the set of one or more logical data groupings, each location from that logical data grouping's associated set of one or more location is a write location comprised by the set of one or more write locations.

74. The system of claim 73, wherein the method comprises:

receiving a request to retrieve a particular logical data grouping from the set of one or more logical data groupings;

retrieving, from the index, the particular logical data grouping's associated set of one or more locations; and

determining the particular location in the storage device based on the particular logical data grouping's associated set of one or more locations.

75. The system of claim 73, wherein, for each logical data grouping from the set of one or more logical data groupings, that logical data grouping's associated set of one or more locations comprises a starting location and an ending location.

76. The system of claim 73, wherein, for each logical data grouping from the set of one or more logical data groupings, each location from that logical data grouping's associated set of one or more locations is a location in a two-dimensional grid.

77. The system of claim 73, wherein the method comprises:

storing the index in a non-nucleotide memory; and

storing the index using nucleotides on a bead.

78. The system of claim 63, wherein transferring the copy of the polynucleotide to the read location comprises:

fixing the copy of the polynucleotide to a bead at the particular location; and

transferring the bead from the particular location to the read location.

79. The system of claim 63, wherein the particular location is on the surface of a bead.

80. The system of claim 63, wherein transferring the copy of the polynucleotide to the read location is performed using a technique selected from the group consisting of:

electrophoresis;

dielectrophoresis; and

laminar fluid flow.

81. One or more non-transitory computer readable media storing instructions for performing a method comprising:

receiving a read request, wherein the read request is associated with a particular location in a storage device;

creating a copy of a polynucleotide located at the particular location in the storage device;

transferring the copy of the polynucleotide to a read location; and

reading the copy of the polynucleotide at the read location.

82. The computer readable media of claim 81, wherein:

the storage device comprises a set of one or more write locations;

the particular location is comprised by the set of one or more write locations;

the read location is not comprised by the set of one or more write locations; and

the storage device is to, whenever it receives a write request, only write data to locations comprised by the set of one or more write locations.

83. The computer readable media of claim 82, wherein:

the storage device comprises a flow cell;

each write location from the one or more write locations is disposed on a first surface of the flow cell; and

the read location is disposed on a second surface of the flow cell.

84. The computer readable media of claim 83, wherein the first surface and the second surface are opposed to each other.

85. The computer readable media of claim 83, wherein:

the first surface is a bottom surface of the flow cell; and

the second surface is a top surface of the flow cell.

86. The computer readable media claim 82, wherein each write location from the set of one or more write locations has a corresponding set of electrodes to encode data using nucleotides in that write location.

87. The computer readable media of claim 86, wherein:

the storage device comprises a dedicated integrated circuit; and

the dedicated integrated circuit is to, for each write location from the set of one or more write locations, drive the set of electrodes corresponding to that location to thereby encode data using nucleotides in that write location.

88. The computer readable media of claim 87, wherein the storage device comprises a second integrated circuit, wherein the second integrated circuit is to read data from nucleotides at the read location.

89. The computer readable media of claim 88, wherein the dedicated integrated circuit and the second integrated circuit are both CMOS chips.

90. The computer readable media of claim 82, wherein:

each write location from the set of one or more write locations is addressable; and

the storage device does not comprise any addressable locations to store data in the form of polynucleotides other than the set of one or more write locations.

91. The computer readable media of claim 82, wherein:

the storage device stores a set of one or more logical data groupings;

the method comprises creating an index specifying, for each logical data grouping from the set of one or more logical data groupings, an associated set of one or more locations; and

for each logical data grouping from the set of one or more logical data groupings, each location from that logical data grouping's associated set of one or more location is a write location comprised by the set of one or more write locations.

92. The computer readable media of claim 91, wherein the method comprises:

receiving a request to retrieve a particular logical data grouping from the set of one or more logical data groupings;

retrieving, from the index, the particular logical data grouping's associated set of one or more locations; and

determining the particular location in the storage device based on the particular logical data grouping's associated set of one or more locations.

93. The computer readable media of claim 91, wherein, for each logical data grouping from the set of one or more logical data groupings, that logical data

~~grouping's associated set of one or more locations comprises a starting location and an ending location.~~

~~94. The computer readable media of claim 91, wherein, for each logical data grouping from the set of one or more logical data groupings, each location from that logical data grouping's associated set of one or more locations is a location in a two-dimensional grid.~~

~~95. The computer readable media of claim 91, wherein the method comprises:~~

~~storing the index in a non-nucleotide memory; and~~

~~storing the index using nucleotides on a bead.~~

~~96. The computer readable media of claim 81, wherein transferring the copy of the polynucleotide to the read location comprises:~~

~~fixing the copy of the polynucleotide to a bead at the particular location; and~~

~~transferring the bead from the particular location to the read location.~~

~~97. The computer readable media of claim 81, wherein the particular location is on the surface of a bead.~~

~~98. The computer readable media of claim 81, wherein transferring the copy of the polynucleotide to the read location is performed using a technique selected from the group consisting of:~~

~~electrophoresis;~~

~~dielectrophoresis; and~~

~~laminar fluid flow.~~