~~WHAT IS CLAIMED IS:~~CLAIMS

~~1. An apparatus, comprising:~~

~~(a) a flow cell body defining one or more flow channels and a plurality of wells, each flow channel of the one or more flow channels to receive a flow of fluid, each well of the plurality of wells being fluidically coupled with the corresponding flow channel of the one or more flow channels, each well of the plurality of wells to contain at least one polynucleotide;~~

~~(b) a plurality of electrodes, each electrode of the plurality of electrodes being positioned in a corresponding well of the plurality of wells, the plurality of electrodes to effect writing of polynucleotides in the corresponding wells of the plurality of wells;~~

~~(c) an integrated circuit, the integrated circuit to drive selective deposition or activation of selected nucleotides to attach to polynucleotides in the wells of the plurality of wells to thereby generate polynucleotides representing machine-written data in the plurality of wells; and~~

~~(d) an imaging assembly to capture images indicative of one or more nucleotides in a polynucleotide.~~

~~2. The apparatus of claim 1, each electrode of the plurality of electrodes defining an aperture.~~

~~3. The apparatus of claim 2, the imaging assembly including at least one image sensor to receive light through the aperture of each electrode of the plurality of electrodes.~~

~~4. The apparatus of any one or more of claims 2 through 3, each electrode of the plurality of electrodes being annularly shaped.~~

5. The apparatus of any one or more of claims 2 through 3, each electrode of the plurality of electrodes comprising a plurality of electrode segments arranged in quadrants, the aperture being defined at a central region of the arrangement of quadrants.

6. The apparatus of claim 5, the integrated circuit being further in communication with the imaging assembly.

7. The apparatus of any one or more of claims 1 through 6, the integrated circuit comprising a CMOS chip.

8. The apparatus of any one or more of claims 1 through 7, the plurality of wells being formed as a plurality of discrete recesses arranged in a pattern along a floor of the corresponding flow channel of the one or more flow channels.

9. The apparatus of any one or more of claims 1 through 8, each well of the plurality of wells being defined by at least one sidewall and a floor.

10. The apparatus of claim 9, each electrode of the plurality of electrodes being positioned on the floor of the corresponding well of the plurality of wells.

11. The apparatus of claim 9, each electrode of the plurality of electrodes being positioned on a sidewall of the at least one sidewall of the corresponding well.

12. The apparatus of any one or more of claims 9 through 11, the floor of each well of the plurality of wells further defining an aperture, the aperture to provide a path for fluid communication between the well of the plurality of wells and a fluid source.

13. The apparatus of any one or more of claims 1 through 12, the integrated circuit to drive the plurality of electrodes to selectively deposit or activate selected nucleotides by applying a voltage within the corresponding well of the plurality of wells.

~~14. The apparatus of claim 13, each nucleotide being associated with a particular voltage, the integrated circuit to drive the electrodes of the plurality of electrodes to selectively deposit or activate a selected nucleotide by applying the particular voltage associated with the selected nucleotide.~~

~~15. The apparatus of claim 14, each well of the plurality of wells including a set of four electrodes from the plurality of electrodes, each electrode in the set of four being associated with a corresponding voltage of the particular voltages associated with the nucleotides, such that each electrode in the set of four corresponds with a particular one of four nucleotides.~~

~~16. The apparatus of any one or more of claims 1 through 15, the integrated circuit to drive the selective deposition or activation of selected nucleotides by applying a change in pH within the corresponding well of the plurality of wells.~~

~~17. The apparatus of any one or more of claims 1 through 16, further comprising at least one light source, the integrated circuit to drive the selective deposition or activation of selected nucleotides by activating the at least one light source.~~

~~18. The apparatus of claim 17, each nucleotide being associated with a particular wavelength of light, the integrated circuit to drive the at least one light source to selectively deposit or activate a selected nucleotide by applying the particular wavelength of light associated with the selected nucleotide.~~

~~19. The apparatus of any one or more of claims 17 through 18, the integrated circuit to drive the selective deposition or activation of selected nucleotides by applying a change in pH within the corresponding well of the plurality of wells in addition to driving the activation of the at least one light source.~~

~~20. The apparatus of any one or more of claims 17 through 18, the at least one light source comprising a light matrix.~~

~~21. The apparatus of claim 20, the light matrix comprising a matrix of microscopic light emitting diodes.~~

~~22. The apparatus of any one or more of claims 20 through 21, the light matrix to project light onto a bottom of each well of the plurality of wells.~~

~~23. The apparatus of any one or more of claims 20 through 22, the light matrix being positioned under a bottom of each well of the plurality of wells.~~

~~24. The apparatus of any one or more of claims 17 through 23, further comprising one or more polarizers, the integrated circuit to drive the selective deposition or activation of selected nucleotides by activating the at least one polarizer of the one or more polarizers in coordination with the at least one light source.~~

~~25. The apparatus of any one or more of claims 1 through 24, the integrated circuit to drive the selective deposition or activation of selected nucleotides by activating communication of pre-charged enzymes to the one or more flow channels.~~

~~26. The apparatus of any one or more of claims 1 through 24, further comprising a printhead, the integrated circuit to drive the selective deposition or activation of selected nucleotides by activating the printhead.~~

~~27. The apparatus of claim 26, the printhead including four nozzles, each nozzle of the four nozzles to dispense a corresponding nucleotide.~~

~~28. The apparatus of any one or more of claims 26 through 27, the integrated circuit further to drive acoustic tamping of droplets emitted by the printhead.~~

~~29. The apparatus of any one or more of claims 26 through 27, the integrated circuit further to activate the printhead and the plurality of electrodes in~~

cooperation to thereby drive the selective deposition or activation of selected nucleotides.

30. An apparatus, comprising:

(a) a flow cell body defining one or more flow channels and a plurality of wells, each flow channel of the one or more flow channels to receive a flow of fluid, each well of the plurality of wells being fluidically coupled with the corresponding flow channel of the one or more flow channels, each well of the plurality of wells to contain at least one polynucleotide;

(b) a plurality of electrodes, each electrode of the plurality of electrodes being positioned in a corresponding well of the plurality of wells, the plurality of electrodes to effect writing of polynucleotides in the corresponding wells of the plurality of wells; and

(c) an integrated circuit, the integrated circuit to drive selective deposition or activation of selected nucleotides to attach to polynucleotides in the plurality of wells to thereby generate polynucleotides representing machine-written data in the plurality of wells, each nucleotide being associated with a particular voltage, the integrated circuit to drive the plurality of electrodes to selectively deposit or activate a selected nucleotide by applying the particular voltage associated with the selected nucleotide.

31. The apparatus of claim 30, each well of the plurality of wells including a set of four electrodes from the plurality of electrodes, each electrode in the set of four being associated with a corresponding voltage of the particular voltages associated with the nucleotides, such that each electrode in the set of four corresponds with a particular one of four nucleotides.

32. An apparatus, comprising:

(a) a flow cell body defining one or more flow channels and a plurality of wells, each flow channel of the one or more flow channels to receive a flow of fluid, each well of the plurality of wells being fluidically coupled with the corresponding flow channel of the one or more flow channels, each well of the plurality of wells to contain at least one polynucleotide;

(b) a plurality of electrodes, each electrode of the plurality of electrodes being positioned in a corresponding well of the plurality of wells, the plurality of electrodes to effect writing of polynucleotides in the corresponding wells of the plurality of wells;

(c) at least one light source; and

(d) an integrated circuit, the integrated circuit to drive selective deposition or activation of selected nucleotides to attach to polynucleotides in the plurality of wells to thereby generate polynucleotides representing machine-written data in the plurality of wells, the integrated circuit to drive the selective deposition or activation of selected nucleotides by activating the at least one light source.

33. The apparatus of claim 32, each nucleotide being associated with a particular wavelength of light, the integrated circuit to drive the at least one light source to selectively deposit or activate a selected nucleotide by applying the particular wavelength of light associated with the selected nucleotide.

34. The apparatus of any one or more of claims 32 through 33, the integrated circuit to drive the selective deposition or activation of selected nucleotides by applying a change in pH within the corresponding well of the plurality of wells in addition to driving the activation of the at least one light source.

35. The apparatus of any one or more of claims 32 through 34, the at least one light source comprising a light matrix.

36. The apparatus of claim 35, the light matrix comprising a matrix of micro-LEDs.

37. The apparatus of any one or more of claims 35 through 36, the light matrix to project light onto a bottom of each well of the plurality of wells.

38. The apparatus of any one or more of claims 35 through 37, the light matrix being positioned under a bottom of each well of the plurality of wells.

39. The apparatus of any one or more of claims 32 through 38, further comprising one or more polarizers, the integrated circuit to drive the selective deposition or activation of selected nucleotides by activating the one or more polarizers in coordination with the at least one light source.

40. An apparatus, comprising:

(a) a flow cell body defining one or more flow channels and a plurality of wells, each flow channel of the one or more flow channels to receive a flow of fluid, each well of the plurality of wells being fluidically coupled with the corresponding flow channel of the one or more flow channels, each well of the plurality of wells to contain at least one polynucleotide;

(b) a plurality of electrodes, each electrode of the plurality of electrodes being positioned in a corresponding well of the plurality of wells, the plurality of electrodes to effect writing of polynucleotides in the corresponding wells of the plurality of wells;

(c) a printhead to deposit nucleotides; and

(d) an integrated circuit, the integrated circuit to drive selective deposition of selected nucleotides to attach to polynucleotides in the plurality of wells to thereby generate polynucleotides representing machine-written data in the plurality of wells, the integrated circuit to drive the selective deposition of selected nucleotides by activating the printhead.

~~41. The apparatus of claim 40, the printhead including four nozzles, each nozzle to dispense a corresponding nucleotide.~~

~~42. The apparatus of any one or more of claims 40 through 41, the integrated circuit further to drive acoustic tamping of droplets emitted by the printhead.~~

~~43. The apparatus of any one or more of claims 40 through 42, the integrated circuit further to activate the printhead and the plurality of electrodes in cooperation to thereby drive the selective deposition or activation of selected nucleotides.~~

~~44~~1. A method comprising:

flowing a fluid through a flow channel of a flow cell, the fluid comprising a plurality of types of nucleotides, the flow cell including a plurality of primary bases to support polynucleotides, the primary bases being secured to a floor region of the flow cell;

selecting one type of nucleotide for attachment to a selected primary base of the plurality of primary bases in the flow cell; and

activating the selected one type of nucleotide to thereby cause the selected one type of nucleotide to attach to the selected primary base, the attached nucleotide representing machine-written data, activating the selected type of nucleotide comprising applying a change in pH within the flow cell, the applied pH being associated with the selected type of nucleotide.

~~45~~2. The method of claim ~~44~~1, further comprising repeating selecting one type of nucleotide for attachment to a selected primary base in the flow cell and activating the selected one type of nucleotide to thereby cause the selected one type of nucleotide to attach to the selected primary base, to thereby generate a polynucleotide

on the primary base, the generated polynucleotide including a plurality of selected types of nucleotides, the generated polynucleotide representing machine-written data.

~~46~~3. The method of ~~any one or more of claims 44 through 45~~ claim 1, activating the selected type of nucleotide comprising activating an electrode in the flow cell to thereby apply a voltage to the selected type of nucleotide.

~~47~~4. The method of claim ~~46~~3, each type of nucleotide being associated with a particular voltage, activating the electrode comprising activating the electrode to apply the particular voltage associated with the selected type of nucleotide.

~~48~~5. The method of claim ~~47~~4, the flow cell including electrodes associated with different corresponding voltages, the method further comprising selecting an electrode from the electrodes, the selected electrode corresponding to the voltage associated with the selected type of nucleotide, the activated electrode being the selected electrode.

~~49. The method of any one or more of claims 44 through 48, activating the selected type of nucleotide comprising applying a change in pH within the flow cell, the applied pH being associated with the selected type of nucleotide.~~

~~50. The method of any one or more of claims 44 through 48, activating the selected type of nucleotide comprising activating at least one light source.~~

~~51. The method of claim 50, each type of nucleotide being associated with a particular wavelength of light, activating at least one light source comprising activating the at least one light source to emit light at the particular wavelength associated with the selected type of nucleotide.~~

~~52. The method of any one or more of claims 50 through 51, activating the selected type of nucleotide further comprising applying a change in pH within the flow cell in coordination with activating the at least one light source, the applied pH being associated with the selected type of nucleotide.~~

~~53. The method of any one or more of claims 50 through 52, activating the selected type of nucleotide further comprising activating at least one polarizer in coordination with activating the at least one light source.~~

~~54~~6. The method of any ~~one or more of claims 44 through 53~~ claim 1, activating the selected type of nucleotide comprising communicating pre-charged enzymes to the flow channel.

~~55. A method comprising:~~

~~selecting one type of nucleotide for attachment to a selected primary base in a flow cell; and~~

~~depositing the selected one type of nucleotide into the flow cell, the flow cell including a plurality of primary bases to support polynucleotides, the primary bases being secured to a floor region of the flow cell, the deposited nucleotide attaching to a corresponding primary base of the plurality of primary bases, the attached nucleotide representing machine-written data.~~

~~56. The method of claim 55, depositing the selected type of nucleotide comprising emitting the selected type of nucleotide from a printhead.~~

~~57. The method of claim 56, the printhead including a plurality of nozzles, each nozzle of the plurality of nozzles being associated with a particular type of nucleotide, the method further comprising selecting the nozzle of the plurality of nozzles corresponding to the selected type of nucleotide, the deposited nucleotide being deposited from the selected nozzle of the plurality of nozzles.~~

~~58. The method of any one or more of claims 56 through 57, depositing the selected type of nucleotide further comprising activating an electrode in the flow cell in coordination with emitting the selected type of nucleotide from the printhead.~~

~~59. The method of claim 58, the flow cell including electrodes associated with different corresponding voltages, each type of nucleotide being associated with a particular voltage, the method further comprising selecting an electrode of the electrodes, the selected electrode corresponding to the voltage associated with the selected type of nucleotide, the activated electrode being the selected electrode.~~