What is Claimed Is:

1. A cell culture chamber for use in an automated cell engineering system, the cell culture chamber comprising:
   a flat and non-flexible chamber, having a low chamber height and a cell-contacting surface,
   wherein at least a portion of the cell-contacting surface comprises a non-porous, gas-permeable material.
2. The cell culture chamber of claim 1, wherein the cell culture chamber further comprises at least one of:
   (a) a distal port configured to allow for the removal of air bubbles from the cell culture chamber and/or as a recirculation port;
   (b) a medial port configured to function as a recirculation inlet port; and
   (c) a proximal port configured to function as a drain port for cell removal.
3. The cell culture chamber of claim 1 or claim 2, wherein the cell-contacting surface comprises a plurality of separate sections, each section comprising the non-porous, gas-permeable material.
4. The cell culture chamber of claim 1 or claim 2, wherein at least about 50% of the cell-contacting surface comprises the non-porous, gas-permeable material.
5. The cell culture chamber of claim 1 or claim 2, wherein the entire cell-contacting surface comprises the non-porous, gas-permeable material.
6. The cell culture chamber of any one of claims 1-5, wherein the non-porous, gas-permeable material comprises silicone, fluoroethylene polypropylene (FEP), or ethyl vinyl olefin (EVO).
7. The cell culture chamber of any one of claims 1-6, having a chamber height of about 0.5 cm to about 4 cm.
8. The cell culture chamber of any one of claims 1-7, having a volume of about 50 ml to about 200 ml.
9. The cell culture chamber of any one of claims 1-8, wherein the cell culture chamber is not a centrifugation chamber.

10. The cell culture chamber of any one of claims 1-9, wherein the cell-contacting surface further comprises a surface coating on the cell-contacting surface selected from the group consisting of:
    i. a surface coating that activates a cell;
    ii. a surface coating that modulates a biological pathway in a cell;
    iii. a surface coating that enhances growth of a cell;
    iv. a surface coating that improves adhesion of a cell;
    v. a surface coating that inhibits a cells;
    vi. a surface coating that response to media conditions; and
    vii. a surface coating that has controlled solubility.
11. The cell culture chamber of claim 10, wherein the surface coating comprises an adhesion molecule.
12. The cell culture chamber of claim 11, wherein the adhesion molecule is fibronectin or a modified fibronectin.
13. The cell culture chamber of any one of claims 1-12, wherein a portion of the cell-contacting surface further comprises a surface treatment.
14. A cell culture chamber for use in an automated cell engineering system, the cell culture chamber comprising:
    a flat and non-flexible chamber, having a chamber height of about 0.5 cm to about 4 cm, and a cell-contacting surface,
    wherein at least 50% of the cell-contacting surface comprises a non-porous, gas-permeable material comprising silicone, fluoroethylene polypropylene (FEP), or ethyl vinyl olefin (EVO), and
    wherein the cell culture chamber further comprises at least one of:
        (a) a distal port configured to allow for the removal of air bubbles from the cell culture chamber and/or as a recirculation port;
        (b) a medial port configured to function as a recirculation inlet port; and
        (c) a proximal port configured to function as a drain port for cell removal.

15. The cell culture chamber of claim 14, wherein the cell-contacting surface comprises a plurality of separate sections, each section comprising the non-porous, gas-permeable material.
16. The cell culture chamber of claim 14, wherein the entire cell-contacting surface comprises the non-porous, gas-permeable material.
17. The cell culture chamber of any one of claims 14-16, having a volume of about 50 ml to about 200 ml.
18. The cell culture chamber of any one of claims 14-17, wherein the cell culture chamber is not a centrifugation chamber.
19. The cell culture chamber of any one of claims 14-18, wherein the cell-contacting surface further comprises a surface coating on the cell-contacting surface selected from the group consisting of:
    i. a surface coating that activates a cell;
    ii. a surface coating that modulates a biological pathway in a cell;
    iii. a surface coating that enhances growth of a cell;
    iv. a surface coating that improves adhesion of a cell;
    v. a surface coating that inhibits a cell;
    vi. a surface coating that responds to media conditions; and
    vii. a surface coating that has controlled solubility.
20. The cell culture chamber of claim 19, wherein the surface coating comprises an adhesion molecule.
21. The cell culture chamber of claim 20, wherein the adhesion molecule is fibronectin or a modified fibronectin.
22. The cell culture chamber of any one of claims 14-21, wherein a portion of the cell-contacting surface further comprises a surface treatment.
23. A cassette for use in an automated cell engineering system, comprising:
    (a) a high temperature chamber for carrying out activation, transduction and/or expansion of a cell culture, the high temperature chamber including a cell culture chamber; and
    (b) one or more fluidics pathways connected to the cell culture chamber, wherein the fluidics pathways provide recirculation, removal of waste and

homogenous gas exchange and distribution of nutrients to the cell culture chamber without disturbing cells within the cell culture chamber,

wherein the cell culture chamber is a flat and non-flexible chamber, having a low chamber height and a cell-contacting surface, and the cell culture chamber is maintained in a substantially planar orientation in the cassette, and

wherein at least a portion of the cell-contacting surface comprises a non-porous, gas-permeable material.

24. The cassette of claim 23, wherein the cell culture chamber further comprises at least one of:

i. a distal port configured to allow for the removal of air bubbles from the cell culture chamber and/or as a recirculation port;

ii. a medial port configured to function as a recirculation inlet port; and

iii. a proximal port configured to function as a drain port for cell removal.

25. The cassette of claim 23 or claim 24, wherein the cell-contacting surface comprises a plurality of separate sections, each section comprising the non-porous, gas-permeable material.

26. The cassette of claim 23 or claim 24, wherein at least about 50% of the cell-contacting surface comprises the non-porous, gas-permeable material.

27. The cassette of claim 23 or claim 24, wherein the entire cell-contacting surface comprises the non-porous, gas-permeable material.

28. The cassette of any one of claims 23-27, wherein the non-porous, gas-permeable material comprises silicone, flouroethylenepolypropylene (FEP), or ethyl vinyl olefin (EVO).

29. The cassette of any one of claims 23-28, having a chamber height of about 0.5 cm to about 4 cm.

30. The cassette of any one of claims 23-29, having a volume of about 50 ml to about 200 ml.

31. The cassette of any one of claims 23-29, wherein the cassette does not include a centrifugation chamber.

32. The cassette of any one of claims 23-31, wherein the cell-contacting surface further comprises a surface coating on the cell-contacting surface selected from the group consisting of:
    i. a surface coating that activates a cell;
    ii. a surface coating that modulates a biological pathway in a cell;
    iii. a surface coating that enhances growth of a cell;
    iv. a surface coating that improves adhesion of a cell;
    v. a surface coating that inhibits a cells;
    vi. a surface coating that response to media conditions; and
    vii. a surface coating that has controlled solubility.
33. The cassette of claim 32, wherein the surface coating comprises an adhesion molecule.
34. The cassette of claim 33, wherein the adhesion molecule is fibronectin or a modified fibronectin.
35. The cassette of any one of claims 23-34, wherein the cassette is pre-filled with culture media, activation reagent, and optionally a vector.
36. The cassette of any one of claims 23-35, further comprising one or more of a pH sensor, a glucose sensor, an oxygen sensor, a lactate sensor, a cell counting module, a carbon dioxide sensor, and/or an optical density sensor.
37. The cassette of any one of claims 23-36, further comprising one or more sampling ports and/or injection ports.
38. The cassette of any one of claims 23-37, further comprising an access port for connecting the cassette to an external device.
39. The cassette of claim 38, wherein the external device includes an electroporation unit or an additional media source.
40. The cassette of any one of claims 23-39, wherein one or more of the fluidic pathways comprise a silicone-based tubing component that allows oxygenation through the tubing component.
41. The cassette of any one of claims 23-40, wherein a portion of the cell-contacting surface further comprises a surface treatment.

42. The cassette of any one of claims 23-41, further comprising a low temperature chamber, for storage of a cell culture media.

43. A cell culture chamber for use in an automated cell engineering system, comprising:

(a) a flat and non-flexible chamber, having a low chamber height; and

(b) a surface coating on the chamber selected from the group consisting of:

i. a surface coating that activates a cell;

ii. a surface coating that modulates a biological pathway in a cell;

iii. a surface coating that enhances growth of a cell;

iv. a surface coating that improves adhesion of a cell;

v. a surface coating that inhibits a cell;

vi. a surface coating that responds to media conditions; and

vii. a surface coating that has controlled solubility.

44. The cell culture chamber of claim 43, wherein the cell is an immune cell.

45. The cell culture chamber of claim 43, wherein the cell is a stem cell or a progenitor cell.

46. The cell culture chamber of claim 45, wherein the stem cell is a pluripotent stem cell, a hematopoietic stem cell or a mesenchymal stem cell.

47. The cell culture chamber of claim 43, wherein the cell is a connective tissue cell, a cardiac cell or a retinal cell.

48. The cell culture chamber of any one of claims 43-47, wherein the cell culture chamber further comprises at least one of:

(a) a distal port configured to allow for the removal of air bubbles from the cell culture chamber and/or as a recirculation port;

(b) a medial port configured to function as a recirculation inlet port; and

(c) a proximal port configured to function as a drain port for cell removal.

49. The cell culture chamber of any one of claims 43-48, wherein the surface coating comprises an adhesion molecule.

50. The cell culture chamber of claim 49, wherein the adhesion molecule is fibronectin or a modified fibronectin.

51. The cell culture chamber of any one of claims 53-50, having a height of about 0.5 cm to about 4 cm.
52. The cell culture chamber of any one of claims 43-51, having a volume of about 50 ml to about 200 ml.
53. The cell culture chamber of any one of claims 43-52, wherein the cell culture chamber is not a centrifugation chamber.
54. The cell culture chamber of any one of claims 43-53, wherein a portion of the chamber further comprises a surface treatment.
55. A cassette for use in an automated cell engineering system, comprising:
    (a) a high temperature chamber for carrying out activation, transduction and/or expansion of a cell culture, the high temperature chamber including a cell culture chamber; and
    (b) one or more fluidics pathways connected to the cell culture chamber, wherein the fluidics pathways provide recirculation, removal of waste and homogenous gas exchange and distribution of nutrients to the cell culture chamber without disturbing cells within the cell culture chamber,

    wherein the cell culture chamber is a flat and non-flexible chamber, having a low chamber height, and the cell culture chamber is maintained in a substantially planar orientation in the cassette, and

    wherein the cell culture chamber has a surface coating selected from the group consisting of:
        i. a surface coating that activates a cell;
        ii. a surface coating that modulates a biological pathway in a cell;
        iii. a surface coating that enhances growth of a cell;
        iv. a surface coating that improves adhesion of a cell;
        v. a surface coating that inhibits a cell;
        vi. a surface coating that responds to media conditions; and
        vii. a surface coating that has controlled solubility.
56. A cassette for use in an automated cell engineering system, comprising:

(a) a high temperature chamber for carrying out activation, transduction and/or expansion of a cell culture, the high temperature chamber including a cell culture chamber;
wherein the cell culture chamber is a flat and non-flexible chamber, having a low chamber height, and the cell culture chamber is maintained in a substantially planar orientation in the cassette;

(b) one or more fluidics pathways connected to the cell culture chamber, wherein the fluidics pathways provide recirculation, removal of waste and homogenous gas exchange and distribution of nutrients to the cell culture chamber without disturbing cells within the cell culture chamber; and

(c) a fluidics pathway connected to the cell culture chamber configured to introduce a surface coating material to the cell culture chamber, the surface coating material selected from the group consisting of:

i. a surface coating material that activates a cell;
ii. a surface coating material that modulates a biological pathway in a cell;
iii. a surface coating material that enhances growth of a cell;
iv. a surface coating material that improves adhesion of a cell;
v. a surface coating material that inhibits a cell;
vi. a surface coating material that responds to media conditions; and
vii. a surface coating material that has controlled solubility.

57. The cassette of claim 55 or 56, further comprising a low temperature chamber, for storage of a cell culture media.

58. The cassette of claim 55 or claim 56, wherein the cell is an immune cell.

59. The cassette of claim 55 or claim 56, wherein the cell is a stem cell.

60. The cassette of claim 59, wherein the stem cell is a pluripotent stem cell or a mesenchymal stem cell.

61. The cassette of claim 55 or claim 56, wherein the cell is a connective tissue cell, a cardiac cell or a retinal cell.

62. The cassette of any one of claims 55-61, wherein the cell culture chamber further comprises at least one of:
    (a) a distal port configured to allow for the removal of air bubbles from the cell culture chamber and/or as a recirculation port;
    (b) a medial port configured to function as a recirculation inlet port; and
    (c) a proximal port configured to function as a drain port for cell removal.
63. The cassette of any one of claims 55-62, wherein the surface coating material comprises an adhesion molecule.
64. The cassette of claim 63, wherein the adhesion molecule is fibronectin or a modified fibronectin.
65. The cassette of any one of claims 55-64, having a height of about 0.5 cm to about 4 cm.
66. The cassette of any one of claims 55-65, having a volume of about 50 ml to about 200 ml.
67. The cassette of any one of claims 55-66, wherein the cell culture chamber is not a centrifugation chamber, and the cassette does not comprise a centrifugation chamber.
68. The cassette of any one of claims 55-67, wherein the cassette is pre-filled with culture media, activation reagent, the surface coating material, and optionally a vector.
69. The cassette of any one of claims 55-68, further comprising one or more of a pH sensor, a glucose sensor, an oxygen sensor, a lactate sensor, a cell counting module, a carbon dioxide sensor, and/or an optical density sensor.
70. The cassette of any one of claims 55-69, further comprising one or more sampling ports and/or injection ports.
71. The cassette of any one of claims 55-70, further comprising an access port for connecting the cassette to an external device.
72. The cassette of claim 71, wherein the external device includes an electroporation unit or an additional media source.

73. The cassette of any one of claims 55-72, wherein one or more of the fluidic pathways comprise a silicon-based tubing component that allows oxygenation through the tubing component.

74. The cassette of any one of claims 55-73, wherein a portion of the cell-contacting surface further comprises a surface treatment.