

WHAT IS CLAIMED IS:

1. A bioprocessing method comprising
activating cells of a population of cells in a bioreactor vessel using magnetic or non-magnetic beads to produce a population of activated cells;
genetically modifying the activated cells in the bioreactor vessel to produce a population of genetically modified cells;
washing the genetically modified cells in the bioreactor vessel to remove unwanted materials; and
expanding the population of genetically modified cells in the bioreactor vessel to produce an expanded population of transduced cells;
wherein activating, genetically modifying, washing, and expanding are carried out in the bioreactor vessel without removing the cells from the bioreactor vessel, and the bioreactor vessel has a rigid vessel body.
2. The bioprocessing method according to claim 1, wherein:
the beads are retained in the bioreactor vessel during the step of washing the genetically modified cells.
3. The bioprocessing method according to claim 1, wherein:
the step of washing is carried out without immobilizing magnetic isolation beads using a magnet.
4. The bioprocessing method according to claim 1, additionally comprising washing the genetically modified cells via filterless perfusion.
5. The bioprocessing method according to claim 1, further comprising the steps of:
harvesting the expanded population of genetically modified cells from the bioreactor vessel; and
debeading the expanded population of genetically modified cells.
6. The bioprocessing method according to claim 5, wherein:

the steps of harvesting the expanded population of genetically modified cells and debearing the expanded population of genetically modified cells are carried out simultaneously.

7. The bioprocessing method according to claim 5, wherein:
the steps of harvesting and debearing the expanded population of genetically modified cells are carried out using perfusion; and
during perfusion the magnetic beads remain in the bioreactor vessel.
8. The bioprocessing method according to claim 1, wherein:
the cells are one or more of immune cells, T-cells, T cell subsets, B cells, NK cells and dendritic cells.
9. The bioprocessing method according to claim 1, wherein the bioreactor vessel comprises a first bioreactor vessel and a second bioreactor vessel disposed within a processing chamber of a bioprocessing apparatus.
10. The bioprocessing method according to claim 9, wherein the steps of activating and genetically modifying are performed in the first bioreactor vessel, and the step of expanding is performed in the second bioreactor vessel.
11. A bioprocessing method as claimed in any one of the preceding claims, comprising:
introducing a suspension comprising cells suspended in a cell culture medium through at least a feed port or a drain port into a cavity of a cell culture vessel, the suspension being in an amount sufficient to cover a gas permeable, liquid impermeable membrane positioned at a bottom of the cell culture vessel, the feed port configured to permit additional cell culture medium into the cavity, and the drain port configured to permit removal of the cells, cell culture medium, and used cell culture medium from the cavity;
allowing the cells to settle on the gas permeable, liquid impermeable membrane by gravity;
removing the used cell culture medium through the drain port and introducing the additional cell culture medium through the feed port such that a constant volume is maintained in the cell culture vessel until the cells expand to a desired density, wherein the

removing and introducing are preformed subsequent to allowing the cells to settle on the gas permeable, liquid impermeable membrane;
resuspending the cells in the cell culture medium in the cell culture vessel, wherein the resuspending is performed after the desired cell density is attained; and
removing the resuspended cells and the cell culture medium through the drain port.

12. The method of claim 11, wherein removing the used cell culture medium comprises removing impurities, cell culture byproducts, or a combination thereof from within the cell culture vessel.

13. The method of claim 11 or 12, wherein the allowing the cells to settle to the gas permeable, liquid impermeable membrane, the removing the used cell culture medium, and the introducing the additional cell culture medium comprise positioning the cell culture vessel such that the gas permeable, liquid impermeable membrane is level to allow even distribution of cells.

14. The method of claim 11, 12 or 13, wherein the resuspending of the cells in the cell culture medium comprises oscillating the cell culture vessel through a defined angle for a period of time.

15. The method of any one of the preceding claims 11 to 14, wherein the removing of the resuspended cells and the cell culture medium through the drain port comprises tilting the cell culture vessel to a low angle to minimize a hold-up volume during removal while maintaining a low overall profile of the cell culture vessel.