

CLAIMS

1. A method, comprising;
supplying a 3D bioprocessor comprising a plurality of spheres and a plurality of rods interconnecting the plurality of spheres;
providing a coating on the bioprocessor surface area;
providing a protein attached to the coating;
providing one or more biotinylated antibodies immobilized on the protein;
flowing cells through said bioprocessor, wherein the cells bind to the one or more biotinylated antibodies.
2. The method of claim 1, wherein the cells comprise T-cells, wherein receptors of the T-cells bind to the one or more biotinylated antibodies and are activated and further comprising exposing the activated T-cells to a perfusion media containing a signaling molecule to promote T-cell expansion.
3. The method of claim 1, wherein the coating is a protein coating.
4. The method of claim 1, wherein the protein comprises a tetrameric protein.
5. The method of claim 4, wherein the tetrameric protein comprises avidin or streptavidin.
6. The method of claim 1, wherein the one or more biotinylated antibody is selected from the group consisting of: anti-CD3 antibody, anti-CD28 antibody, and anti-CD2 antibody.
7. The method of claim 1, wherein the signaling molecule comprises a cytokine signaling molecule.
8. The method of claim 1, wherein the 3D bioprocessor is formed from a material that has a Tensile Modulus of at least 0.01 GPa.
9. The method of claim 1, wherein the 3D bioprocessor is formed from a material that is biocompatible.

10. The method of claim 1, wherein the 3D bioprocessor is formed from a material not susceptible to hydrolysis during cell cultivation such that the amount of hydrolysis does not exceed 5.0% by weight of the material present.
11. The method of claim 1, wherein the diameter of the spherical beads is from about 10 μm to about 10 mm.
12. The method of claim 11 wherein the diameter of the spherical beads is from about 1 mm to about 3 mm.
13. The method of claim 1, wherein the length of the cylindrical rods is from about 0.1 μm to about 10 mm.
14. The method of claim 13, wherein the length of the cylindrical rods is from about 100 μm to about 3 mm.
15. The method of claim 1, wherein the plurality of spheres and the plurality of rods are organized in one or more layers.
16. The method of claim 15, wherein the one or more layers comprises at least two layers, with each layer offset from an adjacent layer.
17. A quantity of T cells made by the method of claim 1.
18. An apparatus, comprising:
a plurality of spheres and a plurality of rods interconnecting the plurality of spheres, wherein the diameter of the spherical beads is from about 10 μm to about 10 mm, the length of the cylindrical rods is from about 0.1 μm to about 10 mm, the plurality of spheres and the plurality of rods are organized in two or more layers, with each layer offset from an adjacent layer.
19. The apparatus of claim 18, wherein diameter of the spherical beads is from about 1 mm to about 3 mm and the length of the cylindrical rods is from about 100 μm to about 3 mm.

20. The apparatus of claim 18, comprising a protein coating on the surface of the apparatus.
21. The apparatus of claim 20, comprising one or more biotinylated antibodies attached to the protein coating.
22. The apparatus of claim 21, comprising one or more biotinylated antibody selected from the group consisting of: anti-CD3 antibody, anti-CD28 antibody, and anti-CD2 antibody.