CLAIMS

What is claimed is:

1. A cell cultivation system comprising:

at least one growth substrate for growing one or more cell types, wherein the at least one growth substrate has a mesh porosity and a surface area, and wherein cell growth density per unit area of the at least one growth substrate increases with: 1) increasing mesh porosity of the at least one growth substrate, or 2) decreasing surface area per unit area of the at least one growth substrate.

2. The system of claim 1, wherein the mesh porosity and the surface area per unit area are based on a number of openings in the at least one growth substrate, and wherein the openings are arranged in a repeating pattern across a surface of the at least one growth substrate.

3. The system of claim 2, wherein the cell growth density per unit area on the at least one growth substrate increases with the number of openings by at least 5% when the number of openings is increased by at least 10%.

4. The system of claim 1, wherein the cell growth density per unit area on the at least one growth substrate increases by at least 5% when the surface area per unit area is decreased by at least 10%.

5. The system of claim 1, further comprising at least one spacer substrate adjacent to the at least one growth substrate, wherein the at least one spacer substrate is used to facilitate transport and distribution of a growth medium over or across a surface of the at least one growth substrate.

6. A cell cultivation system comprising:

at least one growth substrate for growing one or more cell types; and

at least one spacer substrate adjacent to the at least one growth substrate, wherein the at least one spacer substrate is sized to influence a cell growth density per unit area on the at least one growth substrate such that a higher cell growth density per unit area is achieved on the at least one growth substrate when using a smaller spacer substrate as compared to a larger spacer substrate.

7. The system of claim 6, wherein a size of the at least one spacer substrate is based on a dimension as measured along a radial or longitudinal direction of the at least one spacer substrate, and wherein the cell growth density per unit area on the at least one growth substrate increases as the dimension of the at least one spacer substrate is reduced along the radial or longitudinal direction.

8. The system of claim 6, wherein the cell growth density per unit area on the at least one growth substrate increases by at least 5% when the size of the at least one spacer substrate is increased by at least 10%.

9. The system of claim 6, wherein the smaller spacer substrate has a smaller surface area than the larger spacer substrate, and wherein the smaller spacer substrate has a same thickness as the larger spacer substrate.

10. The system of claim 6, wherein a size of the at least one growth substrate is substantially equal to or greater than a size of the at least one spacer substrate.

11. The system of claim 6, wherein the at least one growth substrate and the at least one spacer substrate comprise a same number of openings per unit area.

12. The system of claim 6, wherein the at least one growth substrate and the at least one spacer substrate each comprise a different number of openings per unit area.

13. A bioreactor comprising:

a container configured to retain a growth medium;

a rotatable shaft disposed in the container;

a first growth substrate and a second growth substrate , wherein the first growth substrate and the second growth substrate are coupled to the rotatable shaft and configured to grow a biological material; and

a first spacer substrate disposed between the first growth substrate and the second growth substrate.

14. The bioreactor of claim 13, wherein a growth surface on the first growth substrate or second growth substrate is substantially planar.

15. The bioreactor of claim 13, wherein each of the first growth substrate and the second growth substrate comprise a mesh formed from a plurality of wires.

16. The bioreactor of claim 15, wherein adjacent wires of the plurality of wires are separated by a distance of 1 μm to 5,000 μm.

17. The bioreactor of claim 13, wherein the first growth substrate and the second growth substrate are porous and have a porosity of 0.001 to 0.999.

18. The bioreactor of claim 13, wherein the first growth substrate is disposed 1 μm to 5,000 μm from the first spacer substrate.

19. The bioreactor of claim 13, further comprising a plurality of growth substrates and a plurality of spacer substrates, wherein the plurality of growth substrates are arranged substantially parallel to the plurality of spacer substrates.

20. The bioreactor of claim 13, wherein the biological material comprises cells, tissues, organs, cell-based meat, cell-based fat, or a combination thereof.

21. The bioreactor of claim 13, wherein the rotatable shaft is coupled to a lateral center of the first growth substrate and to a lateral center of the second growth substrate.

22. The bioreactor of claim 19, wherein a ratio of an area of the plurality of growth substrates to an area of the plurality of spacer substrates is 1000:1 to 1:1.

23. The bioreactor of claim 19, wherein the plurality of growth substrates have an average pore size greater than an average pore size of the plurality of spacer substrates.

24. The bioreactor of claim 19, wherein the container comprises a hermetically sealable container.

25. The bioreactor of claim 19, wherein the plurality of growth substrates are formed from a first material, and wherein the plurality of spacer substrates are formed from a second material, the first material being different than the second material.

26. The bioreactor of claim 13, wherein the growth substrates comprise a coating that selectively adheres to the cells, wherein the coating comprises a cell-adhesive protein, a cell-adhesive peptide, a coating derived from an animal cell extracellular matrix, collagen, fibronectin, laminin, poly-L-lysine, poly-D-lysine, a coating derived from a plant, arginine-glycine-aspartic acid (RGD)-containing vitronectin-like protein, or a combination thereof.