CLAIMS

What is claimed is:

1. A method for forming a structured porous cell substrate for growing cells, the method comprising:

injecting a cell substrate solution into a mold comprising a surface having a wettability gradient;

cooling the surface of the mold to freeze the cell substrate solution, form a temperature gradient within the mold, and nucleate crystals;

removing the frozen cell substrate solution from the mold;

sublimating the nucleated crystals of the frozen cell substrate solution to form an edible cell substrate;

seeding cells onto the edible cell substrate; and

gelating the seeded cells by immersing the edible cell substrate and the seeded cells in a saline solution comprising a salt concentration between and including 5g/L to 30g/L.

2. The method of claim 1, wherein the mold comprises two semi-cylindrical compartments.

3. The method of claim 1, wherein the mold comprises a cylindrical compartment.

4. The method of claim 1, further comprising seeding cells onto the edible cell substrate by:

suspending cells in an alginate solution to form a cell mixture;

filling a container with the cell mixture and the edible cell substrate;

sealing the container; and

forcing the cell mixture through the edible cell substrate to seed cells throughout the edible cell substrate.

5. The method of claim 1, wherein the salt concentration is further between and including 10 g/L and 25 g/L.

6. The method of claim 1,

wherein seeding cells onto the edible cell substrate comprises:

flowing cells of a first cell type comprising at least one of myocytes, adipocytes, or fibroblasts through the edible cell substrate;

flowing cells of a second cell type comprising at least one of myocytes, adipocytes, or fibroblasts through the edible cell substrate; and

wherein gelating the seeded cells comprises gelating seeded cells of the first cell type and seeded cells of the second cell type.

7. The method of claim 1, wherein the mold comprises:

a metal surface having the wettability gradient; and

one or more additional plastic surfaces.

8. The method of claim 7, further comprising cooling the surface of the mold by applying a cooling agent to the metal surface, wherein the cooling agent comprises at least one of dry ice or liquid nitrogen.

9. The method of claim 7, further comprising insulating the mold prior to cooling the surface of the mold by applying insulating materials to the one or more additional plastic surfaces of the mold.

10. The method of claim 1, wherein the mold comprises rods to form pores in the edible cell substrate.

11. The method of claim 10, wherein the rods comprise silicone extensions.

12. The method of claim 1, further comprising cross-linking the edible cell substrate and washing the edible cell substrate prior to seeding the cells onto the edible cell substrate.

13. The method of claim 12, further comprising heating the edible cell substrate at a cross-linking temperature for a heated period.

14. The method of claim 1, further comprising gelating the seeded cells by incubating the seeded cells and the edible cell substrate at an incubation temperature for an incubation period.

15. The method of claim 1, further comprising forming a wettability gradient on the surface by treating an electrolytic cell with one or more electrodes producing a current for a wettability treatment period.

16. The method of claim 1, further comprising forming the temperature gradient by:

cooling the surface of the mold to a temperature between and including 0C to -70C; and

leaving an opposite surface of the mold at room temperature.

17. The method of claim 1, further comprising sublimating the nucleated crystals by freeze drying the frozen cell substrate for a freeze-drying period.

18. The method of claim 1, wherein the edible cell substrate comprises parallel-honeycomb tubes with a diameter of 200-500 μm.

19. The method of claim 1, wherein the edible cell substrate has pores of a size averaging between 40 and 60 micrometers in diameter.