What is claimed is:

1. A cell culture cartridge comprising:

a top surface comprising a plurality of inlets and a plurality of corners, wherein each of the plurality of inlets is positioned at one of the plurality of corners;

a bottom surface, wherein the bottom surface and the top surface together, at least in part, define a plurality of zones, each zone comprising one of the corners and one of the inlets, and wherein the zones converge at a center of the top surface; and

an outlet positioned at the center of the top surface;

wherein each of the plurality of zones, due at least in part to the position of the inlet in each zone relative to the outlet provide for symmetrical fluid flow between its respective inlet and the outlet to avoid dead areas in flow within each of the plurality of zones.

2. The cell culture cartridge of claim 1, wherein the cell culture cartridge comprises an octagonal shape with eight corners, each comprising an inlet.

3. The cell culture cartridge of claim 1, wherein the ~~cell culture cartridge comprises a~~ bottom surface comprises~~d of~~ a material to which cells adhere.

4. The cell culture cartridge of claim 3, wherein the material of the bottom surface is treated with an air or oxygen plasma in glow discharge or corona discharge.

5. The cell culture cartridge of claim 3, wherein the material of the bottom surface is modified with proteins or poly-amino acids such as fibronectin, laminin, and collagen.

6. The cell culture cartridge of claim 3, further comprising one or more pillars extending between the bottom surface and the top surface.

7. The cell culture cartridge of claim 3, wherein the bottom surface comprises one or more notches at a perimeter of the bottom surface.

8. The cell culture cartridge of claim 1, wherein the cell culture cartridge is transparent and made from one or more materials selected from the group consisting of polystyrene and acrylate.

9. The cell culture cartridge of claim 1, further comprising one or more stopcocks operably coupled to the cell culture cartridge.

10. A cell culture system comprising:

a cell culture cartridge comprising:

a top surface comprising a plurality of inlets and a plurality of corners, wherein each of the plurality of inlets is positioned at one of the plurality of corners;

a bottom surface, wherein the bottom surface and the top surface together, at least in part, define a plurality of zones, each zone comprising one of the corners and one of the inlets, and wherein the zones converge at a center of the top surface; and

an outlet positioned at the center of the top surface;

wherein each of the plurality of zones, due at least in part to the position of the inlet in each zone relative to the outlet provide for symmetrical fluid flow between its respective inlet and the outlet to avoid dead areas in flow within each of the plurality of zones; and

one or more pumps operably associated with the cell culture chamber.

11. The cell culture system of claim 10, wherein the cell culture cartridge comprises an octagonal shape with eight corners, each comprising an inlet, wherein placement of inlets allows for symmetrical fluid flow channels in the cell culture cartridge.

12. The cell culture system of claim 1<u>0</u>, wherein the ~~cell culture cartridge comprises a~~ bottom surface comprises<u>d</u> ~~of~~ a material to which cells adhere.

13. The cell culture system of claim 12, further comprising one or more pillars extending between the bottom surface and the top surface.

14. The cell culture system of claim 12, wherein the bottom surface comprises one or more notches at a perimeter of the bottom surface.

15. The cell culture system of claim 10, further comprising one or more stopcocks operably coupled to the cell culture cartridge.

16. The cell culture system of claim 10~~2~~, further comprising at least one fluidic connector configured to fluidically couple the cell culture cartridge to a second vessel.

17. The cell culture system of claim 10, further comprising one or more sensors operably coupled to the cell culture cartridge.

18. The cell culture system of claim 17, wherein the one or more sensors measure one or more parameters selected from the group consisting of pH, dissolved oxygen, total biomass, cell diameter, glucose concentration, lactate concentration, and cell metabolite concentration.

19. The cell culture system of claim 10, further comprising a central processing unit, wherein the central processing unit executes instructions to cause the system to:

receive a first input data comprising a size of the cell culture cartridge;

receive a second input data comprising a first concentration of a first cell type and a second concentration of a second cell type in one or more fluids that will be introduced into the cell culture cartridge; and

calculate, based on the first and second inputs, a perfusion rate of a perfusion fluid that will be introduced into the cell culture chamber that maximizes a probability of the first cell type and the second cell type contacting each other within the cell culture cartridge.

20. The system of claim 19, wherein the first cell type is a peripheral blood mononuclear cell and the second cell type is a dendritic cell.

21. The system of claim 19, further comprising one or more pumps operably coupled to one or more perfusion fluid reservoirs and operably coupled to the central processing unit, wherein the central processing unit controls the perfusion rate of the perfusion fluid by controlling the one or more pumps.

22. A method of culturing dendritic cells comprising:

providing a cell culture cartridge comprising:

a top surface comprising a plurality of inlets and a plurality of corners, wherein each of the plurality of inlets is positioned at one of the plurality of corners;

a bottom surface, wherein the bottom surface and the top surface together, at least in part, define a plurality of zones, each zone comprising one of the corners and one of the inlets, and wherein the zones converge at a center of the top surface; and

an outlet positioned at the center of the top surface;

wherein each of the plurality of zones, due at least in part to the position of the inlet in each zone relative to the outlet provide for symmetrical fluid flow between its respective inlet and the outlet to avoid dead areas in flow within each of the plurality of zones;

seeding monocyte cells in the cell culture cartridge; and

incubating the monocyte cells in the cell culture cartridge to generate dendritic cells by providing continuous perfusion of differentiation medium into the cell culture cartridge via the plurality of inlets and removing depleted medium into a waste reservoir via the outlet.

23. The method of claim 22, further comprising harvesting the dendritic cells, wherein harvesting the cells comprises cooling the cartridge.

24. The method of claim 22, further comprising transferring immature dendritic cells to a second cartridge, wherein the second cartridge is smaller than the cell culture cartridge.

25. The method of claim 24, wherein the immature dendritic cells undergo maturation and antigen pulsing in the second cartridge.

26. The method of claim 22, wherein fluid flows symmetrically through the cell culture cartridge.