

CLAIMS

What Is Claimed Is:

1. An artificial antigen presenting cell complex comprising:
 - (a) one or more gelated human dendritic cells; and
 - (b) a controlled release system associated with one or more cytokines;wherein the one or more gelated human dendritic cells are attached to the controlled release system.
2. The artificial antigen presenting cell complex of claim 1, further comprising an antigenic peptide displayed on the surface of the one or more gelated human dendritic cells.
3. The artificial antigen presenting cell complex of claim 1 or claim 2, wherein the controlled release system comprises a microparticle, which encapsulates the one or more cytokines.
4. The artificial antigen presenting cell of any one of claims 1-3, wherein the one or more cytokines comprise IL-2, IL-3, IL-4, IL-6, IL-7, IL-9, IL-12, IL-15, IL21, IL-23, IL-10, TNF- α , IFN- α , IFN- β , IFN- γ , IFN λ , granulocyte-macrophage colony-stimulating factor, or a combination thereof.
5. The artificial antigen presenting cell complex of any one of claims 1-4, wherein the microparticle comprises one or more degradable polymers.
6. The artificial antigen presenting cell complex of claim 5, wherein the one or more degradable polymers comprise poly(lactic-co-glycolic acid), polylactic acid, polycaprolactone, polyurethane, polyacrylate, or a combination thereof.
7. The artificial antigen presenting cell complex of any one of claims 2-6, wherein the antigenic peptide is displayed by a major histocompatibility complex class I molecule on the gelated human dendritic cell.
8. The artificial antigen presenting cell complex of any one of claims 1-7, wherein the gelated human cells comprise intracellular cross-linked polyethylene glycol diacrylate (PEG-DA).

9. A method for producing a gelated human dendritic cell, the method comprising:
- (a) providing a population of human dendritic cells;
 - (b) permeating a gelation buffer into the human dendritic cells, wherein the
5 gelation buffer comprises a photo initiator, a polymer or a polymerizable monomer, and dimethyl sulfoxide; and
 - (c) exposing the human dendritic cells permeated with the gelation buffer to a light to cause crosslinking the polymer, thereby forming the gelated human dendritic cells.
10. The method of claim 9, further comprising:
- (d) coupling the gelated human dendritic cells to a controlled release system,
which is associated with one or more cytokines.
11. The method of claims 9 or 10, wherein the gelation buffer comprises the polymer,
15 which is an acrylic polymer.
12. The method of claim 11, wherein the acrylic polymer comprises poly(ethylene glycol) diacrylate (PEG-DA).
13. The method of claim 12, wherein the acrylic polymer is PEG-DA having an
20 average molecular weight of about 250 to about 2,000 dalton.
14. The method of claim 13, wherein the PEG-DA has an average molecular weight of about 600 to about 800 dalton.
15. The method of claim 9 or claim 10, wherein the gelation buffer comprises the polymerizable monomer.
16. The method of claim 15, wherein the polymerizable monomer is 2-hydroxyethyl
30 methacrylate, (hydroxyethyl)methacrylate, acrylic acid, sodium acrylate, ethylene glycol dimethacrylate, or a combination thereof.
17. The method of any one of claims 9-16, wherein the photo initiator is 2-hydroxy-4'-(2-hydroxyethoxy)-2-methylpropiophenone.
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18. An artificial antigen presenting human dendritic cell, which is produced by a method of any one of claims 9-17.

19. A method of activating an immune cell, comprising:

- 5 (i) providing an artificial antigen presenting cell complex of any one of claims 1-8 and 18;
- (ii) priming the artificial antigen presenting cell complex with an antigenic peptide to display the peptide on the surface of the gelated human dendritic cell in the artificial antigen presenting cell complex; and
- 10 (iii) contacting the artificial antigen presenting cell complex produced in step (ii) with a cell population comprising immune cells to activate the immune cells.

20. The method of claim 19, wherein the immune cells comprise T cells.

15 21. The method of claims 19 or 20, wherein the peptide is derived from a viral antigen, a bacterial antigen, a fungal antigen, a parasite antigen, a cancer antigen, or a self antigens associated with an autoimmune disease.

22. The method of any one of claims 19-21, further comprising administering the
20 activated immune cells produced in step (iii) to a subject in need thereof.