CLAIMS

What is claimed is:

1. A method for obtaining a population of cells comprising dorsal neural progenitor cells (dNPCs) from undifferentiated human pluripotent stem cells, the method comprising:

a) obtaining a culture of undifferentiated human pluripotent stem cells;

b) culturing the undifferentiated human pluripotent stem cells adherently in the presence of at least one inhibitor of mitogen-activated protein kinase/extracellular signal-regulated kinase (MAPK/ERK), at least one inhibitor of bone morphogenetic protein (BMP) signaling and retinoic acid for a first time period, thereby inducing differentiation to neuroectoderm; and

c) culturing the cells from b) adherently in the presence of retinoic acid and in the absence of sonic hedgehog (SHH) or a SHH signaling activator for a second time period, thereby obtaining dorsal neural progenitor cells.

2. The method of claim 1, further comprising an additional step of harvesting the cells from c), replating the harvested cells on a substrate and further culturing the cells adherently in the presence of basic fibroblast growth factor (bFGF) and epidermal growth factor (EGF) for a further time period, thereby expanding the neural progenitor cells.

3. The method of claim 2, further comprising an additional step of harvesting the expanded cells and culturing them further as aggregates in suspension in the presence of bFGF and EGF for a further time period, until the cells have matured into glial progenitor cells.

4. The method of claim 3, further comprising an additional step of plating down the aggregates comprising glial progenitor cells on a substrate and culturing the cells adherently for a further time period in the presence of epidermal growth factor (EGF), optionally splitting the cells from time to time, until the cells have matured into oligodendrocyte progenitor cells (OPCs).

5. The method of claim 3, further comprising an additional step of plating down the aggregates comprising glial progenitor cells on a substrate and culturing the cells adherently for a further time period in the presence of platelet-derived growth factor AA (PDGF-AA) and EGF, optionally splitting the cells from time to time, until the cells have matured into oligodendrocyte progenitor cells (OPCs).

6. The method of claim 3, wherein the cells are cryopreserved at a stage in the method and subsequently thawing the cells and proceeding with the method.

7. The method of claims 1, in which the substrate is recombinant human laminin-521.

8. The method of claim 1, wherein the human pluripotent stem cells are human embryonic stem cells (hESCs).

9. The method of claim 1, wherein the human pluripotent stem cells are human induced pluripotent stem cells (hiPSCs).

10. The method of claim 1, wherein the at least one inhibitor of MAPK/ERK kinase is selected from the group consisting of PD0325901, AZD6244, GSK1120212, PD184352 and Cobimetinib.

11. The method of claim 1, wherein the at least one inhibitor of MAPK/ERK kinase is PD0325901.

12. The method of claim 1, wherein the at least one inhibitor of BMP signaling is an inhibitor of activin receptor-like kinase 2 (ALK2).

13. The method of claim 1, wherein the at least one inhibitor of BMP signaling is selected from the group consisting of Dorsomorphin, DMH-1, K02288, ML347, LDN193189 and Noggin protein.

14. The method of claim 1, wherein the at least one inhibitor of BMP signaling is Dorsomorphin.

15. The method of claim 1, wherein the first period is ~~about~~ three to four days.

16. The method of claim 1, wherein the second period is ~~about~~ three to four days.

17. The method of claim 3, wherein the aggregates are cultured in suspension for ~~about~~ seven days.

18. The method of claim 4, wherein the cells are cultured adherently after the plate-down of aggregates for ~~about~~ twenty-one days.

~~19. A differentiated cell population comprising paired box 6 (PAX6) positive dNPCs obtained according to the method of claim 1.~~

~~20. The differentiated cell population of claim 18, wherein the dNPCs express one or more markers selected from paired box 3 (PAX3), paired box 7 (PAX7) and activating protein 2 (AP2).~~

~~21~~19. A method for obtaining a population of cells comprising oligodendrocyte progenitor cells (OPCs) from undifferentiated human pluripotent stem cells, the method comprising:

a) obtaining dorsal neural progenitor cells (dNPCs) according to the method of claim 1;

b) harvesting the cells from a), replating them on a substrate and culturing the cells adherently in the presence of basic fibroblast growth factor (bFGF) and epidermal growth factor (EGF) for a further time period, thereby expanding the neural progenitor cells;

c) harvesting the cells from b) and further culturing the cells as aggregates in suspension in the presence of bFGF and EGF for a further time period, until the cells have matured into dorsal glial progenitor cells; and

d) plating down the aggregates from c) on a substrate and culturing the cells adherently for a further time period in the presence of epidermal growth factor (EGF), optionally splitting the cells from time to time, until the cells have matured into OPCs;

wherein the OPCs express one or more markers selected from neural/glial antigen 2 (NG2), platelet-derived growth factor receptor A (PDGFRα), and ganglioside GD3 (GD3).

~~22~~20. The method of claim ~~21~~19, wherein the adherent culturing is performed on a substrate selected from: (i) a cell adhesion peptide and (ii) an extracellular matrix selected from laminin and vitronectin.

~~23~~21. The method of claim ~~21~~19, wherein the adherent culturing is performed on recombinant human laminin-521.

~~24~~22. The method of claim ~~21~~19, wherein the adherent culturing is performed on laminin-511 E8 fragment.

~~25~~23. The method of claim ~~21~~19, wherein step c) is performed in dynamic suspension.

~~26~~24. The method of claim ~~21~~19, wherein during step d), the media additionally comprises platelet-derived growth factor AA (PDGF-AA).

~~27~~25. The method of claim ~~21~~19, wherein the human pluripotent stem cells are hESCs.

~~28~~26. The method of claim ~~21~~19, wherein the human pluripotent stem cells are hiPSCs.

~~29~~27. The method of claim ~~21~~19, wherein the OPCs are cryopreserved and ready for administration to a subject upon thawing.

~~30. A differentiated cell population comprising OPCs obtained according to the method of claim 21.~~