What is claimed is:

1. A method for generating mammalian patterned neuroectoderm comprising: providing pluripotent cells; inducing development of the pluripotent cells into neuroectoderm by culturing the pluripotent cells in the presence of one or more inhibitors of an activin-nodal pathway and one or more inhibitors of a bone morphogenetic protein pathway; and inducing development of patterned neuroectoderm by culturing the neuroectoderm in the presence of one or more of sonic hedgehog, retinoic acid and noggin.

2. A method for generating mammalian oligodendrocyte progenitor cells comprising: providing a pluripotent cell; inducing development of the pluripotent cell into neuroectoderm by culturing the pluripotent cell in the presence of one or more inhibitors of an activin-nodal pathway and one or more inhibitors of a bone morphogenetic protein pathway; inducing development of patterned neuroectoderm by culturing the neuroectoderm in the presence of one or more of sonic hedgehog, retinoic acid and noggin; and inducing development of oligodendrocyte progenitor cells by culturing the patterned neuroectoderm cells in the presence of one or more of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog.

3. The method of claim 2, wherein two or more of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog are used in the culture of the patterned neuroectoderm cells.

4. The method of claim 3, wherein a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog are used in the culture of the patterned neuroectodermal cells.

5. The method of claim 2, wherein the fibroblast growth factor is FGF2 and the platelet-derived growth factor is PDGF-AA.

6. The method of claim 2, wherein two of retinoic acid, sonic hedgehog and noggin are used in the culture of the neuroectodermal cells.

7. The method of claim 2, wherein retinoic acid, sonic hedgehog and noggin are used in the culture of the neuroectodermal cells.

8. The method of claim 2, wherein at least 75% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

9. The method of claim 8, wherein at least 90% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

10. The method of claim 9, wherein at least 95% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

11. The method of claim 10, wherein at least 99% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

12. The method of claim 2, wherein the one or more inhibitors of an activin-nodal pathway is SB431542.

13. The method of claim 2, wherein the one or more inhibitors of a bone morphogenetic protein pathway is selected from dorsomorphin, LDN-193189 or noggin.

14. A composition comprising the oligodendrocyte progenitor cells produced according to claim 2.

15. The composition of claim 12, further comprising neurons or neuron precursors.

16. A research tool comprising the oligodendrocyte progenitor cells produced according to claim 2.

17. A diagnostic tool comprising the oligodendrocyte progenitor cells produced according to claim 2.

18. The method of claim 2, further comprising maintaining the oligodendrocyte progenitor cells by culturing the oligodendrocyte progenitor cells in the presence of an activator of Wnt-β-catenin signaling pathway.

19. The method of claim 18, wherein the activator of Wnt-β-catenin signaling is a GSK3β inhibitor.

20. The method of claim 19, wherein the GSK3β inhibitor is CHIR99021.

21. A composition comprising the oligodendrocyte progenitor cells maintained according to claim 18.

22. The composition of claim 21, further comprising neurons or neuron precursors.

23. A research tool comprising the oligodendrocyte progenitor cells maintained according to claim 18.

24. A diagnostic tool comprising the oligodendrocyte progenitor cells maintained according to claim 18.

25. The method of claim 18, further comprising generating oligodendrocytes from the maintained oligodendrocyte progenitor cells by culturing the oligodendrocyte progenitor cells in the absence of FGF and PDGF and presence of T3.

26. The method of claim 18, further comprising generating astrocytes from the maintained oligodendrocyte progenitor cells by culturing the maintained

oligodendrocyte progenitor cells in the presence of a bone morphogenetic protein and a JAK/STAT pathway activator.

27. The method of claim 26, wherein the bone morphogenetic protein is bone morphogenetic protein 4 and the JAK/STAT pathway activator is leukemia inhibitory factor.

28. A method for generating mammalian oligodendrocyte progenitor cells and maintaining the mammalian oligdendrocyte progenitor cells in culture comprising: providing pluripotent cells; inducing development of the pluripotent cells into neuroectoderm by culturing the pluripotent cells in the presence of one or more inhibitors of an activin nodal pathway and one or more inhibitors of a bone morphogenetic protein pathway; inducing development of patterned neuroectoderm by culturing the neuroectoderm in the presence of sonic hedgehog, retinoic acid and noggin; inducing development of oligodendrocyte progenitor cells by culturing the patterned neuroectoderm cells in the presence of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog; and maintaining the oligodendrocyte progenitor cells by culturing the oligodendrocyte progenitor cells in the presence of an activator of Wnt-β-catenin signaling.

29. The method of claim 28, wherein the one or more inhibitors of the activin nodal pathway is SB431542 and the one or more inhibitors of the bone morphogenetic protein pathway is selected from dorsomorphin, LDN-193189 or noggin.

30. The method of claim 28, wherein the fibroblast growth factor is FGF2 and the platelet-derived growth factor is PDGF-AA.

31. The method of claim 28, wherein at least 95% of cells in culture are oligodendrocyte progenitor cells.

32. A method for generating patterned neuroectoderm from neuroectoderm comprising culturing the neuroectoderm in the presence of sonic hedgehog, retinoic acid and noggin.

33. A method for generating oligodendrocyte progenitor cells from patterned neuroectoderm comprising culturing the patterned neuroectoderm cells in the presence of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog.

34. The method of claim 33, further comprising maintaining the oligodendrocyte progenitor cells in cell culture by culturing the oligodendrocyte progenitor cells in the presence of an activator of Wnt-β-catenin signaling.

35. The method of claim 34, further comprising generating astrocytes from the oligodendrocyte progenitor cells by culturing the maintained oligodendrocyte progenitor cells in the presence of a bone morphogenetic protein and a JAK/STAT pathway activator.

36. The method of claim 34, further comprising generating oligodendrocytes from the oligodendrocyte progenitor cells by culturing the oligodendrocyte progenitor cells in the absence of FGF and PDGF and presence of T3.

What is claimed is:

~~1. A method for generating mammalian neuroectoderm comprising: providing pluripotent cells; and inducing development of the pluripotent cells into neuroectoderm by culturing the pluripotent cells in the presence of one or more inhibitors of an activin-nodal pathway and one or more inhibitors of a bone morphogenetic protein pathway.~~

~~2. The method of claim 1, wherein the one or more inhibitors of an activin-nodal pathway is SB431542.~~

~~3. The method of claim 1, wherein the one or more inhibitors of a bone morphogenetic protein pathway is selected from dorsomorphin, LDN-193189 or noggin.~~

~~4. The method of claim 1, wherein the pluripotent cell is an epiblast stem cell.~~

~~5. The method of claim 1, wherein at least 75% or more of cells resulting from the culture of the pluripotent cells are neuroectoderm cells.~~

~~6. The method of claim 5, wherein at least 90% or more of cells resulting from the culture of the pluripotent cells are neuroectoderm cells.~~

1~~7~~. A method for generating mammalian patterned neuroectoderm comprising: providing pluripotent cells; inducing development of the pluripotent cells into neuroectoderm by culturing the pluripotent cells in the presence of one or more inhibitors of an activin-nodal pathway and one or more inhibitors of a bone morphogenetic protein pathway; and inducing development of patterned neuroectoderm by culturing the neuroectoderm in the presence of one or more of sonic hedgehog, retinoic acid and noggin.

2~~8~~. A method for generating mammalian oligodendrocyte progenitor cells comprising: providing a pluripotent cell; inducing development of the pluripotent cell into neuroectoderm by culturing the pluripotent cell in the

presence of one or more inhibitors of an activin-nodal pathway and one or more inhibitors of a bone morphogenetic protein pathway; inducing development of patterned neuroectoderm by culturing the neuroectoderm in the presence of one or more of sonic hedgehog, retinoic acid and noggin; and inducing development of oligodendrocyte progenitor cells by culturing the patterned neuroectoderm cells in the presence of one or more of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog.

39. The method of claim 28, wherein two or more of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog are used in the culture of the patterned neuroectoderm cells.

410. The method of claim 39, wherein a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog are used in the culture of the patterned neuroectodermal cells.

511. The method of claim 28, wherein the fibroblast growth factor is FGF2 and the platelet-derived growth factor is PDGF-AA.

612. The method of claim 28, wherein two of retinoic acid, sonic hedgehog and noggin are used in the culture of the neuroectodermal cells.

713. The method of claim 28, wherein retinoic acid, sonic hedgehog and noggin are used in the culture of the neuroectodermal cells.

814. The method of claim 28, wherein at least 75% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

915. The method of claim 814, wherein at least 90% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

10~~16~~. The method of claim 9~~15~~, wherein at least 95% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

11~~17~~. The method of claim 10~~16~~, wherein at least 99% or more of cells resulting from the culture of the patterned neuroectodermal cells are oligodendrocyte progenitor cells.

12~~18~~. The method of claim 2~~8~~, wherein the one or more inhibitors of an activin-nodal pathway is SB431542.

13~~19~~. The method of claim 2~~8~~, wherein the one or more inhibitors of a bone morphogenetic protein pathway is selected from dorsomorphin, LDN-193189 or noggin.

14~~20~~. A composition comprising the oligodendrocyte progenitor cells produced according to claim 2~~8~~.

15~~21~~. The composition of claim 12~~20~~, further comprising neurons or neuron precursors.

16~~22~~. A research tool comprising the oligodendrocyte progenitor cells produced according to claim 2~~8~~.

17~~23~~. A diagnostic tool comprising the oligodendrocyte progenitor cells produced according to claim 2~~8~~.

~~24. A method of treating a medical condition of the CNS in a subject comprising administering to the subject a therapeutically effective amount of the oligodendrocyte progenitor cells produced according to claim 8~~.

18~~25~~. The method of claim 2, further comprising ~~A method for~~ maintaining the oligodendrocyte progenitor cells ~~of claim 8 in cell culture, comprising:~~ by

culturing the oligodendrocyte progenitor cells in the presence of an activator of Wnt-β-catenin signaling pathway.

~~26. A method for maintaining the oligodendrocyte progenitor cells of claim 8 in cell culture, comprising: culturing the oligodendrocyte cells in the presence of fibroblast growth factor (FGF), platelet derived growth factor (PDGF) and sonic hedgehog (SHH).~~

~~27. The method of claim 26, wherein at least 95% of cells in culture are oligodendrocyte progenitor cells.~~

~~28. The method of claim 27, wherein at least 99% of cells in culture are oligodendrocyte progenitor cells.~~

19~~29~~. The method of claim 18~~28~~, wherein the activator of Wnt-β-catenin signaling is a GSK3β inhibitor.

20~~30~~. The method of claim 19~~29~~, wherein the GSK3β inhibitor is CHIR99021.

21~~31~~. A composition comprising the oligodendrocyte progenitor cells maintained according to claim 18~~25~~.

22~~32~~. The composition of claim 21~~31~~, further comprising neurons or neuron precursors.

23~~33~~. A research tool comprising the oligodendrocyte progenitor cells maintained according to claim 18~~25~~.

24~~34~~. A diagnostic tool comprising the oligodendrocyte progenitor cells maintained according to claim 18~~25~~.

~~35. A method of treating a medical condition of the CNS in a subject comprising administering to the subject a therapeutically effective amount of oligodendrocyte progenitor cells maintained according to claim 25.~~

25~~36~~. The method of claim 18, further comprising ~~A method for~~ generating oligodendrocytes from the maintained oligodendrocyte progenitor cells ~~maintained according to claim 25, comprising~~ by culturing the oligodendrocyte progenitor cells in the absence of FGF and PDGF and presence of T3.

~~37. The method of claim 36, where the oligodendrocyte differentiation activator is thyroid hormone.~~

26~~38~~. The method of claim 18, further comprising ~~A method for~~ generating astrocytes from the maintained oligodendrocyte progenitor cells ~~maintained according to claim 25, comprising~~ by culturing the maintained oligodendrocyte progenitor cells in the presence of a bone morphogenetic protein and a JAK/STAT pathway activator.

27~~39~~. The method of claim 26~~38~~, wherein the bone morphogenetic protein is bone morphogenetic protein 4 and the JAK/STAT pathway activator is leukemia inhibitory factor.

28~~40~~. A method for generating mammalian oligodendrocyte progenitor cells and maintaining the mammalian oligdendrocyte progenitor cells in culture comprising: providing pluripotent cells; inducing development of the pluripotent cells into neuroectoderm by culturing the pluripotent cells in the presence of one or more inhibitors of an activin-nodal pathway and one or more inhibitors of a bone morphogenetic protein pathway; inducing development of patterned neuroectoderm by culturing the neuroectoderm in the presence of sonic hedgehog, retinoic acid and noggin; inducing development of oligodendrocyte progenitor cells by culturing the patterned neuroectoderm cells in the presence of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog; and maintaining the

oligodendrocyte progenitor cells by culturing the oligodendrocyte progenitor cells in the presence of an activator of Wnt-β-catenin signaling.

2941. The method of claim 2840, wherein the one or more inhibitors of theanan activin nodal pathway is SB431542 and the one or more inhibitors of theа bone morphogenetic protein pathway is selected from dorsomorphin, LDN-193189 or noggin.

3042. The method of claim 2840, wherein the fibroblast growth factor is FGF2 and the platelet-derived growth factor is PDGF-AA.

3143. The method of claim 2840, wherein at least 95% of cells in culture are oligodendrocyte progenitor cells.

3244. A method for generating patterned neuroectoderm from neuroectoderm comprising culturing the neuroectoderm in the presence of sonic hedgehog, retinoic acid and noggin.

3345. A method for generating oligodendrocyte progenitor cells from patterned neuroectoderm comprising culturing the patterned neuroectoderm cells in the presence of a fibroblast growth factor, a platelet-derived growth factor and sonic hedgehog.

3446. The method of claim 33, further comprising ~~A method for~~ maintaining the oligodendrocyte progenitor cells in cell culture~~, comprising:~~ by culturing the oligodendrocyte progenitor cells in the presence of an activator of Wnt-β-catenin signaling.

3547. The method of claim 34, further comprising ~~A method for~~ generating astrocytes from the oligodendrocyte progenitor cells~~, comprising~~ by culturing the maintained oligodendrocyte progenitor cells in the presence of a bone morphogenetic protein and a JAK/STAT pathway activator.

3648. The method of claim 34, further comprising ~~A method for~~ generating oligodendrocytes from the oligodendrocyte progenitor cells ~~maintained, comprising~~ by culturing the oligodendrocyte progenitor cells in the absence of FGF and PDGF and presence of T3.