What is claimed is:

CLAIMS

1. A method of generating a population of oligodendrocyte progenitor cells (OPCs) comprising:
    a. providing a pluripotent stem cell (PSC);
    b. overexpressing SOX9 in said PSC; and
    c. generating said population of OPCs from said PSC.

2. The method of claim 1, further comprising contacting SOX9 or a nucleic acid molecule encoding SOX9 with said PSC.

3. The method of claim 2, wherein said nucleic acid molecule encoding SOX9 is expressed in said PSC via a vector.

4. The method of claim 1, further comprising contacting a protein encoding SOX9 with said PSC.

5. The method of claim 2, wherein said nucleic acid molecule encoding SOX9 is engineered.

6. The method of claim 2, wherein said PSC is transfected with said nucleic acid molecule encoding SOX9.

7. The method of claim 2, wherein said PSC comprises less than 20 copies of said nucleic acid molecule encoding SOX9 per cell.

8. The method of claim 1, wherein at least 30% of said population of OPCs expresses at least one OPC-specific marker.

9. The method of claim 1, wherein at least one of the following pluripotency genes is down-regulated in a cell of said population of OPCs: POU Class 5 Homeobox 1 (POU5F1), Nanog Homeobox (NANOG), and SRY-Box Transcription Factor 2 (SOX2).

10. The method of claim 1, wherein said PSC is an induced PSC (iPSC).

11. The method of claim 1, wherein (b) further comprises the step of contacting said PSC with an engineered nucleic acid encoding IL- 10 or IFNβ.

12. The method of claim 11, wherein said population of OPCs express or secrete IL- 10 or IFNβ.

13. The method of claim 1, further comprising culturing said population of OPCs to produce an oligodendrocyte.

14. The method of claim 13, wherein said population of OPCs or said oligodendrocyte express at least one biomarker selected from the group consisting of O4, NG2, Myelin Basic Protein (MBP), NK2 Homeobox 1 (NKX2-1), Myelin Oligodendrocyte Glycoprotein (MOG), Myelin Associated Oligodendrocyte Basic Protein (MOBP), OLIG2 (Oligodendrocyte Transcription Factor 2), Chondroitin Sulfate Proteoglycan 4 (CSPG4), Oligodendrocyte Transcription Factor 1 (OLIG1), SRY-Box Transcription Factor 8 (SOX8), SRY-Box Transcription Factor 10 (SOX10), Myelin Regulatory Factor (MYRF), Platelet Derived Growth Factor Receptor Alpha (PDGFRA), Matrix Metallopeptidase 15 (MMP15), Proteolipid Protein 1 (PLP1), Transmembrane Protein 88B (TMEM88B), Ectonucleotide Pyrophosphatase/Phosphodiesterase 6 (ENPP6), A2B5, 2',3'-Cyclic Nucleotide 3' Phosphodiesterase (CNPase), Galactosylceramidase (GALC), Myelin Associated Glycoprotein (MAG), and Neurofascin (NFASC).

15. The method of claim 14, further comprising culturing a first population of said PSCs with at least a second population of PSCs.

16. The method of claim 15, wherein said second population of PSCs comprises a nucleic acid encoding a lineage- specifying gene.

17. The method of claim 15, wherein said second population of PSCs comprises unmodified PSCs.

18. The method of claim 17, wherein said nucleic acid encoding SOX9 is operably linked to an inducible promoter.

19. The method of claim 18, wherein culturing said first population of PSCs with said second population of PSCs induces expression of said nucleic acid molecule encoding SOX9.

20. The method of claim 1, wherein said population of OPCs is to be administered to a patient suffering from demyelination.