CLAIMS

What is claimed is:

1. A method of generating a population of oligodendrocyte progenitor cells (OPCs) comprising:
   (a) contacting pluripotent stem cells (PSCs) with SOX9 or a nucleic acid molecule encoding SOX9; and
   (b) culturing the PSCs to generate said population of OPCs.

2. The method of claim 1, wherein said nucleic acid molecule encoding SOX9 is expressed in said PSCs via a vector.

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

4. The method of claim 1, wherein said nucleic acid molecule encoding SOX9 is engineered.

5. The method of claim 1, wherein said PSCs are transfected with said nucleic acid molecule encoding SOX9.

6. The method of claim 1, wherein said PSCs comprise less than 20 copies of said nucleic acid molecule encoding SOX9 per cell.

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

8. 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).

9. The method of claim 1, wherein said PSCs are induced PSCs (iPSCs).

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

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

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

13. The method of claim 12, 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).

14. The method of claim 13, further comprising culturing a first population of said PSCs with at least a second population of PSCs.

15. The method of claim 14, wherein said second population of PSCs comprises a nucleic acid encoding a lineage- specifying gene.

16. The method of claim 14, wherein said second population of PSCs comprises unmodified PSCs.

17. The method of claim 16, wherein said nucleic acid molecule encoding SOX9 is operably linked to an inducible promoter.

18. The method of claim 17, wherein culturing said first population of PSCs with said second population of PSCs induces expression of said nucleic acid molecule encoding SOX9.