WHAT IS CLAIMED IS:

1. An *in vitro* method for inducing differentiation of stem cells, comprising:

contacting the stem cells with at least one inhibitor of Small Mothers Against Decapentaplegic (SMAD) signaling, at least one activator of Sonic hedgehog (SHH) signaling, and at least one activator of wingless (Wnt) signaling; and

contacting the cells with at least one activator of fibroblast growth factor (FGF) signaling and at least one inhibitor of Wnt signaling to obtain a population of differentiated cells expressing at least one marker indicating a midbrain dopamine neuron or a precursor thereof;

wherein the at least one marker indicating a midbrain dopamine neuron or a precursor thereof is selected from the group consisting of EN1, OTX2, TH, NURR1, FOXA2, PITX3, LMX1A, LMO3, SNCA, ADCAP1, CHRNA4, SOX6, DAT, VMAT2, WNT1, GIRK2, and combinations thereof;

wherein the stem cells are selected from the group consisting of pluripotent stem cells, nonembryonic stem cells, embryonic stem cells, induced pluripotent stem cells, and combinations thereof.

2. The method of claim 1, wherein the contact of the cells with the at least one inhibitor of Wnt signaling is initiated ~~at least~~ about 5 days to about 15 days from the initial contact of the stem cells with the at least one inhibitor of SMAD signaling;

wherein the cells are contacted with the at least one inhibitor of Wnt signaling for about 1 day to about 30 days.

~~3. The method of claim 1 or 2, wherein the contact of the cells with the at least one inhibitor of Wnt signaling is initiated no later than about 15 days from the initial contact of the stem cells with the at least one inhibitor of SMAD signaling.~~

~~4. The method of any one of claims 1-3, wherein the contact of the cells with the at least one inhibitor of Wnt signaling is initiated about 10 days from the initial contact of the stem cells with the at least one inhibitor of SMAD signaling.~~

~~5. The method of any one of claims 1-4, wherein the contact of the cells with the at least one inhibitor of Wnt signaling is initiated 10 days, 11 days, 12 days, or 13 days from the initial contact of the stem cells with the at least one inhibitor of SMAD signaling.~~

~~6. The method of any one of claims 1-5, wherein the cells are contacted with the at least one inhibitor of Wnt signaling for at least about 1 day.~~

~~7. The method of any one of claims 1-6, wherein the cells are contacted with the at least one inhibitor of Wnt signaling for up to about 30 days or up to about 25 days.~~

~~8. The method of any one of claims 1-7, wherein the cells are contacted with the at least one inhibitor of Wnt signaling for about 5 days, about 15 days, or about 20 days.~~

~~9. The method of any one of claims 1-8, wherein the cells are contacted with the at least one inhibitor of Wnt signaling for 4 days, 5 days, 6 days, 7 days, 14 days, 15 days, 19 days, or 20 days.~~

~~10.~~3. The method of ~~any one of~~ claim~~s~~ 1 or 2~~-9~~, wherein the contact of the cells with the at least one activator of FGF signaling is initiated ~~at least~~ about 5 days ~~or at least about 10 days~~ to about 20 days from the initial contact of the cells with the at least one inhibitor of SMAD signaling; wherein the cells are contacted with the at least one activator of FGF signaling for at least about 1 day and/or for up to about 20 days; at least about 3 days and/or for up to about 10 days; or at least 4 days and/or for up to 7 days.

~~11. The method of any one of claims 1-10, wherein the contact of the cells with the at least one activator of FGF signaling is initiated no later than about 20 days, or no later than 18 days from the initial contact of the cells with the at least one inhibitor of SMAD signaling.~~

~~12. The method of any one of claims 1-11, wherein the contact of the cells with the at least one activator of FGF signaling is initiated about 10 days from the initial contact of the cells with the at least one inhibitor of SMAD signaling.~~

~~13. The method of any one of claims 1-12, wherein the contact of the cells with the at least one activator of FGF signaling is initiated 10 days, 11 days, 12 days, or 13 days from the initial contact of the cells with the at least one inhibitor of SMAD signaling.~~

~~14. The method of any one of claims 1-13, wherein the cells are contacted with the at least one activator of FGF signaling for at least about 1 day and/or for up to about 20 days; at least about 3 days and/or for up to about 10 days; or at least 4 days and/or for up to 7 days.~~

~~15. The method of any one of claims 1-14, wherein the cells are contacted with the at least one activator of FGF signaling for about 5 days.~~

~~16. The method of any one of claims 1-15, wherein the cells are contacted with the at least one activator of FGF signaling for 4 days, 5 days, 6 days, or 7 days.~~

~~17.~~4. The method of any one of claims 1-~~316~~, wherein the cells are contacted with the at least one inhibitor of SMAD signaling for about 5 days to about 7 days.

~~18. The method of any one of claims 1-17, wherein the cells are contacted with the at least one inhibitor of SMAD signaling for 6 days or 7 days.~~

~~19.~~5. The method of any one of claims 1-~~418~~, wherein the cells are contacted with the at least one activator of SHH signaling for about 5 days to about 7 days.

~~20. The method of any one of claims 1-19, wherein the cells are contacted with the at least one activator of SHH signaling for 6 days or 7 days.~~

~~21.~~6. The method of any one of claims 1-~~520~~, wherein the cells are contacted with the at least one activator of Wnt signaling for about 15 days to about 17 days.

~~22. The method of any one of claims 1-21, wherein the cells are contacted with the at least one activator of Wnt signaling for 16 days or 17 days.~~

~~23.~~7. The method of any one of claims 1-~~622~~, wherein the concentration of the at least one activator of Wnt signaling is increased about 4 days from its initial contact with the stem cells.

~~24.~~8. The method of claim ~~7~~23, wherein the concentration of the at least one activator of Wnt signaling is increased by between about 200 % and about 1000 % from the initial concentration of the at least one activator of Wnt signaling.

~~25. The method of claim 23 or 24, wherein the concentration of the at least one activator of Wnt signaling is increased by about 500 % from the initial concentration of the at least one activator of Wnt signaling.~~

~~26.~~9. The method of ~~any one of~~ claim~~s~~ 7 or 8~~23-25~~, wherein the concentration of the at least one activator of Wnt signaling is increased to from about 1 μM to between about 5 μM and about 10 μM.

~~27. The method of any one of claims 23-26, wherein the concentration of the at least one activator of Wnt signaling is increased to a concentration of about 6 μM.~~

~~28. The method of any one of claims 1-27, wherein the at least one inhibitor of Wnt signaling is capable of inhibiting non-canonical Wnt signaling and canonical Wnt signaling.~~

~~29.~~10. The method of any one of claims 1-~~9~~28, wherein the at least one inhibitor of Wnt signaling is selected from the group consisting of IWP2, IWR1-endo, XAV939, IWP-O1, Wnt-C59, IWP-L6, and ICG-001, and combinations thereof.

~~30. The method of any one of claims 1-29, wherein the at least one inhibitor of Wnt signaling comprises IWP2.~~

~~31.~~11. The method of any one of claims 1-~~13~~0, wherein the at least one activator of FGF signaling is selected from the group consisting of FGF18, FGF17, FGF8a, FGF8b, FGF4, FGF2, and combination thereof.

~~32. The method of any one of claims 1-31, wherein the at least one activator of FGF signaling is capable of causing expansion of the midbrain and upregulating midbrain gene expression.~~

~~33. The method of claim 32, wherein the at least one activator of FGF signaling is selected from the group consisting of FGF18, FGF17, FGF8a, , FGF4, FGF2, and combination thereof.~~

~~34. The method of claim 33, wherein the at least one activator of FGF signaling comprises FGF18.~~

~~35.~~12. The method of any one of claims 1-11~~34~~, wherein the at least one inhibitor of SMAD signaling comprises an inhibitor of TGFβ/Activin-Nodal signaling, an inhibitor of bone morphogenetic protein (BMP) signaling, or a combination thereof; wherein the at least one inhibitor of TGFβ/Activin-Nodal signaling is selected from the group

consisting of SB431542, A83-01, derivatives of SB431542, and combinations thereof; wherein the at least one inhibitor of BMP signaling is selected from the group consisting of LDN193189, Noggin, dorsomorphin, derivatives of LDN193189, derivatives of Noggin, derivatives of dorsomorphin, and combinations thereof.

~~36. The method of claim 35, wherein the at least one inhibitor of TGFβ/Activin-Nodal signaling comprises an inhibitor of ALK5.~~

~~37. The method of claim 35 or 36, wherein the at least one inhibitor of TGFβ/Activin-Nodal signaling is selected from the group consisting of SB431542, derivatives of SB431542, and combinations thereof.~~

~~38. The method of claim 37, wherein the derivative of SB431542 comprises A83-01.~~

~~39. The method of any one of claims 35-38, wherein the at least one inhibitor of TGFβ/Activin-Nodal signaling comprises SB431542.~~

~~40. The method of claim 35, wherein the at least one inhibitor of BMP signaling is selected from the group consisting of LDN193189, Noggin, dorsomorphin, derivatives of LDN193189, derivatives of Noggin, derivatives of dorsomorphin, and combinations thereof.~~

~~41. The method of claim 35 or 40, wherein the at least one inhibitor of BMP comprises LDN-193189.~~

~~42. The method of any one of claims 1-41, wherein the at least one activator of Wnt signaling comprises an inhibitor of glycogen synthase kinase 3β (GSK3β) signaling.~~

~~43.~~13. The method of any one of claims 1-~~14~~2, wherein the at least one activator of Wnt signaling is selected from the group consisting of CHIR99021, CHIR98014, AMBMP hydrochloride, LP 922056, Lithium, deoxycholic acid, BIO, SB-216763, Wnt3A, Wnt1, Wnt5a, derivatives thereof, and combinations thereof.

~~44. The method of any one of claims 1-43, wherein the at least one activator of Wnt signaling comprises CHIR99021.~~

~~45.~~14. The method of any one of claims 1-13~~44~~, wherein the at least one activator of SHH signaling is selected from the group consisting of SHH proteins, recombinant

SHHs, modified N-terminal SHHs, SHH C25II, Smoothened agonists (SAG), purmorphamine, and combinations thereof.

~~46. The method of claim 45, wherein the SHH protein is selected from the group consisting of recombinant SHHs, modified N-terminal SHHs, and combinations thereof.~~

~~47. The method of claim 46, wherein the modified N-terminal SHH comprises two Isoleucines at the N-terminus.~~

~~48. The method of claim 46 or 47, wherein the modified N-terminal SHH has at least about 90% sequence identity to an un-modified N-terminal SHH.~~

~~49. The method of claim 48, wherein the un-modified N-terminal SHH is a un-modified mouse N-terminal SHH or a un-modified human N-terminal SHH.~~

~~50. The method of any one of claims 46-49, wherein modified N-terminal SHH comprises SHH C25II.~~

~~51. The method of claim 45, wherein the SAG comprises purmorphamine.~~

~~52.~~15. The method of any one of claims 1-~~5~~14, wherein at least about 80% of the differentiated cells express FOXA2 and EN1 about 15 days from the initial contact of the stem cells with the at least one inhibitor of SMAD signaling.

~~53. The method of any one of claims 1-52, wherein greater than about 80% or greater than about 90% of the differentiated cells express FOXA2 and EN1 16 days from the initial contact of the stem cells with the at least one inhibitor of SMAD signaling.~~

~~54. The method of any one of claims 1-53, wherein the at least one marker indicating a midbrain dopamine neuron or a precursor thereof is selected from the group consisting of EN1, OTX2, TH, NURR1, FOXA2, PITX3, LMX1A, LMO3, SNCA, ADCAP1, CHRNA4, SOX6, DAT, VMAT2, WNT1, GIRK2, and combinations thereof.~~

~~55. The method of any one of claims 1-54, wherein the differentiated cells do no express at least one marker selected from the group consisting of PAX6, EMX2, LHX2, SMA, SIX1, PITX2, SIM1, POU4F1, PHOX2A, BARHL1, BARHL2, GBX2, HOXA1, HOXA2, HOXB1, HOXB2, POU5F1, NANOG, and combinations thereof.~~

~~56.~~16. The method of any one of claims 1-~~15~~5, further comprising isolating cells that express at least one positive surface marker and do not express at least one negative surface marker; wherein the at least one positive surface marker is selected from the group consisting of CD171, CD184, and combinations thereof; and wherein the at least one negative surface marker is selected from CD49e, CD99, CD340, and combinations thereof.

~~57. The method of claim 56, wherein the at least one positive surface marker is selected from the group consisting of CD171, CD184, and combinations thereof.~~

~~58. The method of claim 56 or 57, wherein the at least one positive surface marker comprises CD184.~~

~~59. The method of any one of claims 56-58, wherein the at least one negative surface marker is selected from CD49e, CD99, CD340, and combinations thereof.~~

~~60. The method of any one of claims 56-59, wherein the at least one negative surface marker comprises CD49e.~~

~~61. The method of any one of claims 56-60, comprising sorting cells that express CD184 and do not express CD49e.~~

~~62. The method of any one of claims 1-61, wherein the stem cells are pluripotent stem cells.~~

~~63. The method of any one of claims 1-62, wherein the stem cells are selected from the group consisting of nonembryonic stem cells, embryonic stem cells, induced pluripotent stem cells, and combinations thereof.~~

~~64. The method of any one of claims 1-63, wherein the stem cells are human stem cells, non-human primate stem cells, or rodent stem cells.~~

~~65. The method of any one of claims 1-64, wherein the stem cells are human stem cells.~~

~~66.~~17. A cell population of *in vitro* differentiated cells, wherein the *in vitro* differentiated cells are obtained by a method of any one of claims 1-~~16~~5.

~~67.~~18. A composition comprising the cell population of claim 17~~66~~.

~~68.~~19. The composition of claim 18~~67~~, which is a pharmaceutical composition further comprising a pharmaceutically acceptable carrier.

~~69.~~20. A kit for inducing differentiation of stem cells to midbrain dopamine neurons or precursors thereof, comprising:

(a) at least one inhibitor of SMAD signaling;

(b) at least one activator of SHH signaling;

(c) at least one activator of Wnt signaling;

(d) at least one inhibitor of Wnt signaling; ~~and~~

(e) at least one activator of FGF signaling; and

(f) instructions for inducing differentiation of the stem cells into a population of differentiated cells that express at least one marker indicating a midbrain dopamine neuron or a precursor thereof.

~~70. The kit of claim 69, further comprising (f) instructions for inducing differentiation of the stem cells into a population of differentiated cells that express at least one marker indicating a midbrain dopamine neuron or a precursor thereof.~~

~~71. A method of preventing, modeling, and/or treating at least one symptom in a subject having a neurological disorder, comprising administering to the subject an effective amount of one of the followings:~~

~~(a) the cell population of claim 66; or~~

~~(b) the composition of claim 67 or 68.~~

~~72. The method of claim 71, wherein the neurological disorder is characterized by reduction of midbrain dopamine neuron function.~~

~~73. The method of claim 72, wherein the reduction of midbrain dopamine neuron function is age related.~~

~~74. The method of any one of claims 71-73, wherein the neurological disorder is selected from the group consisting of Parkinsonism, Parkinson's disease, Huntington's disease, Alzheimer's disease, multiple sclerosis, and combinations thereof.~~

~~75. The method of any one of claims 71-74, wherein the neurological disorder is selected from the group consisting of Parkinsonism, Parkinson's disease, and combinations thereof.~~

~~76. The method of any one of claims 71-75, wherein the symptom for a neurological disorder is selected from the group consisting of tremor, bradykinesia, flexed posture, postural instability, rigidity, dysphagia, and dementia.~~

~~77. The cell population of claim 66 or the composition of claim 67 or 68 for use in preventing, modeling, and/or treating at least one symptom in a subject having a neurological disorder in a subject.~~

~~78. The cell population or composition for use of claim 77, wherein the neurological disorder is characterized by reduction of midbrain dopamine neuron function.~~

~~79. The cell population or composition for use of claim 78, wherein the reduction of midbrain dopamine neuron function is age related.~~

~~80. The cell population or composition for use of any one of claims 77-79, wherein the neurological disorder is selected from the group consisting of Parkinsonism, Parkinson's disease, Huntington's disease, Alzheimer's disease, multiple sclerosis, and combinations thereof.~~

~~81. The cell population or composition for use of any one of claims 77-80, wherein the neurological disorder is selected from the group consisting of Parkinsonism, Parkinson's disease, and combinations thereof.~~

~~82. The cell population or composition for use of any one of claims 77-81, wherein the symptom for a neurological disorder is selected from the group consisting of tremor, bradykinesia, flexed posture, postural instability, rigidity, dysphagia, and dementia.~~