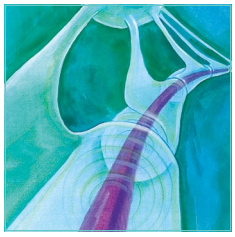


NEUROSCIENCE FOCUS: NEURAL STEM CELLS

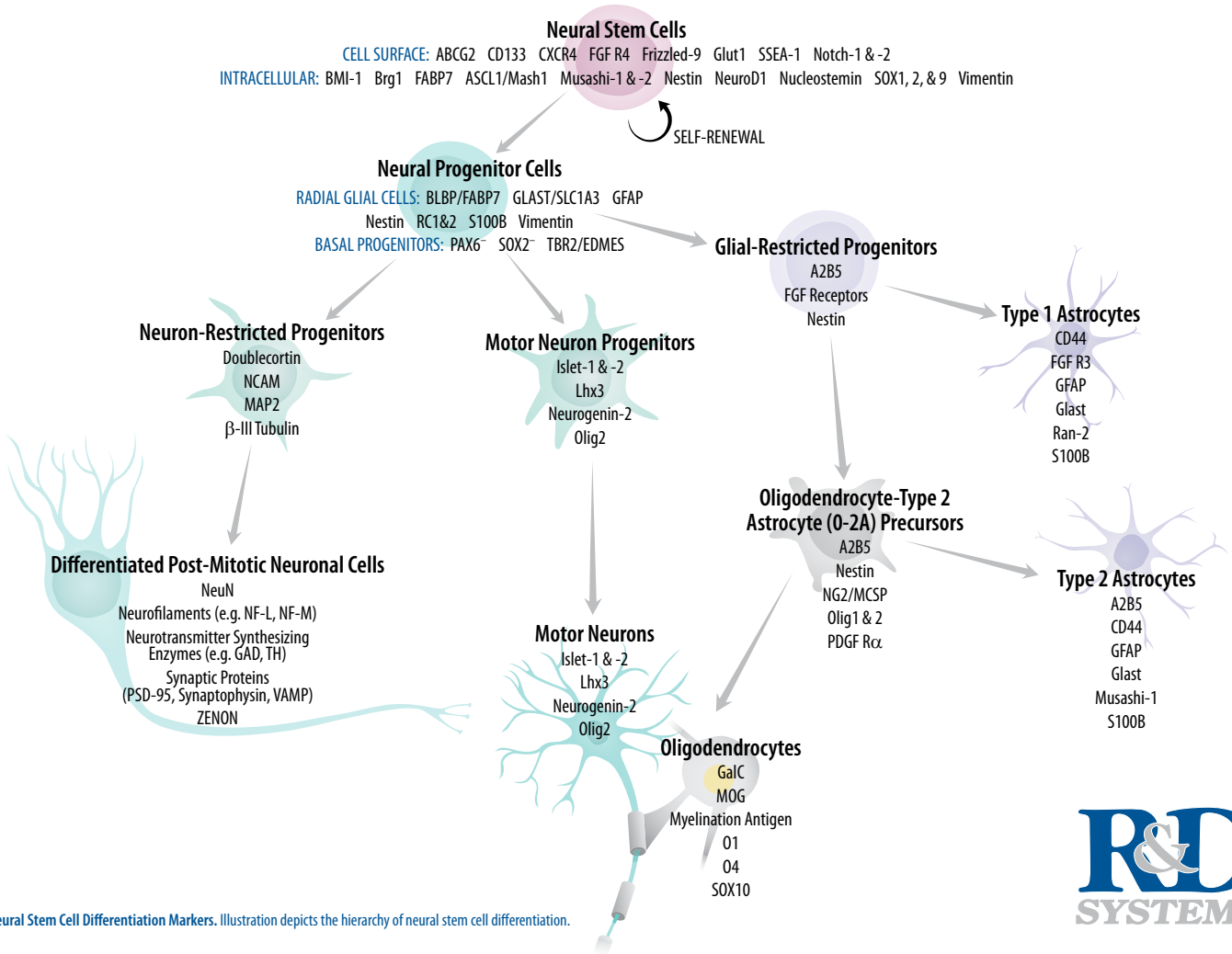
Neural Stem Cells & Differentiation Markers

FEATURED DATA: β-III Tubulin · CXCR4 · E-Cadherin · GFAP · Nestin · Notch-1 · Olig2 · Oligodendrocyte Marker O4 · SOX2 · SSEA-1

Neural Stem Cells

Neural stem cells (NSC) are undifferentiated precursor cells defined by their capacity for self-renewal and multipotency. Through proliferation and division, NSCs generate clonally related progeny that differentiate to form all the major cell types of the central nervous system. These cells include neurons, astrocytes, oligodendrocytes, and the ependymal cells that line the ventricles of the brain. The symmetric division of NSCs underlies their ability to self-renew and serves to maintain the NSC population. In contrast, asymmetric mitosis produces one NSC and one neural progenitor cell (NPC), daughter cells with restricted differentiation capacity for neuronal or glial lineages. In addition, terminal asymmetric division generates two NPCs, but does not contribute to maintaining the NSC pool. Extrinsic factors believed to be essential for NSC maintenance and proliferation include Epidermal Growth Factor, Fibroblast Growth Factors, Sonic Hedgehog, and members of the Wnt family.

Neural Stem Cell Differentiation Markers



Neural Stem Cell Differentiation Markers. Illustration depicts the hierarchy of neural stem cell differentiation.

R&D Systems Products for Neural Stem Cell Expansion & Differentiation

MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
Neural Stem Cell & Progenitor Markers			
ABCG2		H (FC, IHC)	
ASCL1/Mash1		M (IHC, WB)	
BMI-1		H (ChIP, FC, IHC, WB)	H
Brg1		H (WB)	
CDCP1		H (FC, IHC, IP, WB) M (FC, IHC, WB)	
CXCR4		H (B/N, FC, IHC) M (B/N, FC, IHC) F (FC, IHC)	
FABP7/B-FABP		H (IHC, WB)	
FGF R4	H	H (FC, IHC, WB) M (IHC, WB)	H
Frizzled-9		M (IHC, WB)	
GFAP		H (IHC, WB)	
Glut1		H (FC, IHC)	
HOXB1		H (IHC)	
Musashi-1		H (IHC, WB)	
Musashi-2		H (WB)	
Nestin		H (FC, IHC) M (FC, IHC, WB) R (FC, IHC, WB)	
NeuroD1		H (IHC, WB) M (IHC, WB)	
Noggin	H M	M (IHC, WB)	
Notch-1	H M R	H (ChIP, ELISA, FC, IHC, WB) M (FC, IHC, WB) R (B/N, FC, IHC, WB)	H
Notch-2	H M R	H (FC, IHC, WB) M (FC, WB) R (B/N, FC, IHC, WB)	
Nucleostemin		H (IHC, WB) M (IHC, WB) R (IHC, WB)	
Pax6		M (IHC) R (IHC) Ch (IHC)	
PDGF Rα	H M	H (B/N, FC, IHC, IP, WB) M (B/N, IHC, WB)	H M
Prominin 2		H (FC, IHC)	
S100B		H (IHC, WB)	
SOX1		H (IHC, WB) M (WB)	
SOX2		H (ChIP, FC, IHC, WB) M (FC, IHC, WB)	H M
SOX21		H (IHC, WB)	
SOX9		H (IHC, WB)	
SSEA-1		H (FC, IHC, IP) M (FC, IHC, IP)	
Vimentin	H	H (FC, IHC, WB)	
Neuronal Lineage Markers			
ACE/CD143	H M	H (FC, IHC, IP, WB) M (ELISA, FC, IHC, IP, WB)	H M
ALCAM/CD166	H M		H M
α-Internexin		H (IHC, WB) M (WB) R (WB)	
CD90/Thy1		H (FC)	
GAD1/GAD67		H (IHC, WB)	
GAD2/GAD65		H (IHC, WB)	
Glut1		H (FC, IHC)	
HOXA1		H (IHC, WB)	
Latexin	H M	H (IP, WB) M (B/N, IP, WB)	
MSX1		H (WB) M (WB)	
NCAM-L1/L1CAM	H M	H (IHC, WB) M (FC)	
Nectin-2/CD112	H M	H (FC, WB) M (WB)	
NeuroD1		H (IHC, WB) M (IHC, WB)	
NeuroD2		H (WB) M (WB)	

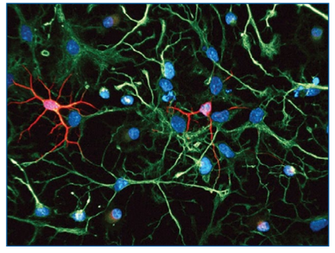
MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
NF-H		H (IHC, WB)	
NF-L		H (IHC, WB)	
NF-M		H (IHC, WB)	
PRG-1/LPPR4		H (WB)	
PSD-95		H (WB) M (WB) R (WB)	
ROBO3	H M	H (IHC, WB) M (IHC, WB)	
Synaptophysin		H (IHC, WB) R (IHC, WB)	
TLE3		H (WB) M (WB)	
β-III Tubulin		Ms (FC, IHC, WB)	
Tyrosine Hydroxylase		M (IF, IHC, WB) R (IF, IHC, WB) Ms (IF, IHC, IP, WB) Pr (IF, IHC, WB)	
VAMP-1		H (IHC, WB) M (IHC, WB)	
VAMP-1/VAMP-2		H (IHC, WB) M (IHC, WB)	
VAMP-2		H (IHC, WB) M (IHC, WB) R (WB)	
VAMP-7		H (IHC, WB)	
VAMP-8		H (WB)	
Motor Neuron Markers			
Islet-1		H (IHC, WB)	
Islet-2		H (IHC, WB)	
Neurogenin-2		H (IHC) R (IHC)	
Olig2		H (ChIP, IHC, WB)	H
Glial Lineage Markers			
A2B5		H (FC, IHC) M (FC, IHC) R (FC, IHC) Ch (FC, IHC)	
Carbonic Anhydrase II/CA2	H	H (IHC, IP, WB)	
CD44	H M R	H (FC, IHC, IP, WB) M (B/N, WB) R (B/N, WB) Ca (FC)	
Claudin-11		H (FC)	
Claudin-12		H (FC, IHC)	
FABP6		H (IHC, WB)	
FGF R1-4		H (WB)	
FGF R1	H	H (B/N, WB)	H
FGF R1α	H		
FGF R1β	H		
FGF R2	H M	H (B/N, FC, IHC, WB) M (B/N, WB)	H
FGF R2α	H M	H (WB)	H
FGF R2β	H M		
FGF R3	H M	H (B/N, FC, IHC, WB) M (B/N)	H
FGF R4	H	H (FC, IHC, WB) M (IHC, WB)	H
FGF R5/FGFRL1	M	H (WB) M (IHC, WB)	
GFAP		H (IHC, WB)	
GMF-β		H (IHC, WB)	
LINGO-1		H (FC, IHC, WB)	
LRRN1/NLRR-1		H (IHC, WB) M (IHC, WB)	
LRRN3/NLRR-3	H		
MAG/Siglec-4a	R	R (B/N, ELISA, IHC, WB)	R
MBP		H (WB) M (WB) R (WB) B (WB)	
Meteorin	M	M (ELISA, IHC, WB)	M

R&D Systems Products for Neural Stem Cell Expansion & Differentiation

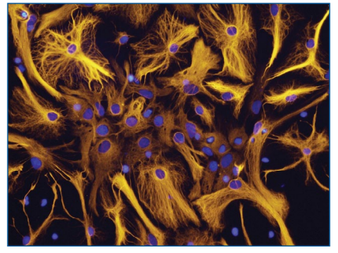
MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
Meteorin-like/METRNL	M		
MOG		H (IHC, WB) M (IHC, WB)	
Musashi-1		H (IHC, WB)	
Nestin		H (FC, IHC) M (FC, IHC, WB) R (FC, IHC, WB)	
Neurofascin	R	H (IHC, WB) M (IHC, WB) R (IHC, WB)	
Neuroglycan C/CSPG5	H M	H (IHC, WB) M (IHC, WB) R (IHC, WB)	
NG2/MCSP		H (FC, IHC, IP, WB) M (FC, IHC) R (FC)	
NGF R/TNFRSF16	H M	H (FC, IHC, WB) M (IHC, WB)	
NgR3/NgRH2		H (WB)	
Nogo Receptor/NgR	H M	H (B/N, WB) M (WB)	
Olig 1, 2, 3		H (FC, IHC)	
Olig1		H (IHC, WB) M (IHC, WB)	
Olig2		H (ChIP, IHC, WB)	H
Olig3		H (IHC, WB) M (IHC, WB)	
Oligodendrocyte Marker 01		H (FC, IHC) M (FC, IHC) R (FC, IHC) Ch (FC, IHC)	
Oligodendrocyte Marker 04		H (FC, IHC) M (FC, IHC) R (FC, IHC) Ch (FC, IHC)	
OMgp	H M	H (WB) M (WB)	
PDGF Rα	H M	H (B/N, FC, IHC, IP, WB) M (B/N, IHC, WB)	H M
PLP		H (IHC)	
S100B		H (IHC, WB)	
SLC22A1		H (WB)	
SOX10		H (IHC, WB) R (IHC)	
TROY/TNFRSF19	H M	H (WB) M (ELISA, IHC, WB)	M
Growth Factors & Receptors			
Macroglobulin	H	H (IHC, IP, WB) M (WB)	
Activin A	H M R	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB) R (B/N, ELISA, IHC, WB)	H M R

MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
Activin AB	H		
Activin AC	H		
Activin B	H	H (B/N, WB)	
Activin C		H (IHC, WB) M (WB)	
Activin RIA/ALK-2	H M	H (FC, IHC, WB)	
Activin RIB/ALK-4	H M	H (B/N, FC, WB) M (B/N, IHC, WB)	
Activin RIIA	H M	H (B/N, FC, IHC, WB)	
Activin RIIA/B		H (WB)	
Activin RIIB	H M	H (B/N, FC, IHC, WB)	
BMP-1/PCP	H	H (IHC, IP, WB)	
BMP-10	H M	H (B/N, WB) M (B/N, IHC, WB)	
BMP-15/GDF-9B	H	H (IHC, WB) M (IHC, WB) R (WB)	
BMP-2	H Z	H (B/N, ELISA, IHC, WB) Z (B/ N, WB)	H M R
BMP-2/BMP-4		H (B/N, IHC, WB) Z (WB)	
BMP-2/BMP-7 Heterodimer	H	H (WB)	
BMP-2a	Z		
BMP-3	H	H (IHC, WB)	
BMP-3b/GDF-10	H	H (IHC, WB)	
BMP-4	H M Z	H (B/N, ELISA, IHC, WB) Z (WB)	H
BMP-4/BMP-7 Heterodimer	H		
BMP-5	H M	H (B/N, ELISA, IHC, WB) M (IHC, WB)	H
BMP-6	H M	H (B/N, ELISA, IHC, WB) M (IHC, WB)	H
BMP-7	H M	H (B/N, ELISA, IHC, WB)	H
BMP-8		H (IHC, WB)	
BMP-8a	H		
BMP-8b		H (WB) M (WB)	
BMP-9	H M	H (B/N, ELISA, WB) M (B/N, ELISA, WB)	H

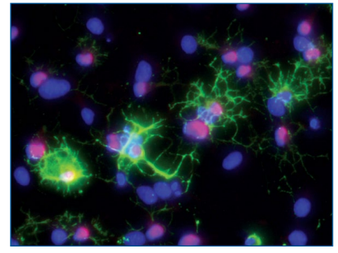
Species Key: H Human M Mouse R Rat B Bovine Ca Canine Ch Chicken Ms Multispecies P Porcine Pr Primate Z Zebrafish
Application Key: **B/N** Blocking/Neutralization **ChIP** Chromatin Immunoprecipitation **ELISA** ELISA Capture and/or Detection **FC** Flow Cytometry **IF** Immunofluorescence **IHC** Immunohistochemistry **IP** Immunoprecipitation **WB** Western blot



β-III Tubulin and Nestin in Differentiated Rat Cortical Stem Cells. β-III Tubulin and Nestin were detected in immersion-fixed differentiated Rat Cortical Stem Cells (Catalog # NSC001) using a Mouse Anti-Neuron-specific β-III Tubulin Monoclonal Antibody (Catalog # MAB1195) and a Goat Anti-Rat Nestin Antigen Affinity-purified Polyclonal Antibody (Catalog # AF2736). The cells were stained for β-III Tubulin using the NorthernLights™ 557-conjugated Donkey Anti-Mouse IgG Secondary Antibody (Catalog # NL007; red) and for Nestin using the NorthernLights 493-conjugated Donkey Anti-Goat IgG Secondary Antibody (Catalog # NL003; green). Nuclei were counterstained with DAPI (blue).



GFAP in Differentiated Rat Cortical Stem Cells. Glial Fibrillary Acidic Protein (GFAP) was detected in immersion-fixed differentiated Rat Cortical Stem Cells (Catalog # NSC001) using a NorthernLights 557-conjugated Sheep Anti-Human GFAP Monoclonal Antibody (Catalog # NL2594R; yellow). Nuclei were counterstained with DAPI (blue).



Olig2 and Oligodendrocyte Marker O4 in Differentiated Rat Cortical Stem Cells. Olig2 and Oligodendrocyte Marker O4 were detected in immersion-fixed 7 day differentiated Rat Cortical Stem Cells (Catalog # NSC001) using a Goat Anti-Human Olig2 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF2418) and a Mouse Anti-Human/Mouse/Rat/Chicken Oligodendrocyte Marker O4 Monoclonal Antibody (Catalog # MAB1326). The cells were stained for Olig2 using the NorthernLights 637-conjugated Donkey Anti-Goat IgG Secondary Antibody (Catalog # NL002; red), and stained for O4 using an anti-mouse IgM secondary antibody (pseudo-stained green). Nuclei were counterstained with DAPI (blue).

MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
Growth Factors & Receptors, continued			
BMPR-IA/ALK-3	H M	H (FC, IHC, WB)	
BMPR-IB/ALK-6	H M	H (FC, IHC, WB) M (WB)	
BMPR-II	H M	H (FC, IHC, WB)	
CELSR2		H (IHC, WB)	
Desert Hedgehog/ Dhh	H M	M (IHC, WB)	
Draxin	H M	H (IHC, WB) M (IHC, WB) R (IHC, WB)	
EGF	H M R	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB) R (B/N, ELISA, WB)	H M R
EGF R/ErbB1	H M	H (ELISA, FC, IHC, IP, WB) M (IHC, WB)	H
EGF-L6	M		
FGF acidic	H M B	H (B/N, IHC, WB) M (WB) B (B/N, WB)	H
FGF basic	H M R B	H (B/N, ELISA, IHC, WB) B (B/N, WB)	H
FGF R1	H	H (B/N, WB)	H
FGF R1-4		H (WB)	
FGF R1α	H		
FGF R1β	H		
FGF R2	H M	H (B/N, FC, IHC, WB) M (B/N, WB)	H
FGF R2α	H M	H (WB)	H
FGF R2β	H M		
FGF R3	H M	H (B/N, FC, IHC, WB) M (B/N)	H
FGF R4	H	H (FC, IHC, WB) M (IHC, WB)	H
FGF R5/FGFRL1	M	H (WB) M (IHC, WB)	
FGF-10	H M	H (IHC, WB) M (IHC, WB)	
FGF-11		H (WB)	
FGF-12	H	H (WB)	
FGF-13		H (WB)	
FGF-15		M (IHC)	
FGF-16	H	H (B/N, WB)	
FGF-17	H	H (B/N, IHC, WB)	
FGF-19	H	H (B/N, ELISA, IHC, WB)	H
FGF-20	H	H (B/N, IHC, WB)	
FGF-21	H	H (FC, IHC, WB) M (WB)	H M
FGF-22	H	H (B/N, WB)	
FGF-23	H M	H (B/N, WB) M (IHC, WB)	
FGF-3	H	H (B/N, IHC, WB)	
FGF-4	H M	H (B/N, ELISA, IHC, WB) M (IHC, WB)	H
FGF-5	H	H (B/N, IHC, WB)	
FGF-6	H M	H (B/N, ELISA, WB) M (IHC)	
FGF-8	H M	H (B/N, IHC, WB) M (B/N, IHC, WB)	
FGF-9	H	H (B/N, ELISA, IHC, WB)	H
FGF-BP	H R	H (WB) R (B/N, IHC, WB)	
Fibronectin	H B	H (FC, IHC, IP, WB)	
Frizzled-1	H M	H (FC, IHC, WB) M (FC, IHC, WB)	
Frizzled-10	H		
Frizzled-2	M	M (WB)	

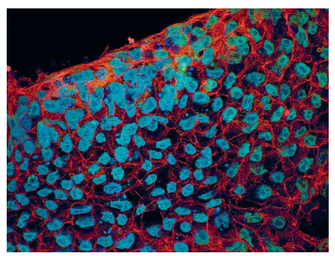
MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
Frizzled-3		H (FC, IHC, WB) M (FC, IHC, WB)	
Frizzled-4	H M	H (FC, IHC, WB) M (FC, IHC, WB)	
Frizzled-5	H	H (WB)	
Frizzled-6		H (FC, WB) M (FC, IHC, WB)	
Frizzled-7	H M	H (FC, IHC) M (FC, IHC, WB)	
Frizzled-8	H M	M (IHC, WB)	
Frizzled-9		M (IHC, WB)	
GDF-1	H	M (WB)	
GDF-11/BMP-11	H		
GDF-15	H	H (ELISA, WB) M (IHC)	H
GDF-3	H M	H (IHC, WB) M (IHC, WB)	
GDF-5/BMP-14	M	M (B/N, IHC, WB)	
GDF-6/BMP-13	M		
GDF-7/BMP-12	M	M (WB)	
GDF-8/Myostatin	H M R	H (B/N, IHC, WB) M (B/N, IHC, WB) R (B/N, IHC, WB)	
GDF-9	M	M (IHC, WB)	
GFRα-1/GDNF Rα-1	H R	H (IHC, WB) R (B/N, IHC, WB)	
GFRα-2/GDNF Rα-2	H M	H (B/N, IHC, WB) M (B/N, IHC, WB)	
GFRα-3/GDNF Rα-3	H M	H (IHC, WB) M (IHC, WB)	
GFRα-4/GDNF Rα-4		H (WB) M (IHC, WB)	
IGFBP-1	H M	H (B/N, ELISA, WB) M (IHC, WB)	H
IGFBP-2	H M	H (B/N, ELISA, WB) M (B/N, ELISA, WB)	H M
IGFBP-3	H M	H (B/N, ELISA, IHC, WB) M (ELISA, WB)	H M
IGFBP-4	H	H (B/N, ELISA, IHC, WB)	H
IGFBP-5	H M	H (ELISA, IHC, WB) M (ELISA, IHC, WB)	H M
IGFBP-6	H M	H (B/N, ELISA, WB) M (ELISA, IHC, WB)	H M
IGFBP-L1	M	H (WB) M (IHC, WB)	
IGFBP-rp1/IGFBP-7	H M	H (IHC, WB) M (IHC, WB)	
IGFBP-rP10		H (WB) M (WB)	
IGF-I	H M R	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB)	H M R
IGF-I R	H M	H (B/N, ELISA, FC, IHC, WB) M (B/N, FC, IHC, WB)	H
IGF-II	H M	H (B/N, IHC, WB) M (B/N, ELISA, IHC, WB)	M
IGF-II R	H	H (B/N, ELISA, FC, IHC, WB)	H
IGFL-3		H (IHC, WB)	
Indian Hedgehog/ Ihh	H M	H (WB) M (IHC, WB)	
KGF/FGF-7	H M Ca	H (B/N, ELISA, IHC, WB) Ca (IHC)	H
LRP-1 Cluster II	H	H (WB)	
LRP-1 Cluster III	H	H (IHC, WB)	
LRP-1 Cluster IV	H		
LRP-1B		H (WB)	
LRP-4		H (IHC, WB) R (IHC, WB)	
LRP-5		H (WB)	
LRP-6	H M	H (FC, IHC, WB) M (WB)	
MESDC2	M	H (IHC, WB) M (IHC, WB)	
Meteorin	M	M (ELISA, IHC, WB)	M

R&D Systems Products for Neural Stem Cell Expansion & Differentiation

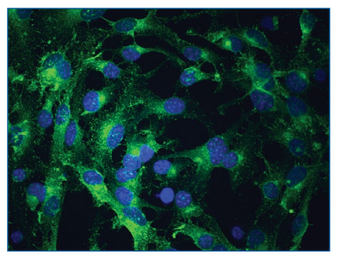
MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
Meteorin-like/ METRNL	M		
NGF R/TNFRSF16	H M	H (FC, IHC, WB) M (IHC, WB)	
Noggin	H M	M (IHC, WB)	
Patched 1/PTCH		M (FC, IHC, WB)	
Patched 2/PTCH2		H (FC, IHC, WB)	
PDGF	H P	H (B/N, WB) Ms (B/N, WB)	
PDGF Rα	H M	H (B/N, FC, IHC, IP, WB) M (B/N, IHC, WB)	H M
PDGF Rβ	H M	H (B/N, FC, IHC, IP, WB) M (IHC, WB)	H M
PDGF-A		H (ELISA, WB)	
PDGF-AA	H R	H (B/N, ELISA, IHC, WB) R (B/N, IHC, WB) Ms (B/N, WB)	H M
PDGF-AB	H R	H (B/N, ELISA, IHC, WB) Ms (B/N, WB)	H M R
PDGF-B		H (B/N, ELISA, WB) Ms (B/N, WB)	
PDGF-BB	H R	H (B/N, ELISA, WB)	H M R
PDGF-C		H (B/N, IHC, WB) M (B/N, IHC, WB)	
PDGF-CC	H M		
PDGF-D		H (B/N, IHC, WB)	
PDGF-DD	H		
PIGF-2	M	M (B/N, ELISA, WB)	M
ROR1 Receptor Tyrosine Kinase		H (FC, WB)	H
RTK-like Orphan Receptor 2/ROR2		H (FC, WB)	H
Ryk		H (WB) M (IHC, WB)	
SDNSF/MCFD2		H (IHC, WB) M (IHC, WB)	
Sonic Hedgehog/Shh	H M	H (FC, WB) M (B/N, ELISA, FC, IHC, WB)	M
TGF-α	H	H (B/N, ELISA, IHC, WB)	H
TGF-β RI/ALK-5	M	H (FC, IHC, WB) M (FC, WB)	
TGF-β RII	H M	H (B/N, ELISA, FC, IHC, WB) M (FC, WB)	H
TGF-β RIIb	H	H (WB)	

MOLECULE	RECOMBINANT PROTEINS	ANTIBODIES	ELISAs
TGF-β RIII	H M	H (ELISA, FC, WB) M (FC, WB)	H
VEGF	H M R Ca F Z	H (B/N, ELISA, FC, IF, IHC, WB) M (B/N, ELISA, IHC, WB) R (B/N, ELISA, IHC, WB) Ca (B/N, ELISA, IHC, WB) Z (B/N, WB)	H M R Ca
VEGF R1, R2, R3		H (FC)	
VEGF R1/Flt-1	H M	H (B/N, ELISA, FC, IHC, WB) M (B/N, ELISA, FC, IHC, WB)	H M
VEGF R2/KDR/Flk-1	H M	H (B/N, ELISA, FC, IHC, WB) M (B/N, ELISA, FC, IHC, WB)	H M
VEGF R3/Flt-4	H M	H (ELISA, FC, IHC, WB) M (ELISA, FC, WB)	H M
VEGF/PIGF Heterodimer	H	H (WB)	H
VEGF-B	H M	H (IHC, WB) M (B/N, IHC, WB)	
VEGF-C	H	H (IHC, WB) M (WB) R (WB)	H
VEGF-D	H M	H (B/N, ELISA, IHC, WB) M (ELISA, IHC, WB)	H M
Wnt-1		M (IHC, WB)	
Wnt-2		H (IHC, WB)	
Wnt-2b		M (IHC, WB)	
Wnt-3a	H M	H (B/N, WB) M (B/N, WB)	
Wnt-4	H M	H (WB) M (IHC, WB)	
Wnt-5a	H M	H (IHC, WB) M (IHC, WB) R (IHC, WB)	
Wnt-5b	M	M (IHC)	
Wnt-6		H (IHC, WB)	
Wnt-7a	H	H (IHC, WB)	
Wnt-7b		H (IHC, WB)	
Wnt-8a		M (IHC, WB)	
Wnt-8b		H (IHC, WB) M (IHC, WB)	
Wnt-9a		H (IHC, WB)	
Wnt-9b	M	H (IHC, WB) M (IHC, WB)	
Wnt-10b	M	M (WB)	
Wnt-11	H	H (IHC, WB) M (IHC, WB)	

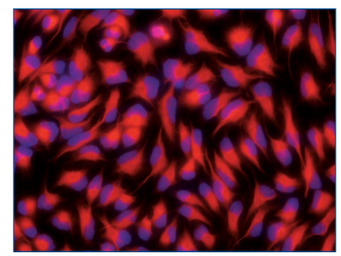
Species Key: H Human M Mouse R Rat B Bovine Ca Canine Ch Chicken Ms Multispecies P Porcine Pr Primate Z Zebrafish
Application Key: **B/N** Blocking/Neutralization **ChIP** Chromatin Immunoprecipitation **ELISA** ELISA Capture and/or Detection **FC** Flow Cytometry **IHC** Immunohistochemistry **IP** Immunoprecipitation **WB** Western blot



E-Cadherin and SOX2 in BG01V Human Embryonic Stem Cells. E-Cadherin and SOX2 were detected in BG01V human embryonic stem cells using a Goat Anti-Human E-Cadherin Antigen Affinity-purified Polyclonal Antibody (Catalog # AF648) and a Mouse Anti-Human/Mouse SOX2 Monoclonal Antibody (Catalog # MAB2018). The cells were stained for E-Cadherin using the NorthernLights 557-conjugated Donkey Anti-Goat IgG Secondary Antibody (Catalog # NL001; green) and for SOX2 using the NorthernLights 493-Conjugated Donkey Anti-Mouse Secondary Antibody (Catalog # NL009; red). Nuclei were counterstained with DAPI (blue).



Notch-1 in Differentiated Mouse Cortical Stem Cells. Notch-1 was detected in immersion-fixed 7 day differentiated Mouse Cortical Stem Cells (Catalog # NSC002) using the goat anti-rat Notch-1 antigen affinity-purified antibody included in the Human/Mouse/Rat Neural Progenitor Cell Marker Antibody Panel (Catalog # SC025). The cells were stained using the NorthernLights 493-Conjugated Donkey Anti-Goat Secondary Antibody (Catalog # NL003; green) and nuclei were counterstained with DAPI (blue).



Nestin in Undifferentiated Rat Cortical Stem Cells. Nestin was detected in immersion-fixed undifferentiated Rat Cortical Stem Cells (Catalog # NSC001) using a Mouse Anti-Rat Nestin Monoclonal Antibody (Catalog # MAB2736). The cells were stained using the NorthernLights 557-conjugated Donkey Anti-Mouse IgG Secondary Antibody (Catalog # NL007; red) and counterstained with DAPI (blue).

Neural Stem Cells: Primary Cells, Culture Supplements, & Complete Kits

Primary Cortical Stem Cells

R&D Systems offers ready-to-use primary cortical stem cells isolated from E14.5 Sprague-Dawley rats or E14.5 CD-1 mice. Every lot is tested for high levels of Nestin expression and the capacity for multi-lineage differentiation (astrocytes, neurons, and oligodendrocytes). Depending on your research needs, cortical stem cells can be optimally expanded as monolayers or neurospheres.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Rat Cortical Stem Cells	1 vial; Vial contains 3 x 10^6 cells	NSC001	1 vial
Mouse Cortical Stem Cells	2 vials; Each vial contains 2 x 10^6 cells	NSC002	2 vials

StemXVivo™ Culture Matrix

StemXVivo Culture Matrix is a defined proprietary mixture of recombinant human adhesion molecules for the culture of stem/progenitor cells. It can be used as a substitute for EHS basement membrane extract (such as Matrigel™) or as a feeder layer in the maintenance and/or differentiation of stem/progenitor cells. The culture matrix is tested for its ability to support attachment and growth of multiple stem/progenitor cell populations.

PRODUCT	DESCRIPTION	CATALOG #	SIZE
StemXVivo™ Culture Matrix	A defined proprietary mixture of recombinant human adhesion molecules for the culture of stem/progenitor cells. Supplied as a 100X concentrate in PBS.	CCM013	1.0 mL

StemXVivo is a trademark of R&D Systems, Inc. Matrigel is a trademark of Becton Dickinson and Company.

Fibronectin Coating Substrates

Fibronectin plays an important role in normal morphogenesis, including cell adhesion, migration, differentiation, and specific gene expression.

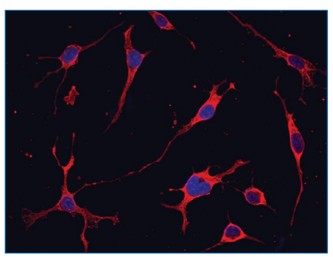
PRODUCT	DESCRIPTION	CATALOG #	SIZE
Human Fibronectin, CF	Human plasma-derived	1918-FN-02M	2 mg
Bovine Fibronectin, CF	Bovine plasma-derived	1030-FN-01M	1 mg
Bovine Fibronectin, CF	Bovine plasma-derived	1030-FN-05M	5 mg
Recombinant Human Fibronectin, CF	NS0 murine myeloma cell line-derived.	4305-FN-200	200 µg
Recombinant Human Fibronectin Fragment 2, CF	NS0 murine myeloma cell line-derived.	3225-FN-100	100 µg
Recombinant Human Fibronectin Fragment 4, CF	NS0 murine myeloma cell line-derived.	3624-FN-050	50 µg
Recombinant Human Fibronectin Fragment 3, CF	NS0 murine myeloma cell line-derived.	3938-FN-050	50 µg
Recombinant Human Fibronectin, ACFP	*Spodoptera frugiperda*, *Sf* 9 (baculovirus)-derived. Produced in an animal component free process (ACFP).	ACFP4305	50 µg

CF Carrier Free Carrier Free proteins do not contain bovine serum albumin (BSA).

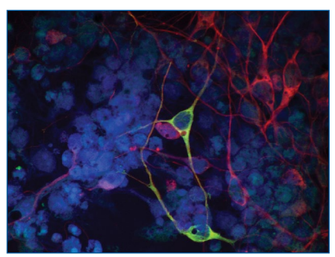
N-2 MAX Media Supplement

A serum-free, chemically defined, concentrated media supplement formulated to provide optimal growth conditions for neural stem cell expansion. N-2 MAX is composed of Human Insulin, Human Transferrin, Putrescine, Selenite, and Progesterone.

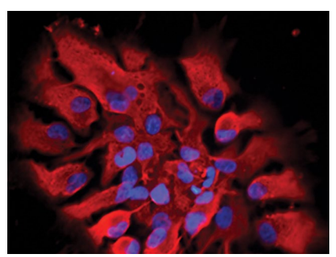
PRODUCT	DESCRIPTION	CATALOG #	SIZE
N-2 MAX Media Supplement	A modification of Bottenstein's formulation, providing optimal conditions for neural stem cell expansion. Sufficient for 500 mL of medium. The supplement is supplied as a 100X concentrate in deionized water.	AR009	5 mL



CXCR4 in Differentiated Rat Cortical Stem Cells. Chemokine (C-X-C motif) Receptor 4 (CXCR4) was detected in immersion-fixed 7 day differentiated Rat Cortical Stem Cells (Catalog # NSC001) using the mouse anti-human CXCR4 monoclonal antibody included in the Human/Mouse/Rat Neural Progenitor Cell Marker Antibody Panel (Catalog # SC025). The cells were stained using the NorthernLights™ 637-Conjugated Donkey Anti-Mouse Secondary Antibody (Catalog # NL008; red) and nuclei were counterstained with DAPI (blue).



Dopaminergic Neuron Differentiation. Dopaminergic neurons generated using the Dopaminergic Neuron Differentiation Kit (Catalog # SC001B) were immersion-fixed and incubated with a mouse anti-tyrosine hydroxylase monoclonal antibody followed by the NorthernLights™ 493-conjugated Donkey Anti-Mouse IgG Secondary Antibody (Catalog # NL009; green). In addition, cells were incubated with a NorthernLights 577-conjugated Mouse Anti-Neuron-specific β-III Tubulin Monoclonal Antibody (Clone TuJ-1) (Catalog # NL1195R; red). The nuclei were counterstained with DAPI (blue).



Vimentin in Differentiated Human Neural Stem Cells. Vimentin was detected in immersion-fixed differentiated human neural stem cells using the rat anti-human Vimentin monoclonal antibody included in the Human/Mouse/Rat Neural Progenitor Cell Marker Antibody Panel (Catalog # SC025). The cells were stained using the NorthernLights 637-Conjugated Goat Anti-Rat Secondary Antibody (Catalog # NL014; red) and nuclei were counterstained with DAPI (blue). *Data courtesy of Dr. S. Hu, University of Minnesota.*

Neural Progenitor Cell Marker Kit

The Human/Mouse/Rat Neural Progenitor Cell Marker Antibody Panel is designed for the identification and characterization of human, mouse, or rat neural progenitor cells by marker expression using immunocytochemistry and flow cytometry techniques.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Human/Mouse/Rat Neural Progenitor Cell Marker Antibody Panel	Contains 25 µg each of antibodies to rat Notch-2, human CXCR4, human Vimentin, human/mouse SSEA-1, human Musashi-1, human SOX1, human/mouse SOX2, and rat Nestin.	SC025	1 Kit

Neural Precursor Cell-based Screening & Bioassay Kit

The Neural Precursor Cell-based Screening & Bioassay Kit is intended as an *in vitro* screening tool to determine how bioactive agents, such as toxins, drugs, and growth factors, influence neural precursor differentiation and proliferation.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Neural Precursor Cell-based Screening & Bioassay Kit	Neural Stem Cell Maintenance Supplement, Neural Differentiation Supplement, Fibronectin, HRP-conjugated Anti-Neuron-Specific β-III Tubulin, Resazurin, Buffers, Substrates, and Diluents	SC014	1 Kit

Neural Differentiation Kits

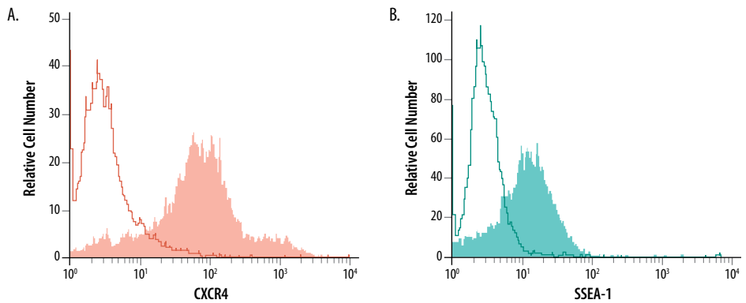
Kits are available for the serum-free differentiation of embryonic stem cells into dopaminergic neurons or oligodendrocytes. Each kit contains specially formulated media supplements and a growth factor panel designed to direct the differentiation to the specific neural lineage. These kits contain sufficient reagents for the induction of approximately 3 x 10^7 embryonic stem cells.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Human/Mouse Dopaminergic Neuron Differentiation Kit	ITS Media Supplement, N-2 Plus Media Supplement, FGF basic, FGF-8b, Fibronectin, Shh-N	SC001B	1 Kit
Mouse Oligodendrocyte Differentiation Kit	ITS Media Supplement, N-2 Plus Media Supplement, EGF, FGF basic, Fibronectin, PDGF-AA	SC004	1 Kit

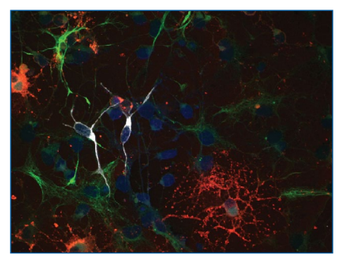
Neural Multi-Color Immunocytochemistry Kit

Kit contains three fluorochrome-conjugated primary antibodies that can be used together for single-step immunocytochemical staining of human, mouse, or rat neural cell types. The antibodies included in the kit specifically stain oligodendrocytes, neurons, or astrocytes to simplify the identification of these three cell types.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Human/Mouse/Rat Neural 3-Color Immunocytochemistry Kit	NL557-conjugated Anti-Oligodendrocyte Marker O4, NL637-conjugated Anti-β-III Tubulin, NL493-conjugated Anti-GFAP	SC024	1 Kit



Detection of Neural Cell Progenitor Markers CXCR4 and SSEA-1 by Flow Cytometry. Cells were stained with antibodies included in the Human/Mouse/Rat Neural Progenitor Cell Marker Antibody Panel* (Catalog # SC025). **A.** CXCR4 was detected in undifferentiated Mouse Cortical Stem Cells (Catalog # NSC002) using a mouse anti-CXCR4 monoclonal antibody (filled histogram) or a mouse IgG_{2A} isotype control (open histogram). **B.** SSEA-1 was detected in undifferentiated Rat Cortical Stem Cells (Catalog # NSC001) using a mouse anti-SSEA-1 monoclonal antibody (filled histogram) or a mouse IgM isotype control (open histogram). Cells were stained using PE-conjugated secondary developing reagents. **This panel also includes primary antibodies to detect Nestin, SOX1, SOX2, Vimentin, Notch-1, and Musashi-1.*



β-III Tubulin, GFAP, and O4 in Differentiated Rat Cortical Stem Cells. β-III Tubulin, GFAP, and Oligodendrocyte Marker O4 were simultaneously detected in immersion-fixed 7 day differentiated Rat Cortical Stem Cells (Catalog # NSC001) using the Human/Mouse/Rat Neural 3-Color Immunocytochemistry Kit (Catalog # SC024). Proteins were detected using antibodies included in the kit: neurons were stained with a NorthernLights (NL) 637-conjugated mouse anti-neuron-specific β-III Tubulin monoclonal antibody (gray), astrocytes were stained with a NL493-conjugated sheep anti-GFAP antigen affinity-purified polyclonal antibody (green), and oligodendrocytes were stained with a NL557-conjugated mouse anti-Oligodendrocyte Marker O4 monoclonal antibody (red). Nuclei were counterstained with DAPI (blue).

R&D Systems, Inc.
614 McKinley Place NE
Minneapolis, MN 55413
TEL: (800) 343-7475
(612) 379-2956
FAX: (612) 656-4400
www.RnDSystems.com

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Recent Citations: R&D Systems References for Neural Stem Cell-related Products

1. Takemoto, T. *et al.* (2011) Tbx6-dependent Sox2 regulation determines neural or mesodermal fate in axial stem cells. Nature **470**:394.

   Goat Anti-Human SOX2 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF2018)

   Sample: Mouse embryo
   Application: Immunohistochemistry

2. Huang, X. *et al.* (2011) CHL1 negatively regulates the proliferation and neuronal differentiation of neural progenitor cells through activation of the ERK1/2 MAPK pathway. Mol. Cell Neurosci. **46**:296.

   Recombinant Mouse CHL-1/L1CAM-2 (Catalog # 2147-CH)

   Sample: Mouse neural progenitor cells
   Application: Bioassay

   Goat Anti-Mouse CHL-1/L1CAM-2 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF2147)

   Sample: Mouse brain
   Application: Immunohistochemistry

3. Boneva, N. *et al.* (2011) Expression of Fatty Acid-Binding Proteins in adult hippocampal neurogenic niche of post-ischemic monkeys. Hippocampus **21**:162.

   Sheep Anti-Human FABP3 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF1678)

   Goat Anti-Human FABP5 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF3077)

   Goat Anti-Human FABP7 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF3166)

   Sample: *Macaca fuscata* (Japanese monkey) brain
   Application: Immunohistochemistry and Western blot

4. Mutnal, M. *et al.* (2011) Murine cytomegalovirus infection of neural stem cells alters neurogenesis in the developing brain. PLoS One **6**:e16211.

   APC-conjugated Rat Anti-Human/Mouse Oct-3/4 Monoclonal Antibody (Catalog # IC1759A)

   PE-conjugated Mouse Anti-Mouse/Rat Nestin Monoclonal Antibody (Catalog # IC2736P)

   Sample: Mouse brain (single-cell suspension)
   Application: Flow cytometry

5. Fang, J.D. *et al.* (2011) Endogenous expression of matriptase in neural progenitor cells promotes cell migration and neuron differentiation. J. Biol. Chem. **286**:5667.

   Mouse Laminin I (Catalog # 3400-010-01)

   Sample: Mouse neural progenitor cells
   Application: Adhesion of cells to culture wells

   Recombinant Human FGF basic (Catalog # 233-FB)

   Sample: Mouse neural progenitor cells
   Application: Proliferation

   Sheep Anti-Human/Mouse CCR4 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF5207)

   Sample: Mouse neural progenitor cells
   Application: Immunocytochemistry

   Sheep Anti-Human Matriptase/ST14 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF3946)

   Sample: Mouse neural progenitor cells
   Application: Immunocytochemistry and Western blot

6. Imaizumi, Y. *et al.* (2011) Galectin-1 is expressed in early-type neural progenitor cells and down-regulates neurogenesis in the adult hippocampus. Mol. Brain **4**:7.

   Goat Anti-Mouse Galectin-1 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF1245)

   Sample: Mouse brain
   Application: Immunohistochemistry

7. Andersson, T. *et al.* (2011) Noggin and Wnt3a enable BMP4-dependent differentiation of telencephalic stem cells into GluR-agonist responsive neurons. Mol. Cell. Neurosci. **47**:10.

   Recombinant Human FGF-basic (Catalog # 233-FB)

   Sample: Rat neural stem cells
   Application: Proliferation

   Recombinant Mouse Wnt-3a (Catalog # 1324-WN)

   Recombinant Human BMP-4 (Catalog # 314-BP)

   Sample: Rat neural stem cells
   Application: Differentiation

   Recombinant Mouse Noggin (Catalog # 1967-NG)

   Sample: Rat neural stem cells
   Application: Blocking differentiation

   Goat-Anti Mouse Noggin Antigen Affinity-purified Polyclonal Antibody (Catalog # AF719)

   Sample: Rat neural stem cell culture media
   Application: Immunodepletion

8. Vik-Mo, E.O. *et al.* (2011) A comparative study of the structural organization of spheres derived from the adult human subventricular zone and glioblastoma biopsies. Exp. Cell Res. **317**:1049.

   Mouse Anti- Human Nestin Monoclonal Antibody (Catalog # MAB1259)

   Mouse Anti-Human/Mouse SOX2 Monoclonal Antibody (Catalog # MAB2018)

   Sample: Human neurosphere and tumorsphere
   Application: Immunohistochemistry

   PE-conjugated Mouse Anti- Human/Mouse SSEA-1 Monoclonal Antibody Catalog # FAB2155P)

   Sample: Human neurosphere and tumorsphere
   Application: Flow cytometry