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Product Guide

Neuroscience



Antibodies, Proteins, Kits,  
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Neuroscience Research

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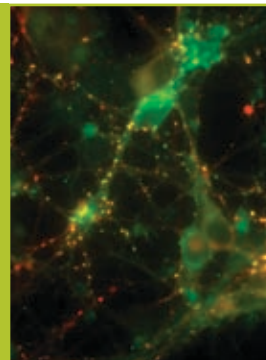
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IS NOW A PART OF MILLIPORE

# What is Neuroscience?

"Men ought to know that from nothing else but the brain comes joys, delights, laughter and sports, and sorrows, griefs, despondency, and lamentations. And by this... we acquire wisdom and knowledge, and see and hear....and know what are foul and what are fair, what are bad and what are good, what are sweet and what unsavory....And by the same organ we become mad and delirious and fears and terrors assail us.... All these things we endure from the brain."

– Hippocrates, *Functions of the Brain*, 12, 300 BCE



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We have so many new products that only a select few have been included in this brochure. For complete listings, please visit our website at [www.millipore.com](http://www.millipore.com).

**Photo on cover:** Guinea Pig anti-VGLUT1 (Cat. No. AB5905) and Mouse anti-Synapsin (Cat. No. MAB355). Localization of VGLUT1 (green) and Synapsin (red) in rat brain Hippocampal cells thawed and cultured for 7 days. The cells were obtained from QBMCell Science, QBMCellScience.com. Photo courtesy of QBMCell Science.

Understanding our complex brain requires dedicated research from overlapping but diverse fields of science. From biophysics to molecular biology, cell physiology, and cognitive neuroscience, researchers are utilizing a broad range of tools to advance brain science. The delicacy and complexity of neural systems requires the utmost in precision methods, from basic laboratory reagents like water, filtration, and culture reagents, to specific biotools like antibodies, kits, cell lines, and immunodetection reagents.

## Millipore is Your Complete Neuroscience Solution Provider.

By combining the immunoresearch reagent expertise and resources of Chemicon®, Upstate®, and Linco® with their globally respected line of sample preparation, filtration, and laboratory water, Millipore is now the leading provider of neuroscience research products for research on the central and peripheral nervous systems.

Our vast portfolio includes everything from pathway-, cell type-, and state-specific antibodies and stem cell lines to neurological disease assays and markers. Products for every major disease and research area within neuroscience are available from Millipore's well supported and rapidly growing line. In addition, Millipore helps neuroscientists to optimize laboratory productivity and improve experiment repeatability by providing high-quality, reliable, innovative reagents, kits, and other enabling technologies for life science research and development.

Millipore is committed to creating and supplying key tools for research, which spans development, differentiation, and disorders in the nervous system.

# Development

Breakthrough studies have recently rejected the long-standing belief that neuronal tissue is incapable of regeneration. The discovery that neurons, astrocytes and oligodendrocytes arise from neural stem cells has created new opportunities for treating central nervous system diseases, including Parkinson's Disease. Successful engraftment of Neural Stem Cells (NSCs)

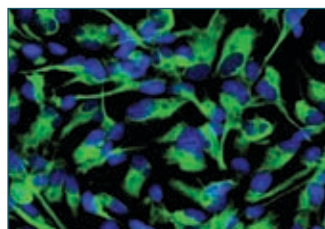
following implantation into the brains of rodent models has demonstrated the potential of neural stem cells in the development of regenerative therapeutic strategies. Millipore has developed an extensive array of neural stem cell products for both rodent and human systems. These products include novel cell lines derived from both adult and embryonic neural tissue, optimized media for expansion and differentiation of these cells, and a complete selection of antibodies for effective characterization.

## ReNcell™ CELLS & MEDIA

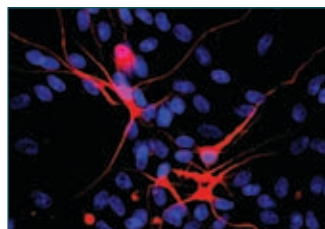
### Benefits

- o Convenient source of immortalized, human fetal neural progenitor cells
- o Immortalized cells replicate indefinitely, maintaining karyotype stability
- o ReNCell Neural Progenitors are multipotent – they have been shown to differentiate into all three major neuronal lineages (neurons, astrocytes, oligodendrocytes)
- o Readily expandable in proprietary, serum-free, defined ReNcell Maintenance Media

Description	Quantity	Cat. No.
ReNcell CX Kit (SCC007, SCM005, SCM007)	1 kit	SCC009
ReNcell CX Immortalized Cell Line	> 1 x 10 <sup>6</sup> cells	SCC007
ReNcell Freezing Medium	50 mL	SCM007
ReNcell Maintenance Media	500 mL	SCM005
ReNcell VM Immortalized Cell Line	> 1 x 10 <sup>6</sup> cells	SCC008
ReNcell VM Kit (SCC008, SCM005, SCM007)	1 kit	SCC010



ReNcell cells express the marker Nestin (ReNcell CX shown, Nestin, green; Hoechst nuclear stain, blue; 60X C.



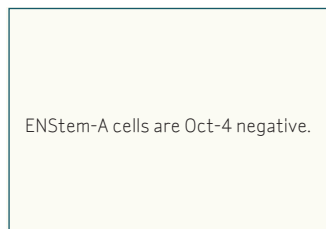
ReNcell cells are readily differentiated into all three neuronal phenotypes: neurons, astrocytes (GFAP, red, 40X, shown) and oligodendrocytes.

## ENStem™-A CELLS & MEDIA

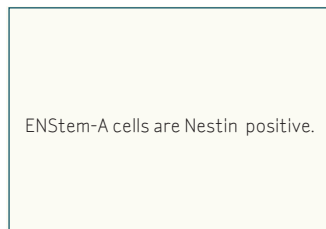
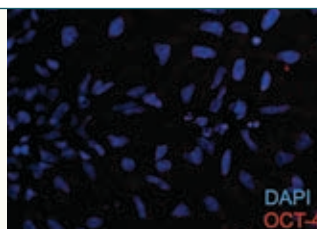
### Benefits

- o Derived from NIH-approved WA09 cell line, >95 % positive for neural stem cell markers
- o Cryopreserved cells are provided with Neural Expansion Medium for optimal growth conditions
- o Grow in adherent monolayers for complete versatility of study
- o Maintain karyotype stability following differentiation to neural sub-types
- o Can be used in multiple quantitative analyses or neurotoxicity screening

Description	Quantity	Cat. No.
ENStem-A Human Neural Expansion Media	500 mL	SCM004
ENStem-A Human Neural Freezing Media	50 mL	SCM011
ENStem-A Human Neural Progenitor Expansion Kit (> 1 x 10 <sup>6</sup> , plus SCM004)	1 kit	SCRO55
ENStem-A Human Neuronal Differentiation Media	100 mL	SCC017



ENStem-A cells are Oct-4 negative.



ENStem-A cells are Nestin positive.

## SERUM-FREE NEURONAL & NEURAL STEM CELL CULTURE

### Benefits

#### NDiff® Neuro-2 Medium Supplement

- o Serum-free supplement developed for the *in vitro* differentiation of murine embryonic stem (ES) cells into post-mitotic neurons particularly via monolayer differentiation<sup>1-3</sup>
- o For the derivation, propagation and maintenance of mouse neural stem cells<sup>4-6</sup>

#### NDiff Neuro-27 Medium Supplement

- o Serum-free supplement developed for the *in vitro* propagation and maintenance of undifferentiated murine embryonic stem (ES) cells<sup>1</sup>
- o Also used to differentiate murine ES cells into post-mitotic neurons, particularly via monolayer differentiation<sup>2-3</sup>

Description	Quantity	Cat. No.
EmbryoMax® DMEM/F12 media, with L-Glutamine, without HEPES	500 mL	DF-042-B
NDiff Neuro-2 Medium Supplement (200x)	5 mL	SCM012
NDiff Neuro-27 Medium Supplement (100x)	10 mL	SCM013

### References:

1. Nichols J, Ying QL. (2006) Derivation and propagation of embryonic stem cells in serum- and feeder-free culture. *Methods Mol Biol.* **329**:91-8.
2. Ying QL, Smith AG. (2003) Defined conditions for neural commitment and differentiation. *Methods Enzymol.* **365**:327-41.
3. Ying QL, Stavridis M, Griffiths D, Li M, Smith A. (2003) Conversion of embryonic stem cells into neuroectodermal precursors in adherent monoculture. *Nat Biotechnol.* **21**(2):183-6.
4. Conti L, Reitano E, Cattaneo E. (2006) Neural stem cell systems: diversities and properties after transplantation in animal models of diseases. *Brain Pathol.* **16**(2):143-54.
5. Pollard SM, Conti L, Sun Y, Goffredo D, Smith A. (2006) Adherent neural stem (NS) cells from fetal and adult forebrain. *Cereb Cortex.* **16** Suppl 1:i112-20.
6. Conti L, Pollard SM, Gorba T, Reitano E, Toselli M, Biella G, Sun Y, Sanzone S, Ying QL, Cattaneo E, Smith A. (2005) Niche-independent symmetrical self-renewal of a mammalian tissue stem cell. *PLoS Biol.* **3**(9):e283.



MAB5654 Anti-PROX1 staining in rat dentate gyrus.

Photo courtesy of Ms. Katie Mitterling and Dr. Teresa Milner.

## MARKERS FOR DEVELOPMENTAL BRAIN RESEARCH

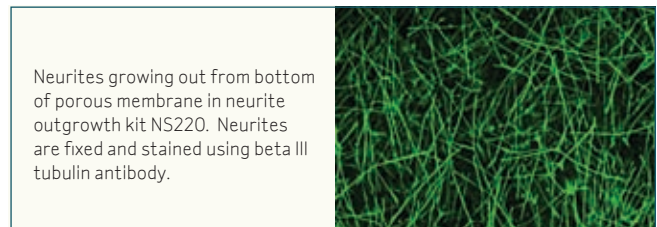
The study of the developing nervous system beyond stem cell biology has a long history. Recent advances in protein isolation and molecular biology have greatly improved the identification of neural-specific developmental processes and allowed significant advances in the field. As a result, novel brain proteins involved in development and maturation of the various systems account for a significant portion of the new targets studied to date.

### Some of the Newest Reagents:

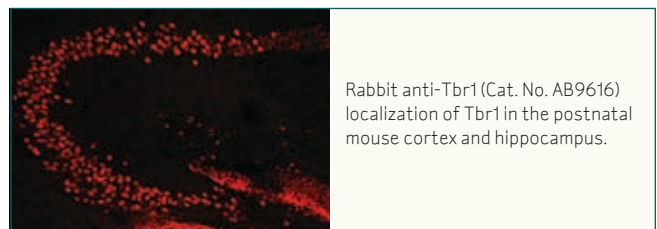
Description	Quantity	Cat. No.
Anti-DUF1220	100 µL	AB15369
Anti-Fbx2	100 µg	AB15184P
Anti-PROX1	100 µg	MAB5652
Anti-PROX1	100 µg	MAB5654
Anti-Tbr1	100 µg	AB9616
Anti-Tbr2	100 µg	AB9618
Neurite Outgrowth Assay - 1 µm	1 kit (12 assays)	NS225
Neurite Outgrowth Assay - 3 µm	1 kit (12 assays)	NS220

### Most Requested Antibodies:

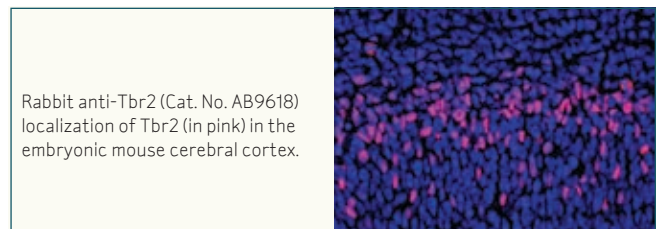
Description	Quantity	Cat. No.
Anti-Brain Lipid-Binding Protein	100 µL	AB9558
Anti-Doublecortin (DCX)	50 µL	AB5910
Anti-Musashi-1	100 µg	AB5977
Anti-Neural Cell Adhesion Molecule (NCAM)	50 µg	AB5032
Anti-Olig-2	100 µL	AB9610
Anti-TrkA	200 µg	06-574



Neurites growing out from bottom of porous membrane in neurite outgrowth kit NS220. Neurites are fixed and stained using beta III tubulin antibody.



Rabbit anti-Tbr1 (Cat. No. AB9616) localization of Tbr1 in the postnatal mouse cortex and hippocampus.



Rabbit anti-Tbr2 (Cat. No. AB9618) localization of Tbr2 (in pink) in the embryonic mouse cerebral cortex.

# The Differentiated Nervous System

Once differentiated, neural stem cells have the potential to become one of the three major cell types in the central nervous system: neurons, astrocytes, or oligodendrocytes. These building blocks of the brain must expand, connect, and mature to create the sophisticated functions that we well understand. The study of the differentiated nervous system includes many disparate fields, converging on the following key research areas to which Millipore is strongly dedicated.

## NEURAL/GLIAL MARKERS

The differentiated central nervous system is a complex environment composed of an estimated 100 billion neurons and at least that many glial support cells. An amazing diversity of neuronal and glial structure and function can lead to difficulties in identifying specific cell types. Likewise, lack of distinguishing features often confounds classification of newly differentiated cells in primary or slice cultures. Millipore has available numerous antibodies to assist in the identification, cellular and subcellular localization, and measurement of defining structures in most cell types comprising the differentiated central and peripheral nervous systems.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-4.1N Protein	100 µL	AB9578
Anti-βIII-Tubulin	100 µg	MAB5564
Anti-Myelin oligodendrocyte glycoprotein (MOG)	100 µg	MAB5680
Anti-RC2 (radial glia marker)	Inquire	MAB5740
Anti-Tryptophan Hydroxylase 1 (TPH1)	100 µL	AB15570
Anti-Tryptophan Hydroxylase 2 (TPH2)	100 µL	AB15572

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Choline Acetyltransferase (ChAT)	500 µL	AB144P
Anti-Glial Fibrillary Acidic Protein (GFAP)	40 µg	MAB3402
Anti-Glial Fibrillary Acidic Protein (GFAP)	50 µL	AB5804
Anti-Glutamate Decarboxylase 1 (GAD67)	100 µg	MAB5406
Anti-Microtubule-Associated Protein 2 (MAP2), clone AP20	200 µg	MAB3418
Anti-Microtubule-Associated Protein 2 (MAP2)	100 µL	AB5622
Anti-NG2 Chondroitin Sulfate Proteoglycan	100 µg	AB5320
Anti-Neuron Specific Nuclear Protein (NeuN)	500 µg	MAB377
Anti-Oligodendrocyte O4	500 µg	MAB345
Anti-Sox2	100 µg	AB5603
Anti-Tau 1, clone PC1C6	100 µg	MAB3420
Anti-Tyrosine Hydroxylase	100 µL	AB152
Anti-Tyrosine Hydroxylase, clone LNC1	100 µL	MAB318
Anti-Vesicular Glutamate Transporter 1 (VGLUT1)	50 µL	AB5905

## SYNAPTIC PROTEINS/ RECEPTORS/TRANSPORTERS

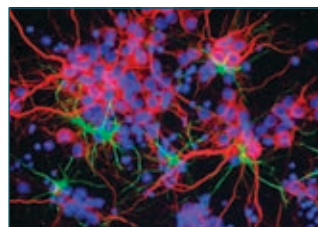
Synaptic biology is at the heart of all neuroscience processes. Synapses provide not only neuronal signal transmission but their modulation. Not surprisingly, the vast majority of all neuropharmacological agents on the market today act at the synapse. Synaptic dynamics, receptor function, and neurotransmitter transport are heavily studied to gain insight into learning, memory, addictions, and many neurological diseases and disorders.

### Some of the Newest Antibodies:

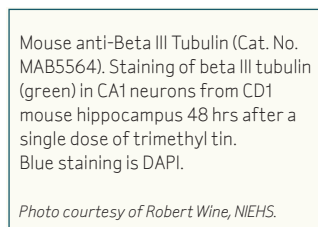
Description	Quantity	Cat. No.
Anti-Dopamine Transporter [DAT]	100 µg	AB15344
Anti-Flotillin-1	100 µL	AB9292
Anti-Glycine Receptor α4	100 µg	AB9696
Anti-NMDAR1	50 µL	AB9864
Anti-Stargazin	100 µg	AB9876

### Most Requested Antibodies:

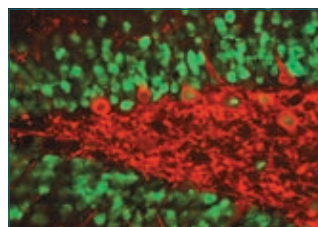
Description	Quantity	Cat. No.
Anti-α-Synuclein	50 µL	AB5038
Anti-Dopamine Transporter (DAT), N-terminus	100 µL	MAB369
Anti-Glutamate Receptor 1 (GluR1)	50 µg	AB1504
Anti-Glutamate Transporter, Glial (GLT-1)	50 µL	AB1783
Anti-Vesicular Glutamate Transporter 1 (VGLUT1)	50 µL	AB5905



Mouse anti-MAP2 (Cat. No. MAB3418). Localization of MAP2 (red) and GFAP (green) in rat Cortical cells thawed and cultured for 7 days. The blue staining is DAPI. The cells were obtained from QBMCell Science, QBMCellScience.com. Photo courtesy of QBMCell Science.



Mouse anti-Beta III Tubulin (Cat. No. MAB5564). Staining of beta III tubulin (green) in CA1 neurons from CD1 mouse hippocampus 48 hrs after a single dose of trimethyl tin. Blue staining is DAPI. Photo courtesy of Robert Wine, NIEHS.



Mouse anti-NeuN (Cat. No. MAB377) and Rabbit anti-Substance P Receptor (Cat. No. AB5060) staining of normal rat hippocampus. NeuN immunoreactivity in green and Substance P Receptor immunoreactivity in red. Photo courtesy of Dr. Robert Sloviter.

## NERVOUS EXCITABILITY - Channels & Associated Proteins

Membrane depolarization is a special cellular characteristic taken to the extreme in neuronal tissue. The study of channel structure and function is still a demanding and complicated field despite the decided progress made following the Hodgkin/Huxley years. Interest in nervous excitability for modulation and disease states has been facilitated greatly by protein structure and function studies, and Millipore's antibody tools from the expertise of Chemicon have long been entrenched in this research.

### Numerous New Antibodies...

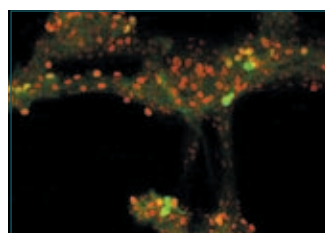
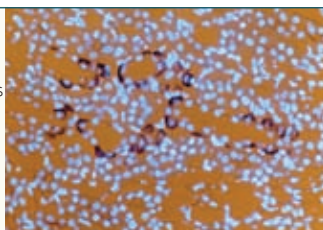
are available for the following targets; please see website at [www.millipore.com](http://www.millipore.com) for more details.

- o Calcium Channels
- o Epithelial Sodium Channels
- o Hyperpolarization Activated Cation Channels
- o Potassium Channels
- o Sodium Channels

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Calcium Channel, Voltage Gated $\alpha$ -1C	200 $\mu$ L	AB5156
Anti-Calcium Channel, Voltage Gated $\alpha$ -1D	200 $\mu$ L	AB5158
Anti-Sodium Channel, Voltage Gated, brain type II (Nav1.2)	200 $\mu$ L	AB5206
Anti-Sodium Channel Nav1.8, pain	50 $\mu$ L	AB9274-50UL

Rabbit anti-ROMK1 (Cat. No. AB5196). Staining of rat kidney. Cat. No. AB5196 staining is black and appears in segments of the cross section of ducts. The counterstain is the fluorescent dye DAPI (blue).  
*Photo courtesy of Dr. Shai Shoham, Herzog Hospital, Jerusalem.*



Rabbit anti-Pan Voltage Gated Sodium Channel, SP19 (Cat. No. AB5210). Staining of two myenteric ganglia with Cat. No. AB5210 (red) and an antibody to calbindin (green) which stained some of the neurons. *Photo courtesy of Dr. W. Hartig, Leipzig University; Dr. M. Hanani, Hebrew University, Jerusalem.*

## NEURAL STRUCTURE & SOMATIC FUNCTION

More than any other cell type, neurons are easily recognizable by the general public at a young age. The long sinewy processes and delicate branched structures of the archetypal textbook neurons do indeed reflect their unique functions in processing and transmitting information. Underlying this neural structure is a unique, neural-specific set of proteins that are under intense research.

From the structural protein and useful neural marker MAP2 to the gateway signaling protein DARPP-32 involved in addiction and schizophrenia, Millipore is creating specific antibodies to novel neuronal soma targets. Besides Millipore's exclusive neuronal nuclear marker NeuN (Cat. No. MAB377), our neurofilament antibody selection is the most extensive available, and many of the phosphospecific products are to key proteins in neural somatic function.

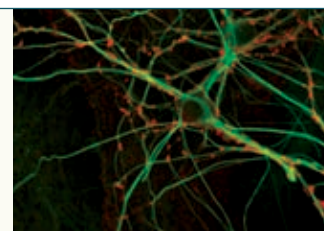
### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-4.1G Protein	100 $\mu$ L	AB9576
Anti-4.1N Protein	100 $\mu$ L	AB9578
Anti- $\alpha$ -Tubulin, detyrosinated	100 $\mu$ L	MAB5566
Anti- $\beta$ II-Tubulin	100 $\mu$ L	MAB5562
Anti-Peripherin	50 $\mu$ L	AB9282
Anti-Proteolipid Protein (PLP)	500 $\mu$ L	AB15454

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti- $\beta$ III-Tubulin, C-terminus	100 $\mu$ L	MAB1637
Anti-Calbindin D-28K	100 $\mu$ L	AB1778
Anti-Calretinin	100 $\mu$ L	AB5054
Anti-Choline Acetyltransferase (ChAT)	500 $\mu$ L	AB144P
Anti-Dopamine and cAMP Regulated Phosphoprotein (DARPP-32)	100 $\mu$ L	AB1656
Anti-Glutamate Transporter, Glial (GLAST)	50 $\mu$ L	AB1782
Anti-Growth Associated Protein 43 (GAP-43)	100 $\mu$ L	AB5220
Anti-Microtubule-Associated Protein 2 (MAP2)	100 $\mu$ L	AB5622
Anti-Microtubule Associated Protein, MAP2A and 2B	200 $\mu$ g	MAB3418
Anti-Neuron-Specific Nuclear Protein (NeuN)	500 $\mu$ g	MAB377
Anti-Nitrotyrosine	100 $\mu$ g	06-284
Anti-Tyrosine Hydroxylase (TH)	100 $\mu$ L	AB152
Anti-Tyrosine Hydroxylase (TH)	100 $\mu$ L	MAB318

Rabbit anti-4.1G (Cat. No. AB9576) localization of 4.1G (green) in rat hippocampus neuronal cultures.



## SENSORY SYSTEMS

Sensory system dysfunction is often the most keenly felt result of neural damage or developmental disorder. Both peripheral and central processing mechanisms in the visual, auditory, olfactory, gustatory, and nociceptive systems have significant research programs, with vision and pain research dominating the field. Millipore has an extensive array of precision neuroscience antibodies, assays, and kits for most facets of vision research, including: lens, retinal structure and pharmacology, circadian rhythm, eye development, and vision-related diseases.

We also have many key targets in pain reception, transmission, and modulation (see Pain in the Disorders section of this piece). We have also added olfactory and taste receptors to our vast line of sensory receptor antibodies. Furthermore, these and additional Millipore products are available for the identification, localization, and quantification of peripheral and CNS sensory system targets in a variety of applications including Western blot, immunohistochemistry, flow cytometry, and high-throughput screening.

## HOMEOSTATIC & HORMONE SYSTEMS

Hypothalamic function has long been known to be critical in maintaining body homeostasis, including blood pressure, glucose levels and satiety. Recent identification of key neurohormones and receptors has demonstrated a much more extensive role for the CNS in monitoring and adjusting key body parameters, now also including energy expenditure and growth and reproductive hormones. The balance and timing of anabolic and catabolic reactions in the body now seems tied to CNS function. Millipore has a very comprehensive set of antibodies targeting many of the receptors and associated proteins involved in cardiovascular, glucose, lipid/obesity, and growth and reproductive metabolism.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-Ghrelin, active & proform	100 µL	AB15157
Anti-PYY	100 µL	AB15666
Anti-Secretagogin	100 µg	MAB5622
Anti-Sortilin	50 µL	AB9584-50UL
Anti-Timeless (TIM)	50 µg	AB15550

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Cocaine and Amphetamine Related Transcript (CART)	50 µg	AB5340P
Anti-Ghrelin, active	100 µg	AB9756
Anti-Neuropeptide Y(NPY)	100 µL	AB1583
Anti-Phospho-Leptin Receptor (Tyr985)	100 µg	07-097

# Signal Transduction in Neuroscience

Neurons, like all cells, are dynamic entities, sensing and responding to their immediate environment through a battery of receptors. The staggering diversity in neuronal receptors and channels reflects an underlying complexity in intracellular signaling that drives neuronal development, excitability, and plasticity. From key phosphorylation and histone modification events in most neuronal processes, to CaM kinase regulation of synaptic plasticity and memory, to activation of AMPK pathways in hypothalamic energy regulation, signal transduction pathways continue to be important targets in basic and drug research.

### Most requested products for signal transduction and chromatin:

Description	Quantity	Cat. No.
Anti-Acetyl Histone H3 (Lys 9 & 14)	200 µg	06-599
Anti-Dimethyl Histone H3 (Lys9)	100 µg	07-441
Anti-Dimethyl Histone H3 (Lys4)	200 µL	07-030
Anti-Phospho Histone H3 (Ser10), mitosis marker	200 µg	06-570
Anti-Phospho HistoneH2A.X (Ser139)	200 µg	05-636
Anti-Phosphoserine, clone 4A4	100 µg	05-1000
Anti-Phospho-Ser/Thr/Pro, mitotic protein monoclonal 2	200 µg	05-368
Anti-Phosphotyrosine, clone 4G10®	100 µg	05-321
Anti-Phosphotyrosine, Platinum 4G10/PY20	100 µg	05-1050
Anti-Trimethyl Histone H3 (Lys9)	100 µg	07-442
EZ-ChIP™ kit	22 assays	17-371
Magna-ChIP™ Kits (with protein A or G, respectively)	22 assays	17-610/17-611

### Most requested products for cell signaling:

Description	Quantity	Cat. No.
Anti-Calmodulin	100 µg	05-173
Anti-Phospho CREB (Ser133)	200 µL	06-519
Anti-PI3 Kinase, p85	125 µL	06-195
Anti-MAP Kinase (Erk) 1/2, C-terminus	100 µg	06-182
Anti-NFκB, p65 active subunit	100 µg	MAB3026

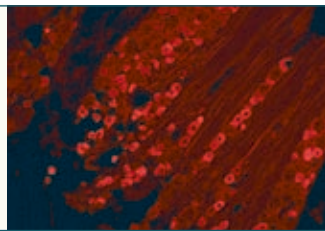
Millipore offers a full line of antibodies and assays for important neuroscience signaling pathways, including: AMPK, CAM Kinases, cAMP and cGMP assays, insulin signaling, CREB, DARPP-32, Erk pathways, MAP2 kinases, NMDAR phosphorylation, synaptic signaling and regulation, and Trk signaling.

# Neural Degeneration & Disorders

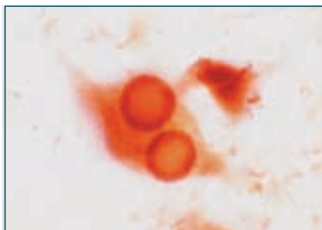
Research into neurological diseases is critical to our understanding and treatment of these crippling conditions. Millipore offers a broad range of antibodies and detection kits for tracking many steps in neuronal dysfunction and degeneration. Diseases such as Parkinson's, Alzheimer's, ALS, MS, and addiction as well as degenerative factors like oxidative stress, free radical damage, and inflammation all follow certain complicated cellular pathways.

Whether studying receptor structure, protein activation, protein misfolding, DNA breakdown, or signaling, Millipore is deeply committed to assisting neuroscientists by offering products to study developmental neuroscience, neurotransmission, glial biology, vision, and degeneration. Now that the expertise of Chemicon, Upstate, and Linco are a part of Millipore, researchers, students, and clinicians will benefit from the breadth of our neuroscience line. We are constantly developing new neuroscience antibodies as different targets are identified. These products are highly qualified, often in multiple applications and species and backed by world-class technical support, making Millipore an excellent resource for all your neurological degeneration research.

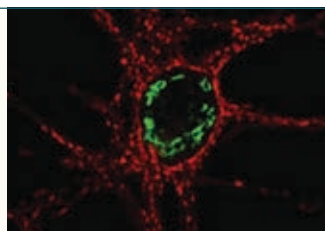
Guinea Pig anti-Capsaicin Receptor (Cat. No. AB5566). Localization of the Capsaicin Receptor in rat dorsal root ganglion.



Rabbit anti-Synphilin-1 (Cat. No. AB5388). Synphilin-1 positive Lewy bodies in Dorsal raphe nucleus in a case of Parkinson's Disease.



Rabbit anti-GODZ (Cat. No. AB9556) Localization of GODZ (green) in neuronal cultures.



## ALZHEIMER'S DISEASE

Every 72 seconds, someone in the world is diagnosed with Alzheimer's Disease (AD). After age 85, one in every two people will be diagnosed with this progressively deteriorating disease that includes memory loss, confusion, problems with judgment, planning and concentration, and personality changes. In its later stages, AD also affects physical abilities. The disease's causes, cures, and preventions are unknown; however, some proteins likely involved in the degenerative mechanism have been identified.

Alzheimer's Disease is characterized by neuronal loss, alterations in neurotransmitter systems, and the presence of neurofibrillary tangles composed of abnormal tau paired helical filaments. A prominent feature of AD is the formation of senile plaques in selected regions of the brain, the center of which is occupied by an amyloid deposit composed mainly of amyloid- $\beta$  ( $A\beta$ ) peptide. The  $A\beta$  peptide is cleaved from the larger amyloid- $\beta$  precursor protein (APP) by  $\beta$ - and  $\gamma$ -secretase.

Caspases also have a role in APP processing and the biogenesis of  $A\beta$  peptides. Millipore offers antisera to APP,  $A\beta$ ,  $\beta$ -site APP cleaving enzyme (BACE), neurofibrillary tangles, Tau proteins, presenilins and nicastrin. Since a prominent feature of AD is the degeneration of cholinergic neurons, Millipore also provides several markers for acetylcholine-containing neurons, as well as acetylcholine receptors.

As the population ages, more research dollars will be devoted to finding a cure. Millipore has the scope and resources to assist researchers in identifying new targets – ultimately benefiting scientists, families who are devastated by this disorder, and society as a whole.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-14-3-3- $\epsilon$ , C-terminus	100 $\mu$ g	AB9732
Anti-Advanced Glycated End-products (AGE)	200 $\mu$ L	AB9890
Anti-Phospho Tau (Thr231)	100 $\mu$ L	AB9668
Anti-WW Domain-Containing Oxidoreductase (WWOX)	100 $\mu$ g	AB9560

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Alzheimer Precursor Protein (APP) A4	50 $\mu$ g	MAB348
Anti- $\beta$ -Amyloid 1-42	50 $\mu$ g	AB5078P
Anti-Choline Acetyltransferase (ChAT)	50 $\mu$ L	AB143
Anti-Tau-1	100 $\mu$ g	MAB3420



## HUNTINGTON'S DISEASE

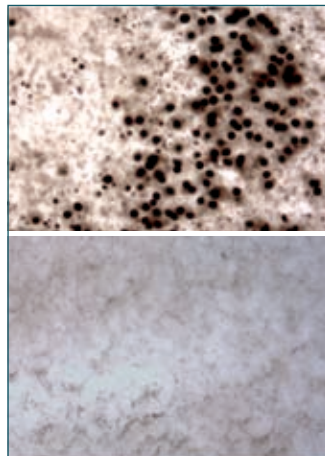
Huntington's Disease (HD) is a devastating, hereditary, degenerative brain disorder for which there is, at present, no effective treatment or cure. HD slowly diminishes the affected individual's ability to walk, think, talk, and reason. Eventually, the person with HD becomes totally dependent upon others. Huntington's Disease profoundly affects the lives of entire families – emotionally, socially and economically. An inherited, autosomal dominant neurodegenerative disorder, HD affects approximately 1 in 15,000 people. The disease is caused by polyglutamine expansion in the N-terminal region of the disease protein, appropriately named huntingtin, which is pathogenic in neurons. Antibodies to aggregated huntingtin and its inclusions have been used as markers for the pathogenesis of HD and to diagnose disease progression. New protein targets associated with huntingtin are now detectable using Millipore antibodies.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-Beclin 1	50 µL	AB15417
Anti-Huntingtin Associated Protein-1 (HAP-1)	100 µL	MAB5516
Anti-Huntingtin Associated Protein-1B (HAP-1B)	100 µg	AB15085
Anti-Huntingtin Interacting Protein 1 (HIP1)	100 µL	AB9880
Anti-Huntingtin Interacting Protein 1 related (HIP1R)	100 µL	AB9882

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Huntingtin Protein	100 µL	MAB2166
Anti-Huntingtin Protein	100 µL	MAB5374
Anti-Polyglutamine-Expansion Diseases Marker	100 µL	MAB1574



Mouse anti-Huntingtin (Cat. No. MAB5374) immunohistochemistry. Brain sections containing the hippocampus from HD transgenic mouse (R6/2) (Davis *et al.*, 1997) and wild type mouse (WT) at the age of 12 weeks were stained with MAB5374. Note that the antibody specifically reacts with intranuclear mutant huntingtin aggregates and smaller neuropil aggregates outside the nucleus. For immunohistochemistry, MAB5374 was used at 1:400 dilution.

## PARKINSON'S DISEASE

Parkinson's Disease is a degenerative disorder of the central nervous system that occurs when cells in an area of the brain called the substantia nigra begin to malfunction and die. These are the cells that produce the chemical messenger dopamine, which sends information between nerve cells in the brain to produce smooth, coordinated movement.

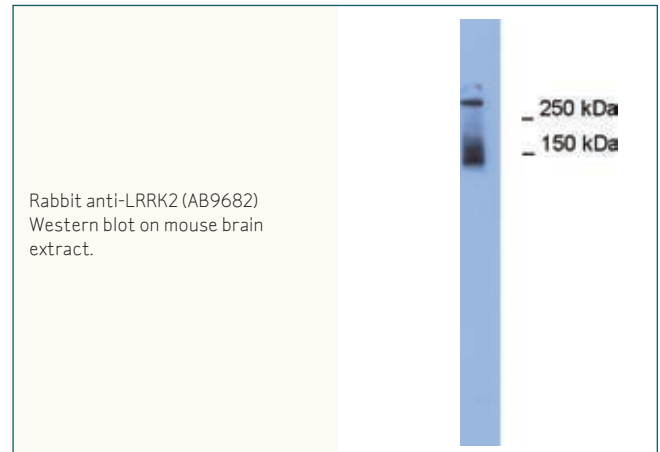
Although its exact cause is in most cases unknown, it has been linked to genetic mutations, trauma, and toxins. The Parkin gene was discovered on human chromosome 6 and is associated with an early onset form of autosomal recessive juvenile Parkinson's Disease. The function of this gene product is currently unknown, but it is speculated that this protein may function in the control of cell growth, differentiation and development. Lewy bodies are also often present, with  $\alpha$ -Synuclein as their major component. There are a number of key proteins correlated to the disease progression and Millipore has a comprehensive set of research antibodies available.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-Leucine-Rich Repeat Kinase 2 (LRRK2, Dardarin)	100 µL	AB9682
Anti-PAEL Receptor (GPR37)	50 µg	AB9245
Anti-LINGO-1	100 µg	07-678
Anti-PTEN-Induced Kinase 1 (PINK1)	100 µg	AB9570
Anti-Tubulin Polymerization Promoting Protein (TPPP), p25	100 µg	AB15346

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti- $\alpha$ -Synuclein	50 µL	AB5038
Anti-Dopamine Receptor D2 (D2S and D2L)	50 µg	AB5084P
Anti-Tyrosine Hydroxylase (TH)	100 µL	AB152
Anti-Tyrosine Hydroxylase (TH)	100 µL	MAB318
Anti-Tyrosine Hydroxylase (TH)	100 µL	AB151



Rabbit anti-LRRK2 (AB9682) Western blot on mouse brain extract.

## MULTIPLE SCLEROSIS

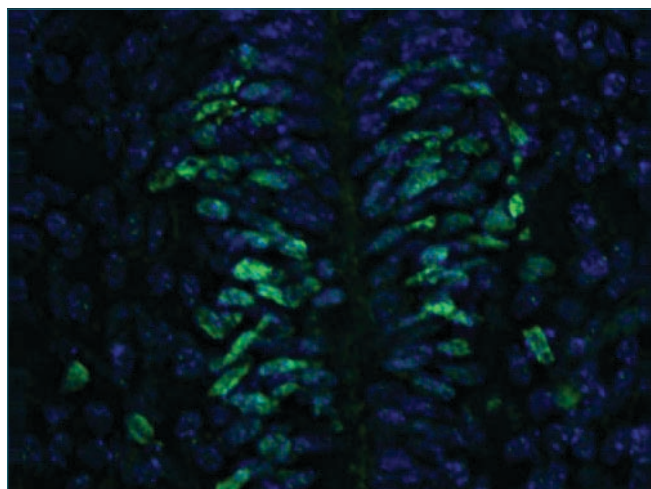
Multiple Sclerosis (MS) is a nerve disorder caused by the autoimmune destruction of the insulating myelin layer surrounding neurons in the brain and spinal cord. When the myelin is destroyed, nerve messages are sent more slowly and less efficiently. Patches of scar tissue, called plaques, form over the affected areas, further disrupting nerve communication. The symptoms of MS occur when the brain and spinal cord nerves no longer communicate properly with other parts of the body. MS causes a wide variety of symptoms and can affect vision, balance, strength, sensation, coordination, and bodily functions in over 2.5 million people world-wide.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-14-3-3- $\beta$	100 $\mu$ L	AB9730
Anti-14-3-3- $\epsilon$ N-terminus	100 $\mu$ L	AB9734
Anti-LINGO-1	100 $\mu$ g	07-678
Anti-Neurofascin, NF186/NF155 common epitope	100 $\mu$ g	AB15188
Anti-Phospho-14-3-3 (Ser185)	100 $\mu$ L	AB9740

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Galactocerebroside (GalC)	50 $\mu$ g	MAB342
Anti-Myelin Basic Protein (MBP)	500 $\mu$ L	AB980
Anti-Oligodendrocyte O4	50 $\mu$ g	MAB345
Anti-Olig-2	100 $\mu$ L	AB9610



Rabbit anti-Olig2 (Cat. No. AB9610). Staining of Olig2 (green) in the developing mouse (e12.5) spinal cord. Blue staining is Dapi.

## OXIDATIVE STRESS/REACTIVE SPECIES DAMAGE

Oxidative Stress is a state characterized by an excess of free radical groups in the body, which creates a potentially unstable cellular environment linked to tissue damage, accelerated aging, and degenerative disease. Oxidative stress can result from many factors, including exposure to alcohol, medications, poor nutrition, trauma, cold, toxins, and over-exercise.

There is increasing evidence that free radicals damage biomolecules, leading to several specific and diverse diseases in humans, such as atherosclerosis, cerebral and heart ischemia-reperfusion injury, cancer, rheumatoid arthritis, inflammation, diabetes, aging, and neurodegenerative conditions such as AD. 8-Hydroxydeoxyguanosine (8OHdG) is a modified base that occurs in DNA due to attack by hydroxyl radicals, and has become increasingly popular as a sensitive, stable, and integral marker of oxidative damage in cellular DNA.

Reactive Oxygen Species (ROS), including superoxide, hydroxyl radicals, hydrogen peroxide and singlet oxygen, are formed when cells are exposed to oxidizing agents or ionizing radiation as the result of metabolic processes. These ROS can cause damage to the genome, an early step in the development of cancerous conditions.

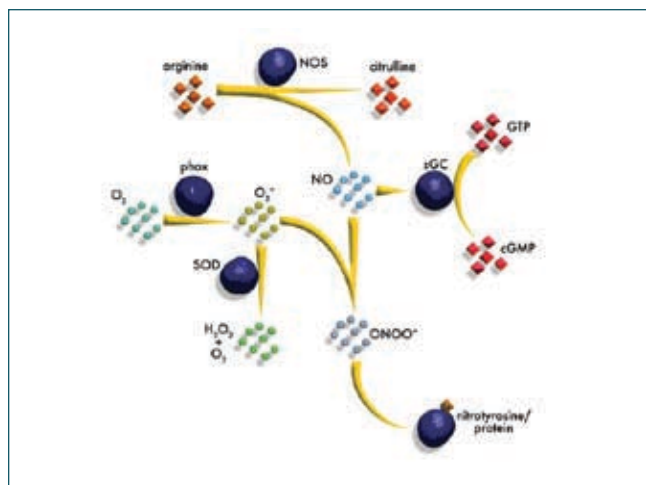
### Some of the Newest Products:

Description	Quantity	Cat. No.
Glutathione Detection Kit	Inquire	NS190*
Nitrotyrosine ELISA	1 kit (192 assays)	17-376
S-Nitrosylation Detection Kit	Inquire	NS180*

\* Coming soon!

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Nitrotyrosine	100 $\mu$ g	06-284
Anti-Nitrotyrosine	100 $\mu$ g	05-233
Anti-Nitrotyrosine, agarose conjugate	100 $\mu$ g	16-163



## PRION DISEASES

The prion protein is a large membrane protein that occurs normally in neurons of the human brain and is thought to be involved in synaptic transmission. In prion diseases, such as Creutzfeldt-Jakob Disease (CJD), Gerstmann-Straussler-Scheinker syndrome (GSS), Fatal Familial Insomnia (FFI), Alpers Syndrome, and Kuru, the normal cellular form of this protein (PrP<sup>c</sup>) is transformed into an altered protein when it comes into contact with an infectious prion protein (PrP<sup>Sc</sup>) from another host. This altered PrP<sup>Sc</sup> accumulates in cytoplasmic vesicles of diseased individuals forming lesions, vacuoles, and amyloid deposits.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-14-3-3-β, N-terminus	100 μL	AB9730
Anti-14-3-3-β	100 μL	AB9748
Anti-14-3-3-ε, N-terminus	100 μL	AB9734
Anti-14-3-3-γ, N-terminus	100 μL	AB9738
Anti-14-3-3-α, N-terminus	100 μL	AB9742

### Most Requested Antibodies:

Description	Quantity	Cat. No.
Anti-Prion Protein, a.a. 109-112	100 μg	MAB1562
Anti-Prion Protein, a.a. 23-237	100 μg	MAB5424
Anti-Prion Protein, N-terminus, a.a. 78-97	200 μL	AB5058
Anti-Tau-1	100 μg	MAB3420

## ACUTE INJURY AND CHRONIC NEURODEGENERATION

A general feature of many neurological diseases, disorders, or injuries is the degeneration of proximal and/or distal neural processes. Key to understanding the degenerative progression is detecting and staining these dying neurons. Millipore has developed an ELISA for detecting neuronal degeneration in blood/CSF samples (Cat. No. NS170). In addition, Millipore's non-antibody based stains for various stages of degenerating neurons are very robust regardless of specific insult or mechanism of cell death.

### Some of the Newest Products:

Description	Quantity	Cat. No.
Anti-Autophagy-Related Proteins (APG)	Inquire	Multiple
Anti-Axotomy-Induced Glycosylated/Golgi Complex Protein 1 (AIGP1)	100 μg	AB15255
Fluoro-Ruby® Reagent	30 mg	AG335
Phosphorylated Neurofilament H (pNF-H) Sandwich ELISA kit	96 wells	NS170

### Most Requested Products:

Description	Quantity	Cat. No.
Fluoro-Jade® B Reagent	50 mg	AG310
Fluoro-Jade® C Reagent	50 mg	AG325
NeuN	500 μg	MAB377

## PAIN

Pain is the burning, aching, throbbing, stinging sensation associated with injury, potential injury, disease, or ailment. There are two basic forms of physical pain: acute and chronic. Acute pain is a normal response to injury, disease, or inflammation to the tissues. It is immediate and usually short in duration. Moreover, causes of acute pain can usually be diagnosed and treated. In contrast, chronic pain is continuous pain that persists for a more substantial time, usually even after healing. Chronic pain can range from mild to severe and can last weeks, months or years.

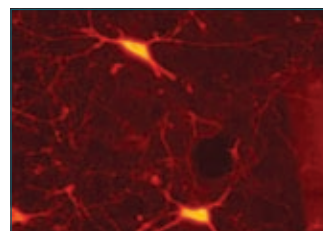
The cause of chronic pain is not always evident, although it is often associated with many chronic diseases. The identification of new neuropeptides, receptors, and associated proteins that have significant modulatory actions has greatly increased our understanding of the neural roots of acute and chronic pain. This research into the physiological and biochemical causes of pain is an ever expanding, complex area of sensory research. Millipore is pleased to provide numerous antibodies and other reagents for pain research.

### Some of the Newest Antibodies:

Description	Quantity	Cat. No.
Anti-Cannabinoid Receptor 1 (CB1)	50 μg	AB9129
Anti-Capsaicin Receptor (VR1)	50 μL	AB9564
Anti-Opioid Receptor μ1	50 μg	AB9463
Anti-Neuropeptide FF1 Receptor	50 μg	AB9456
Anti-TRPA1[ANKTM1]	50 μL	AB15756-50UL

### Most Requested Antibodies:

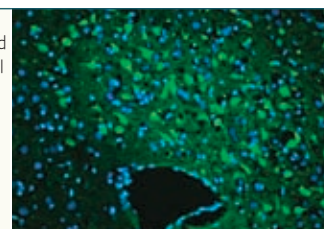
Description	Quantity	Cat. No.
Anti-β-Endorphin	50 μg	AB5028
Anti-Calcitonin Gene Related Peptide (CGRP)	100 μL	AB5920
Anti-Capsaicin Receptor (TRPV1)	50 μg	MAB5568
Anti-Capsaicin Receptor (VR1)	50 μL	AB5566
Anti-NMDAR2A&B, pan	50 μg	AB1548



Fluoro-Ruby Reagent (Cat. No. AG335) Neurons of the thalamic parafascicular nucleus seen following injection of Fluoro-Ruby Reagent into the striatum.

Photomicrograph courtesy of Dr. Larry Schmued.

Double exposure using ultraviolet and blue light excitation reveals blue DAPI labeled nuclei and green Fluoro-Jade C (Cat No. AG325) positive cells and terminals in the dorsal thalamus following kainic acid exposure. Photomicrograph courtesy of Dr. Larry Schmued.



## ADDITIONAL NEUROLOGICAL DISEASE RESEARCH SUPPORTED BY MILLIPORE

Millipore is dedicated to long-term support of the neuroscience community with a variety of products and services. Additional neurological research areas for which Millipore offers reagents are: ALD, Ataxias, brain inflammation, Fragile X, reward pathways, and addiction.

## Here's to the Future of Neuroscience!

Through its acquisition of Chemicon, Millipore is now deeply committed to neuroscience product development. We are dedicated to providing quality, cutting-edge tools to the research community and look forward to a mutually beneficial collaboration for decades to come.

For more information, please visit our website at [www.millipore.com](http://www.millipore.com).



[www.millipore.com/offices](http://www.millipore.com/offices)

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