MERCK

Elevating Neurobiology Research

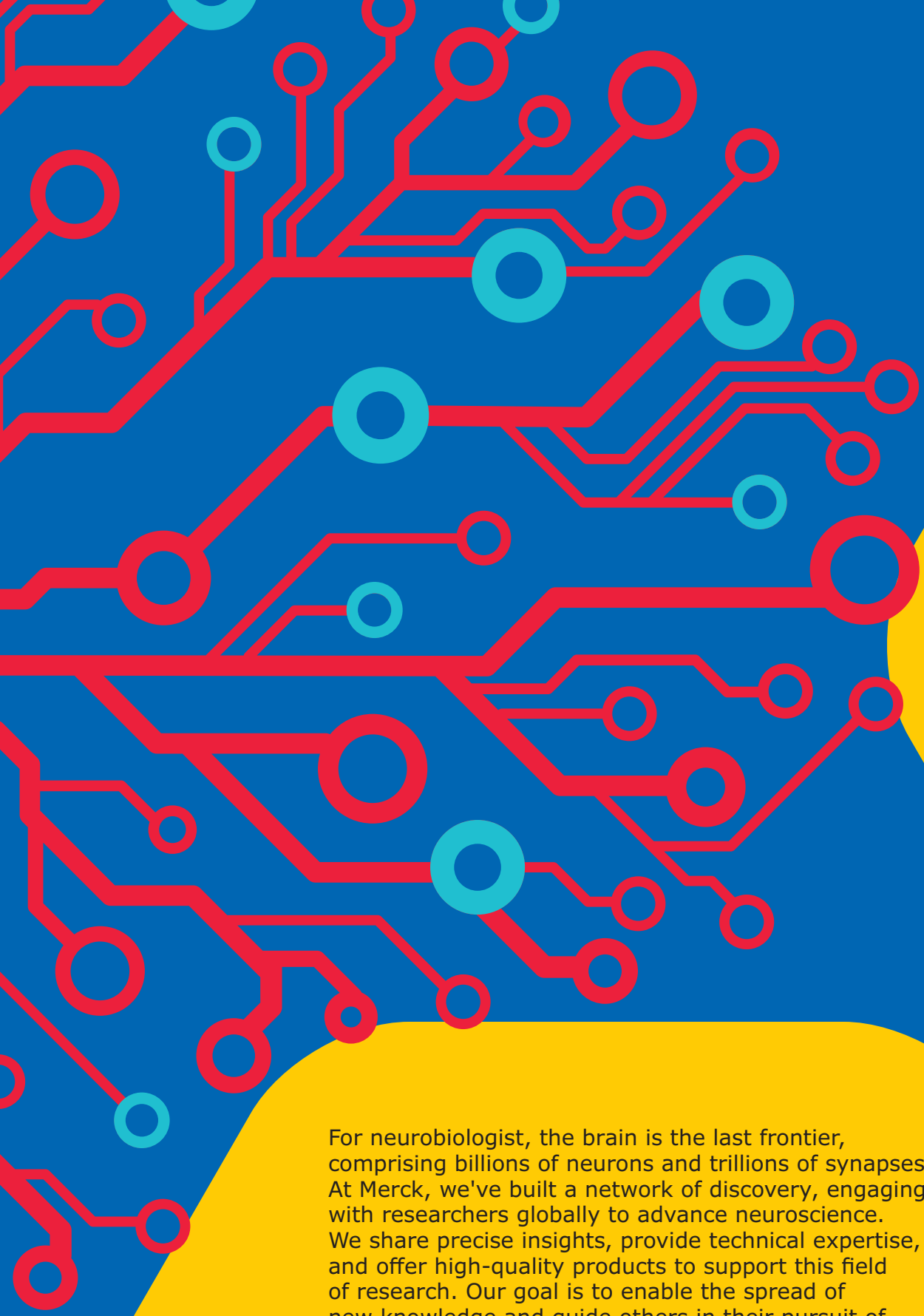
Neural Models, Neural Modulation, Biomarker Discovery and Neural Detection Tools

Millipore®

Preparation, Separation, Filtration & Monitoring Products

Sigma-Aldrich®

Lab & Production Materials



For neurobiologist, the brain is the last frontier, comprising billions of neurons and trillions of synapses. At Merck, we've built a network of discovery, engaging with researchers globally to advance neuroscience. We share precise insights, provide technical expertise, and offer high-quality products to support this field of research. Our goal is to enable the spread of new knowledge and guide others in their pursuit of discovery. Join us in unlocking the mysteries of the brain and driving transformative advancements in **Elevating Neurobiology Research**.

Develop Predictive Neural Models

Modulate and Discover

Characterize

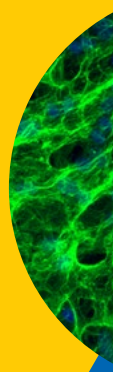
develop

Predictive Neural Models

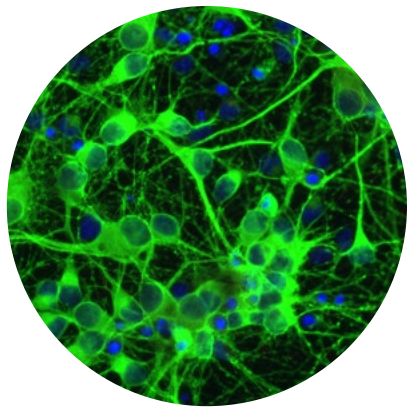
For neurobiologists, the quest for truly predictive neural models has its challenges given the brain is a very complex organ comprised of many diverse cell types, complex cell-to-cell interactions and intricate signaling pathways. But new breakthroughs using molecular tools and stem cell models are now better able to mimic the physiology of the brain to help explore the origins of neurological disorders and disease. With the help of these models new treatments and even personalized therapies are being created.

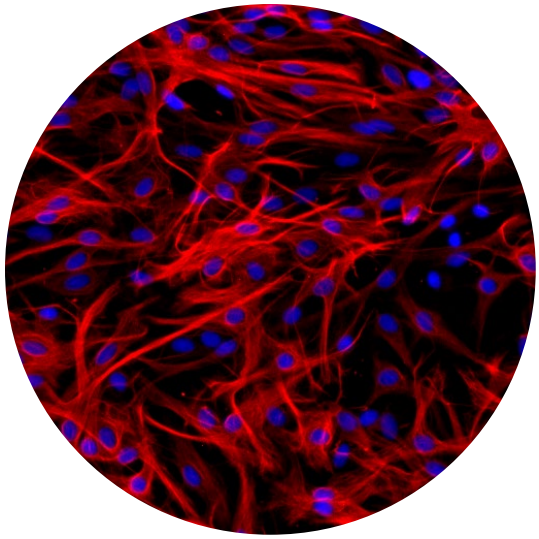
Creating predictive neural models involves three processes:

Select Cell Type of Interest → **Create** Genetic Modification → **Optimize** Growth and Consistency



SELECT > cell type

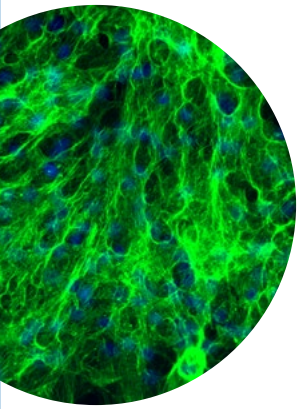




Cells that mimic the physiology of the human brain and the blood-brain barrier (BBB) will produce more relevant and accurate results.
Count on our full offering of stem cells, primary cells and other novel cell lines that are well characterized and designed specifically for neuroscience research.

Challenge

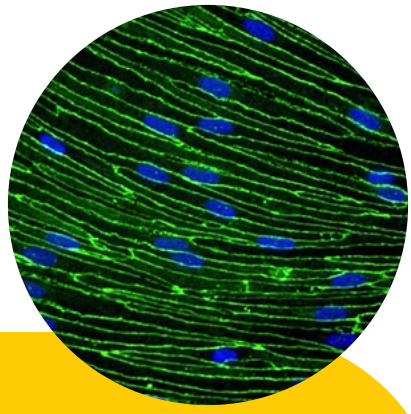
Creation of more physiological *in vitro* culture systems that mimic *in vivo* environments.



Solution

Neural Cell Lines

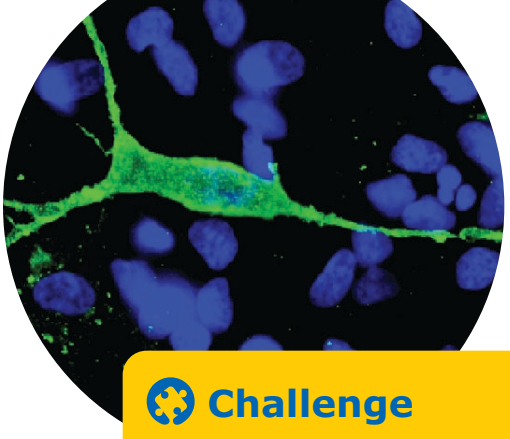
The use of immortalized cell lines has many advantages including the capability of long-term growth and ease to cultivate. Additionally, when neural stem cells (NSCs) are used they have an added benefit of self-renewal and differentiation along specific pathways to generate physiological relevant neuronal and glial cell types of the central nervous system (CNS).



Neural Cell Lines

Cat. No.	Product Description
Mouse Cell Lines	
SCC049	Mouse Cranial Neural Crest Cell Line O9-1
SCR029	Mouse Cortical NSC, 1 million cells
SCR031	Mouse Spinal Cord NSC, 1×10^6
Rat Cell Lines	
SCC048	N27 Rat Dopaminergic Neural Cell Line
SCR022	Adult Rat Hippocampal, 1×10^6
Human Cell Lines	
SCC066	Blood Brain Barrier hCMEC/D3 Cell Line

Sigma-Aldrich®
Lab & Production Materials



Challenge

Authenticated cell lines that are free of contamination (e.g. other cell lines and microbes) are of the utmost importance to safeguard reproducibility.

Solution

Culture Collection Cell Lines

We have formed a working partnership with The European Collection of Authenticated Cell Cultures (ECACC), a world leader and recognized expert in the maintenance, cultivation and distribution of a unique repository of over 1,300 validated cells. Cell lines obtained from ECACC are tested for viability (plating efficiency and cell density), morphology, sterility, mycoplasma contamination and authenticity, offering the most diverse and validated selection available so you can ensure reproducible results.

ECACC
European Collection of Authenticated Cell Cultures
Operated by Public Health England

ECACC Cells

Cat. No.	Product Description	
94030304	SH-SY5Y cells, Human Neuroblastoma	The SH-SY5Y cell line has become a popular cell model for PD research because this cell line possess many characteristics of DAergic neurons. For example, these cells express tyrosine hydroxylase and dopamine-beta-hydroxylase, as well as the dopamine transporter. Moreover, this cell line can be differentiated into a functionally mature neuronal phenotype in the presence of various agents. Upon differentiation, SH-SY5Y cells stop proliferating and a constant cell number is subsequently maintained.
89081402	U-87 MG Human Glioblastoma Astrocytoma	U87MG cells express the astrocyte cell marker glial fibrillary acidic protein (GFAP) and are widely used as an *in vitro* astrocyte model.
89121404	Neuro 2A Mouse Albino Neuroblastoma	Neuro 2A (N2a) is a mouse neural crest-derived cell line that has been extensively used to study neuronal differentiation, axonal growth and signaling pathways.
92090903	ND7/23 Mouse Neuroblastoma X Rat Neuron	The ND7/23 immortalized rat dorsal root ganglion (DRG)-mouse N18Tg2 neuroblastoma hybrid cell line has shown great utility for transient and stable expression of exogenous ion channels and receptors in a native milieu, yielding useful fluorescence and electrophysiology assays for academic and drug discovery applications.

See more at **SigmaAldrich.com/ecacc**

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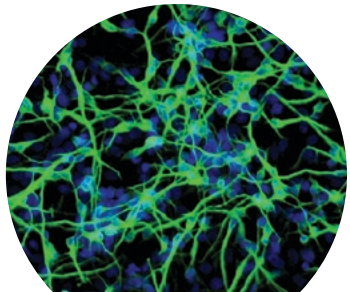


SELECT > cell type

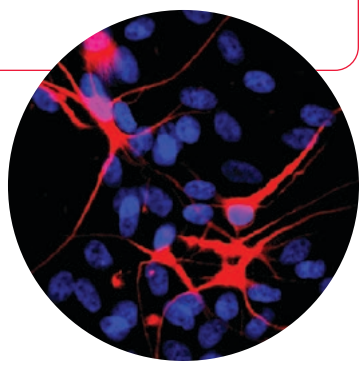
Product Highlight

ReNcell® VM Human Neural Stem Cell (NSC) Line

As seen in Nature. 2015 Jul;10(7): 985–1006

Immortalized human neural progenitor cell line with the ability to readily differentiate into neurons and glial cells, making them the ideal platform for neuroscience research.

- Consistent and dependable neural stem cell culture
- Immortalized to produce a robust and consistent NSC culture
- Offers phenotype and genotype stability
- Includes multipotential neuronal and glial differentiation capacity
- Culture in optimized defined serum-free media



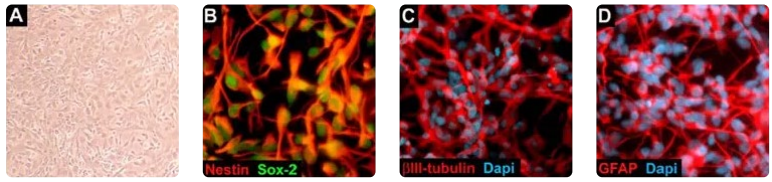
Challenge

A need for more physiological *in vitro* culture systems that are more comparable to *in vivo* environments.

Solution

ReNcell® VM and ReNcell® CX

ReNcell® VM and **ReNcell® CX** are two highly published neural stem cell lines derived from developing human brains. ReNcell® VM and CX cells are generated from the ventral mesencephalon and cortical regions of the brain, respectively, and transduced with the myc transcription factor. Both cell lines offer phenotype and genotype stability, in addition to the multipotential neuronal differentiation capacity, over long-term culture.



NSC Marker Expression. Both ReNcell® VM and CX human neural progenitors are grown as monolayers (A) and express NSC markers, Nestin (B, Red) and Sox-2 (B, Green). ReNcell® CX cells are able to differentiate into neurons expressing βIII-tubulin (C; Red) and glial cells expressing GFAP (D; Red). DAPI nuclear counterstain in Blue.

Cat. No.	Product Description
AB5804	**Anti-Glial Fibrillary Acidic Protein (GFAP)** Antibody serum, Chemicon®
MAB5326	**Anti-Nestin Antibody, clone 10C2** from mouse, Chemicon®
AB5603	**Anti-Sox2 Antibody** from rabbit, Chemicon®
MAB1637	**Anti-Tubulin Antibody, beta III isoform, CT, clone TU-20** (Similar to TUJ1) ascites fluid, clone TU-20 (Similar to TUJ1), Chemicon®
DF-042	**EmbryoMax® DMEM/F12, with L-Glutamine, without HEPES** The EmbryoMax DMEM/F12, with L-Glutamine, without HEPES is available in a 500 mL format and may be used for routine mouse embryonic stem cell culture applications
SCC007	**ReNcell® CX Human Neural Progenitor Cell Line** ReNcell® CX is an immortalized human neural progenitor cell line with the ability to readily differentiate into neurons & glial cells
SCM007	**ReNcell® Neural Stem Cell Freezing Medium** ReNcell® Neural Stem Cell Freezing Medium is qualified for use with ReNcell® immortalized human neural progenitor cell lines, CX
SCM005	**ReNcell® NSC Maintenance Media** ReNcell® NSC Maintenance Medium is a defined serum-free, growth factor-free neural stem cell medium that has been optimized for the growth & *in vitro* differentiation of ReNcell® immortalized human neural progenitor cells
SCC008	**ReNcell® VM Human Neural Progenitor Cell Line** ReNcell® VM is an immortalized human neural progenitor cell line with the ability to readily differentiate into neurons & glial cells

See more at SigmaAldrich.com/rencell

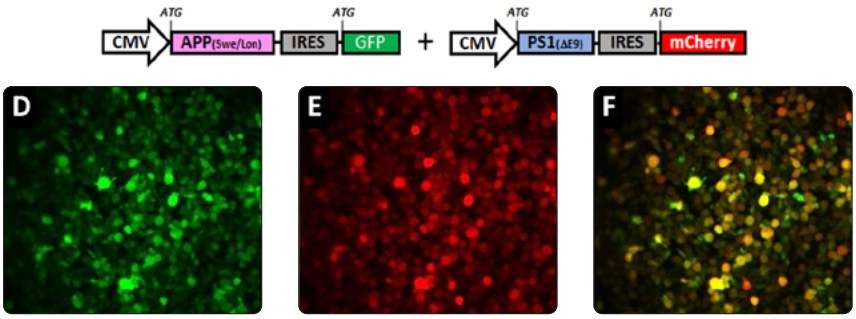
Challenge

Reliable model to study AD dementia.

Solution

Alzheimer's In A Dish™: 3D Neural Stem Cell Models of Alzheimer's Disease

3D cell culture technologies aim to provide improved predictive cellular models for research, drug discovery or regenerative medicine applications. Historically, In vitro human cell models of Alzheimer's disease (AD) have been challenging due to high levels of soluble and insoluble toxic amyloid β (Aβ) species that do not recapitulate the true AD pathology. Recently, Kim et. al created a three-dimensional (3D) human neural stem cell model of Alzheimer's Disease using β-amyloid precursor protein and presenilin-1 overexpressing ReNcell™ VM human neural stem cell lines. This 3D cell model was able to induce robust extracellular deposition of amyloid-β, including amyloid-β plaques, and high levels of phosphorylated tau in the soma and neurites, as well as filamentous tau.



Alzheimer's In a Dish™ clonal FAD ReNcell® VM human neural stem cell lines. Alzheimer's in a Dish™ is a proprietary collection of immortalized single cell derived ReNcell® VM human neural progenitor cells that express stable levels of fluorescently tagged AD genes with multiple FAD mutations. The clonal FAD neural progenitor cells secrete different amounts of total Aβ and differ in the Aβ42/40 ratios. All clonal FAD cell lines express neural stem cell markers Nestin (B) and Sox-2 (C). For example: the ReN-mGAP10 Clone D4 neural progenitor cells (SCC008FAD2) were double infected with polycistronic lentiviruses expressing APP (Swe/Lon)-GFP, (D) PS1 (deltaE9)-mCherry (E), merged images (F).

Cat. No.	Product Description
Cell Lines	
SCC007	ReNcell® CX Human Neural Progenitor Cell Line: ReNcell® CX is an immortalized human neural progenitor cell line with the ability to readily differentiate into neurons & glial cells
SCC008	ReNcell® VM Human Neural Progenitor Cell Line: ReNcell® VM is an immortalized human neural progenitor cell line with the ability to readily differentiate into neurons & glial cells
SCC009	ReNcell® CX Human Neural Progenitor Cell Line & Culture Media Kit: ReNcell® CX Kit contains human neural progenitor cells, optimized maintenance media & freezing media for culture of human neural stem cells
SCC010	ReNcell® VM Immortalized Cell Kit: ReNcell® VM Kit contains human neural progenitor cells, optimized maintenance media & freezing media for culture of human neural stem cells
Lentiviral Particles	
SCR526M	Alzheimer's In A Dish™ APPSL-GFP Lentivirus
SCR527M	Alzheimer's In A Dish™ PSEN1-RFP Lentivirus
Cell Media and Reagents	
SCM005	ReNcell® NSC Maintenance Medium is a defined serum-free, growth factor-free neural stem cell medium that has been optimized for the growth & *in vitro* differentiation of ReNcell® immortalized human neural progenitor cells
SCM007	ReNcell® Neural Stem Cell Freezing Medium is qualified for use with ReNcell® immortalized human neural progenitor cell lines, CX
E9644	hEGF, recombinant, expressed in *E. coli*, lyophilized powder, suitable for cell culture
F0291	hBFGF-Basic, recombinant, expressed in *E. coli*, suitable for cell culture
P4957	Poly-L-ornithine solution, mol wt 30,000-70,000, 0.01%, sterile-filtered, BioReagent, suitable for cell culture
L2020	Laminin from Engelbreth-Holm-Swarm murine sarcoma basement membrane, 1-2 mg/mL in Tris-buffered saline, 0.2 µm filtered, BioReagent, suitable for cell culture
TMS-012	Endotoxin-Free Dulbecco's PBS (1X) (w/o Ca++ & Mg++) Cell Culture
A6964	Accutase® solution, sterile-filtered, suitable for cell culture
Antibodies and Stains	
MAB348	Anti-APP A4 Antibody, a.a. 66-81 of APP {NT}, clone 22C11 from mouse, Chemicon®
AB9668	Anti-Tau phospho Threonine 231 Antibody from rabbit, Chemicon®
MAB5326	Anti-Nestin Antibody, clone 10C2 from mouse, Chemicon®
HT60	Amyloid Stain, Congo Red Kit
HNABTMAG-68K	MILLIPLEX® Human Amyloid Beta and Tau Magnetic Bead Panel - Multiplex Assay. The MILLIPLEX® MAP Human Amyloid Beta and Tau Panel is a 4-plex kit containing all reagents needed for simultaneous quantification of Aβ40, Aβ42, Total Tau proteins (tTau), and Phosphorylated Tau Thr181 (pTau181) in CSF samples

See more at **SigmaAldrich.com/3DAlzheimer**

Challenge

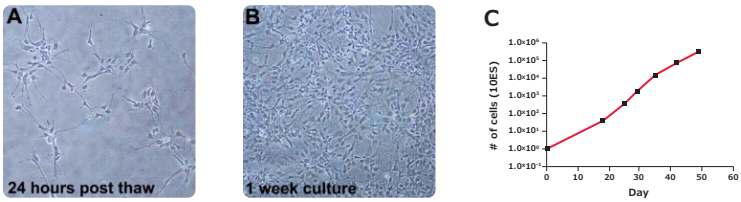
Consistent differentiation of Human Oligodendrocyte Progenitor Cells (OPCs) into mature oligodendrocytes.

Solution

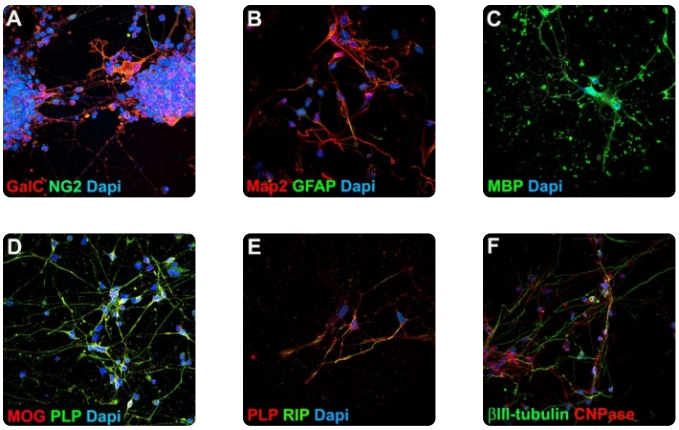
Human Oligodendrocyte Differentiation Kit NEW

Human Oligodendrocyte Differentiation Kit contains Human Oligodendrocyte Progenitor Cells (OPCs) along with optimized media for their expansion and spontaneous differentiation into mature oligodendrocytes. (OPCs) are derived from NIH approved H9 human embryonic stem cells (hESCs). These hESC-derived OPCs proliferate as an adherent cell monolayer and greater than 70% express the appropriate early-tointermediate oligodendrocyte markers, including O4, NG2, Olig2, Sox10 and GalC. Upon growth factor withdrawal, Human OPCs spontaneously differentiate into mature oligodendrocytes expressing terminally differentiated markers including proteolipid protein (PLP), myelin basic protein (MBP), and myelin oligodendrocyte glycoprotein (MOG). Spontaneous differentiation leads to approximately 30% of the cells expressing PLP, MBP and MOG while the remaining 70% express mostly neuronal markers, MAP2 and βIII-tubulin with very little to no astrocytes (<5% GFAP-positive cells) observed.

Human OPCs can be used for a variety of research applications including studies of neurotoxicity, coculture applications and screening for molecules that induce or inhibit preferential differentiation to mature oligodendrocytes.



Bright field images of proliferating Human OPCs 24 hours post-thawing (A) and after one week in culture (B). Human OPCs double every 48 hours (C).



After 2 weeks of spontaneous differentiation, Human OPCs generate approximately 30% mature oligodendrocytes and ~50% neurons. Human OPCs were plated at 10^4 cells/cm^2 onto poly-L-ornithine and laminin coated 24 well plates in Human OPC Expansion Complete Media. Twenty-four hours post-seeding, spontaneous differentiation was initiated by media exchange with Human OPC Spontaneous Differentiation Complete Media. All images were captured using the Leica DMI-4000 confocal microscope with a 40X objective. 3D reconstruction was performed using the Leica AF software.

Cat. No.		Product Description
SCR600	NEW	Human Oligodendrocyte Differentiation Kit
SCM106	NEW	Huma n OPC Spontaneous Differentiation Culture Media Kit
SCM107	NEW	Human OPC Expansion Culture Media Kit
SCR601		Human Oligodendrocyte Characterization Kit

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Lab & Production Materials

CREATE > Genetic Modification

The ability to modify genes (e.g. edit or knockout genes) in cell models enables the discovery and study of novel neurological pathways. Count on our extensive portfolio of CRISPRs, ZFNs, and other technologies to engineer the predictive neural model you need.

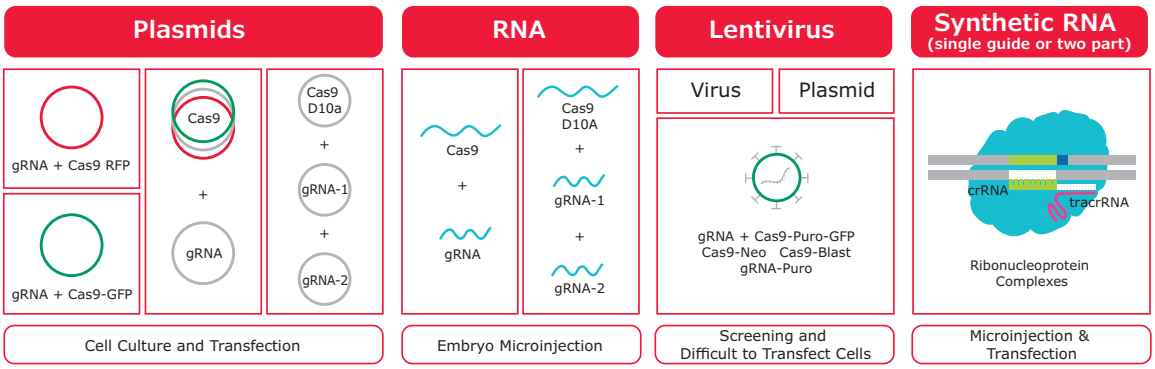
Challenge

Neural models are difficult to generate and manipulate. Novel tools and techniques are needed to overcome a variety of barriers.

Solution

Genome Editing Tools

The recent advancement of functional genomic tools, like CompoZr® ZFN and CRISPR, allows researchers to knock-out, knock-in and modify genes in order to create their ideal cell model, revealing novel relationships between genes and neurological phenotypes.



CRISPR

The advent of CRISPR has been timed perfectly with a reduction in DNA sequencing costs and a recent boom in neuroscience research. Through the democratization of genome editing researchers worldwide are now able to uncover genes implicated in neural development and disease whose relationship was previously unknown. A greater depth in the understanding of the pathways involved in Alzheimer's, schizophrenia, and a host of other neurological diseases is now a reality. In addition to using CRISPR to study cultured cells, a sizable and growing number are using this tool to generate transgenic animals enabling heretofore impossible interrogations of the brain and complex neural tissues.

See more at **SigmaAldrich.com/crispr**

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optimize > growth and consistency

Challenge

Creating similar environmental conditions that exist in nature is essential for relevant neural models.

Solution

Growth Environment

Media and Growth Factors

To closely represent the *in vivo* environment of neural cells correct biological conditions are essential. Achieve relevant growing conditions with our well cited, sterile media options optimized for neuroscience research. Get consistent cell proliferation and differentiation with our high quality growth factors to achieve a more neurological phenotype.

Finally SOS and NeuroSOS photostable medias and supplements facilitate long term visualization, reduced photobleaching and radiation death.

Media and Growth Factors

Cat. No.	Product Description
G0800	GS21™ Supplement (50X), Serum-free Natural Media Supplement
N3100	NeuralQ™ Basal Medium
S3194	Stemline® Neural Stem Cell Expansion Medium
SCM005	ReNcell® NSC Maintenance Media
B3795	Brain-derived neurotrophic factor, Human
F0291	hBFGF FGF-Basic, recombinant, expressed in *E. coli*, suitable for cell culture
GF446	HumanKine® Thermostable bFGF, Human Recombinant
V7259	Vascular Endothelial Growth Factor, Human
G1777	Glial Cell Line-derived Neurotrophic Factor, Human
SCM146	BrightCell NEUMO Photostable Media
SCM147	BrightCell SOS Neuronal Supplement (25X)

See more at **SigmaAldrich.com/3D**

3D Cell Culture

Cells in their natural environment have constant interactions with the extracellular matrix (ECM) and other cells, regulating complex biological functions like cellular migration, apoptosis, or receptor expression. Most of these interactions are lost, or significantly reduced, in 2D cell culture. By culturing cells in the presence of ECM components, particularly ECM proteins like collagen, laminin or fibronectin, they allow you to recapitulate a 3D cell culture and produce a more predictive neural model. Finally, SOS and NeuroSOS photostable media and supplements facilitate long term visualization, reduced photobleaching and radiation death.

Recent advances in 3D cell culture methods using ECM-based and synthetic hydrogels have enabled *in vitro* culture and differentiation of stem cells into neuronal cells and the formation of cerebral organoids with structural similarity to brain tissue[1,2]. These culture systems can be used as models of human brain development and microcephaly[2]. Permeable supports can also be used for multi-cellular co-culture studies to establish neural and other cell type physiological interactions such as the blood-brain barrier[3].

1. Ortinau, S. et al. Biomed. Eng. Online 9:70-87 (2010).
2. Lancaster, M.A. et al. Nature 501: 373-379 (2013).
3. Urich, E. et al. Sci. Rep. 3:1500 (2013).

PromoCell 3D Tumorsphere Media XF

The PromoCell 3D Tumorsphere Media XF (**C-28070**, **C-28075**) is designed to serially passage brain tumor derived cell lines as undifferentiated 3D neurospheres with high cell proliferation rates. Its defined and serum-free formulation allows consistent and standardized expansion of neurospheres while maintaining the cancer stem cell characteristics such as self-renewal and chemoresistance.

Materials

Cat. No.	Product Description
C-28070	3D Tumorsphere Medium XF Ready-to-use kit including Basal Medium and Supplement Mix, 250 ml
C-28075	3D Tumorsphere Medium XF Ready-to-use kit including Basal Medium and Supplement Mix, phenol red-free, 250 ml

Discover more at **SigmaAldrich.com/3Dneurosphere**

Solution

CORNING Spheroid Microplates

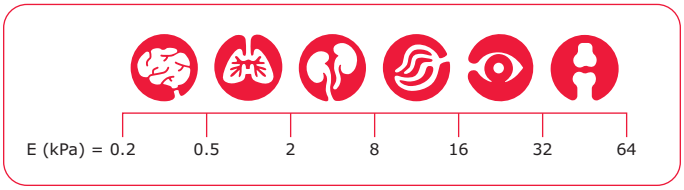
In vitro 3D cell culture models are widely recognized as more physiologically relevant systems compared to 2D formats. To recapitulate features of native tumor microenvironments, cancer cells can be cultured in Corning spheroid microplates, which combine the Corning Ultra-Low Attachment surface with innovative well geometry to provide an ideal tool for generating, culturing, and assaying 3D multicellular spheroids in the same plate, without the need for a transfer step.

Cat. No.	Quantity	Product Description	
CLS4515	**5**	Corning 96-well Spheroid Microplate	Clear round-bottom with lid, Ultra-Low Attachment Surface, Sterile
CLS4520	**50**	Corning 96-well Spheroid Microplate	Clear round-bottom with lid, Ultra-Low Attachment Surface, Sterile
CLS4516	**5**	Corning 384-well Spheroid Microplate	Clear round-bottom with lid, Ultra-Low Attachment Surface, Sterile
CLS3830	**50**	Corning 384-well Spheroid Microplate	Clear round-bottom with lid, Ultra-Low Attachment Surface, Sterile

CytoSoft® Elastic Modulus Plates

An Innovative Tool to Analyze the Effect of Matrix Stiffness/Rigidity on Regulating Cellular Behavior

Mechanotransduction refers to the processes through which cells sense and respond to mechanical stimuli by converting them to biochemical signals that elicit specific cellular responses. Focal adhesions are large macromolecular assemblies through which mechanical force and regulatory signals are transmitted between the **extracellular matrix** (ECM) and an interacting cell. Cells in the body interact with their local 3D microenvironments which can vary based on tissue location and disease states. Cells reside in various matrix stiffnesses throughout the body. In order to create more relevant *in vitro* cell models, researchers have started to grow on softer **3D hydrogels** and substrates that more closely represent their native tissue rigidities.



Native matrix stiffnesses of various *in vivo* tissues.

Cell Type: Neural Stem Cells

Observation: NSCs proliferated on substrates below 10 kPa and exhibited maximal proliferation on 3.5 kPa surfaces. Neuronal differentiation was favored on the softest surfaces with EY < 1 kPa. Oligodendrocyte differentiation was favored on stiffer scaffolds >7 kPa. Astrocyte differentiation was only observed on <1 and 3.5 kPa surfaces and represented less than 2% of the total cell population.

Cat. No.	Product Description
5190	CytoSoft®, Discovery Kit Multiple Elastic Moduli, (0.2, 0.5, 2, 8, 16, 32, 64 kPa)
5140	CytoSoft® Elastic Moduli 0.5 kPa
5142	CytoSoft® Elastic Moduli 8 kPa
CC306	CytoSoft® Imaging 24-Well Plate Elastic Moduli 0.2 kPa
CC307	CytoSoft® Imaging 24-Well Plate Elastic Moduli 0.5 kPa
CC308	CytoSoft® Imaging 24-Well Plate Elastic Moduli 2 kPa
CC309	CytoSoft® Imaging 24-Well Plate Elastic Moduli 8 kPa
CC313	CytoSoft® Imaging 96-Well Plate Elastic Moduli 0.2 kPa
CC314	CytoSoft® Imaging 96-Well Plate Elastic Moduli 0.5 kPa
CC315	CytoSoft® Imaging 96-Well Plate Elastic Moduli 2 kPa
CC316	CytoSoft® Imaging 96-Well Plate Elastic Moduli 8 kPa

Learn more at **SigmaAldrich.com/cytosoftplates**

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Cell Types, ECMs and Biological Coatings

Extracellular Matrices (ECMs) and Biological Coatings	Cell-Tak™	Collagen I	Collagen IV	Matrigel® Matrix	Fibronectin	Gelatin	Laminin	Osteopontin	Poly-Lysine (PDL, PLL)	PDL/LM and PLO/LM	PuraMatrix®	Vitronectin
PRIMARY CELLS												
Dorsal Root Ganglia				●					●	●		
Embryonic Cortical Neurons				●						●		
Embryonic Sympathetic Neurons			●	●			●			●		
Endothelial Cells; Endothelial Colony Forming Cells			●		●		●					
Hippocampal Neurons				●	●		●		●	●	●	
Neuronal Cells (Cortical, Cerebeller Granule, Astrocytes, Sensory, Sympathetic)			●				●		●	●		
Oligodendrocytes (Glial; Precursors)			●									
Schwann Cells (Glial)			●								●	●
CELL LINES (TRANSFORMED OR TRANSFECTED)												
Dorsal Root Ganglia (Transfected)				●								●
PC-3, PC-12		●		●			●		●	●	●	
SH-SY5Y		●	●	●			●			●	●	●
STEM AND PROGENITOR CELL EXPANSION												
Neuronal Stem Cell					●		●					
***IN VITRO* DIFFERENTIATION OF PLURIPOTENT STEM CELLS**												
hESC (Cerebral Organoid Model)				●								
hESC, hiPSC (Neuronal)				●	●		●		●	●	●	●
Human NPCs (Differentiation to Neuronal Cells)				●			●				●	
mESC, rESC, miPSC (Neuronal, Progenitor)				●	●	●	●		●		●	
***IN VITRO* DIFFERENTIATION OF ADULT STEM CELLS**												
MSC (Cardiomyocyte, Chondrocyte, Hematopoetic, Hepatocyte, Neuron, Osteocyte, Spheroid)		●		●	●		●	●			●	●
Neural Progenitor/Stem Cells (Neuron, Astrocytes, Neuroblast)				●		●	●			●	●	
Prenatal Rat Cells (Neuron, Glial Cells)							●					
3D CELL CULTURE APPLICATIONS												
N2AB-1 (Neuroblastoma)	●											

Solution

Extracellular Matrix Proteins and Tools for Cell Culture Optimization

Animal cells and tissue culture techniques are constantly improved to optimize *in vitro* cell culture conditions. Extracellular Matrix (ECM) proteins coating, chemical or physical modification of the cell culture vessel, have proven to be efficient methods to better mimic *in vivo* cell behavior.

Collagen is the most abundant protein in mammals, constituting 25% of total protein mass. In tissues, collagen provides structural support, strength and resilience, and in cell culture it is used to study growth, differentiation and migration of cells. Laminin is major component of basal lamina; it acts as a glue, which holds cells and ECM together. It has active domains for collagen binding, cell adhesion, heparin binding and neurite outgrowth fragment. Laminin modulate cell growth, motility and signaling pathways.

Chemical/Synthetic Coatings

Coating of synthetic polymers: Poly-Lysine and poly-ornithine (poly amino acids) facilitates the attachment of both cells and proteins. Poly-amino acids like poly-lysine and poly-ornithine create a positive charge on polystyrene and increase the positively-charged sites available for cell binding.

Name	Cat. No	Cell Line Used	Area of Research
Collagen, Type I	**C9791, C7661, C1809, C2249, C2124**	Myoblasts, spinal ganglia, hepatocytes, embryonic lung, heart explants, fibroblasts, endothelial cells, and islet cells	Basic research, Angiogenesis, Neurobiology, Endocrinology
Collagen, Type IV	**C0543, C5533**	Epithelial cells, endothelial cells, muscle cells and nerve cells	Basic research, Angiogenesis, Neurobiology
Laminin	**L6274, L2020, L4544**	Epithelial cells, endothelial cells, muscle cells, schwannoma, tumor cells, hepatocytes	Cancer research, Regenerative medicine, Host pathogen interaction studies, Neurobiology and Endocrinology
Poly-lysine	**P4707, P4832, P7280, P9155, P6407, P6282, P7405, P5899**	Primary neurons, glial cells, neuroblastomas, transfected cell lines, fibroblasts and epithelial cells	Basic research, Cancer research and Neurobiology
Poly-L-ornithine	**P4957**	Primary neurons, glial cells, neuroblastomas, transfected cell lines, fibroblasts and epithelial cells	Basic research, Cancer research and Neurobiology
Superfibronectin *Source: Human plasma and recombinant*	**S5171**	Epithelial cells, Mesenchymal cells, Neuronal cells, Fibroblasts, Neural Crest cells, Endothelial cells	–
Tenascin *Source: Human glioblastoma cells*	**T9427**	Epithelial cells, mesenchymal cells, neuronal cells, neural crest cells	–
Thrombospondin *Source: Human platelets*	**T7043**	Osteoblasts, neurons, melanoma cells, smooth muscle cells and fibroblasts	–

Find more at **Sigmaaldrich.com/Attachmentfactors**

Sigma-Aldrich®
Lab & Production Materials

CORNING MATRIX PRODUCTS

CORNING

Neuroscience Research Product Selection Guide: Extracellular Matrix Proteins

Cat. No.	Product Description		Quantity
CLS356234	Corning® Matrigel® Basement Membrane Matrix	Corning Matrigel Matrix	5 mL
CLS354234		Corning Matrigel Matrix	10 mL
CLS356235		Corning Matrigel Matrix (50 mL)	5x10 mL
CLS354248		Corning Matrigel Matrix High Concentration (HC)	10 mL
CLS356237		Corning Matrigel Matrix Phenol Red-Free	10 mL
CLS354262		Corning Matrigel Matrix HC Phenol Red-free	10 mL
CLS356230		Corning Matrigel Matrix Growth Factor Reduced (GFR)	5 mL
CLS354230		Corning Matrigel Matrix GFR	10 mL
CLS354263		Corning Matrigel Matrix HC GFR	10 mL
CLS354277		Corning Matrigel hESC- qualified Matrix	5 mL
CLS356231		Corning Matrigel Matrix Phenol Red-free GFR	10 mL
CLS354008	Fibronectin	Fibronectin, human	1 mg
CLS356008		Fibronectin, human	5 mg
CLS356009		Fibronectin, human (25 mg)	5x5 mg
CLS354231	Collagen I	Collagen I, bovine	30 mg
CLS354243		Collagen I, human	0.25 mg
CLS354265		Collagen I, human	10 mg
CLS354236		Collagen I, rat tail	100 mg
CLS356236		Collagen I, rat tail (1 g)	10x100 mg
CLS354254		Collagen I, human recombinant	250 ug
CLS354245	Collagen IV	Collagen IV, human	0.25mg
CLS354233		Collagen IV, mouse	1mg
CLS354233		Collagen IV, mouse	10x1mg
CLS354232	Laminin	Laminin, mouse	1 mg
CLS354239		Ultra-pure Laminin, mouse	1 mg
CLS354259		Laminin/Entactin Complex High Concentration	10.5 mg
CLS354210	Poly-D-Lysine	Poly-D-Lysine, synthetic	20 mg
CLS354250	Corning PuraMatrixTM	Peptide Hydrogel, synthetic	5 mL
CLS354220	Corning rLaminin-521 (Human)	Corning rLaminin-521, human	20 µg vial
CLS354221		Corning rLaminin-521, human	100 µg vial
CLS354222		Corning rLaminin-521, human	1 mg (10 x 100 µg vials)
CLS354223		Corning rLaminin-521, human	5 mg (50 x 100 µg vials)

Corning Matrigel basement membrane matrix is a solubilized basement membrane preparation extracted from the Engelbreth-Holm-Swarm (EHS) mouse sarcoma, a tumor rich in extracellular matrix proteins to include laminin (a major component), collagen IV, heparan sulfate proteoglycans, and entactin/nidogen[1,2]. Corning Matrigel matrix also contains TGF-beta, epidermal growth factor, insulin-like growth factor, fibroblast growth factor, tissue plasminogen activator[3,4], and other growth factors which occur naturally in the EHS tumor.

1. Kleinman HK, et al. Isolation and characterization of type IV procollagen, laminin, and heparan sulfate proteoglycan from the EHS sarcoma. Biochemistry, 21:6188 (1982).
2. Kleinman HK, et al. Basement membrane complexes with biological activity. Biochemistry, 25:312 (1986).
3. Vukicevic S, et al. Identification of multiple active growth factors in basement membrane Matrigel suggests caution in interpretation of cellular activity related to extracellular activity related to extracellular matrix components. Exp. Cell Res., 202:1 (1992).
4. McGuire PG and Seeds, NW. The interaction of plasminogen activator with a reconstituted basement membrane matrix and extracellular macromolecules produced by cultured epithelial cells. J. Cell. Biochem., 40:215 (1989).

optimize > growth and consistency

Challenge

Narrow the gap between *in vitro* and *in vivo* neural cell environment and create more predictive models.

Solution

Millicell® inserts and plates

More natural cell growth is the result of biologically thoughtful engineering.

Cells *in vivo* live in a truly three-dimensional environment, and can access nutrients from every side.
In contrast, traditional plastic culture plates force cells to grow on a smooth, two-dimensional surface, leading to flattened nuclei and poor function.

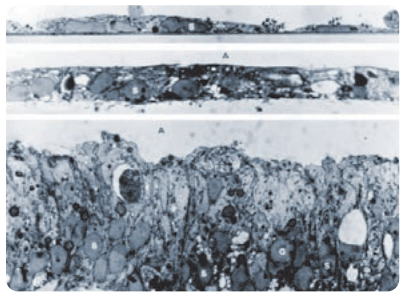
Millicell® inserts and plates feature membranes that allow easy access to both the apical and basolateral sides of cells. This encourages three-dimensional growth and opens up more options for co-culture and extended length studies. All of these enable a more accurate, predictive *in vitro* model than regular plastic plates.

Flexible formats

Our flexible formats include hanging and standing single-well inserts, multi-well plate assemblies, and tissue culture-treated receiver plates–all of which are available in a full selection of well sizes and membranes.

Closer to nature

- Improved cell morphology
- More intracellular organelles
- Better cell differentiation
- Higher cell densities
- More culture stability over time



A comparison of Sertoli cells grown on various surfaces. This seminal publication demonstrates that cells grown on Millipore® membranes impregnated with reconstituted basement membrane (RBM) form tall, columnar monolayers with ovoid or pyramidal nuclei that more closely mimic *in vivo* growth.

Byers SW, Hadley MA, Djakiew D, Dym M. Growth and characterization of polarized monolayers of epididymal epithelial cells and Sertoli cells in dual environment culture chambers. J Androl. 1986 Jan-Feb;7(1):59-68.

Millipore®

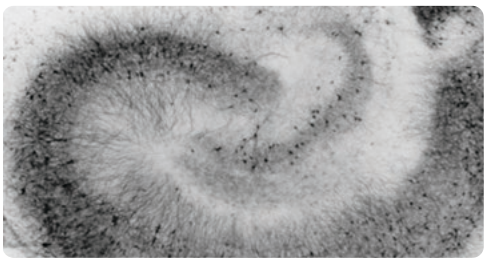
Preparation, Separation,
Filtration & Monitoring Products

Millicell® Inserts and Plates

Millicell Organotypic Insert

For High Cell Viability and Superior Study of Three Dimensional Tissue Explant Structure

These standing inserts have a lower wall, so they are easy to manipulate and can fit inside a standard petri dish. They also enable the use of optical microscopes and electro-physiology equipment above the insert, without having to remove and handle the slices. The membrane in this insert is Biopore (PTFE), which provides high viability — for as long as 40 days — and excellent trans-membrane oxygen transport. The membrane is optically clear when wet and optimized for long-term organotypic explant maintenance.



Publication: Anna De Simoni & Lily MY Yu; Preparation of organotypic hippocampal slice cultures: interface method; NATURE PROTOCOLS, VOL.1 NO.3, 1439-1445, 2006

NEW

Millicell® ERS 3.0 Digital Voltohmmeter

The Millicell® ERS 3.0 offers features for simplified data capture and enhanced analysis.

- Intuitive touchscreen interface
- Ergonomic standing in-well probe
- On-instrument data logging and background subtraction
- Option to export results to USB drive or upload to cloud
- Corded power or battery pack power source for use on the bench or in the hood
- Adjustable electrode, compatible with a wide variety of cell culture inserts
- Built-in sensor to measure and record media temperature
- Additional cloud-based features to simplify data analysis across wells and between experiments
- Resistance range of 0–100 kΩ, with 1 Ω resolution

Learn more at **Voltohmmeter webpage**

Millicell®-24 and Millicell®-96 Plate Assemblies

- Complete system with a multiwell membrane-bottom plate, single-well and/or multiwell receiver tray, and lid
- Apical assist protects the cell monolayer; allows for easier pipetting and basolateral access
- Teardrop-shaped receiver wells eliminate air bubbles
- Raised well edges for improved tape sealing, and large font labeling for easy well identification

Ordering Information

Membrane	Pore Size	Device Size	Qty/Pk	Cat. No.
Millicell® Single-Well Standing Inserts				
Organotypic Biopore™ (PTFE): Height 5 mm	0.4 µm	6-well	50	**PICM0RG50**
HA insert MF-Millipore™ (mixed cellulose esters)	0.45 µm	6-well 24-well	50 50	**PIHA03050** **PIHA01250**
CM insert Biopore™ (PTFE)	0.4 µm	6-well 24-well	50 50	**PICM03050** **PICM01250**
PCF insert Isopore (polycarbonate):	0.4 µm 0.4 µm 3 µm 8 µm 12 µm	6-well 24-well 24-well 24-well 24-well	50 50 50 50 50	**PIHP03050** **PIHP01250** **PITP01250** **PI8P01250** **PIXP01250**
Millicell® Single-Well Hanging Inserts				
PET	0.4 µm 1.0 µm 3.0 µm 5.0 µm 8.0 µm	6-well	48	**PTHT06H48** **PTRP06H48** **PTSP06H48** **PTMP06H48** **PTEP06H48**
PET	0.4 µm 1.0 µm 3.0 µm 5.0 µm 8.0 µm	12-well	48	**PTHT12H48** **PTRP12H48** **PTSP12H48** **PTMP12H48** **PTEP12H48**
PET	0.4 µm 1.0 µm 3.0 µm 5.0 µm 8.0 µm	24-well	48	**PTHT24H48** **PTRP24H48** **PTSP24H48** **PTMP24H48** **PTEP24H48**
Millicell®-24 Cell Culture Plate Assemblies				
24-well cell culture plate, single-well feeder tray, 24-well receiver tray, and lid	PCF PET PCF PCF PCF	0.4 µm 1 µm 3 µm 5 µm 8 µm	1	**PSHT010R1** **PSRP010R1** **PSST010R1** **PSMT010R1** **PSET010R1**
24-well cell culture plate, 24-well receiver tray, and lid	PCF PCF PCF	3 µm 5 µm 8 µm	5	**PSST010R5** **PSMT010R5** **PSET010R5**
24-well cell culture plate, single-well feeder tray, and lid	PCF PET	0.4 µm 1 µm	5	**PSHT010R5** **PSRP010R5**
Millicell®-96 Cell Culture Plate Assemblies				
96-well cell culture plate, single-well feeder tray, 96-well receiver tray, and lid	PCF PET	0.4 µm 1 µm	1	**PSHT004R1** **PSRP004R1**
96-well cell culture plate, 96-well receiver tray, and lid	PCF	0.4 µm	5	**PSHT004S5**
96-well cell culture plate, single-well feeder tray, and lid	PCF PET	0.4 µm 1 µm	5	**PSHT004R5** **PSRP004R5**
Millicell® ERS 3.0 Digital Voltohmmeter Instrument				
Millicell® ERS 3.0 Digital Voltohmmeter Instrument Includes: • Millicell® ERS 3.0 Digital Voltohmmeter • Millicell® ERS 3.0 Standard Adjustable Electrode (for 6-, 12-, 24-well plates) • Millicell® ERS 3.0 Wi-Fi® USB Dongle • Millicell® ERS 3.0 Power Cord • Millicell® ERS 3.0 Verification Device • Free six month trial subscription to Millicell® Cloud				**MERS03000**

optimize > growth and consistency

Challenge

A simple, reproducible method for the critical steps of accurately preparing cells and media.

Solution

Sterile Filtration

Establishing a successful neural cell culture begins with optimizing cells and media with the highest standards. From challenging neuronal cell lines to minimal sample availability, count on our sterile filtration products to provide quality and reproducibility to your media and supplements.

Stericup® and Steritop® Filter Units

Remove undesirable contaminants and sterilize your media with our high-flow rate Stericup® and Steritop® filters. This compact, stable and easy to grip system allows for very low protein binding with a wide range of membranes and volume capacities. As an added precaution it has recessed threads on the cap to safeguard against contaminants. You can also use Steritop® bottle-top devices with your own sterile capture flask or bottle.

Introducing Stericup® Quick Release Filtration Systems

Streamline your workflow with ergonomic design updates and safeguard your results with the proven performance of Millipore® membranes.

NEW Stericup®-E Eco-friendly Filtration Systems

The new 'E' (eco-friendly) additions to the Stericup® family eliminate the plastic filler funnel entirely by threading directly onto the media bottle. Stericup® E and Steritop® E filter devices reduce environmental impact by cutting down on disposable plastic, hazardous vaste and lab storage space requirements.

Learn more about the Stericup® E and the Steritop® E at:
SigmaAldrich.com/Stericup-E

Cat. No.	Product Name	Description
S2GPU11RE	Stericup® Quick Release-GP Sterile Vacuum Filtration System	1000 mL process volume, 0.22 µm pore size, polyethersulfone membrane, pkg of 12, radio-sterilized
S2GPU05RE	Stericup® Quick Release-GP Sterile Vacuum Filtration System	500 mL process volume, 0.22 µm pore size, polyethersulfone membrane, pkg of 12, radio-sterilized
SEGPT0038	Steritop® E-GP Eco-friendly Filter Unit	38 mm threaded collar, 150-1000 mL process volume, 0.2 µm pore size, fast flow PES Express Plus membrane, pkg of 12, radio-sterilized
SEGPT0045	Steritop® E-GP Eco-friendly Filter Unit	45 mm threaded collar, 150-1000 mL process volume, 0.2 µm pore size, fast flow PES Express Plus membrane, pkg of 12, radio-sterilized
SEGPU0538	Stericup® E-GP Eco-friendly Filter Unit	38 mm threaded collar, 500 mL process volume, 0.2 µm pore size, fast flow PES Express Plus membrane, pkg of 12, radio-sterilized
SEGPU0545	Stericup® E-GP Eco-friendly Filter Unit	45 mm threaded collar, 500 mL process volume, 0.2 µm pore size, fast flow PES Express Plus membrane, pkg of 12, radio-sterilized
SEGPU1138	Stericup® E-GP Eco-friendly Filter Unit	38 mm threaded collar, 1000 mL process volume, 0.2 µm pore size, fast flow PES Express Plus membrane, pkg of 12, radio-sterilized
SEGPU1145	Stericup® E-GP Eco-friendly Filter Unit	45 mm threaded collar, 1000 mL process volume, 0.2 µm pore size, fast flow PES Express Plus membrane, pkg of 12, radio-sterilized

Millipore®

Preparation, Separation,
Filtration & Monitoring Products

Challenge

Accurate and precise counts of neural cell lines is a sensitive step for reproducible downstream assays.

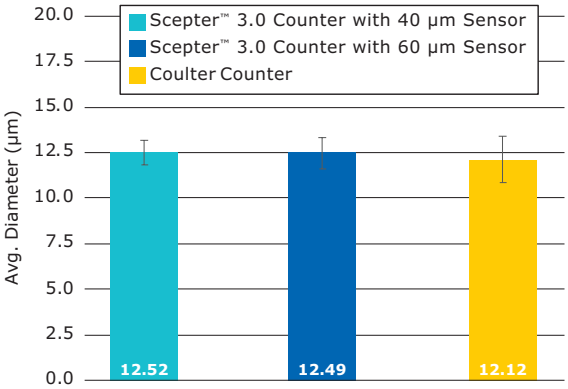
Solution

Scepter™ 3.0 Portable Cell Counter

Scepter™ cell counter provides the precision of Coulter impedance counting in a convenient, handheld format.

- Precision counts in <30 sec
- Requires no sample prep, dedicated reagents, or hazardous dyes
- No cleaning
- Does not rely on user technique or manual calculation for accuracy

Precision cell measurements



Jurkat cells were measured to test accuracy and reproducibility of cell size measurements using the Scepter™ 3.0 Cell Counter with both 40 µm and 60 µm sensors. Results are compared to the same measurement obtained with a Coulter Counter Z2™ Instrument equipped with 100 µm aperture. Data are from five measurements per sample.

Cat. No.	Description
PHCC340KIT	Scepter™ 3.0 Handheld Automated Cell Counter with 40 µm Scepter™ sensors (50/pk)
PHCC360KIT	Scepter™ 3.0 Handheld Automated Cell Counter with 60 µm Scepter™ sensors (50/pk)

Learn more about the Scepter™ cell counter and find out a list of validated cell lines at SigmaAldrich.com/Scepter

Modulate and Discover

Understanding and treating neurological diseases is a major challenge due to the complexity and dynamic environment of the central nervous system (CNS). Fortunately,precise modulation of neural function enables the correlation of cellular response to pathway biology and ultimately, mechanisms of diseases, making a big impact in neuroscience research. Ultimately, with the use of sensitive and specific biomarkers, derived from different platforms, neuroscientists can unearth new neurological findings and forge a path for new therapeutic discoveries.

Modulate
Modify the System

Discover
Novel Targets and Biomarkers

Modulate > Modify the system

With the use of gene silencing and bioactive small molecules neuroscientists have a high degree of control over their neural pathways enabling a Precise Modulation of neural function.

Challenge

There is a need for targeted modulation so scientists can understand the role of pathways in and between cells of the nervous system.

Solution

Gene Silencing

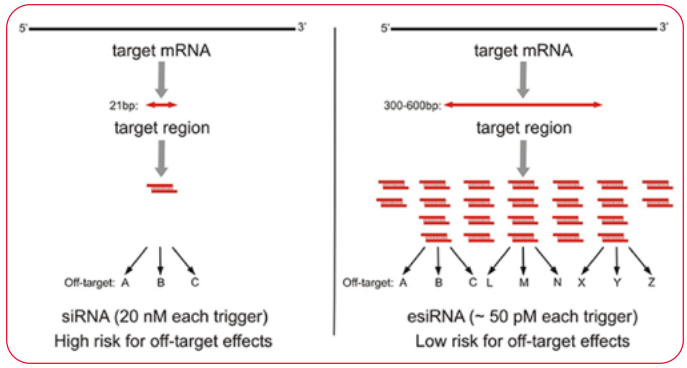
Our large portfolio of RNA interference (RNAi) tools (siRNA, esiRNA, shRNA, miRNA) allow researchers to investigate gene function and silence selected genes in order to study phenotypic responses and the role they may play in the field of neuroscience. The choice of method depends on a variety of factors, including susceptibility to transfection and desired knockdown duration. The study and manipulation of RNAi is a valued experimental tool for biomedical research that can, for example, lead to discovering new therapeutic targets for neurological diseases or identifying nerve sheath tumor driver genes.[1]

1. EBioMedicine. 2016 Jul; 9: 110-119.

Learn more at **SigmaAldrich.com/RNAi**

Custom & Predesigned esiRNA

esiRNA—powered by Eupheria Biotech—provide RNAi researchers with a proven, cost-effective, and simple way to perform post-transcriptional silencing of protein-coding genes and lncRNA (long non-coding RNA). Biologically-prepared, esiRNA are comprised of a heterogeneous pool of siRNA (natural RNA, no modifications) that all target the same mRNA sequence. These multiple silencing triggers lead to highly specific and effective gene knockdowns with lower off-target effects than single, chemically-synthesized siRNA.



Knockdown of target mRNA can be accomplished by chemically-synthesized siRNA or enzymatically-prepared siRNA (esiRNA). A) Chemically-synthesized siRNA consists of a single silencing trigger of 21 bp that is complementary to the target mRNA. The high concentration of the siRNA in the transfection reaction leads to pronounced off-target effects. B) In contrast, esiRNA consists of a pool of hundreds of siRNA (21 bp) that cover a region of 300 – 600 bp of the target mRNA. Each individual siRNA has a lower concentration in the pool, leading to lower off-target effects, while producing an efficient knockdown.

Product Benefits

- Guaranteed gene silencing
- Lower off-target effects than single, chemically-synthesized siRNA
- High on-target specificity makes for an effective primary screening tool
- Affordable genome-scale RNAi screening tool

Product Features

The following apply to all product options presented in the esiRNA specifications table:

- **Purification:** Q-Sepharose separation, isopropanol precipitation & ethanol washing
- **Sequence Form:** Pool of hundreds of siRNA with an average duplex length of 21 bp
- **Quality Control:** Conducted at two stages
  - PCR product of cDNA clone is analyzed by gel electrophoresis & DNA sequencing
  - Digestion reaction is analyzed by gel electrophoresis
- Stability: Viable for 2 years when stored at -20 °C

To learn more, visit **SigmaAldrich.com/esiRNA**

Sigma-Aldrich®
Lab & Production Materials

Solution

Bioactive Small Molecules

Bioactive small molecules (BSM) provide an essential means for controlling cellular process in order to understand the underlying biology of neural pathways. From preventing a process from occurring, stopping cell division or stimulating a different process, BSMs can control the activity of protein targets and facilitate the study of mechanisms that underlie disease. The discoveries made with BSMs allow scientists to work on the next generation neurological treatments (e.g. stem cell and personalized medicine). Count on our high quality, well-cited agonists, antagonists and modulators for targeted manipulation of neuroscience pathways. Highlighted neural specific BSMs are shown below.

Cat. No.	Product Description	Bioactivity
Monoamines		
C5976	CL 316,243	β3 adrenoceptor agonist
A9611	Atipamezole	Selective α2 adrenergic blocker
F9552	Formoterol	Fumarate β2-adrenoreceptor agonist
H8502	Dopamine hydrochloride	Neurotransmitter
M0896	MPTP hydrochloride	Dopaminergic neurotoxin
Glutamate		
SML0233	Ro 61-8048	Kynurenine 3-monooxygenase (KMO) inhibitor
SML0601	BPTES	Glutaminase GLS1 inhibitor
K3375	Kynurenic acid	NMDA, AMPA/kainate glutamate receptor antagonist
SML0053	CP-101,606	NR2B selective NMDA antagonist
M9292	Memantine hydrochloride	NMDA glutamate receptor antagonist
C239	CNQX disodium salt	AMPA/kainate receptor antagonist
Serotonin		
F132	Fluoxetine hydrochloride	Selective serotonin reuptake inhibitor; antidepressant
P9623	Paroxetine hydrochloride	Selective serotonin reuptake inhibitor; antidepressant
SML0797	Flibanserin	5-HT1A receptor agonist; 5-HT2A receptor antagonist
R0875	Reserpine	Inhibits vesicular uptake of catecholamines and serotonin
GABA		
SML0035	Tiagabine hydrochloride	Selective GAT1 inhibitor; anticonvulsant
S106	SR-95531	Specific GABAA receptor antagonist
Z103	Zolpidem	GABAA receptor-associated benzodiazepine receptor agonist
G154	Gabapentin	Anti-convulsant, anxiolytic; increases brain GABA
Acetylcholine		
P6503	Pilocarpine hydrochloride	Nonselective muscarinic acetylcholine receptor agonist
SML1102	Darifenacin hydrobromide	M3 muscarinic acetylcholine receptor antagonist; antispasmodic
SML0881	Rivastigmine tartrate	Reversible cholinesterase inhibitor
SML3034	Tolterodine l-tartrate	Bladder-specific muscarinic antagonist

Cat No.	Product Description	Bioactivity
Parkinson's Disease		
M0896	MPTP hydrochloride	Dopaminergic neurotoxin
A4393	Apomorphine hydrochloride	Nonselective dopamine agonist with anti-Parkinsonian effects
R9281	Rotigotine hydrochloride	Dopamine receptor agonist with preference for D3 receptors
SML0124	Rasagiline mesylate	Irreversible inhibitor of monoamine oxidase-B
SML0150	Tolcapone	Catechol-O-methyltransferase (COMT) inhibitor
SML1966	SK609 hydrochloride	Dopamine D3 receptor (D3R) selective agonist
SML2170	HX531	Potent antagonist of the retinoid X receptor
SML2324	NLX-112 hydrochloride	Highly selective 5-HT1A receptor full agonist
Alzheimer's Disease		
553030	RAGE Antagonist, FPS-ZM1	Blood brain barrier permeant; Blocks RAGE-mediated influx of Aβ40 and Aβ42
580222	Tau Aggregation Inhibitor	BBB-permeable aminothienopyridazine tau aggregation inhibitor
PZ0190	Avasimibe	Boavailable Acyl-CoA:Cholesterol O-Acyltransferase inhibitor
S3442	SB 216763	Potent, selective, cell permeable glycogen synthase kinase-3 (GSK-3) inhibitor
SML0244	Thiamet G	Potent inhibitor of the enzyme O-GlcNAcase; BBB permeable
SML0282	Bexarotene	Highly selective retinoid X receptor (RXR) agonist
SML0743	EUK-134	Salen-manganese complex that inhibits amyloid fibril formation
SML2063	Davunetide trifluoroacetate salt	Active component of activity-dependent neuroprotective protein
Huntington's Disease		
SML2404	EC23	Induces neural differentiation of hESCs
317240	Metformin	Enhances neurogenesis
T2952	Tetrabenazine	Reversible type 2 vesicular monoamine transporter inhibitor
SML1648	24(S)-Hydroxycholesterol	Potent allosteric modulator of N-methyl-d-aspartate receptors
SML0583	Ferrostatin-1	Prevents neurotoxicity induced by glutamate in cellular models
SML0474	(S)-Duloxetine hydrochloride	Dual serotonin/norepinephrine reuptake inhibitor
M107	(+)-MK-801 hydrogen maleate	Highly potent, selective non-competitive NMDA glutamate receptor antagonist

Sigma-Aldrich®
Lab & Production Materials

Modulate > Modify the system

Solution

Proteins

Neurodegenerative diseases have been associated with abnormal accumulation of misfolded, hyperphosphorylated, and aggregated proteins. These protein inclusions within neurons are the primary hallmarks of major disorders. Biochemical changes affecting multiple protein pathways contribute to the formation of neuronal disease.

Whether it's Alzheimer's disease, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis (ALS), or other neuronal diseases, to support your neuronal research our broad portfolio of neuronal proteins features:

- High purity for precision
- Extensive characterization
- Lot-to-lot consistency

With a diverse portfolio of proteins and peptides, we offer multiple protein formats and formulations as well as a variety of neuronal peptides to maximize your experimental agility and flexibility while planning your next big breakthrough. Our portfolio also provides product specifications suitable for neuronal research and high experimental reproducibility.

Our Top Neural Proteins

Cat No.	Product Description
M1891	Myelin Basic Protein bovine
N7161	Nogo-66(1-40) antagonist peptide
M2295	Myelin Basic Protein from guinea pig brain
M3755	Myelin Basic Protein Guinea Pig Fragment 68-82

Selected Top Proteins for Alzheimer's Disease Research

Aggregation of amyloid beta peptides and accumulation of hyperphosphorylated aggregated microtubule- associated Tau, are two major Alzheimer's disease hallmarks. Our portfolio includes several Amyloid and Tau proteins and fragments as well as Secretases and Signaling Proteins for their processing.

Cat No.	Product Description
A9810	Amyloid β Protein Fragment 1-42
A4559	Amyloid β-Protein Fragment 25-35
S4195	β-Secretase human
G4296	GSK3β, active, His tagged human
T0576	Tau-441 human, recombinant, expressed in *E. coli*, ≥90% (SDS-PAGE), lyophilized powder
SAE0076	Tau-441 human, recombinant, lyophilized powder, expressed in HEK 293 cells, ≥95% (SDS-PAGE)

Selected Top Proteins for Parkinson's Disease Research

With its complex etiology and impact on millions, Parkinson's disease continues to be the subject of intensive research effort.

Cat No.	Product Description
S7820	α-Synuclein human
S1071	α-Synuclein A53T human
C1224	Caspase 3 human
A4861	p38α, active, GST tagged human

Selected Top Proteins for Huntington's Disease, ALS, and Prion Diseases

Pathogenesis in Huntington's disease, ALS, and Prion diseases appears to involve a variety of mechanisms making their research vital to help understand these complex diseases.

Cat No.	Product Description
SRP0187	Bcl-xL Active human
C6108	Calpain 1 human
SRP5173	CBP (1319-1710), GST tagged human
P4238	Prion Protein Fragment 106-126 Scrambled Human

DISCOVER >
Novel Targets & Pathways

The ability to screen large numbers of DNA/RNA/proteins involved in neurological diseases can result in identifying new cellular pathways and potentially new therapeutics (e.g. specifically inhibit the disease-causing mechanisms of cellular targets). Count on our powerful technologies to screen genes and small molecules to thoroughly examine neural pathways.

Challenge

Within complex neural pathways there is a need to identify novel targets.

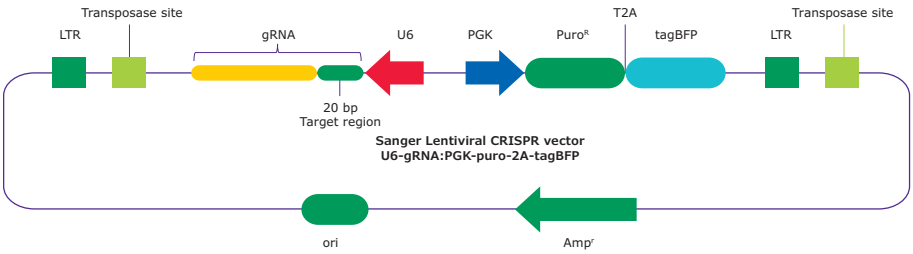
Solution

CRISPR Screening Libraries

Sanger library

Genome-wide loss-of-function screening is a powerful approach to discover genes and pathways that underlie biological processes in neuroscience. We have partnered with The Wellcome Sanger Institute to make the first arrayed lentiviral CRISPR knockout library for human and mouse genomes.

- Whole genome arrayed Sanger libraries for human and mouse with BFP detection



Sanger Lentiviral CRISPR vector schematic (U6-gRNA:PGK-puro-2A-tagBFP)

Gene knockout

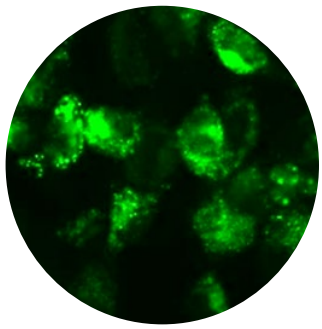
CRISPR Cas9 nucleases have revolutionized the field of gene editing and high-throughput lentiviral screens continue to hold ever-increasing promise for both basic research and development of future therapies to benefit human health. Explore these genetic screens for neural pathway target discovery.

We offer a range of screening libraries for genomic manipulations.

	Library	Type	Pooled or Arrayed	Number of Clones	Avg. Clones per Gene	Available Formats	Specifications	Vector Components	Price
CRISPR	Sanger whole genome library	Knockout	Arrayed	~34,000	~2 per gene	Lentivirus or Glycerol stocks	10 µL @ min. 1x106 VP/mL in 102x384 well plates	gRNA only; Puromycin; BFP	+++
	GeCKO whole genome library	Knockout	Pooled	~124,000	~6 per gene	Lentivirus	200 µL (8x25 µL) @ min. 5x108 VP/mL	gRNA only or all-in-one with Puromycin	+
	Sigma whole genome library	Knockout	Pooled	~184,000	~10 per gene	Lentivirus	200 µL (8x25 µL) @ min. 5x108 VP/mL	Puromycin	+
	CRISPRa SAM whole genome library	Activation	Pooled	~70,000	~3 per Transcriptional Start Sites	Lentivirus	200 µL (8x25 µL) @ min. 5x108 VP/mL	gRNA only with Puromycin or Zeocin	++
	CRISPRi whole genome library	Inhibition	Pooled	~258,000	~10 per Transcriptional Start Sites	Lentivirus	200 µL (8x25 µL) @ min. 5x108 VP/mL	gRNA only; Puromycin; BFP	++

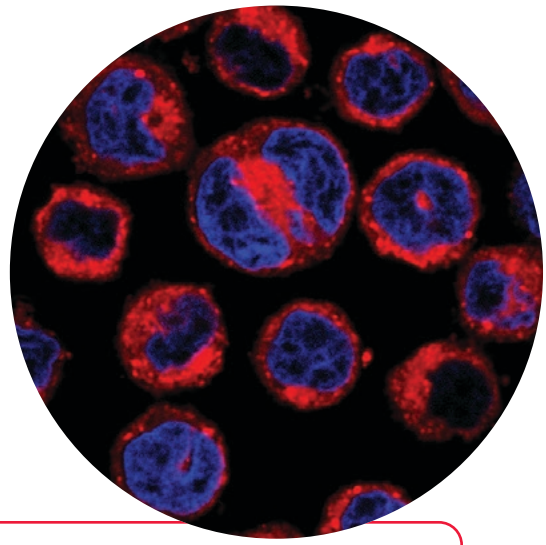
Learn more at SigmaAldrich.com/screening

Solution



RNA interference

RNA interference (RNAi), either synthetic small interfering RNA (siRNA) or the vector-based short hairpin RNA (shRNA), is an important tool to study genes by silencing gene function and examine which processes are affected in neural pathways. RNAi screening is a very powerful tool to map out gene functions, identify redundant genes that perform similar or compensatory functions, as well as validate predicted (hypothetical) gene functions.



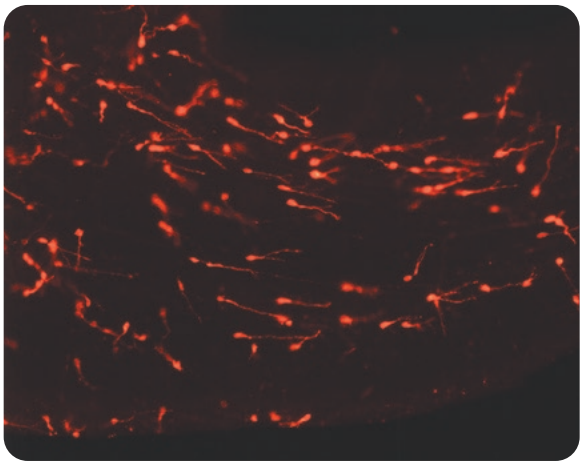
MISSION® shRNA library

The most comprehensive and thoroughly validated shRNA collection available, MISSION® shRNA library is an exclusive technology and contains almost 250,000 clones including more than 80,000 validated clones. It combines all of the highly trusted TRC1 content plus an additional 88,000 clones targeting 4,000 new human genes and more than 5,000 new mouse genes.

To learn more about the Mission® shRNA products offering please visit: **SigmaAldrich.com/shRNA**

Technology Highlight

Need tools to create your cell based assay?



Learn more at
SigmaAldrich.com/livecellimagingreagents

Live cell imaging tools

Flow cytometry and antibody based assays are a great way to capture a snap shot of cellular events. However, if you want to track real time changes in cell based assays, chelators and ion probes can be used to track ionic concentrations in fluorescent measurements and provide information on your assay including cell viability, ions, pH, nitric oxide or oxygen. Because slight ionic changes can indicate deviations in neuronal function, count on our fluorescent dyes, probes, and biosensors to build your cell based assay and monitor your area of interest.

- PKH/CellVue® Cell Labeling Kits: PKH and CellVue® Fluorescent Cell Linker Kits provide fluorescent membrane labeling of live cells over an extended period of time.
- LentiBrite™ Fluorescent Biosensors: Pre-packaged high-titer fluorescent lentiviral particles encoding GFP/RFP labeled proteins for topics such as autophagy, apoptosis, and cell structure.

Sigma-Aldrich®
Lab & Production Materials

DISCOVER > BIOMARKERS

As various research labs measure and evaluate neurological biomarkers, highly verified assays are essential to ensure accuracy, precision and reproducibility. This level of robustness allows you to produce results you can trust, with minimal repetition.

Challenge

Inconsistent batches make it difficult to quantify biomarkers.

Solution

As your research uncovers the significant role of biomarkers in neurological disease states, you need a reliable partner for quality assays and consistent performance. Validate and quantify your biomarkers with our ELISA and MILLIPLEX® map (multi-analyte profiling) assays that provide reproducibility in every lot, backed by unwavering technical support. Be assured whether you are quantifying basic research or critical patient targets, you can rely on our assays to provide consistent results.

Enzyme-Linked Immunosorbent Assays (ELISA)

Get a fuller picture of the complexities associated with non-disease and disease states of the nervous system with reliable quantification of biomarkers in sera and lysates using trusted ELISA techniques. ELISAs combine the specificity of antibodies with the sensitivity of simple enzyme assays, so you can successfully quantify critical targets. We lead in developing neuro-specific ELISAs, with over 20 ELISAs supporting neuroscience research and more than 1,000 available within our comprehensive ELISA portfolio.

Highlighted Neuroscience ELISAs

Description	Species	Standard Curve Range	Sensitivity	Sample Volume	Cat. No.
Amyloid beta 1–40	Human	16–500 pg/mL	4 pg/mL	50 µL	**EZHS40**
Amyloid beta 1–42	Human	16–500 pg/mL	5 pg/mL	50 µL	**EZHS42**
Amyloid beta, Set	Human	Contains 1 each of EZHS40 and EZHS42			**EZHS-SET**
Amyloid beta (Brain) 1–42	Human	16–500 pg/mL	5 pg/mL	50 µL	**EZBRAIN42**
Amyloid beta (Brain), Set	Human	Contains 1 each of EZBRAIN40 and EZBRAIN42			**EZBRAIN-SET**
BDNF (Brain-Derived Neurotrophic Factor)	Human, Rat	7.8–500 pg/mL	7.8 pg/mL	50 µL	**CYT306**
GFAP (Glial Fibrillary Acidic Protein)	Human, Mouse, Rat	1.5–100 ng/mL	1.5 ng/mL	100 µL	**NS830-M**
NPY (Neuropeptide Y)	Human	5–1000 pg/mL	2 pg/mL	50 µL	**EZHNPY-25K**
NPY (Neuropeptide Y)	Mouse, Rat	0.01–2 ng/mL	0.004 ng/mL	20 µL	**EZRMNPY-27K**
PEDF (Pigment Epithelium-Derived Factor)	Human	0.9–62.5 ng/mL	0.9 ng/mL	50 µL	**CYT420**
Phosphorylated Neurofilament, (pNF-H) Sandwich	Multi-Species	0.0293–15 ng/mL	0.0585 ng/mL	1–10 µL	**NS170**
S100B	Human	2.7–2000 pg/mL	1.3 pg/mL	50 µL	**EZHS100B-33K**
Conferma™ ELISA Kits					
Human IL-6 Conferma™ ELISA					**EZIL6-98K**
Human IL-8 Conferma™ ELISA					**EZHIL8-100**
Human MCP-1 Conferma™ ELISA					**EZMCP1-99KRM**
Human TNFa Conferma™ ELISA					**EZHTNFA-150K**

Discover more at **SigmaAldrich.com/conferma**

Discover our comprehensive portfolio of ELISAs at **SigmaAldrich.com/ELISA**

Millipore®

Preparation, Separation,
Filtration & Monitoring Products

Challenge

Low volume samples can create serious challenges for analyzing data.

Solution

MILLIPLEX® Multiplex Platform

Neuroscientists are often limited by their sample amount (e.g. cerebrospinal fluid, plasma, etc.) and need a method that allows for reproducibility with low volume sample requirements. Count on our neuroscience-specific MILLIPLEX® panels, where you can simultaneously measure multiple biomarker analytes in a single sample, in a single plate well and generate an abundance of reliable data from a single experiment. This multiplex method can save you time and valuable sample material so you can bring your neuroscience biomarkers to life.

MILLIPLEX® multiplex assays enable you to measure neuroscience-related biomarkers. A sample of key targets are shown below:

Neurodegenerative Disease

- Amyloid β40
- Amyloid β42
- Apo E
- GDNF
- **s**ICAM-1
- PAI-1
- **s**RAGE
- S100B
- **s**VCAM-1

Neurological Disorders

- AGP
- CP
- NGFβ
- NSE
- Park5
- Park7
- Phospho Tau
- SAP
- Tau

Neuropeptide/ Neurohormone Signaling

- α-MSH
- Cortisol
- Melatonin
- Orexin A
- Oxytocin
- Substance P

s = Soluble

Discover our comprehensive portfolio at SigmaAldrich.com/milliplex

Highlighted MILLIPLEX® Neuroscience Panels

Human Neuroscience

Human Amyloid Beta and Tau (CSF samples)

(Cat. No. HNABTMAG-68K)

- Amyloid beta 1-40
- Amyloid beta 1-42
- pTau (Thr181)
- Tau (total)

Human Neuroscience Panel 1 (CSF samples)

(Cat. No. HNS1MAG-95K)

- α-Synuclein
- Glial Fibrillary Acidic Protein (GFAP)
- Neuron-specific Enolase (NSE)
- PARK5/UCHL1
- PARK7/DJ1
- Transglutaminase 2 (TGM2)

Human Neuroscience Panel 2

(Cat. No. HNS2MAG-95K)

- Angiogenin
- ApoE4
- FABP3
- Ferritin
- Neurogranin
- TREM2

Human Neurodegenerative Disease Panel 1

(Cat. No. HNDG1MAG-36K)

- α-2-Macroglobulin
- Apo AI
- Apo CIII
- Apo E
- Complement C3
- Complement Factor H

Human Neurodegenerative Disease Panel 2

(Cat. No. HNDG2MAG-36K)

- α-1-Antitrypsin (A1AT)
- C4
- CRP
- MIP-4/PARC/CCL18
- PEDF
- Serum Amyloid P (SAP)

Human Neurodegenerative Disease Panel 3

(Cat. No. HNDG3MAG-36K)

- BDNF
- Cathepsin D
- sICAM-1
- Myeloperoxidase (MPO)
- sNCAM
- PAI-1 (total)
- PDGF-AA
- PDGF-AB/BB
- RANTES/CCL5
- sVCAM-1

Human Neurodegenerative Disease Panel 4 (CSF samples)

(Cat. No. HNDG4MAG-36K)

- Amyloid beta 1-40
- Amyloid beta 1-42
- GDNF
- sRAGE
- S100B

Human Neurological Disorders Panel 3

(Cat. No. HND3MAG-39K)

- Angiotensinogen (AGT)
- Contactin-1
- Fetuin A
- Kallikrein-6
- Osteopontin (OPN)
- Soluble Superoxide Dismutase 1 (sSOD1)
- Soluble Superoxide Dismutase 2 (sSOD2)

Human Neuropeptide

(Cat. No. HNPMAG-35K)

- α-MSH
- β-Endorphin
- Neurotensin
- Oxytocin
- Substance P

Human Circadian Stress

(Cat. No. HNCSMAG-35K)

- Cortisol
- Melatonin

Mouse Amyloid Beta

(Cat. No. MABMAG-83K)

- Amyloid beta 1-40
- Amyloid beta 1-42

Mouse Neuropeptide

(Cat. No. RMNPMAG-83K)

- α-MSH
- β-Endorphin
- Neurotensin
- Oxytocin
- Substance P

Rat Neuropeptide

(Cat. No. RMNPMAG-83K)

- α-MSH
- β-Endorphin
- Neurotensin
- Oxytocin
- Substance P

Discover the power of integrating Multiplexing Immunoassays and our ultrasensitive Single Molecule Counting (SMC™) Immunoassay platform to revolutionize the study of Alzheimer's and neurodegenerative diseases.

To explore our offerings, visit SigmaAldrich.com/immunoassays-AD

Request more information on our expanding SMC™ Neurology Kits, including SMC™ Neurofilament Light Chain (NF-L) and Phospho-Alpha Synuclein (S129), at SigmaAldrich.com/smc-neuro

Challenge

Low volume samples can create serious challenges for analyzing data.

Solution

Neuroscience Assay Kits for Metabolite Analysis

Imbalances to metabolites can be an indicator of diseases, such as cancer, diabetes, obesity, and neurodegeneration. Merck metabolism assay kits present a variety of high-quality biochemical reagents for the quantification of metabolites and nutrients that serve as biomarkers during states of disease. Most of our assay kits are suitable for high-throughput analysis and utilize spectrophotometric and/or fluorometric detection methods. A sample of key targets for Neuroscience Research are shown below:

Cat. No.	Product Description
MAK039	Acetyl-Coenzyme A Assay Kit
MAK119	Acetylcholinesterase Assay Kit
MAK324	Acetylcholinesterase Inhibitor Screening Kit
MAK051	Aconitase Activity Assay Kit
MAK337	Aconitase Assay Kit
EPI021	Adenosylhomocysteinase (AHCY) Activity Fluorometric Assay Kit
MAK223	Aldolase Activity Colorimetric Assay Kit
MAK189	Alpha-Ketoglutarate Dehydrogenase Activity Colorimetric Assay Kit
MAK334	Antioxidant Assay Kit
MAK328	Arginase Inhibitor Screening Kit
MAK095	Aspartate Assay Kit
MAK190	ATP Colorimetric/Fluorometric Assay Kit
MAK003	Branched Chain Amino Acid Kit
MAK022	Calcium Colorimetric Assay
MAK056	Choline/Acetylcholine Quantification Kit
MAK139	Colorimetric Aldehyde Assay Kit
MAK140	Colorimetric Aldehyde Assay Kit, Blue
MAK127	Copper Assay Kit
MAK079	Creatine Assay Kit
MAK080	Creatinine Assay Kit
MAK320	D-2-Hydroxyglutarate (D2HG) Assay Kit
MAK336	D-Lactate Assay Kit
MAK058	D-Lactate Colorimetric Assay
MAK352	DL-Serine Assay Kit
MAK369	Ferric Reducing Antioxidant Power (FRAP) Assay Kit (Colorimetric)
MAK165	Fluorimetric Hydrogen Peroxide Assay Kit
MAK166	Fluorimetric Hydrogen Peroxide Assay Kit
MAK141	Fluorometric Aldehyde Assay Kit
MAK150	Fluorometric Intracellular pH Assay Kit
MAK145	Fluorometric Intracellular ROS Kit
MAK143	Fluorometric Intracellular ROS Kit
MAK142	Fluorometric Intracellular ROS Kit
MAK144	Fluorometric Intracellular ROS Kit
MAK089	Gamma Glutamyl Transferase (GGT) Activity Colorimetric Assay Kit

Cat No.	Product Description
MAK004	Glutamate Assay Kit
MAK330	Glutamate Assay Kit
MAK261	Glycine Assay Kit (Fluorometric)
MAK091	Hexokinase Colorimetric Assay Kit
MAK264	High Sensitivity Triglyceride Fluorometric Assay Kit
MAK357	Hydroxyproline Assay Kit (Perchlorate-Free)
MAK164	Intracellular Hydrogen Peroxide Assay
MAK085	Lipid Peroxidation (MDA) Kit
MAK358	Lithium Assay Kit
MAK196	Malate Dehydrogenase Assay Kit
MAK359	Mitochondrial Complex I Activity Colorimetric Assay Kit
MAK360	Mitochondrial Complex III Activity Assay Kit
MAK295	Monoamine Oxidase A (MAO-A) Inhibitor Screening Kit (Fluorometric)
MAK136	Monoamine Oxidase Assay Kit
MAK296	Monoamine Oxidase B (MAO-B) Inhibitor Screening Kit (Fluorometric)
MAK311	Peroxide Assay Kit
MAK365	Phenolic Compounds Assay Kit (Colorimetric)
MAK005	Phenylalanine Assay Kit
MAK049	Phosphatidylcholine Assay Kit
MAK371	Phosphatidylserine Assay Kit (Fluorometric)
MAK172	Proteasome 20S Activity Assay Kit
MAK094	Protein Carbonyl Content Assay Kit
MAK183	Pyruvate Dehydrogenase Activity Assay Kit
MAK262	Sphingomyelin Quantification Colorimetric Assay Kit
MAK197	Succinate Dehydrogenase Activity Colorimetric Assay Kit
MAK217	Succinyl-Coa Synthatase Activity Colorimetric Assay Kit
MAK187	Total Antioxidant Capacity Assay Kit
MAK266	Triglyceride Quantification Colorimetric/Fluorometric Kit
MAK173	Universal Fluorometric Kinase Assay Kit
MAK186	Xanthine/Hypoxanthine Assay Kit
MAK032	Zinc Assay Kit
MAK318	α-Mannosidase Assay Kit
MAK129	β-Glucosidase Assay Kit

Discover more about Metabolite Kits at
SigmaAldrich.com/metabolomics

Sigma-Aldrich®
Lab & Production Materials

characterize

Mapping the sensitivity and variability of the brain is crucial for interpreting findings and driving new discoveries in neuroscience research. With innovative technologies in visualization and detection, scientists can now further their understanding of the brain. This growth of knowledge and information of the nervous system allows you to better treat neurological diseases and ultimately improve the human condition. Our focus is on working with you to provide the neural detection tools you need to enhance your research.

Visualize
changes

Detect
changes

characterize > visualize and detect

Neurons are dynamic entities, sensing and responding to their immediate environment. For this reason, understanding these protein interactions and signaling mechanisms is a focus of neurobiology research and key to understanding normal and disease processes.

Challenge

Acquire visual information on protein interactions in their native state.

Solution

Protein Detection Technology

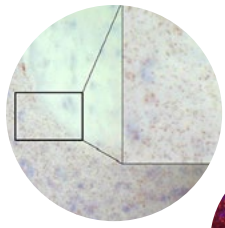
The chance to discover the inner workings of the brain and its components requires a powerful investigative tool to allow scientists to visualize those protein interactions. With Duolink® proximity ligation assay (PLA) technology neuroscientists can visualize protein interactions, locations and quantities by amplifying signals corresponding to single protein events. This protein detection technology lets researchers visualize protein functions under true biological conditions without overexpression or genetic manipulation, providing a significant resource in advancing neuroscience.

Learn more at **SigmaAldrich.com/duolink**

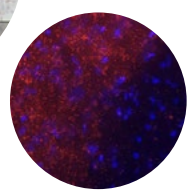
Application Highlight

Mouse Coronal Tissue Analysis with Duolink® PLA

- Duolink® PLA was performed on commercially available mouse Caudate Putamen (striatum) frozen floating sections.
- Brains were fixed overnight in 10% buffered formalin, cryoprotected for 24-36 hours, snapped frozen in O.C.T. medium, and sectioned at a thickness of 30 microns. A polyclonal rabbit antibody targeting the human phosphorylated MAPK pp44/p42 and Duolink® PLA was used.
- Visualized in a standard epi-fluorescence microscope.
- All reactions generated robust and distinct Duolink® PLA staining.



Duolink® Brightfield Detection P-MAPK p44/p42 in Mouse Brain



Duolink® Fluorescence Detection P-MAPK p44/p42 in Mouse Brain showing strong and low staining

Cat. No.	Product Description
DUO92106	Duolink® *In Situ* Orange Starter Kit Goat/Rabbit
DUO92104	Duolink® *In Situ* Orange Starter Kit Mouse/Goat
DUO92102	Duolink® *In Situ* Orange Starter Kit Mouse/Rabbit
DUO92105	Duolink® *In Situ* Red Starter Kit Goat/Rabbit
DUO92103	Duolink® *In Situ* Red Starter Kit Mouse/Goat
DUO92101	Duolink® *In Situ* Red Starter Kit Mouse/Rabbit

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Lab & Production Materials

Challenge

Detecting changes in neural cell structure and function correlating to development and disease.

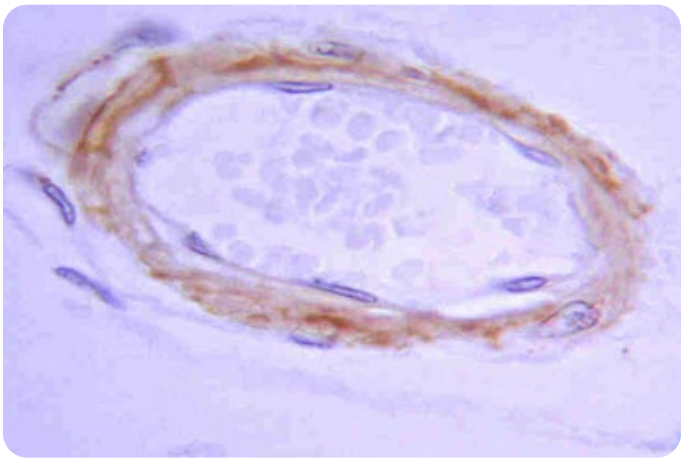
Solution

Targeted Antibodies – Application Tested

With advancements in antibody-based biomarker detection reagents, specific and robust primary antibodies, and improved immunodetection techniques, neuroscience is being transformed. We offer neuroscientists the broadest range of trusted antibodies, fully validated in neuro-specific tissues and cell lines for a wide variety of applications (e.g. IHC, WB, ICC), so researchers can better explore and understand the mechanisms of neurological diseases.

Neurodegeneration

The progressive loss of neuronal function can lead to serious debilitating diseases (e.g. Alzheimer's) and cause premature death. This loss of function (neurodegeneration) has been attributed to cell signaling dysfunction, plaque formations, and membrane damage, and programmed cell death.



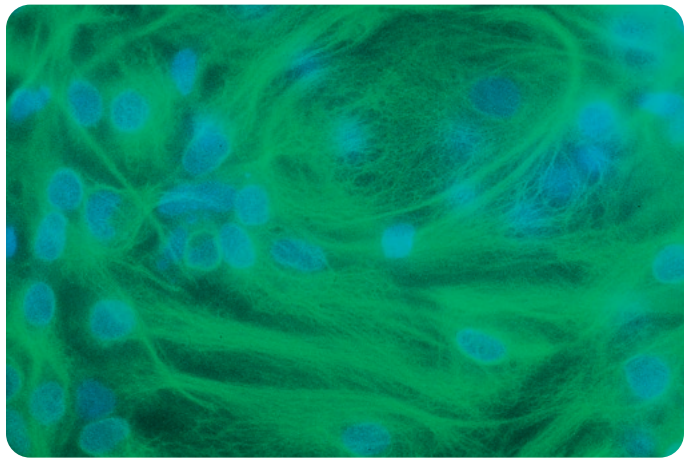
Beta-Amyloid (Cat. No. AB5078P) staining on Alzheimer's Disease-Brain. Tissue pretreated with Citrate, pH 6.0. Polyclonal Ab

Highlighted Neurodegeneration Related Antibodies

Cat. No.	Product Name	Clonality	Species Origin	Applications
ZRB5320	Anti-NG2 Antibody, clone 1L2, ZooMAb® Rabbit Monoclonal	Recombinant Monoclonal	Rabbit	ICC, IF, WB
AB5078P	Anti-Beta-Amyloid 1-42 Antibody	Polyclonal	Rabbit	ELISA, IHC, WB
AB5038	Anti-Synuclein α Antibody	Polyclonal	Rabbit	ICC, IHC, WB
MAB348	Anti-APP A4 Antibody	Monoclonal-22C11	Mouse	IF, IHC, WB
MAB2166	Anti-Huntingtin Protein Antibody	Monoclonal-1HU-4C8	Mouse	ELISA, ICC, IHC, IP, WB

Neuroregeneration

Neuronal development, differentiation, and growth are controlled by a variety of chemical signals and interplay of various transcription factors. Neuronal identity is established by the action of transcriptional programs initiated by the temporal action of transcription factors.



Glial cells cultured from rat amygdala. Nuclei stained blue with DAPI (Cat. No. D9542) and glial processes stained green with Rabbit Anti-GFAP (Cat. No. G9269)

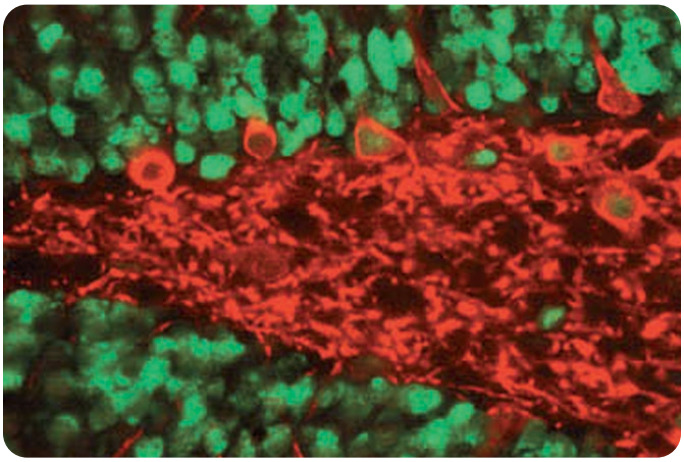
Highlighted Neuroregeneration Related Antibodies

Cat. No.	Product Name	Clonality	Species Origin	Applications
AB9610	Anti-Olig-2 Antibody	Polyclonal	Rabbit	ICC, IHC, IP, WB
ABD69	Anti-Nestin, Human Antibody	Monoclonal-9H10	Hamster	WB, ICC, IHC
AB1554	Anti-Nerve Growth Factor Receptor Antibody, p75	Polyclonal	Rabbit	ICC, IHC, IP
G9269	Anti-Glial Fibrillary Acidic Protein (GFAP) Antibody	Polyclonal	Rabbit	FC, IHC, ICC
HPA004765	Anti-NGFR antibody	Polyclonal	Rabbit	WB, IHC

FC = Flow Cytometry; ICC = Immunocytochemistry; IHC = Immunohistochemistry; IF = Immunofluorescence; IP = Immunoprecipitation; WB = Western Blot

Cell Structure Antibodies

Neuronal cell structure immunostaining is commonly used to visualize morphological changes that occur as a function of a disease state or perturbation and to demonstrate the localization of other biomarkers relative to organelle or cytoskeletal structure.



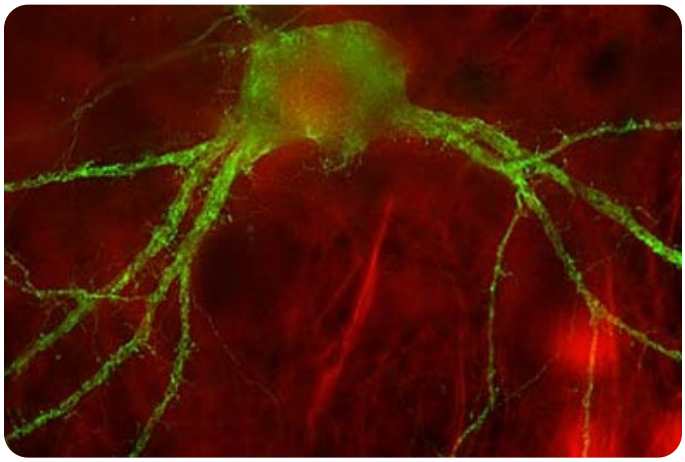
Mouse anti-NeuN (Cat. No. MAB377) and Rabbit anti-Substance P Receptor (Cat. No. AB5060) staining of normal rat hippocampus.

Highlighted Cell Structure Antibodies

Cat. No.	Product Name	Clonality	Species Origin	Applications
MAB377	Anti-NeuN Antibody	Monoclonal-A60	Rabbit	FC, ICC, IF, IHC, IP, WB
MAB345M	Anti-O4 Antibody	Monoclonal-81	Mouse	ICC, IHC
T8578	Anti-β-Tubulin III Antibody	Monoclonal-2G10	Mouse	ICC, IHC, IP, WB
MAB3420	Anti-Tau-1 Antibody	Monoclonal-PC1C6	Mouse	IHC, WB
AB5622	Anti-MAP2 Antibody	Polyclonal	Rabbit	ICC, IHC, WB, IF

Cell Function Antibodies

To monitor and evaluate the ability for neurons to thrive and communicate through neurotransmission is fundamental to this area of research. A wide range of proteins are involved in neuron signaling and regulation of neurotransmitters.



anti-Tyrosine Hydroxylase (TH) staining in mouse primary neural cultures using Cat. No. AB152 shown with an FITC fluorescent secondary (green).

Highlighted Cell Function Antibodies

Cat. No.	Product Name	Clonality	Species Origin	Applications
AB152	Anti-Tyrosine Hydroxylase Antibody	Polyclonal	Rabbit	ELISA, IF, IHC, IP, WB
AB144P	Anti-Choline Acetyltrans-ferase Antibody	Polyclonal	Goat	ICC, IHC, WB
MAB5406	Anti-GAD67 Antibody	Monoclonal-1G10.2	Mouse	IHC, WB
AB1506	Anti-Glutamate Receptor 2 & 3 Antibody	Polyclonal	Rabbit	IHC, ICC, IP, WB
ZRB1365	Anti-Synaptophysin Antibody, clone 2B21, ZooMAb® Rabbit Monoclonal	Recombinant Monoclonal	Rabbit	IHC, ICC, WB

Sigma-Aldrich®
Lab & Production Materials

FC = Flow Cytometry; ICC = Immunocytochemistry; IHC = Immunohistochemistry; IF = Immunofluorescence; IP = Immunoprecipitation; WB = Western Blot

Solution

Prestige Antibodies®

When detecting neural pathways, you can rely with confidence on our target-qualified Prestige Antibodies® that are supported with neural-specific images and access to all characterization data.

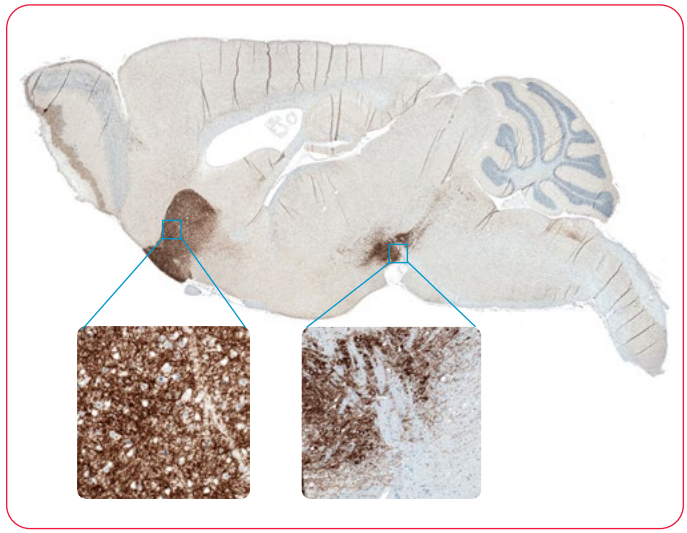
- Each antibody is supported by over 700 IHC, IF and Western blot images
- Developed by the Human Protein Atlas (HPA) Project
- All data is publically available on the Human Protein Atlas website

Prestige Antibodies®
Powered by ATLAS ANTIBODIES

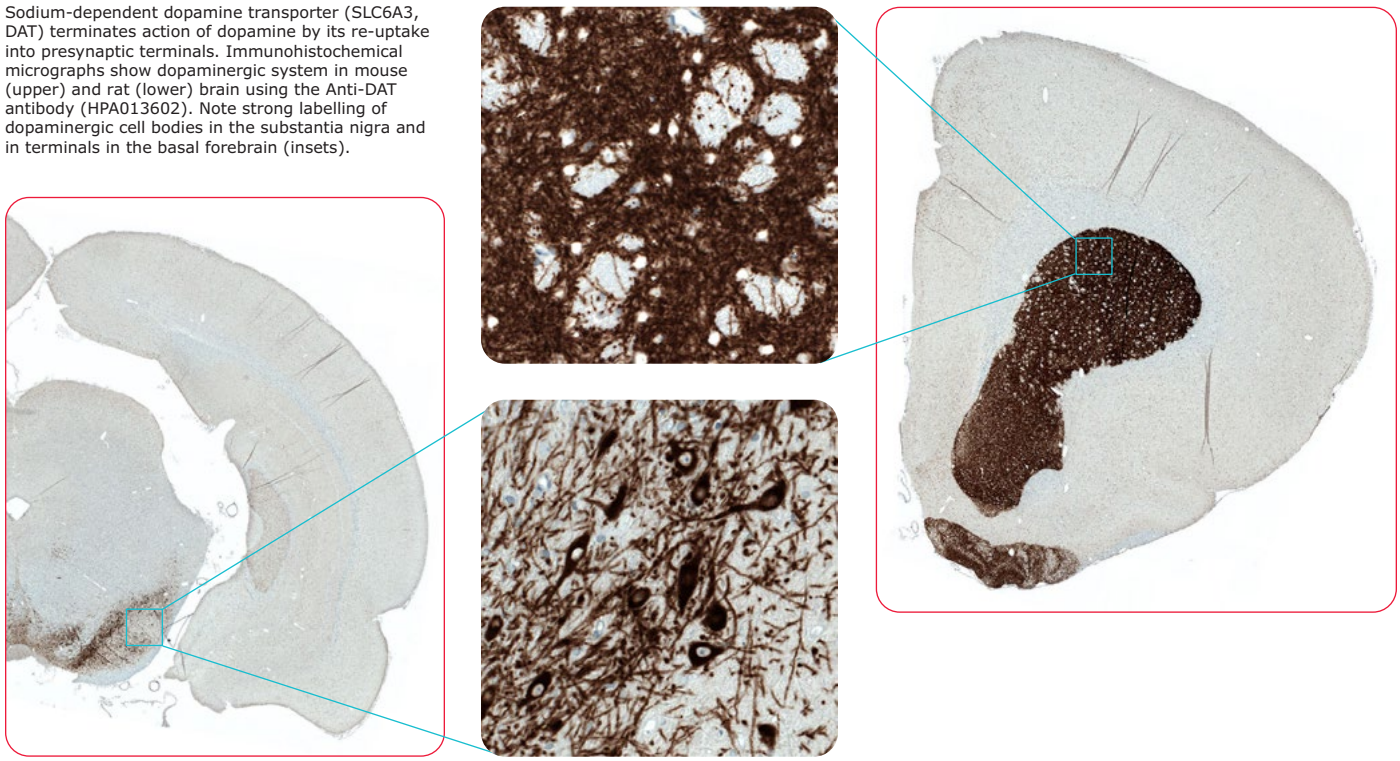
Validation in Human Neuro Tissues and Cell Lines

IHC images from human cerebellum, hippocampus, lateral ventricle wall and cerebral cortex tissues are available for the antibodies, as well as from stainings in the following brain cell lines: D341 Med, SHSY5Y, U-138 MG, U-251 MG, U-87 MG. Malignant glioma tumor samples from up to 12 patients are presented for each antibody in the Cancer Atlas. In addition to IHC images, there are available immunofluorescence (ICC-IF) images from staining in U-251 MG cells for subcellular location information of the proteins.

The Human Protein Atlas (proteinatlas.org) displays a collection of over 13 million images of normal and disease tissues, cell lines, and primary cells. The database not only delivers visible proof of antibody performance, but also provides a knowledge base with regard to the structural and temporal expression of proteins in various cells and tissues.



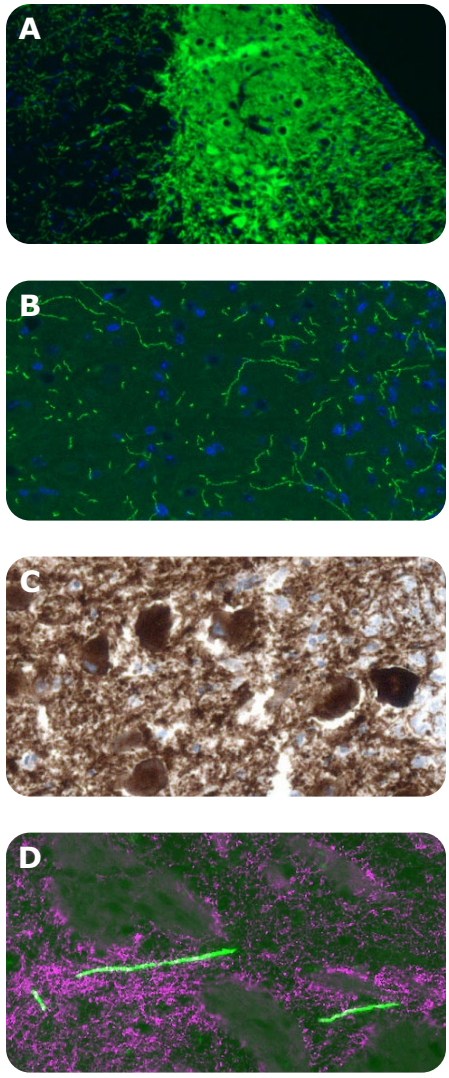
Sodium-dependent dopamine transporter (SLC6A3, DAT) terminates action of dopamine by its re-uptake into presynaptic terminals. Immunohistochemical micrographs show dopaminergic system in mouse (upper) and rat (lower) brain using the Anti-DAT antibody (HPA013602). Note strong labelling of dopaminergic cell bodies in the substantia nigra and in terminals in the basal forebrain (insets).



Prestige Monoclonals Neuroscience Markers

Marker for	Product Name	Product Number	Validated Applications	Isotype
Neurons	Anti-NEFM (NF160)	**AMAb91027**	IHC*, WB*	IgG1 K
Neurons	Anti-NEFM (NF160)	**AMAb91028**	IHC*, WB*	IgG1 K
Neurons	Anti-NEFM (NF160)	**AMAb91029**	IHC*, WB*	IgG2a K
Neurons	Anti-NEFM (NF160)	**AMAb91030**	IHC*, WB*	IgG2b K
Neurons	Anti-NEFH (NF200)	**AMAb91025**	IHC, WB	IgG1 K
Neurons	Anti-UCHL1 (PGP9.5)	**AMAb91145**	IHC*, WB*	IgG1
Astrocytes	Anti-GFAP	**AMAb91033**	IHC*, WB*	IgG1 K
Astrocytes	Anti-S100B	**AMAb91038**	IHC*, WB	IgG1 K
Astrocytes	Anti-GLUL	**AMAb91101**	IHC*, WB*	IgG1
Astrocytes	Anti-GLUL	**AMAb91102**	IHC*, WB*	IgG1
Astrocytes	Anti-GLUL	**AMAb91103**	IHC*, WB*	IgG2a K
Schwann cells, oligodendrocytes	Anti-MBP	**AMAb91062**	IHC*, WB*	IgG2a K
Schwann cells, oligodendrocytes	Anti-MBP	**AMAb91063**	IHC*, WB*	IgG1
Schwann cells, oligodendrocytes	Anti-MBP	**AMAb91064**	IHC*, WB*	IgG1
Oligodendrocytes	Anti-MOG	**AMAb91066**	IHC*, WB	IgG1
Oligodendrocytes	Anti-MOG	**AMAb91067**	IHC*, WB	IgG1
Oligodendrocytes	Anti-CNP	**AMAb91068**	IHC*, WB*	IgG2a K
Oligodendrocytes	Anti-CNP	**AMAb91069**	IHC*, WB*	IgG1
Oligodendrocytes	Anti-CNP	**AMAb91072**	IHC*, WB*	IgG2b K
Acetylcholine neurons	Anti-CHAT	**AMAb91130**	IHC*	IgG2b
Acetylcholine neurons	Anti-CHAT	**AMAb91129**	IHC*	IgG1
Glutamate neurons	Anti-SLC17A7 (VGLUT1)	**AMAb91041**	IHC*, WB	IgG2b K
Glutamate neurons	Anti-SLC17A6 (VGLUT2)	**AMAb91081**	IHC*	IgG1
Glutamate neurons	Anti-SLC17A6 (VGLUT2)	**AMAb91086**	IHC*	IgG1
GABA neurons	Anti-SLC32A1 (VGAT)	**AMAb91043**	IHC*	IgG1 λ
GABA neurons	Anti-GAD1 (GAD67)	**AMAb91076**	IHC*, WB	IgG2a K
GABA neurons	Anti-GAD1 (GAD67)	**AMAb91078**	IHC*, WB	IgG1
GABA neurons	Anti-GAD1 (GAD67)	**AMAb91079**	IHC*, WB*	IgG2b K
GABA neurons	Anti-GAD2 (GAD65)	**AMAb91048**	IHC*, WB*	IgG1 K
Dopamine neurons	Anti-SLC6A3 (DAT)	**AMAb91125**	IHC*	IgG1
Dopamine neurons	Anti-DDC	**AMAb91089**	IHC*, WB	IgG1
Noradrenaline neurons	Anti-SLC6A2 (NET)	**AMAb91116**	IHC*	IgG1
Dopamine and noradrenaline neurons	Anti-TH	**AMAb91112**	IHC*	IgG1
Serotonin neurons	Anti-TPH2	**AMAb91108**	IHC*	IgG1

* Validated for human and rodent samples



IHC-IF (A, B, D) and bright-filed (C) IHC staining demonstrating specificity and selectivity of Anti-NET antibody (AMAb91116) in rat (A, D), mouse (B) and human (C) brain. Staining with Anti-NET (AMAb91116) is shown in green (A, B, D) and in brown (C). DAT immunoreactivity is visualized in magenta using Anti-DAT antibody (AMAb91125).

Sigma-Aldrich®
Lab & Production Materials

Solution

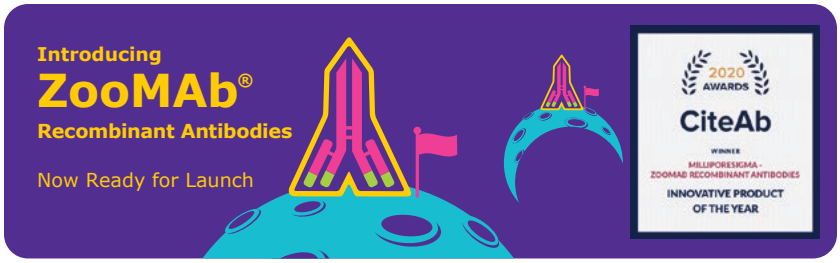
ZooMAb® Antibodies

In your neuroscience experiment where robust and highly reproducible lot-to-lot consistency and high sensitivity is needed our ZooMAb® antibodies (recombinant rabbit monoclonals) can support you.

Each ZooMAb® antibody is manufactured using our proprietary recombinant expression system. Only top-performing clones are released for use by researchers. Each antibody is validated for high specificity and affinity across multiple applications, including its most commonly used application. Compared to commonly used murine species, rabbits have a natural tendency to produce a higher immune response to "difficult" immunogens that include small molecules, peptides, and post-translationally modified proteins. Rabbit antibodies also recognize a greater diversity of epitopes per antigen compared to murine species. Rabbit monoclonal antibodies can detect antigens at the picomolar range with high specificity and provide higher signal intensity in a wide range of applications as in Neurobiology research.

With a continually growing list of new ZooMAb® antibodies, we've produced ZooMAb® antibodies against numerous highly published targets in neurology, enabling researchers to obtain the same robust data time and time again.

Find your target at
SigmaAldrich.com/Antibodies



Cat No.	Product Description
ZRB1134-25UL	Anti-α-synuclein, clone 1D22 ZooMAb® Rabbit Monoclonal
ZMS1045-25UL	Anti-Amyloid β42/40, clone W0-2 ZooMAb® Mouse Monoclonal
ZRB1021-25UL	Anti-Angiotensinogen, clone 1B12 ZooMAb® Rabbit Monoclonal
ZMS1012-25UL	Anti-APP A4, clone 22C11 ZooMAb® Mouse Monoclonal
ZRB1267-25UL	Anti-CGRP-1, clone 2E18 ZooMAb® Rabbit Monoclonal
ZRB1962-25UL	Anti-Calpain-1, clone 1H14 ZooMAb® Rabbit Monoclonal
ZRB1634-25UL	Anti-CD147, clone 1J7 ZooMAb® Rabbit Monoclonal
ZRB1801-25UL	Anti-Flotillin 1, clone 1F12-L1 ZooMAb® Rabbit Monoclonal
ZMS1007-25UL	Anti-GluR1, clone RH95 ZooMAb® Mouse Monoclonal
ZRB1091-25UL	Anti-GAD65, clone 3B23 ZooMAb® Rabbit Monoclonal
ZMS1077-25UL	Anti-Lubricin/PRG4, clone 9G3 ZooMAb® Mouse Monoclonal
ZMS1035-25UL	Anti-MAG, clone 513 ZooMAb® Mouse Monoclonal
ZRB1270-25UL	Anti-mGluR5, clone 1F11 ZooMAb® Rabbit Monoclonal
ZRB1187-25UL	Anti-MRGPRD, clone 3H7 ZooMAb® Rabbit Monoclonal
ZMS1029-25UL	Anti-Na+/K+ ATPase α-1, clone C464.6 ZooMAb® Mouse Monoclonal
ZRB1401-25UL	Anti-Neuropeptide Y, clone 2B5 ZooMAb® Rabbit Monoclonal
ZRB1787-25UL	Anti-PARK7/DJ-1, clone 1F4 ZooMAb® Rabbit Monoclonal
ZRB1728-25UL	Anti-Parkin, clone 2J8 ZooMAb® Rabbit Monoclonal
ZRB1614-25UL	Anti-Presenilin-1, clone 2O13 ZooMAb® Rabbit Monoclonal
ZMS1101-25UL	Anti-Presenilin-1, clone PS1-loop ZooMAb® Mouse Monoclonal
ZRB1268-25UL	Anti-Prion Protein, clone 3D17 ZooMAb® Rabbit Monoclonal
ZRB1924-25UL	Anti-Prion Protein, clone 3F17 ZooMAb® Rabbit Monoclonal
ZRB1110-25UL	Anti-QPRTase, clone 1G22 ZooMAb® Rabbit Monoclonal
ZRB1519-25UL	Anti-RXR-alpha, clone 2I8 ZooMAb® Rabbit Monoclonal
ZRB1674-25UL	Anti-RHOT1/MIRO-1, clone 1F4 ZooMAb® Rabbit Monoclonal
ZRB1328-25UL	Anti-Dopamine β Hydroxylase, clone 2B11 ZooMAb® Rabbit Monoclonal
ZRB1042-25UL	Anti-Somatostatin-28, clone 2B19 ZooMAb® Rabbit Monoclonal
ZRB1073-25UL	Anti-Stathmin-2, clone 1B3 ZooMAb® Rabbit Monoclonal
ZRB1506-25UL	Anti-Substance P, clone 1K3 ZooMAb® Rabbit Monoclonal
ZMS1111-25UL	Anti-Tau, clone Tau-5 ZooMAb® Mouse Monoclonal
ZRB1092-25UL	Anti-Tau, clone 3D20 ZooMAb® Rabbit Monoclonal
ZMS1065-25UL	Anti-Tau, clone Tau 12 ZooMAb® Mouse Monoclonal
ZMS3420-25UL	Anti-Tau-1, clone PC1C6 ZooMAb® Mouse Monoclonal
ZRB1124-25UL	Anti-β-Tubulin, clone 1C9 ZooMAb® Rabbit Monoclonal
ZMS1033-25UL	Anti-Tyrosine Hydroxylase, clone 20/40/15 ZooMAb® Mouse Monoclonal
ZMS1080-25UL	Anti-α-Synuclein, clone 2F12 ZooMAb® Mouse Monoclonal
ZRB1307-25UL	Anti-C9ORF72 (long form), clone 1I9 ZooMAb® Rabbit Monoclonal
ZRB1305-25UL	Anti-TPH-1, clone 3J7 ZooMAb® Rabbit Monoclonal
ZRB1626-25UL	Anti-GABA A Receptor α1, clone 3H10 ZooMAb® Rabbit Monoclonal
ZRB1151-25UL	Anti-APP, clone 5D16 ZooMAb® Rabbit Monoclonal
ZRB1516-25UL	Anti-APP, clone 1F22 ZooMAb® Rabbit Monoclonal
ZRB1778-25UL	Anti-Calbindin D-28K clone 1A11, ZooMAb® Rabbit Monoclonal
ZRB5054-25UL	Anti-Calretinin, clone 3K22 ZooMAb® Rabbit Monoclonal
ZRB1012-25UL	Anti-Choline Acetyltransferase (ChAT), clone 2K16 ZooMAb® Rabbit Monoclonal
ZRB2421-25UL	Anti-Connexin-36, clone 2D22 ZooMAb® Rabbit Monoclonal
ZRB2383-25UL	Anti-GFAP, clone 2E8, ZooMAb® Rabbit Monoclonal
ZRB1102-25UL	Anti-Huntingtin Protein, clone 1M11 ZooMAb® Rabbit Monoclonal
ZRB377-25UL	Anti-NeuN, clone 13E6 ZooMAb® Rabbit Monoclonal
ZRB1347-25UL	Anti-Neurofilament H, clone 5L10 ZooMAb® Rabbit Monoclonal
ZRB04823-25UL	Anti-phospho-GluR1 (Ser831), clone N453 ZooMAb® Rabbit Monoclonal
ZRB1317-25UL	Anti-Synaptophysin, clone 1G7 ZooMAb® Rabbit Monoclonal
ZRB1140-25UL	Anti-β-Tubulin III, clone 5H16 ZooMAb® Rabbit Monoclonal

characterize > visualize and detect

Challenge

Highlight changes in neural genes.

Solution

DNA and RNA extraction and profiling

Although scientists haven't yet characterized the function of every gene, there are already plenty of genes—and associated molecules—that are known to have important implications for neurological hereditary disorders, evolutionary relationships, and more. Our diverse portfolio of products is guaranteed to get your DNA or RNA isolated, purified, and ready for amplification.

Genotyping

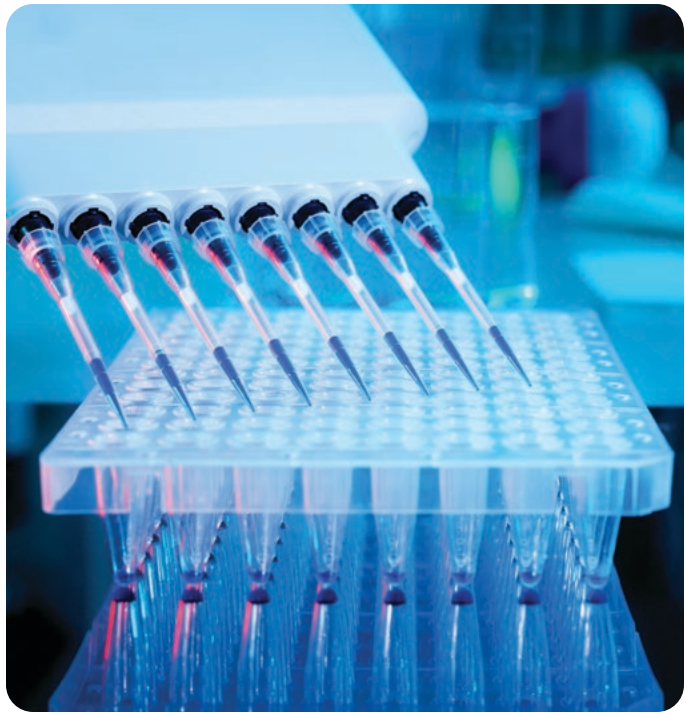
Genotyping is the process of determining an organism's genetic makeup. Our products can extract and amplify genomic DNA from a wide variety of source materials:

- mouse tails and other animal tissues
- buccal swabs
- saliva
- hair shafts

Sigma REDExtract-N-Amp™ Tissue PCR Kit

Designed for rapid genomic DNA isolation, the Sigma REDExtract-N-Amp™ Tissue PCR Kit provides single-step extraction of genomic DNA for PCR from a wide variety of cells and tissues in just 15 minutes. Benefiting from a novel extraction method which eliminates the need for long enzymatic digestions or homogenization, the kit also includes a specially formulated hot start PCR reaction mix for amplification directly from the extract and the addition of an inert tracking dye for convenient gel loading.

- Rapid extraction of genomic DNA from cells and tissues
- No need for enzymatic digestions or homogenization
- Includes PCR ReadyMix™ for amplification directly from extract
- Extract stable at 4 °C for at least 6 months



KAPA® HotStart Mouse Genotyping Kit

Designed for the extraction of PCR-ready DNA from mouse tail, ear, or toe tissue in just 15 minutes, the KAPA HotStart Mouse Genotyping Kit contains sufficient template for multiple assays and is easily scaled to handle samples in a 96-well format. The combination of KAPA Express Extract, a novel thermostable protease and buffer system, with KAPA2G Fast Genotyping Mix allows extraction and amplification to be performed in as little as 1 hour, as compared to ≥1 day with conventional protocols.

- Extract PCR-ready DNA from mouse tail, ear, or toe tissue in 15 minutes
- Minimal handling, reducing the risk of sample loss or contamination
- Easy scalability to a 96-well format
- Fast and reliable amplification across a wide range of amplicon lengths and GC contents

Description	Cat. No.
Sigma REDExtract-N-Amp™ Tissue PCR Kit	**XNAT**
KAPA® HotStart Mouse Genotyping Kit	**HSMGTKB**

Sigma-Aldrich®
Lab & Production Materials

Solution

DNA and RNA Purification

GenElute™ purification kits combine the advantages of a silica-based system with a convenient microspin format for rapid isolation and purification of high-quality genomic DNA and RNA from a variety of sources including blood, cells, and tissues. The GenElute™ UltraMag Cell-Free DNA kit utilizes silica coated magnetic beads for rapid and efficient purification of circulating free DNA from serum and plasma samples of less than 1 mL to over 10 mL. GenElute™-E single spin nucleic acid purification kits provide a fast and sustainable solution for DNA purification and RNA clean up.

The Roche® High Pure kits use glass fibre fleece immobilized in a special plastic filter tube. Nucleic acids bind to the surface of the glass fiber fleece in the presence of a chaotropic salt (guanidine HCl). This allows the High Pure filter tube to specifically immobilize nucleic acids (both DNA and RNA) while they are freed of contaminants.

Description	Product Applications	Cat. No.
GenElute™ Mammalian Genomic DNA Miniprep Kits	Isolate genomic DNA from cultured cells, tissues (including rodent tails), and fresh whole blood or white blood cells.	**G1N70**
GenElute™ Blood Genomic DNA Kit	Isolate genomic DNA from fresh or aged (> 24 hours) whole blood	**NA2020**
GenElute™ Mammalian Total RNA Miniprep Kit	Isolate total RNA from mammalian cells and tissues	**RTN70**
GenElute™ UltraMag Cell-Free DNA Kit	Provides rapid and efficient purification of circulating-free DNA (cfDNA). Compatible with manual and automated formats.	**CFMAG-100ML**
GenElute™-E single spin nucleic acid purification kits	Isolate genomic DNA from blood samples; larger volume blood samples; tissue samples; cell culture samples.	**EC100; EC200; EC300; EC400**
	Clean up DNA from Solvent purifications; Clean up RNA from other purification methods	**EC700; EC800**
High Pure RNA Tissue Kit (Roche®)	The Kit is designed for the purification of total, intact RNA from tissue samples, free of any contaminating DNA.	**12033674001**
High Pure RNA Paraffin Kit (Roche®)	Isolates total RNA from formalin-fixed, paraffin-embedded tissue as well as from fresh-frozen tissue-research samples for direct use in RT-PCR.	**3270289001**
High Pure miRNA Isolation Kit (Roche®)	Purifies and enriches small RNAs, such as microRNA (miRNA) from animal cells and tissue samples (including formalin-fixed, paraffinembedded sections). It can also be used to purify total RNA or to prepare samples enriched for small RNAs (<100 nucleotides).	**5080576001**

Explore the benefits of GenElute™-E kits at **SigmaAldrich.com/singlespin**

Custom Primers and Probes

Whether you are using ISH, NGS, PCR, qPCR, ddPCR, arrays, or another molecular technique to understand Neurobiology or improve neural gene changes detection, primers, qPCR probes, and other types of oligos are critical raw materials for driving the reaction. We manufacture to your specifications with rigorous quality control and fast delivery to meet the needs of busy researchers like you.

Custom DNA & RNA Oligos

- DNA Oligos in Tubes & Plates
- Long Oligos (121-180 bases)
- iScale Oligos™ (milligram quantity)
- Next-Gen Sequencing Oligos
- RNA Oligos
- custom siRNA
- Oligos for Commercial Use (OEM)

Custom qPCR Probes

- Dual-Labeled Probes
- Molecular Beacons
- Scorpions® Probes

For more information on our custom primers and probes, visit **SigmaAldrich.com/oligos**

Solution

qPCR

Quantitative PCR (qPCR) or Real-Time PCR uses fluorescent reporter molecules to allow quantification of amplified products. This technique is useful for numerous areas of research including gene expression analysis, genotyping, microRNA analysis, genetic variation analysis, and protein analysis.

SYBR® Green based qPCR

Roche® FastStart™ Universal SYBR® Green Master (Rox)

The novel reference dye used within Roche® FastStart™ Universal SYBR® Green Master (Rox) binds specifically to dsDNA during each phase of DNA synthesis, allowing the amplicon to be detected by its fluorescence. Utilizing FastStart™ Taq DNA Polymerase, a modified enzyme which is inactive at room temperature and relies on a hot start protocol to improve the specificity, sensitivity, and yield of PCR, this 2x concentrated master mix is suitable for running quantitatFive, real-time DNA detection assays in the SYBR® Green I detection format.

- Amplify and detect a broad range of DNA or cDNA targets, up to 500bp in length
- Compatible for use on all real-time PCR instruments requiring normalization with Rox
- Suitable for real-time DNA detection assays including qPCR and two-step RT-qPCR
- dUTP-containing mix with uracil-DNA glycosylase to eliminate contaminating DNA carried over from previous PCR reactions

KAPA SYBR® FAST

Containing the first DNA polymerase engineered via directed evolution to be more tolerant of SYBR® Green I dye inhibition, the Roche KAPA SYBR® FAST qPCR kits facilitate the completion of real-time PCR runs in just 40 minutes. High reaction efficiency across a wide range of GC contents and amplicon lengths allows more accurate quantitation of changes in gene expression.

- Complete real-time PCR runs in just 40 minutes
- High reaction efficiency of 95 – 105% improves accuracy and reproducibility
- Detect low copy and difficult targets consistently
- Maintain high performance when switching from standard to fast protocols

SYBR® Green Jumpstart TAQ Readymix

SYBR® Green JumpStart™ Taq ReadyMix™ combines the performance enhancements of JumpStart™ Taq antibody for hot start PCR with SYBR® Green I and the convenience of an easy-to-use ReadyMix™ solution. This ready-to-use mixture of SYBR® Green I, JumpStart™ Taq DNA polymerase, 99% pure deoxynucleotides and reaction buffer is provided in a 2× concentrate for ease of use.

- Ready-to-use mix (only add primers and template)
- Jump Start Taq Polymerase
- Formulated/optimized with MgCl2 or packaged with a separate vial for ease of optimization
- Internal Reference Dye is provided for reaction normalization.

Description	Cat. No.
Roche® FastStart™ Universal SYBR® Green Master (Rox)	**FSUSGMMRO**
KAPA SYBR® FAST Universal	**SFUKB**
Sigma SYBR® Green JumpStart™ Taq ReadyMix™ for quantitative PCR, MgCl2 in buffer	**S4438**
SYBR® Green JumpStart™ Taq ReadyMix™ for quantitative PCR, without MgCl2 in buffer	**S5913**

Sigma-Aldrich®
Lab & Production Materials

Solution

Probe based QPCR

Roche® FastStart™ Universal Probe Master (Rox)

A universal ready-to-use hot start reaction mix for qPCR and two-step RT-qPCR, the Roche® FastStart™ Universal Probe Master (Rox) can be used on all real-time PCR systems requiring normalization with Rox. Facilitating the production of lower cycle threshold (Ct) values and benefitting from high room-temperature stability, this product is ideal for use with robotic pipetting stations.

- Compatible with any probe-based assay
- Amplify and detect a broad range of DNA or cDNA targets
- Suitable for use with robotic pipetting stations
- dUTP-containing mix with uracil-DNA glycosylase to eliminate contaminating DNA carried over from previous PCR reactions

KAPA Probe Force qPCR Master Mix Universal

Allowing amplification directly from crude samples which include cells, mouse tails, FFPE and soil, KAPA Probe Force qPCR Master Mix Universal streamlines sample-to-Cq workflows to <1 hour. Use of a DNA polymerase enzyme which maintains high reaction efficiency in the presence of PCR inhibitors enhances levels of sensitivity even in inhibited samples such as blood and plant.

- Direct qPCR from crude samples such as blood, tissue, and plant extracts
- Highly inhibitor resistant qPCR master mix that removes the need for DNA purification
- Streamlines sample-to-Cq workflows to <1 hour
- Multiplex crude samples efficiently

Roche® EagleTaq™ Universal Master Mix (Rox)

Suitable for all real-time PCR instruments on which a Rox reference dye is needed for quantitative analysis, Roche® EagleTaq™ Universal Master Mix (Rox) is provided as a 2× concentrated, ready-to-use hot start master mix for qPCR and qRT-PCR. This highly robust product minimizes PCR protocol optimization.

- Hot start properties for reaction setup at ambient temperature
- dUTP-containing mix with uracil-DNA glycosylase to eliminate contaminating DNA carried over from previous PCR reactions
- Minimizes protocol optimization

Sigma JumpStart™ Taq ReadyMix™ for Quantitative PCR

Ideal for high-throughput applications, Sigma JumpStart™ Taq ReadyMix™ for Quantitative PCR is formulated without a detection chemistry, making it suitable for use with a variety of formats including dual-labeled probes, molecular beacons or double stranded binding dyes such as SYBR® Green I. Using JumpStart™ Taq DNA Polymerase to prevent non-specific amplification and increase target yield, the ReadyMix™ simply requires the addition of a fluorescent detection chemistry, primers, and template.

- Formulated without a detection chemistry
- Ideal for high throughput qPCR
- Includes a reference dye for data normalization

Description	Cat. No.
Roche® FastStart™ Universal Probe Master (Rox)	**FSUPMMRO**
KAPA Probe Force qPCR Master Mix Universal	**PFORCEKB**
Roche® EagleTaq™ Universal Master Mix (Rox)	**EAGLETMMRO**
Sigma JumpStart™ Taq ReadyMix™ for Quantitative PCR	**D7440**

characterize > visualize and detect

Today, researchers are challenged to create high quality samples for meaningful protein analysis, often using cumbersome traditional sample preparation methods. With over 50 years of experience in developing protein sample preparation technologies, Merck is constantly innovating new tools to offer you rapid and efficient solutions that can be smoothly integrated into your neuroscientific workflow.

Challenge

Detecting changes in intact functional neural proteins without arduous sample preparation protocols.

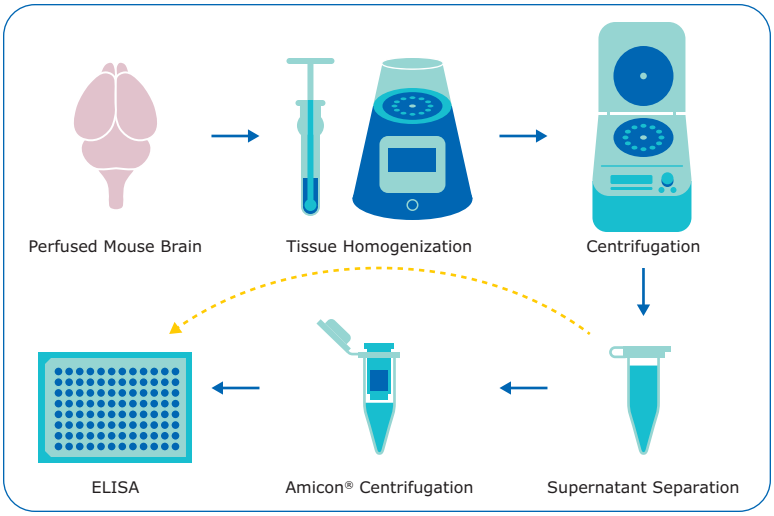
Solution

Amicon® Ultra Centrifugal Filters

Amicon® Ultra Centrifugal Filters provide fast sample processing and promote high sample recoveries, even in dilute samples, through ultrafiltration. The unique features of the Amicon® Ultra Centrifugal Filters give you the fastest, most efficient concentration for sensitive downstream applications. They have been widely used in Neuroscience Research as shown by a recently published method[1] that uses the Amicon Ultra Centrifugal Filters to concentrate mouse brain tissue homogenates, which are then assayed using standard sandwich enzyme-linked immunosorbent assay (ELISA) protocols.

This method improves upon the traditional brain homogenization procedure and ELISA measurements for antibody-biologic fusion proteins by effectively concentrating brain tissue homogenates.

1. J. Yang and R.K. Sumbria / MethodsX 8 (2021) 101584



Brain homogenization and Amicon® concentration. The perfused mouse brain is homogenized and processed. The homogenized supernatant is separated from the brain pellet via centrifugation and either directly run on an enzyme-linked immunosorbent assay (ELISA) (represented by the yellow dotted arrow) or put through the Amicon centrifugation. The Amicon retentate concentrate is further run on an ELISA.

Millipore®

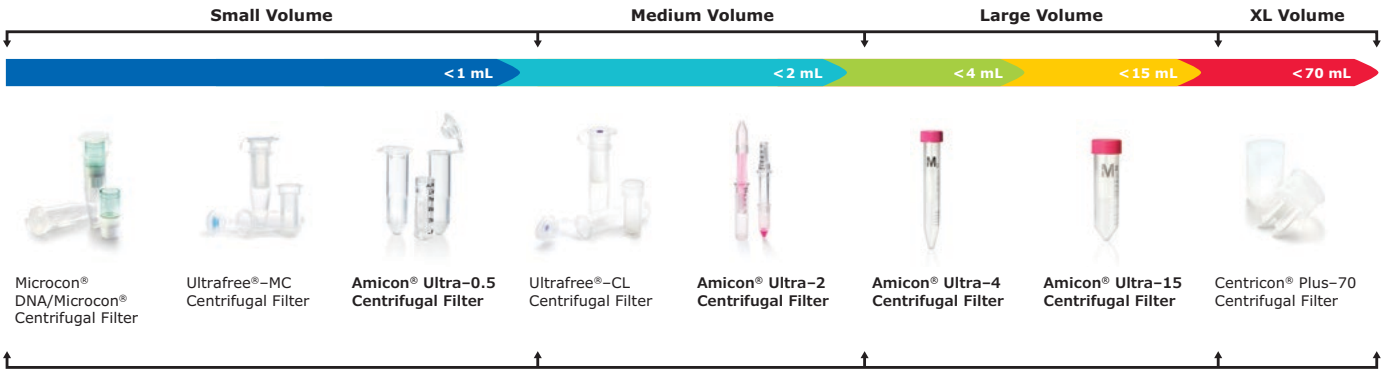
Preparation, Separation,
Filtration & Monitoring Products

Cat No.	Product Description
Protein concentration filters	
UFC500324	Amicon® Ultra 0.5ml 3K 24Pk
UFC501024	Amicon® Ultra 0.5ml 10K 24Pk
UFC503024	Amicon® Ultra 0.5ml 30K 24Pk
UFC505024	Amicon® Ultra 0.5ml 50K 24Pk
UFC510024	Amicon® Ultra 0.5ml 100K 24Pk
UFC200324	Amicon® Ultra 2ml 3K 24Pk
UFC201024	Amicon® Ultra 2ml 10K 24Pk
UFC203024	Amicon® Ultra 2ml 30K 24Pk
UFC205024	Amicon® Ultra 2ml 50K 24Pk
UFC210024	Amicon® Ultra 2ml 100K 24Pk
UFC800324	Amicon® Ultra 4ml 3K 24Pk
UFC801024	Amicon® Ultra 4ml 10K 24Pk
UFC803024	Amicon® Ultra 4ml 30K 24Pk
UFC805024	Amicon® Ultra 4ml 50K 24Pk
UFC810024	Amicon® Ultra 4ml 100K 24Pk
UFC900324	Amicon® Ultra 15ml 3K 24Pk
UFC901024	Amicon® Ultra 15ml 10K 24Pk
UFC903024	Amicon® Ultra 15ml 30K 24Pk
UFC905024	Amicon® Ultra 15ml 50K 24Pk
UFC910024	Amicon® Ultra 15ml 100K 24Pk
UFC700308	Centricon® Plus 70ml 3K 8Pk
UFC701008	Centricon® Plus 70ml 10K 8Pk
UFC703008	Centricon® Plus 70ml 30K 8Pk
UFC710008	Centricon® Plus 70ml 100K 8Pk

Explore our Amicon® Ultra line and select the best one for your application at **SigmaAldrich.com/amicon**

Removal of particles and precipitates from aqueous and some solvent-based samples. Ideal for use with protein and nucleic acid solutions.

Cat No.	Product Description
Ultrafree®-MC Filters with Microporous Membrane	
UFC30GVNB	Ultrafree® MC GV (Durapore, PVDF) 0.22 250PK
UFC30HVNB	Ultrafree® MC HV (Durapore, PVDF) 0.45 250PK
UFC30GV00	Ultrafree®-MC DURA (Durapore, PVDF) 0.22um 100PK
UFC30LG25	Ultrafree®-MC LG (Hydrophilic PTFE) 25pk
UFC30LH25	Ultrafree®-MC LH (Hydrophilic PTFE) 25pk
Ultrafree®-CL Filters with Microporous Membrane	
UFC40GV25	Ultrafree® CL GV (Durapore, PVDF) 25/PK
UFC40GV0S	Ultrafree®-CL GV (Durapore, PVDF) 0.22UM STER.50PK



Microcon® DNA Fast Flow Filter

Concentration of gDNA and Protein

Optimized for the concentration and recovery of genomic DNA with SDS buffer. The low nonspecific binding characteristics of the membrane and the other device components, coupled with its medical-grade o-ring seal, allow the device to accommodate several wash steps with minimal sample loss.

Microcon® DNA Fast Flow Filter Advantages:

- High recovery for small volumes with reverse spin (concentration factor < 20X)
- Low-binding Ultracel® membrane
- Fast processing

Microcon® Centrifugal Filters with Ultracel® Membrane

Simply and efficiently concentrate and desalt solutions of any macromolecule with the low-binding Ultracel® membrane, using any centrifuge that can accept 1.5 mL tubes.

Advantages of Microcon® with Utracel® membrane:

- Dual-cycle EtO treatment on the Microcon® PCR Grade Filter has been shown to render contaminating DNA unamplifiable
- Typical recoveries of > 95 %, even for dilute solutions
- Reverse spin to maximize recovery, even in the smallest samples
- Convenient storage of filtrate or concentrated sample in standard microfuge tube
- Concentration factors up to 100X

Application Guidelines for Microcon® Centrifugal Filters with Ultracel® Membrane

	Microcon® Device		
Application	10K	30K	DNA Fast Flow
Peptide and growth factor concentration	●		
Protein concentration and desalting of columns eluates	●	●	
Protein concentration before electrophoresis or other assays	●	●	
Protein removal prior to HPLC	●	●	
Purification of macromolecular components found in tissue culture extracts and cell lysates	●	●	
Concentration of biological samples (antigens, antibodies, enzymes)		●	
Concentration of gDNA with or without SDS buffer		●	●
Concentration and desalting of nucleic acids (single- or double-stranded)	●	●	●
Removal of labeled nucleotides	●	●	●
Removal of labeled amino acids	●	●	●
Removal of primers from amplified DNA		●	●
Removal of linkers prior to cloning		●	●

Ordering Information

Description	Volume, mL	Min. final concentrate volume, µL	Qty/Pk	Catalog No.
Microcon® filter, Ultracel®-10 membrane, 10 kDa	0.5	5–50	100	**MRCPRT010**
Microcon® filter, Ultracel®-30 membrane, 30 kDa	0.5	5–50	100	**MRCF0R030**
Microcon® DNA Fast Flow Centrifugal Filter with Ultracel® membrane	0.5	5–50	100	**MRCF0R100**
Microcon® DNA Fast Flow PCR Grade filter with Ultracel® membrane, dual cycle EtO treated	0.5	5–50	20	**MRCF0R100ET**

Microcon® with Biomax® PES Membrane

Microcon® filters with Biomax® Polyethersulfone (PES) membrane provide efficient concentration, desalting, or buffer exchange of aqueous biological samples.

Ordering Information

Description	Qty/pk	Catalog No.
Microcon® filter, Biomax® PES membrane, 5K Device	25	**MPE005025**
Microcon® filter, Biomax® PES membrane, 10K Device	25	**MPE010025**
Microcon® filter, Biomax® PES membrane, 30K Device	25	**MPE030025**
Microcon® filter, Biomax® PES membrane, 50K Device	25	**MPE050025**
Microcon® filter, Biomax® PES membrane, 100K Device	25	**MPE100025**
Microcon® filter, Biomax® PES membrane, 300K Device	24	**MPE300025**
Microcon® filter with Biomax® PES membrane, Variety Pack includes 4 of each filter sizes: 5K, 10K, 30K, 50K, 100K, 300K	24	**MPEVAR024**

Solution

mPAGE® Electrophoresis and Blotting Systems

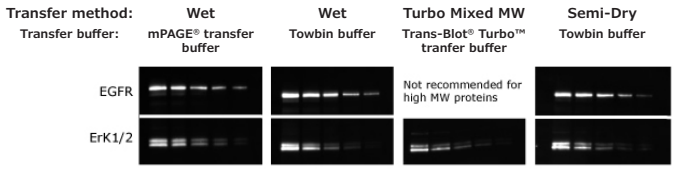
The identification of signaling pathways involved in the development of neurological disorders aids the screening of possible therapeutic targets. Neural protein electrophoresis is still a valid technique to understand more about protein complexes, interactions and modifications.

Description	Cat. No.
mPAGE® Gel Caster	
mPAGE® Caster, 2 pk Device for hand casting mini gels, does not include plates or combs	**GCR2**
mPAGE® Gel Casting Device Kit for hand casting mini gels with a 0.75 mm, 1.0 mm or 1.5 mm thickness, includes plates and combs	**MGCK**
mPAGE® Mini Gel Tank	
mPAGE® Mini Gel Tank, 2-gel	**MGT-2**
mPAGE® Mini Gel Tank, 4-gel	**MGT-4**
mPAGE® Mini Wet Transfer System	
mPAGE® Mini Wet Transfer System	**MWTS**
Gel Casting Reagents	
TurboMix® Bis-Tris Polyacrylamide Gel Casting Kit	**TMKIT-60**
TurboMix® Resolving Solution	**TMRES-216ML**
TurboMix® Stacking Solution	**TMSTK-120ML**
Ammonium persulfate (APS), for molecular biology, suitable for electrophoresis, ≥98%	**A3678**
N,N,N′,N′-Tetramethylethylenediamine (TEMED)	**T9281**
SDS-PAGE and Transfer Reagents	
mPAGE® Color Protein Standard	**MPSTD4**
mPAGE® Unstained Protein Standard	**MPSTD3**
mPAGE® Western Protein Standard	**MPSTD2**
MES SDS running buffer powder for mPAGE® Bis-Tris gels, each packet makes 1 L	**MPMES**
MOPS SDS Running Buffer Powder for mPAGE® Bis-Tris gels, each packet makes 1 L	**MPMOPS**
mPAGE® Transfer Buffer Powder, each packet makes 1 L	**MPTRB**
Immobilon®-P PVDF Transfer Membrane	**IPVH85R**
Immobilon®-E PVDF Transfer Membrane	**IEVH85R**
Immobilon®-FL PVDF Transfer Membrane	**IPFL85R**
Immobilon®-PSQ PVDF Transfer Membrane	**ISEQ85R**
Immobilon®-NC Transfer Membrane	**HATF85R**
Immobilon® NOW Dispenser	**IMDISP**

For more information on our complete solution for electrophoresis and Western blotting equipment, please visit: **SigmaAldrich.com/electrophoresis**

NEW mPAGE® Lux Casting System

The mPAGE® Lux Casting System offers an innovative solution to your gel casting process. You no longer must choose either saving time or resources. Our novel gel casting system allows researchers to easily cast their gels quickly (only 3 minutes) when they need them, at a fraction of the cost of precast gel technologies. Improve your lab efficiency and upgrade your gel electrophoresis workflow with the mPAGE® Lux Casting System.



Western blotting for wet, fast, and semi-dry transfer method comparison. Comparisons were performed using 12% mPAGE® Lux Bis-Tris gels that were run with a titration of A431 human cell lysate and various transfer methods onto Immobilon®-P membranes. Turbo transfer used the Bio-Rad® Trans-Blot® Turbo™ Transfer System and Trans-Blot® Turbo™ Transfer Packs. Membranes were blotted with anti-EGFR and anti-ErK1/2 antibodies, then detected with Immobilon® ECL Ultra Western HRP substrate.

Description	Cat. No.
mPAGE® Lux Casting System	
mPAGE® Lux Casting System, 1 mm	**LUXCSYS-1M**
mPAGE® Lux Casting System, 0.75 mm	**LUXCSYS-75M**
mPAGE® Lux Casting System, 1.5 mm	**LUXCSYS-15M**
mPAGE® Lux Bis-Tris Reagent Kit	**LUXRGTKIT**

mPAGE® precast gels

mPAGE® Bis-Tris Precast Gels (10 gels per box)

Description	Cat. No.	Cat. No.	Cat. No.
Acrylamide Percentage	**10-well (80 µL/well)**	**12-well (60 µL/well)**	**15-well (40 µL/well)**
4-12%	**MP41G10**	**MP41G12**	**MP41G15**
4-20%	**MP42G10**	**MP42G12**	**MP42G15**
8-16%	**MP81G10**	**MP81G12**	**MP81G15**
8%	**MP8W10**	**MP8W12**	**MP8W15**
10%	**MP10W10**	**MP10W12**	**MP10W15**
12%	**MP12W10**	**MP12W12**	**MP12W15**

To learn more about mPAGE® Precast Gels, please visit: **SigmaAldrich.com/mpage**

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