amsbio

PERINEURONAL NET ANALYSIS

Product Listing

Cat. No.	Specificity	Clone	Format	Pack	WB	IHC	ELISA
			Chondroitin Sulfate Stub Antibodies				
270431-CS	**ΔDi-OS**	**1B5**	Supernatant	1 ml	1:100	1:20	✓
270432-CS	**ΔDi-4S**	**2B6**	Supernatant	1 ml	1:100	1:20	✓
270433-CS	**ΔDi-6S**	**3B3**	Supernatant	1 ml	1:100	1:20	✓
			Antibodies to Native Chondroitin Sulfate				
370710-IEC	**Chondroitin Sulfate A (C-4-S)**	**2H6**	Purified	200ug	1:10,000	1:100 (P)	1:1,000 - 1:2,000
AMS.A3143	**Chondroitin Sulfate A**	**LY111**	Purified	100ug	(Immunodot)	✓	✓
270695-A	**Chondroitin Sulfate A+C**	**CS-56**	Raw Ascites Fluid	0.1ml	Not tested	1:100 – 1:400 (F)	Not tested
AMS.A2872	**Chondroitin Sulfate D (C-2,6-S)**	**MO-225**	Purified	100ug	✓	✓	✓
			Other reagents and kits				
AMS.HKD-BC41	**Hyaluronic Acid Binding Protein (b-HABP) (versican G1 domain)**	**N/A**	Biotinylated	50ug	✓	✓	✓
280560-N	**Proteoglycan Detection Kit**	**N/A**	Based on DMB Dye	1 kit	N/A	N/A	N/A

Selected Citations

Chondroitin Sulfate Stub Antibodies

Hu, J., Curinga, G. M., & Smith, G. M. (2015). Chondroitinase Gene Therapy for Spinal Cord Injury. Extracellular Matrix, 139-149 ***(Clone 3B3)***

Alves, J. N., Muir, E. M., Andrews, M. R., Ward, A., Michelmore, N., Dasgupta, D., ... & Rogers, J. H. (2014). AAV vector-mediated secretion of chondroitinase provides a sensitive tracer for axonal arborisations. Journal of neuroscience methods, 227, 107- ***(Clone 2B6, also biotin-HABP)***

Christensen, A. C., Lensjø, K. K., Lepperød, M. E., Dragly, S. A., Sutterud, H., Blackstad, J. S., ... & Hafting, T. (2021). Perineuronal nets stabilize the grid cell network. *Nature communications*, *12*(1), 1-17. ***(Also cites our Ch ABC)***

Cortes, M., Cortes, L. K., & Schwartz, N. B. (2015). Mapping Proteoglycan Functions with Glycosidases. Glycosaminoglycans: Chemistry and Biology, 443-455. ***(Clones 1B5, 2B6, 3B3 & 10E4)***

Hayes, A. J., Mitchell, R. E., Bashford, A., Reynolds, S., Caterson, B., & Hammond, C. L. (2013). Expression of glycosaminoglycan epitopes during zebrafish skeletogenesis. Developmental Dynamics, 242(6), 778-789. ***(Clones 1B5, 2B6, 3B3 & 3G10)***

Rosenzweig, E. S., Salegio, E. A., Liang, J. J., Weber, J. L., Weinholtz, C. A., Brock, J. H., ... & Tuszynski, M. H. (2019). Chondroitinase improves anatomical and functional outcomes after primate spinal cord injury. *Nature neuroscience*, *22*(8), 1269-1275. ***(Clone 2B6)***

Wang, Z., Winsor, K., Nienhaus, C., Hess, E., & Blackmore, M. G. (2017). Combined chondroitinase and KLF7 expression reduce net retraction of sensory and CST axons from sites of spinal injury. Neurobiology of disease, 99, 24-35. **(Clone 2B6: Also cites our Chondroitinase ABC and Proteoglycan Detection Kit cat.# 280560-N)**

Antibodies to Native Chondroitin Sulfate

Deepa, S. S., Yamada, S., Fukui, S., & Sugahara, K. (2007). Structural determination of novel sulfated octasaccharides isolated from chondroitin sulfate of shark cartilage and their application for characterizing monoclonal antibody epitopes. Glycobiology, 17(6), 631-645. ***(Clones MO-225, 2H6 & LY111)***

Foscarin, S., Raha-Chowdhury, R., Fawcett, J. W., & Kwok, J. C. F. (2017). Brain ageing changes proteoglycan sulfation, rendering perineuronal nets more inhibitory. Aging, 9(6), 1607. **(Clone LY111)**

Sugiura, N., Shioiri, T., Chiba, M., Sato, T., Narimatsu, H., Kimata, K., & Watanabe, H. (2012). Construction of a chondroitin sulfate library with defined structures and analysis of molecular interactions. Journal of Biological Chemistry, 287(52), 43390-43400. ***(Clones MO-225, LY111 & 2H6)***

Sugahara, K. (2015). Novel Chondroitin Sulfate Oligosaccharide Motifs as Biomarkers: Insights into Their Involvement in Brain Development. In Biochemical Roles of Eukaryotic Cell Surface Macromolecules (pp. 165-183). Springer International Publishing. **(Clones CS-56 & MO-225)**

Miller, G. M., & Hsieh-Wilson, L. C. (2015). Sugar-dependent modulation of neuronal development, regeneration, and plasticity by chondroitin sulfate proteoglycans. Experimental neurology, 274, 115-125. ***(Clones 2H6 & MO-225)***

Zhang, X., Bhattacharyya, S., Kusumo, H., Goodlett, C. R., Tobacman, J. K., & Guizzetti, M. (2014). Arylsulfatase B modulates neurite outgrowth via astrocyte chondroitin-4-sulfate: Dysregulation by ethanol. Glia, 62(2), 259-271. **(Clone LY111)**

Biotinylated HABP (recombinant VG1 domain)

Alves, J. N., Muir, E. M., Andrews, M. R., Ward, A., Michelmore, N., Dasgupta, D., ... & Rogers, J. H. (2014). AAV vector-mediated secretion of chondroitinase provides a sensitive tracer for axonal arborisations. Journal of neuroscience methods, 227, 107-120. **(Also cites clone 2B6)**

Rácz, É., Gaál, B., & Matesz, C. (2016). Heterogeneous expression of extracellular matrix molecules in the red nucleus of the rat. Neuroscience, 322, 1-17.

Gaál, B., Kecskes, S., Matesz, C., Birinyi, A., Hunyadi, A., & Rácz, É. (2015). Molecular composition and expression pattern of the extracellular matrix in a mossy fiber-generating precerebellar nucleus of rat, the prepositus hypoglossi. Neuroscience letters, 594, 122-126.

Godin, A. G., Varela, J. A., Gao, Z., Danné, N., Dupuis, J. P., Lounis, B., ... & Cognet, L. (2017). Single-nanotube tracking reveals the nanoscale organization of the extracellular space in the live brain. Nature Nanotechnology 12, 238–243

Venturino, A., Schulz, R., De Jesús-Cortés, H., Maes, M. E., Nagy, B., Reilly-Andújar, F., ... & Siegert, S. (2021). Microglia enable mature perineuronal nets disassembly upon anesthetic ketamine exposure or 60-Hz light entrainment in the healthy brain. *Cell reports*, *36*(1), 109313.

Proteoglycan Detection Kit (280560-N)

Wang, Z., Winsor, K., Nienhaus, C., Hess, E., & Blackmore, M. G. (2017). Combined chondroitinase and KLF7 expression reduce net retraction of sensory and CST axons from sites of spinal injury. Neurobiology of disease, 99, 24-35. **(Also cites our Clone 2B6 and our Chondroitinase ABC)**

Zayas-Santiago, A., Cross, S. D., Stanton, J. B., Marmorstein, A. D., & Marmorstein, L. Y. (2017). Mutant Fibulin-3 Causes Proteoglycan Accumulation and Impaired Diffusion Across Bruch's Membrane. Investigative Ophthalmology & Visual Science, 58(7), 3046-3054.

amsbio

CITATIONS FOR CHONDROITINASE ABC (AMS.E1028- codes)

Neuronal Regeneration Models

Abu-Rub, M. T., Newland, B., Naughton, M., Wang, W., McMahon, S., & Pandit, A. (2016). Non-Viral Xylosyltransferase-1 siRNA Delivery as an Effective Alternative to Chondroitinase in an In Vitro Model of Reactive Astrocytes. *Neuroscience* 339, 267-275.

Christensen, A. C., Lensjø, K. K., Lepperød, M. E., Dragly, S. A., Sutterud, H., Blackstad, J. S., ... & Hafting, T. (2021). Perineuronal nets stabilize the grid cell network. *Nature communications*, *12*(1), 1-17. ***(Also cites 3B3 stub antibody)***

Heidemann, M., Streit, J., & Tscherter, A. (2014). Functional regeneration of intraspinal connections in a new in vitro model. Neuroscience, 262, 40-52.

Hu, H. Z., Granger, N., Pai, S. B., Bellamkonda, R. V., & Jeffery, N. D. (2018). Therapeutic efficacy of microtube-embedded chondroitinase ABC in a canine clinical model of spinal cord injury. *Brain*, 141(4), 1017-1027. See also Moon and Bradbury (doi: 10.1093/brain/awy067) for a scientific commentary on this research.

Lensjø, K. K., Lepperød, M. E., Dick, G., Hafting, T., & Fyhn, M. (2016). Removal of perineuronal nets unlocks juvenile plasticity through network mechanisms of decreased inhibition and increased gamma activity. Journal of Neuroscience, 2504-16.

Lensjø, K. K., Christensen, A. C., Tennøe, S., Fyhn, M., & Hafting, T. (2017). Differential Expression and Cell-Type Specificity of Perineuronal Nets in Hippocampus, Medial Entorhinal Cortex, and Visual Cortex Examined in the Rat and Mouse. eNeuro, 4(3), ENEURO-0379.

Paveliev, M., Fenrich, K. K., Kislin, M., Kuja-Panula, J., Kulesskiy, E., Varjosalo, M., ... Kulesskaya, N. & Rauvala, H. (2016). HB-GAM (pleiotrophin) reverses inhibition of neural regeneration by the CNS extracellular matrix. Scientific Reports, 6, 33916.

Silver, D. J., Siebzehnrubl, F. A., Schildts, M. J., Yachnis, A. T., Smith, G. M., Smith, A. A., ... & Steindler, D. A. (2013). Chondroitin sulfate proteoglycans potently inhibit invasion and serve as a central organizer of the brain tumor microenvironment. The Journal of Neuroscience, 33(39), 15603-15617.

Wang, Z., Winsor, K., Nienhaus, C., Hess, E., & Blackmore, M. G. (2017). Combined chondroitinase and KLF7 expression reduce net retraction of sensory and CST axons from sites of spinal injury. Neurobiology of disease, 99, 24-35. **(Also cites 2B6 stub antibody and Proteoglycan Detection Kit cat.# 280560-N)**

Wu, D., Klaw, M. C., Connors, T., Kholodilov, N., Burke, R. E., & Tom, V. J. (2015). Expressing Constitutively Active Rheb in Adult Neurons after a Complete Spinal Cord Injury Enhances Axonal Regeneration beyond a Chondroitinase-Treated Glial Scar. The Journal of Neuroscience, 35(31), 11068-11080.

Wu, D., Klaw, M. C., Kholodilov, N., Burke, R. E., Detloff, M. R., Côté, M. P., & Tom, V. J. (2016). Expressing constitutively active Rheb in adult dorsal root ganglion neurons enhances the integration of sensory axons that regenerate across a chondroitinase-treated dorsal root entry zone following dorsal root crush. Frontiers in Molecular Neuroscience, 9. doi: 10.3389/fnmol.2016.00049

Xu, C., Klaw, M. C., Lemay, M. A., Baas, P. W., & Tom, V. J. (2015). Pharmacologically inhibiting kinesin-5 activity with monastrol promotes axonal regeneration following spinal cord injury. Experimental neurology, 263, 172-176.

amsbio

Glycoanalysis

Dagälv, A., Lundequist, A., Filipek-Górniok, B., Dierker, T., Eriksson, I., & Kjellén, L. (2015). Heparan sulfate structure: methods to study N-sulfation and NDST action. Glycosaminoglycans: Chemistry and Biology, 189-200.

Dierker, T., Shao, C., Haitina, T., Zaia, J., Hinas, A., & Kjellén, L. (2016). Nematodes join the family of chondroitin sulfate-synthesizing organisms: Identification of an active chondroitin sulfotransferase in Caenorhabditis elegans. Scientific Reports, 6. 34662.

Fang, J., Song, T., Lindahl, U., & Li, J. P. (2016). Enzyme overexpression–an exercise toward understanding regulation of heparan sulfate biosynthesis. Scientific Reports, 6, 31242.

Nelson, A., Berkestedt, I., & Bodelsson, M. (2014). Circulating glycosaminoglycan species in septic shock. Acta Anaesthesiologica Scandinavica, 58(1), 36-43.

Roucourt, B., Meeussen, S., Bao, J., Zimmermann, P., & David, G. (2015). Heparanase activates the syndecan-syntenin-ALIX exosome pathway. Cell research, 25(4), 412-428.

Scavenius, C., Nikolajsen, C. L., Stenvang, M., Thøgersen, I. B., Wyrożemski, Ł., Wisniewski, H. G., ... & Enghild, J. J. (2016). The compact and biologically relevant structure of inter-α-inhibitor is maintained by the chondroitin sulfate chain and divalent cations. Journal of Biological Chemistry, 291(9), 4658-4670.

BACKGROUND / REVIEWS:

Burnside, E. R., & Bradbury, E. J. (2014) Review: Manipulating the extracellular matrix and its role in brain and spinal cord plasticity and repair. *Neuropathology and applied neurobiology,* 40(1), 26-59.

Caterson, B. (2012) Fell-Muir Lecture: Chondroitin sulphate glycosaminoglycans: fun for some and confusion for others. *International journal of experimental pathology*, 93(1), 1-10.

Fox, K., & Caterson, B. (2002) Freeing the brain from the perineuronal net. *Science,* 298 (5596), 1187-1189.

HIGHLY CITED PAPERS FEATURING SEIKAGAKU PROTEASE-FREE CHONDROITINASE ABC:

Bradbury, E. J., Moon, L. D., Popat, R. J., King, V. R., Bennett, G. S., Patel, P. N., & McMahon, S. B. (2002) Chondroitinase ABC promotes functional recovery after spinal cord injury. Nature, 416(6881), 636-640.

Moon, L.D.F., Asher, R.A., Rhodes, K.E., & Fawcett, J.W. (2001) Regeneration of CNS axons back to their target following treatment of adult rat brain with chondroitinase ABC. Nature Neuroscience 4, 465-466. **(Also cites 2B6 & 3B3 stub antibodies)**

Pizzorusso, T., Medini, P., Berardi, N., Chierzi, S., Fawcett, J. W., & Maffei, L. (2002). Reactivation of ocular dominance plasticity in the adult visual cortex. Science, 298(5596), 1248-1251. **(Also cites 2B6 stub antibody)**

Thuret, S., Moon, L.D.F., & Gage, F.H. (2006) Therapeutic interventions after spinal cord injury. Nature Reviews Neuroscience 7, 628-643.