

DAFTAR PUSTAKA

- Abcam. (2008). *Fixation and permeabilisation tips for IHC and ICC*. [Http://Www.Abcam.Com/Ps/Pdf/Protocols/Fixation_permeabilization.Pdf](http://www.abcam.com/Ps/Pdf/Protocols/Fixation_permeabilization.Pdf).
- Adami, R., & Bottai, D. (2022). Curcumin and neurological diseases. *Nutritional Neuroscience*, 25(3), 441–461. <https://doi.org/10.1080/1028415X.2020.1760531>
- Alhaji, M., Zubair, M., & Farhana, A. (2025). *Enzyme Linked Immunosorbent Assay*. StatPearls Publishing.
- Anand, P., Kunnumakkara, A. B., Newman, R. A., & Aggarwal, B. B. (2007). Bioavailability of Curcumin: Problems and Promises. *Molecular Pharmaceutics*, 4(6), 807–818. <https://doi.org/10.1021/mp700113r>
- Arnold, W. D., Kassar, D., & Kissel, J. T. (2015). Spinal muscular atrophy: Diagnosis and management in a new therapeutic era. *Muscle & Nerve*, 51(2), 157–167. <https://doi.org/10.1002/mus.24497>
- Aydin, S. (2015). A short history, principles, and types of ELISA, and our laboratory experience with peptide/protein analyses using ELISA. *Peptides*, 72, 4–15. <https://doi.org/10.1016/j.peptides.2015.04.012>
- Bowerman, M., Anderson, C. L., Beauvais, A., Boyl, P. P., Witke, W., & Kothary, R. (2009). SMN, profilin IIa and plastin 3: A link between the deregulation of actin dynamics and SMA pathogenesis. *Molecular and Cellular Neuroscience*, 42(1), 66–74. <https://doi.org/10.1016/j.mcn.2009.05.009>
- Bowerman, M., Beauvais, A., Anderson, C. L., & Kothary, R. (2010). Rho-kinase inactivation prolongs survival of an intermediate SMA mouse model. *Human Molecular Genetics*, 19(8), 1468–1478. <https://doi.org/10.1093/hmg/ddq021>
- Bowerman, M., Shafey, D., & Kothary, R. (2007). Smn Depletion Alters Profilin II Expression and Leads to Upregulation of the RhoA/ROCK Pathway and Defects in Neuronal Integrity. *Journal of Molecular Neuroscience*, 32(2), 120–131. <https://doi.org/10.1007/s12031-007-0024-5>
- Cheever, T. R., & Ervasti, James. M. (2013). *Actin Isoforms in Neuronal Development and Function* (pp. 157–213). <https://doi.org/10.1016/B978-0-12-407704-1.00004-X>
- Clark Brelje, T., Wessendorf, M. W., & Sorenson, R. L. (2002). Multicolor Laser Scanning Confocal Immunofluorescence Microscopy: Practical Application and Limitations. In *Methods in Cell Biology* (pp. 165–249e). [https://doi.org/10.1016/S0091-679X\(02\)70006-X](https://doi.org/10.1016/S0091-679X(02)70006-X)
- Coque, E., Raoul, C., & Bowerman, M. (2014). ROCK inhibition as a therapy for spinal muscular atrophy: understanding the repercussions on multiple cellular targets. *Frontiers in Neuroscience*, 8. <https://doi.org/10.3389/fnins.2014.00271>

- Da Silva, J. S., Medina, M., Zuliani, C., Di Nardo, A., Witke, W., & Dotti, C. G. (2003). RhoA/ROCK regulation of neuritogenesis via profilin IIa-mediated control of actin stability. *The Journal of Cell Biology*, 162(7), 1267–1279. <https://doi.org/10.1083/jcb.200304021>
- D'Amico, A., Mercuri, E., Tiziano, F. D., & Bertini, E. (2011a). Spinal muscular atrophy. *Orphanet Journal of Rare Diseases*, 6(1), 71. <https://doi.org/10.1186/1750-1172-6-71>
- D'Amico, A., Mercuri, E., Tiziano, F. D., & Bertini, E. (2011b). Spinal muscular atrophy. *Orphanet Journal of Rare Diseases*, 6(1), 71. <https://doi.org/10.1186/1750-1172-6-71>
- Ebert, A. D., & Svendsen, C. N. (2010). Stem Cell Model of Spinal Muscular Atrophy. *Archives of Neurology*, 67(6). <https://doi.org/10.1001/archneurol.2010.89>
- Edens, B. M., Ajroud-Driss, S., Ma, L., & Ma, Y.-C. (2015). Molecular mechanisms and animal models of spinal muscular atrophy. *Biochimica et Biophysica Acta (BBA) - Molecular Basis of Disease*, 1852(4), 685–692. <https://doi.org/10.1016/j.bbadis.2014.07.024>
- Farrar, M. A., & Kiernan, M. C. (2015). The Genetics of Spinal Muscular Atrophy: Progress and Challenges. *Neurotherapeutics*, 12(2), 290–302. <https://doi.org/10.1007/s13311-014-0314-x>
- Fauroux, B., Griffon, L., Amaddeo, A., Stremler, N., Mazenq, J., Khirani, S., & Baravalle-Einaudi, M. (2020). Respiratory management of children with spinal muscular atrophy (SMA). *Archives de Pédiatrie*, 27(7), 7S29-7S34. [https://doi.org/10.1016/S0929-693X\(20\)30274-8](https://doi.org/10.1016/S0929-693X(20)30274-8)
- Ferron, F., Rebowski, G., Lee, S. H., & Dominguez, R. (2007). Structural basis for the recruitment of profilin-actin complexes during filament elongation by Ena/VASP. *The EMBO Journal*, 26(21), 4597–4606. <https://doi.org/10.1038/sj.emboj.7601874>
- Finkel, R. S., Mercuri, E., Meyer, O. H., Simonds, A. K., Schroth, M. K., Graham, R. J., Kirschner, J., Iannaccone, S. T., Crawford, T. O., Woods, S., Muntoni, F., Wirth, B., Montes, J., Main, M., Mazzone, E. S., Vitale, M., Snyder, B., Quijano-Roy, S., Bertini, E., ... Sejersen, T. (2018). Diagnosis and management of spinal muscular atrophy: Part 2: Pulmonary and acute care; medications, supplements and immunizations; other organ systems; and ethics. *Neuromuscular Disorders*, 28(3), 197–207. <https://doi.org/10.1016/j.nmd.2017.11.004>
- Ghosh, R., Gilda, J. E., & Gomes, A. V. (2014). The necessity of and strategies for improving confidence in the accuracy of western blots. *Expert Review of Proteomics*, 11(5), 549–560. <https://doi.org/10.1586/14789450.2014.939635>
- Giesemann, T., Rathke-Hartlieb, S., Rothkegel, M., Bartsch, J. W., Buchmeier, S., Jockusch, B. M., & Jockusch, H. (1999a). A Role for Polyproline Motifs in the Spinal Muscular Atrophy Protein SMN. *Journal of Biological Chemistry*, 274(53), 37908–37914. <https://doi.org/10.1074/jbc.274.53.37908>

- Giesemann, T., Rathke-Hartlieb, S., Rothkegel, M., Bartsch, J. W., Buchmeier, S., Jockusch, B. M., & Jockusch, H. (1999b). A Role for Polyproline Motifs in the Spinal Muscular Atrophy Protein SMN. *Journal of Biological Chemistry*, 274(53), 37908–37914. <https://doi.org/10.1074/jbc.274.53.37908>
- Guan, G., Cannon, R. D., Coates, D. E., & Mei, L. (2023). Effect of the Rho-Kinase/ROCK Signaling Pathway on Cytoskeleton Components. *Genes*, 14(2), 272. <https://doi.org/10.3390/genes14020272>
- Hamilton, G., & Gillingwater, T. H. (2013). Spinal muscular atrophy: going beyond the motor neuron. *Trends in Molecular Medicine*, 19(1), 40–50. <https://doi.org/10.1016/j.molmed.2012.11.002>
- Hensel, N., Stockbrügger, I., Rademacher, S., Broughton, N., Brinkmann, H., Grothe, C., & Claus, P. (2014). Bilateral crosstalk of rho- and extracellular-signal-regulated-kinase (ERK) pathways is confined to an unidirectional mode in spinal muscular atrophy (SMA). *Cellular Signalling*, 26(3), 540–548. <https://doi.org/10.1016/j.cellsig.2013.11.027>
- Hodge, R. G., & Ridley, A. J. (2016). Regulating Rho GTPases and their regulators. *Nature Reviews Molecular Cell Biology*, 17(8), 496–510. <https://doi.org/10.1038/nrm.2016.67>
- Im, K., Mareninov, S., Diaz, M. F. P., & Yong, W. H. (2019). *An Introduction to Performing Immunofluorescence Staining* (pp. 299–311). https://doi.org/10.1007/978-1-4939-8935-5_26
- Julian, L., & Olson, M. F. (2014). Rho-associated coiled-coil containing kinases (ROCK). *Small GTPases*, 5(2), e29846. <https://doi.org/10.4161/sgtp.29846>
- Kabiraj, A., Khaitan, T., Gupta, J., Bhattacharya, P. T., & Gupta, K. (2015). Immunofluorescence: a Refined Investigative Method. *International Journal of Contemporary Microbiology*, 1(1), 88. <https://doi.org/10.5958/2395-1796.2015.00021.6>
- Keinath, M. C., Prior, D. E., & Prior, T. W. (2021). Spinal Muscular Atrophy: Mutations, Testing, and Clinical Relevance. *The Application of Clinical Genetics, Volume 14*, 11–25. <https://doi.org/10.2147/TACG.S239603>
- Kholifah, E., & Endah, E. (2022). Analisis Profil Fisika Kimia dan Farmakokinetik Senyawa Pentagamavunon-1 Secara Komputasi. *Duta Pharma Journal*, 2(1), 1–7. <https://doi.org/10.47701/djp.v2i1.1679>
- Kolb, S. J. (2011). Spinal Muscular Atrophy: A Timely Review. *Archives of Neurology*, 68(8), 979. <https://doi.org/10.1001/archneurol.2011.74>
- Kolb, S. J., & Kissel, J. T. (2015). Spinal Muscular Atrophy. *Neurologic Clinics*, 33(4), 831–846. <https://doi.org/10.1016/j.ncl.2015.07.004>
- Konstantinou, G. N. (2017). *Enzyme-Linked Immunosorbent Assay (ELISA)* (pp. 79–94). https://doi.org/10.1007/978-1-4939-6925-8_7
- Lee, S. H., & Dominguez, R. (2010). Regulation of Actin Cytoskeleton Dynamics in Cells. *Molecules and Cells*, 29(4), 311–326. <https://doi.org/10.1007/s10059-010-0053-8>

- Lefebvre, S., Burlet, P., Liu, Q., Bertrand, S., Clermont, O., Munnich, A., Dreyfuss, G., & Melki, J. (1997). Correlation between severity and SMN protein level in spinal muscular atrophy. *Nature Genetics*, *16*(3), 265–269. <https://doi.org/10.1038/ng0797-265>
- Lestari, B., Nakamae, I., Yoneda-Kato, N., Morimoto, T., Kanaya, S., Yokoyama, T., Shionyu, M., Shirai, T., Meiyanto, E., & Kato, J. (2019). Pentagamavunon-1 (PGV-1) inhibits ROS metabolic enzymes and suppresses tumor cell growth by inducing M phase (prometaphase) arrest and cell senescence. *Scientific Reports*, *9*(1), 14867. <https://doi.org/10.1038/s41598-019-51244-3>
- Lin, H.-J., Su, C.-S., Lu, H.-F., Yang, J.-S., Hsu, S.-C., Ip, S.-W., Wu, J.-J., Li, Y.-C., Ho, C.-C., Wu, C.-C., & Chung, J.-G. (2010). Curcumin blocks migration and invasion of mouse-rat hybrid retina ganglion cells (N18) through the inhibition of MMP-2, -9, FAK, Rho A and Rock-1 gene expression. *Oncology Reports*, *23*(3). https://doi.org/10.3892/or_00000682
- Luo, L. (2000). RHO GTPASES in neuronal morphogenesis. *Nature Reviews Neuroscience*, *1*(3), 173–180. <https://doi.org/10.1038/35044547>
- Luo, L., Jan, L. Y., & Jan, Y.-N. (1997). Rho family small GTP-binding proteins in growth cone signalling. *Current Opinion in Neurobiology*, *7*(1), 81–86. [https://doi.org/10.1016/S0959-4388\(97\)80124-9](https://doi.org/10.1016/S0959-4388(97)80124-9)
- Maheshwari, R. K., Singh, A. K., Gaddipati, J., & Srimal, R. C. (2006). Multiple biological activities of curcumin: A short review. *Life Sciences*, *78*(18), 2081–2087. <https://doi.org/10.1016/j.lfs.2005.12.007>
- McDonald, C. M. (2012). Clinical Approach to the Diagnostic Evaluation of Hereditary and Acquired Neuromuscular Diseases. *Physical Medicine and Rehabilitation Clinics of North America*, *23*(3), 495–563. <https://doi.org/10.1016/j.pmr.2012.06.011>
- Meiyanto, E., Hermawan, A., & Anindyajati, A. (2012). Natural Products for Cancer-Targeted Therapy: Citrus Flavonoids as Potent Chemopreventive Agents. *Asian Pacific Journal of Cancer Prevention*, *13*(2), 427–436. <https://doi.org/10.7314/APJCP.2012.13.2.427>
- Mercuri, E., Finkel, R. S., Muntoni, F., Wirth, B., Montes, J., Main, M., Mazzone, E. S., Vitale, M., Snyder, B., Quijano-Roy, S., Bertini, E., Davis, R. H., Meyer, O. H., Simonds, A. K., Schroth, M. K., Graham, R. J., Kirschner, J., Iannaccone, S. T., Crawford, T. O., ... Szlagatys-Sidorkiewicz, A. (2018). Diagnosis and management of spinal muscular atrophy: Part 1: Recommendations for diagnosis, rehabilitation, orthopedic and nutritional care. *Neuromuscular Disorders*, *28*(2), 103–115. <https://doi.org/10.1016/j.nmd.2017.11.005>
- Narita, A. (2011). Minimum requirements for the actin-like treadmill motor system. *BioArchitecture*, *1*(5), 205–208. <https://doi.org/10.4161/bioa.18115>
- Narumiya, S., Tanji, M., & Ishizaki, T. (2009). Rho signaling, ROCK and mDia1, in transformation, metastasis and invasion. *Cancer and Metastasis Reviews*, *28*(1–2), 65–76. <https://doi.org/10.1007/s10555-008-9170-7>

- Nölle, A., Zeug, A., van Bergeijk, J., Tönges, L., Gerhard, R., Brinkmann, H., Al Rayes, S., Hensel, N., Schill, Y., Apkhazava, D., Jablonka, S., O'mer, J., Kumar Srivastav, R., Baasner, A., Lingor, P., Wirth, B., Ponimaskin, E., Niedenthal, R., Grothe, C., & Claus, P. (2011). The spinal muscular atrophy disease protein SMN is linked to the rho-kinase pathway via profilin. *Human Molecular Genetics*, *20*(24), 4865–4878. <https://doi.org/10.1093/hmg/ddr425>
- Nurputra, D. K., Lai, P. S., Harahap, N. I. F., Morikawa, S., Yamamoto, T., Nishimura, N., Kubo, Y., Takeuchi, A., Saito, T., Takeshima, Y., Tohyama, Y., Tay, S. K., Low, P. S., Saito, K., & Nishio, H. (2013). Spinal Muscular Atrophy: From Gene Discovery to Clinical Trials. *Annals of Human Genetics*, *77*(5), 435–463. <https://doi.org/10.1111/ahg.12031>
- Ogino, S., Wilson, R. B., & Gold, B. (2004). New insights on the evolution of the SMN1 and SMN2 region: simulation and meta-analysis for allele and haplotype frequency calculations. *European Journal of Human Genetics*, *12*(12), 1015–1023. <https://doi.org/10.1038/sj.ejhg.5201288>
- Ohashi, K., Nagata, K., Maekawa, M., Ishizaki, T., Narumiya, S., & Mizuno, K. (2000). Rho-associated Kinase ROCK Activates LIM-kinase 1 by Phosphorylation at Threonine 508 within the Activation Loop. *Journal of Biological Chemistry*, *275*(5), 3577–3582. <https://doi.org/10.1074/jbc.275.5.3577>
- Pollard, T. D. (1986). Rate constants for the reactions of ATP- and ADP-actin with the ends of actin filaments. *The Journal of Cell Biology*, *103*(6), 2747–2754. <https://doi.org/10.1083/jcb.103.6.2747>
- Pollard, T. D. (2016). Actin and Actin-Binding Proteins. *Cold Spring Harbor Perspectives in Biology*, *8*(8), a018226. <https://doi.org/10.1101/cshperspect.a018226>
- Pollard, T. D., & Borisy, G. G. (2003). Cellular Motility Driven by Assembly and Disassembly of Actin Filaments. *Cell*, *112*(4), 453–465. [https://doi.org/10.1016/S0092-8674\(03\)00120-X](https://doi.org/10.1016/S0092-8674(03)00120-X)
- Qiu, B., Xu, X., Yi, P., & Hao, Y. (2020). Curcumin reinforces MSC-derived exosomes in attenuating osteoarthritis via modulating the miR-124/NF-kB and miR-143/ROCK1/TLR9 signalling pathways. *Journal of Cellular and Molecular Medicine*, *24*(18), 10855–10865. <https://doi.org/10.1111/jcmm.15714>
- Requejo-Aguilar, R., Alastrue-Agudo, A., Cases-Villar, M., Lopez-Mocholi, E., England, R., Vicent, M. J., & Moreno-Manzano, V. (2017). Combined polymer-curcumin conjugate and ependymal progenitor/stem cell treatment enhances spinal cord injury functional recovery. *Biomaterials*, *113*, 18–30. <https://doi.org/10.1016/j.biomaterials.2016.10.032>
- Schüning, T., Zeug, A., Strienke, K., Franz, P., Tsiavaliaris, G., Hensel, N., Viero, G., Ponimaskin, E., & Claus, P. (2024). The spinal muscular atrophy gene product regulates actin dynamics. *The FASEB Journal*, *38*(18). <https://doi.org/10.1096/fj.202300183R>

- Shah, K., & Maghsoudlou, P. (2016). Enzyme-linked immunosorbent assay (ELISA): the basics. *British Journal of Hospital Medicine*, 77(7), C98–C101. <https://doi.org/10.12968/hmed.2016.77.7.C98>
- Sharma, A., Lambrechts, A., Hao, L. thi, Le, T. T., Sewry, C. A., Ampe, C., Burghes, A. H. M., & Morris, G. E. (2005). A role for complexes of survival of motor neurons (SMN) protein with gemins and profilin in neurite-like cytoplasmic extensions of cultured nerve cells. *Experimental Cell Research*, 309(1), 185–197. <https://doi.org/10.1016/j.yexcr.2005.05.014>
- Shi, T., Zhou, Z., Xiang, T., Suo, Y., Shi, X., Li, Y., Zhang, P., Dai, J., & Sheng, L. (2025a). Cytoskeleton dysfunction of motor neuron in spinal muscular atrophy. *Journal of Neurology*, 272(1), 19. <https://doi.org/10.1007/s00415-024-12724-3>
- Shi, T., Zhou, Z., Xiang, T., Suo, Y., Shi, X., Li, Y., Zhang, P., Dai, J., & Sheng, L. (2025b). Cytoskeleton dysfunction of motor neuron in spinal muscular atrophy. *Journal of Neurology*, 272(1), 19. <https://doi.org/10.1007/s00415-024-12724-3>
- Siranosian, J. J., Nery, F. C., Alves, C. R. R., Siranosian, B. A., Lyons, N. J., Eichelberger, E. J., Garner, R., Da Silva Duarte Lepez, S., Johnstone, A. J., Subramanian, A., & Swoboda, K. J. (2020). Whole-blood dysregulation of actin-cytoskeleton pathway in adult spinal muscular atrophy patients. *Annals of Clinical and Translational Neurology*, 7(7), 1158–1165. <https://doi.org/10.1002/acn3.51092>
- Stankiewicz, T. R., & Linseman, D. A. (2014). Rho family GTPases: key players in neuronal development, neuronal survival, and neurodegeneration. *Frontiers in Cellular Neuroscience*, 8. <https://doi.org/10.3389/fncel.2014.00314>
- Sun, K., Duan, X., Cai, H., Liu, X., Yang, Y., Li, M., Zhang, X., & Wang, J. (2016). Curcumin inhibits LPA-induced invasion by attenuating RhoA/ROCK/MMPs pathway in MCF7 breast cancer cells. *Clinical and Experimental Medicine*, 16(1), 37–47. <https://doi.org/10.1007/s10238-015-0336-7>
- Svitkina, T. (2018). The Actin Cytoskeleton and Actin-Based Motility. *Cold Spring Harbor Perspectives in Biology*, 10(1), a018267. <https://doi.org/10.1101/cshperspect.a018267>
- Tang, A. T., Campbell, W. B., & Nithipatikom, K. (2012). ROCK1 feedback regulation of the upstream small GTPase RhoA. *Cellular Signalling*, 24(7), 1375–1380. <https://doi.org/10.1016/j.cellsig.2012.03.005>
- Verhaart, I. E. C., Robertson, A., Wilson, I. J., Aartsma-Rus, A., Cameron, S., Jones, C. C., Cook, S. F., & Lochmüller, H. (2017). Prevalence, incidence and carrier frequency of 5q-linked spinal muscular atrophy – a literature review. *Orphanet Journal of Rare Diseases*, 12(1), 124. <https://doi.org/10.1186/s13023-017-0671-8>
- Wang, C. H., Finkel, R. S., Bertini, E. S., Schroth, M., Simonds, A., Wong, B., Aloysius, A., Morrison, L., Main, M., Crawford, T. O., & Trela, A. (2007). Consensus Statement for Standard of Care in Spinal Muscular Atrophy.

Journal of Child Neurology, 22(8), 1027–1049.

<https://doi.org/10.1177/0883073807305788>

Zhang, F., Zhang, Z., Chen, L., Kong, D., Zhang, X., Lu, C., Lu, Y., & Zheng, S. (2014). Curcumin attenuates angiogenesis in liver fibrosis and inhibits angiogenic properties of hepatic stellate cells. *Journal of Cellular and Molecular Medicine*, 18(7), 1392–1406. <https://doi.org/10.1111/jcmm.12286>

Zhou, Y., Little, P. J., Xu, S., & Kamato, D. (2021). Curcumin Inhibits Lysophosphatidic Acid Mediated MCP-1 Expression via Blocking ROCK Signalling. *Molecules*, 26(8), 2320. <https://doi.org/10.3390/molecules26082320>

Zwartkruis, M. M., Elferink, M. G., Gommers, D., Signoria, I., Blasco-Pérez, L., Costa-Roger, M., van der Sel, J., Renkens, I. J., Green, J. W., Kortooms, J. V., Vermeulen, C., Straver, R., van Deutekom, H. W. M., Veldink, J. H., Asselman, F., Tizzano, E. F., Wadman, R. I., van der Pol, W. L., van Haaften, G. W., & Groen, E. J. N. (2025). Long-read sequencing identifies copy-specific markers of SMN gene conversion in spinal muscular atrophy. *Genome Medicine*, 17(1), 26. <https://doi.org/10.1186/s13073-025-01448-2>