DAFTAR PUSTAKA

Adcock, S. A., & McCammon, J. A. (2006). *Molecular Dynamics*: Survey of methods for simulating the activity of proteins. Chemical Reviews, 106(5), 1589–1615. https://doi.org/10.1021/cr040426m

Anand, P., & Singh, B. (2013). A review on cholinesterase inhibitors for *Alzheimer's disease*. Archives of Pharmacal Research, 36, 375–399. https://doi.org/10.1007/s12272-013-0036-3

Bao, L.-Q., Baecker, D., Do, T. M. D., Nhung, N. P., Thuan, N. T., Nguyen, P. L., et al. (2023). Development of activity rules and chemical fragment design for *in silico* discovery of AChE and BACE1 dual inhibitors against *Alzheimer's disease*. Molecules, 28(8), 3588. https://doi.org/10.3390/molecules28083588

Bartus, R. T., Dean, R. L., Beer, B., & Lippa, A. S. (1982). The cholinergic hypothesis of geriatric memory dysfunction. Science, 217(4558), 408–414. https://doi.org/10.1126/science.7046051

Berman, H. M., Westbrook, J., Feng, Z., Gilliland, G., Bhat, T. N., Weissig, H., & Bourne, P. E. (2000). The Protein Data Bank. Nucleic Acids Research, 28(1), 235–242. https://doi.org/10.1093/nar/28.1.235

Bloom, G. S. (2014). Amyloid-β and tau: The trigger and bullet in Alzheimer disease pathogenesis. JAMA Neurology, 71(4), 505–508. https://doi.org/10.1001/jamaneurol.2013.5847

Bolognesi, M. L. (2019). *Multi-target*-directed *ligand*s in *Alzheimer's disease*. Current Medicinal Chemistry, 26(27), 4935–4945

Breijyeh, Z., & Karaman, R. (2020). Comprehensive review on *Alzheimer's disease*. Molecules, 25(24), 5789

Busche, M. A., & Hyman, B. T. (2020). Synergy between amyloid-β and tau in *Alzheimer's disease*. Nature Neuroscience, 23, 1183–1193. https://doi.org/10.1038/s41593-020-0687-6

Cacabelos, R. (2007). Donepezil in *Alzheimer's disease*: From conventional trials to pharmacogenetics. Neuropsychiatric Disease and Treatment, 3(3), 303–333

Cavalli, A., Bolognesi, M. L., Minarini, A., Rosini, M., Tumiatti, V., Recanatini, M., & Melchiorre, C. (2008). *Multi-target*-directed *ligand*s to combat neurodegenerative diseases. Journal of Medicinal Chemistry, 51(3), 347–372. https://doi.org/10.1021/jm7009364

Chen, Z. R., Huang, J. B., Yang, S. L., & Hong, F. F. (2022). Role of cholinergic signaling in *Alzheimer's disease*. Molecules, 27(6), 1816. https://doi.org/10.3390/molecules27061816

Cheung, J., Rudolph, M. J., Burshteyn, F., Cassidy, M. S., Gary, E. N., Love, J., Franklin, M. C., & Height, J. J. (2012). Structures of human acetylcholinesterase in complex with pharmacologically important *ligands*. Journal of Medicinal Chemistry, 55(22), 10282–10286. https://doi.org/10.1021/jm300871x

Coimbra, J. R. M., Marques, D. F. F., Baptista, S. J., Pereira, C. M. F., Moreira, P. I., Dinis, T. C. P., & Santos, A. E. (2018). Highlights in BACE1 inhibitors for *Alzheimer's disease* treatment. Frontiers in Chemistry, 6, 178. https://doi.org/10.3389/fchem.2018.00178

Colović, M. B., Krstić, D. Z., Lazarević-Pašti, T. D., Bondžić, A. M., & Vasić, V. M. (2013). Acetylcholinesterase inhibitors: Pharmacology and toxicology. Current Neuropharmacology, 11(3), 315–335. https://doi.org/10.2174/1570159X11311030006

Cummings, J. (2021). New approaches to symptomatic treatments for *Alzheimer's disease*. Molecular Neurodegeneration, 16, 2. https://doi.org/10.1186/s13024-021-00426-0

Daina, A., Michielin, O., & Zoete, V. (2017). SwissADME: A free web tool to evaluate pharmacokinetics, *drug-likeness* and medicinal chemistry friendliness of small molecules. Scientific Reports, 7, 42717. https://doi.org/10.1038/srep42717

Dallakyan, S., & Olson, A. J. (2015). Small-molecule library screening by docking with PyRx. In Chemical Biology (Vol. 1263, pp. 243–250). Humana Press. https://doi.org/10.1007/978-1-4939-2269-7_19

De Strooper, B., & Karran, E. (2016). The cellular phase of *Alzheimer's disease*. Cell, 164(4), 603–615. https://doi.org/10.1016/j.cell.2015.12.056

Dias, K. S. T., & Viegas, C., Jr. (2014). *Multi-target* directed drugs: A modern approach for design of new drugs for the treatment of *Alzheimer's disease*. Current Neuropharmacology, 12(3), 239–255. https://doi.org/10.2174/1570159X11666131120215406

Direktorat Jenderal Pengawasan Obat dan Makanan. (1995). Materia Medika Indonesia Jilid VI. Departemen Kesehatan Republik Indonesia.

Durán-Peña, M. J., Ares, J. M., & Collado, I. G. (2023). Degraded limonoids: Biologically active limonoid fragments re-enhancing interest in Meliaceae and Rutaceae sources. Phytochemistry Reviews, 22, 695–743. https://doi.org/10.1007/s11101-023-09856-1

Egan, M. F., Kost, J., Tariot, P. N., Aisen, P. S., Cummings, J. L., Vellas, B., et al. (2018). Randomized trial of verubecestat for prodromal *Alzheimer's disease*. New England Journal of Medicine, 378, 1408–1420

Ekimoto, H., Kadota, S., Momose, Y., Takeuchi, K., & Hattori, M. (1991). Constituents of the seeds of *Swietenia mahagoni* Jacq. I. Isolation,

structures, and biological activities of tetranortriterpenoids. Chemical and Pharmaceutical Bulletin, 39(3), 640–651. https://doi.org/10.1248/cpb.39.640

Ervina, M., & Sukardiman. (2020). The recent use of *Swietenia mahagoni* (L.) Jacq. as antidiabetes type 2 phytomedicine: A systematic review. Heliyon, 6(3), e03536. https://doi.org/10.1016/j.heliyon.2020.e03536

Ferreira, L. G., Dos Santos, R. N., Oliva, G., & Andricopulo, A. D. (2015). *Molecular docking* and structure-based drug design strategies. Molecules, 20(7), 13384–13421. https://doi.org/10.3390/molecules200713384

Ferreira-Vieira, T. H., Guimaraes, I. M., Silva, F. R., & Ribeiro, F. M. (2016). *Alzheimer's disease*: Targeting the cholinergic system. *Current Neuropharmacology*, 14(1), 101–115. https://doi.org/10.2174/1570159X13666150716165726

Forli, S., Huey, R., Pique, M. E., Sanner, M. F., Goodsell, D. S., & Olson, A. J. (2016). Computational protein–*ligand* docking and virtual drug screening with the AutoDock suite. Nature Protocols, 11(5), 905–919. https://doi.org/10.1038/nprot.2016.051

Genheden, S., & Ryde, U. (2015). The MM/PBSA and MM/GBSA methods to estimate *ligand*-binding affinities. Expert Opinion on Drug Discovery, 10(5), 449–461. https://doi.org/10.1517/17460441.2015.1032936

Ghosh, A. K., Osswald, H. L., & Pradhan, R. (2011). BACE1 (β-secretase) inhibitors for the treatment of *Alzheimer's disease*. Chemical Society Reviews, 40(1), 108–125. https://doi.org/10.1039/B925274A

Greig, N. H., Utsuki, T., Ingram, D. K., Wang, Y., Pepeu, G., Scali, C., et al. (2005). Selective butyrylcholinesterase inhibition elevates brain acetylcholine. Proceedings of the National Academy of Sciences, 102(47), 17213–17218. https://doi.org/10.1073/pnas.0508575102

Guerguer, F. Z., Bouribab, A., Karim, E. M., Khedraoui, M., Amegrissi, F., Raouf, Y. S., et al. (2025). Moroccan natural products for multitarget-based treatment of *Alzheimer's disease*: A computational study. PLoS ONE, 20(1), e0313411. https://doi.org/10.1371/journal.pone.0313411

Guzior, N., Wieckowska, A., Panek, D., & Malawska, B. (2015). Recent development of multifunctional agents as potential drug candidates for the treatment of *Alzheimer's disease*. Current Medicinal Chemistry, 22(3), 373–404. https://doi.org/10.2174/0929867321666141106122628

Hampel, H., Mesulam, M.-M., Cuello, A. C., Farlow, M. R., Giacobini, E., Grossberg, G. T., et al. (2018). The cholinergic system in the pathophysiology and treatment of *Alzheimer's disease*. Brain, 141(7), 1917–1933. https://doi.org/10.1093/brain/awy132

Hardy, J. A., & Selkoe, D. J. (2002). The amyloid hypothesis of *Alzheimer's disease*: Progress and problems on the road to therapeutics. Science, 297(5580), 353–356. https://doi.org/10.1126/science.1072994

Hevener, K. E., Zhao, W., Ball, D. M., Babaoglu, K., Qi, J., White, S. W., & Lee, R. E. (2009). Validation of *Molecular docking* programs for virtual screening against dihydropteroate synthase. Journal of Chemical Information and Modeling, 49(2), 444–460.

Hollingsworth, S. A., & Dror, R. O. (2018). *Molecular Dynamics* simulation for all. Neuron, 99(6), 1129–1143. https://doi.org/10.1016/j.neuron.2018.08.011

Homeyer, N., & Gohlke, H. (2012). Free energy calculations by the Molecular Mechanics Poisson–Boltzmann Surface Area method. Molecular Informatics, 31(2), 114–122. https://doi.org/10.1002/minf.201100135

Humphrey, W., Dalke, A., & Schulten, K. (1996). VMD: Visual *Molecular Dynamics*. Journal of Molecular Graphics, 14, 33–38. https://doi.org/10.1016/0263-7855(96)00018-5

Imbimbo, B. P., & Watling, M. (2019). Investigational BACE inhibitors for the treatment of *Alzheimer's disease*. Expert Opinion on Investigational Drugs, 28(11), 967–975. https://doi.org/10.1080/13543784.2019.1683160

Jack, C. R., Jr., Bennett, D. A., Blennow, K., Carrillo, M. C., Dunn, B., Haeberlein, S. B., et al. (2018). NIA-AA Research Framework: Toward a biological definition of *Alzheimer's disease*. Alzheimer's & Dementia, 14(4), 535–562. https://doi.org/10.1016/j.jalz.2018.02.018

Jazuli, I., Iqbal, J., & Pervaiz, F. (2023). Prospective approach of Swietenia macrophylla as a neuroprotective agent for *Alzheimer's disease*. Current Research in Pharmacology and Drug Discovery, 5, 100186. https://doi.org/10.1016/j.crphar.2023.100186

Kadota, S., Ekimoto, H., Momose, Y., Takeuchi, K., & Hattori, M. (1990). Constituents of the seeds of *Swietenia mahagoni* (Meliaceae): Structure of new tetranortriterpenoids, swietenins B–F and related compounds. *Chemical and Pharmaceutical Bulletin*, 38(3), 639–646. https://doi.org/10.1248/cpb.38.639

Kareem, R. T., Abedinifar, F., Mahmood, E. A., Ebadi, A. G., Rajabi, F., & Vessally, E. (2021). The recent development of donepezil structure-based hybrids as potential multifunctional anti-Alzheimer's agents: Highlights from 2010 to 2020. RSC Advances, 11(49), 30781–30802. https://doi.org/10.1039/D1RA04038G

Karplus, M., & McCammon, J. A. (2002). *Molecular Dynamics* simulations of biomolecules. Nature Structural Biology, 9(9), 646–652. https://doi.org/10.1038/nsb0902-646

Kennedy, M. E., Stamford, A. W., Chen, X., Cox, K., Cumming, J. N., Dockendorf, M. F., et al. (2016). The BACE1 inhibitor verubecestat. Science Translational Medicine, 8(363), 363ra150. https://doi.org/10.1126/scitranslmed.aad9700

Kim, S., Chen, J., Cheng, T., Gindulyte, A., He, J., He, S., Li, Q., Shoemaker, B. A., Thiessen, P. A., Yu, B., Zaslavsky, L., Zhang, J., & Bolton, E. E. (2021). PubChem in 2021: New data content and improved web interfaces. Nucleic Acids Research, 49(D1), D1388–D1395. https://doi.org/10.1093/nar/gkaa971

Kitchen, D. B., Decornez, H., Furr, J. R., & Bajorath, J. (2004). Docking and scoring in virtual screening for drug discovery: Methods and applications. Nature Reviews Drug Discovery, 3(11), 935–949. https://doi.org/10.1038/nrd1549

Knopman, D. S., Amieva, H., Petersen, R. C., Chételat, G., Holtzman, D. M., Hyman, B. T., et al. (2021). Alzheimer disease. *Nature Reviews Disease Primers*, 7, 33. https://doi.org/10.1038/s41572-021-00269-y

Lane, C. A., Hardy, J., & Schott, J. M. (2018). *Alzheimer's disease*. *European Journal of Neurology*, 25(1), 59–70. https://doi.org/10.1111/ene.13439

Leon, R., Garcia, A. G., & Marco-Contelles, J. (2013). Recent advances in the multitarget-directed *ligand*s approach for the treatment of *Alzheimer's disease*. Medicinal Research Reviews, 33(1), 139–189. https://doi.org/10.1002/med.20248

Lionta, E., Spyrou, G., Vassilatis, D. K., & Cournia, Z. (2014). Structure-based virtual screening for drug discovery: Principles, applications and recent advances. Current Topics in Medicinal Chemistry, 14(16), 1923–1938. https://doi.org/10.2174/1568026614666140929124445

Liu, P.-P., Xie, Y., Meng, X.-Y., & Kang, J.-S. (2019). History and progress of hypotheses and clinical trials for *Alzheimer's disease*. Signal Transduction and Targeted Therapy, 4, 29. https://doi.org/10.1038/s41392-019-0063-8

Lodha, T., Birangal, S., Pai, A., Prabhu, S., Nayak, S., Francis, T., Kumar, L., & Verma, R. (2024). An in-silico approach for the identification of natural compounds as potential BACE-1 inhibitors for the treatment of Alzheimer disease. Journal of Applied Pharmaceutical Science, 14(9), 292–304. https://doi.org/10.7324/JAPS.2024.188418

Long, J. M., & Holtzman, D. M. (2019). Alzheimer disease: An update on pathobiology and treatment strategies. *Cell*, 179(2), 312–339. https://doi.org/10.1016/j.cell.2019.09.001

Masters, C. L., Bateman, R., Blennow, K., Rowe, C. C., Sperling, R. A., & Cummings, J. L. (2015). *Alzheimer's disease*. Nature Reviews Disease Primers, 1, 15056. https://doi.org/10.1038/nrdp.2015.56

Meng, X.-Y., Zhang, H.-X., Mezei, M., & Cui, M. (2011). *Molecular docking*: A powerful approach for structure-based drug discovery. Current Computer-Aided Drug Design, 7(2), 146–157. https://doi.org/10.2174/157340911795677602

Miller, B. R., McGee, T. D., Swails, J. M., Homeyer, N., Gohlke, H., & Roitberg, A. E. (2012). MMPBSA.py: An efficient program for end-state free energy calculations. *Journal of Chemical Theory and Computation*, 8(9), 3314–3321. https://doi.org/10.1021/ct300418h

Morris, G. M., Huey, R., Lindstrom, W., Sanner, M. F., Belew, R. K., Goodsell, D. S., & Olson, A. J. (2009). AutoDock4 and AutoDockTools4: Automated docking with selective receptor flexibility. Journal of Computational Chemistry, 30(16), 2785–2791. https://doi.org/10.1002/jcc.21256

Moussa-Pacha, N. M., Abdin, S. M., Omar, H. A., Alniss, H., & Al-Tel, T. H. (2020). BACE1 inhibitors: Current status and future directions. Current Topics in Medicinal Chemistry, 20(18), 1555–1576. https://doi.org/10.2174/1568026620666200427160418

Pagadala, N. S., Syed, K., & Tuszynski, J. (2017). Software for *Molecular docking*: A review. Biophysical Reviews, 9(2), 91–102. https://doi.org/10.1007/s12551-016-0247-1

Pamplona, S. G. S. R., Arruda, M. S. P., Castro, K. C. F., Silva, C. E., Ferreira, A. G., Silva, M. F. G. F., et al. (2018). Phragmalin limonoids from Swietenia macrophylla and their antifeedant assay against mahogany predator. Journal of the Brazilian Chemical Society, 29(8), 1621–1629. https://doi.org/10.21577/0103-5053.20180033

Pinzi, L., & Rastelli, G. (2019). *Molecular docking*: Shifting paradigms in drug discovery. International Journal of Molecular Sciences, 20(18), 4331. https://doi.org/10.3390/ijms20184331

Pires, D. E. V., Blundell, T. L., & Ascher, D. B. (2015). pkCSM: Predicting small-molecule pharmacokinetic and toxicity properties using graph-based signatures. Journal of Medicinal Chemistry, 58(9), 4066–4072. https://doi.org/10.1021/acs.jmedchem.5b00104

Querfurth, H. W., & LaFerla, F. M. (2010). *Alzheimer's disease*. New England Journal of Medicine, 362(4), 329–344. https://doi.org/10.1056/NEJMra0909142

Rahman, A. K. M. S., Chowdhury, A. K. A., Ali, H.-A., Raihan, S. Z., Ali, M. S., Nahar, L., & Sarker, S. D. (2009). Antibacterial activity of two limonoids from *Swietenia mahagoni* against multiple-drug-resistant bacterial strains. Journal of Natural Medicines, 63(1), 41–45. https://doi.org/10.1007/s11418-008-0287-3

Sahgal, G., Ramanathan, S., Sasidharan, S., Mordi, M. N., Ismail, S., & Mansor, S. M. (2009). In vitro antioxidant and xanthine oxidase inhibitory activities of

methanolic *Swietenia mahagoni* seed extracts. Molecules, 14(11), 4476–4485. https://doi.org/10.3390/molecules14114476

Scheltens, P., De Strooper, B., Kivipelto, M., Holstege, H., Chételat, G., Teunissen, C. E., et al. (2021). *Alzheimer's disease*. *The Lancet*, 397(10284), 1577–1590. https://doi.org/10.1016/S0140-6736(20)32205-4

Seeliger, D., & de Groot, B. L. (2010). *Ligand* docking and *binding site* analysis with PyMOL and AutoDock/Vina. Journal of Computer-Aided Molecular Design, 24, 417–422. https://doi.org/10.1007/s10822-010-9345-6

Selkoe, D. J., & Hardy, J. (2016). The amyloid hypothesis of *Alzheimer's disease* at 25 years. EMBO Molecular Medicine, 8(6), 595–608. https://doi.org/10.15252/emmm.201606210

Serrano-Pozo, A., Frosch, M. P., Masliah, E., & Hyman, B. T. (2011). Neuropathological alterations in *Alzheimer's disease*. Cold Spring Harbor Perspectives in Medicine, 1(1), a006189. https://doi.org/10.1101/cshperspect.a006189

Shi, Z., An, L., Yang, X., Xi, Y., Zhang, C., Yuan, S., et al. (2019). Nitric oxide inhibitory limonoids as potential anti-neuroinflammatory agents from *Swietenia mahagoni*. Bioorganic Chemistry, 84, 177–185. https://doi.org/10.1016/j.bioorg.2018.11.012

Silman, I., & Sussman, J. L. (2005). Acetylcholinesterase: How is structure related to function? Chemico-Biological Interactions, 157–158, 3–10. https://doi.org/10.1016/j.cbi.2005.10.007

Sliwoski, G., Kothiwale, S., Meiler, J., & Lowe, E. W. (2014). Computational methods in drug discovery. Pharmacological Reviews, 66(1), 334–395. https://doi.org/10.1124/pr.112.007336

Sousa, S. F., Ribeiro, A. J. M., Coimbra, J. T. S., Neves, R. P. P., Martins, S. A., Moorthy, N. S. H. N., & Fernandes, P. A. (2013). Protein–*ligand* docking in the new millennium—A retrospective of 10 years in the field. Current Medicinal Chemistry, 20(18), 2296–2314. https://doi.org/10.2174/0929867311320180002

Srivastava, S., Sharma, S., Deep, S., & Khare, S. K. (2023). Screening of multitarget-directed natural compounds as drug candidates for *Alzheimer's disease* using *in silico* techniques: Their extraction and in vitro validation. ACS Omega, 8(42), 38118–38129. https://doi.org/10.1021/acsomega.3c04261

Sun, Y.-P., Li, C.-Z., Zhu, L.-L., Wang, G.-K., Zhang, H.-Y., & Yan, X. (2018). Chemical structures and biological activities of limonoids from the genus Swietenia (Meliaceae). Molecules, 23(7), 1588. https://doi.org/10.3390/molecules23071588

Surya, D. (2012). Herbal drug *Swietenia mahagoni* Jacq.—A review. Global Journal of Research on Medicinal Plants & Indigenous Medicine, 1(10), 557–567

Taylor, P., & Radić, Z. (1994). The cholinesterases: From genes to proteins. Annual Review of Pharmacology and Toxicology, 34, 281–320. https://doi.org/10.1146/annurev.pa.34.040194.001433

Thawabteh, A. M., Ghanem, A. W., AbuMadi, S., Thaher, D., Jaghama, W., Karaman, D., et al. (2024). Recent Advances in Therapeutics for the Treatment of *Alzheimer's disease*. Molecules, 29(21), 5131. https://doi.org/10.3390/molecules29215131

Trott, O., & Olson, A. J. (2010). AutoDock Vina: Improving the speed and accuracy of docking with a new scoring function, efficient optimization, and multithreading. Journal of Computational Chemistry, 31(2), 455–461. https://doi.org/10.1002/jcc.21334

Van Gunsteren, W. F., & Berendsen, H. J. C. (1990). Computer simulation of *Molecular Dynamics*: Methodology, applications, and perspectives in chemistry. Angewandte Chemie International Edition, 29(9), 992–1023

Vassar, R. (2014). BACE1 inhibitor drugs in clinical trials for *Alzheimer's disease*. *Alzheimer's Research & Therapy*, 6, 89. https://doi.org/10.1186/s13195-014-0089-7

Wang, E., Sun, H., Wang, J., Wang, Z., Liu, H., Zhang, J. Z. H., & Hou, T. (2019). End-point binding free energy calculation with MM/PBSA and MM/GBSA: Strategies and applications in drug design. *Chemical Reviews*, 119(16), 9478–9508. https://doi.org/10.1021/acs.chemrev.9b00055

World Health Organization. (2023). Dementia. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/dementia

Yan, R. (2017). Physiological functions of the β-site amyloid precursor protein cleaving enzyme 1 and 2. Frontiers in Molecular Neuroscience, 10, 97. https://doi.org/10.3389/fnmol.2017.00097

Yan, R., & Vassar, R. (2014). Targeting the β-secretase BACE1 for *Alzheimer's disease* therapy. *The Lancet Neurology*, 13(3), 319–329. https://doi.org/10.1016/S1474-4422(13)70276-X

Zhao, X., Wang, H., & Li, Y. (2024). Dual-target inhibitors based on acetylcholinesterase: Novel strategies for *multi-target* drug design in *Alzheimer's disease*. Frontiers in Pharmacology, 15, 1380461. https://doi.org/10.3389/fphar.2024.1380461