

menjadi lebih besar dan tidak menyebabkan fungsi spasial menjadi lebih baik dibandingkan dengan tikus yang hanya diinduksi trimetiltin.

## DAFTAR PUSTAKA

- Ahmad, W., Hasan, A., Abdullah, A., Tarannum, T., 2010. Curcuma longa, linn – A Review. *Hippocratic Journal of Unani Medicine* 5(4):179–190.
- Altunkaynak, B.Z., Önger M.E., Altunkaynak, M.E., Ayrancı, E., Canan, S., 2012. A brief introduction to stereology and sampling strategies: basic concepts of stereology. *NeuroQuantology* 10(1):31-43.
- Amrein, I., 2015. Adult hippocampal neurogenesis in natural populations of mammals. *Cold Spring Harbor Perspectives in Biology* 7(1):1–19.
- Anand, K.S. & Dhikav, V., 2012. Review : Progress in medicine (update on advances in pathophysiology) hippocampus in health and disease : an overview. *Annals of Indian Academy of Neurology* 15(4):239-246.
- Andersen, P., Morris, R., Amaral, D., Bliss, T., O’Keefe, J., 2007. *The Hippocampus Book*, Oxford University Press, Inc. United State: Oxford University Press, Inc.
- Anggraini, A., 2018. Efek neurotoksika trimetiltin, skopolamin, d-galaktosa dan aluminium klorida (AlCl<sub>3</sub>) terhadap memori spasial dan jumlah sel pyramidal hippocampus pada tikus wistar [tesis]. Yogyakarta. Universitas Gadjah Mada.
- Anto, R.J., Mukhopadhyay, A., Denning, K., Aggarwal, B.B., 2002. Curcumin (diferuloylmethane) induces apoptosis through activation of caspase-8, BID cleavage and cytochrome c release: its suppression by ectopic expression of Bcl-2 and Bcl-xl. *Carcinogenesis* 23(1):143–150.
- Aschner, M. & Aschner, J.L., 1992. Cellular and molecular effects of trimethyltin and triethyltin : relevance to organotin neurotoxicity. *Neuroscience and Biobehavioral Reviews* 16(80):427–435.
- Azad, N.A., Al Bugami, M., Loy-English, I., 2007. Gender differences in dementia risk factors. *Gender Medicine* 4(2):120–129.
- Balaban, C.D., O’Callaghan, J.P., Billingsley, M.L., 1988. Trimethyltin-induced neuronal damage in the rat brain: comparative studies using silver degeneration stains, immunocytochemistry and immunoassay for neurotypic and gliotypic proteins. *Neuroscience* 26(1):337–361.
- Baptista, P. & Andrade, J.P., 2018. Adult hippocampal neurogenesis : regulation and possible functional and clinical correlates. *Frontiers in Neuroanatomy* 12(1):1–23.
- Barrett, K., Barman, S.M., Boitano, S., Brooks, H., 2010. *Review of Medical Physiology*. 23 ed.
- Bassani, T.B., Turnes, J.M., Moura, E.L.R., Bonato, J.M., Coppola-Segovia, V., Zanata, S.M., Oliveira, R.M.M.W., Vital, M.A.B.F., 2017. Effects of curcumin on short-term spatial and recognition memory, adult neurogenesis and neuroinflammation in a streptozotocin-induced rat model of dementia of Alzheimer type. *Behavioural Brain Research* 335(1):41-54.
- Bendel, O., Bueters, T., von Euler, M., Ove, S., Sandin, J., von Euler, G., 2005. Reappearance of hippocampal CA1 neurons after ischemia is associated with recovery of learning and memory. *Journal of Cerebral Blood Flow & Metabolism* 25(1):1586–1595.

- Besser, R., Kramer, G., Thumler, R., Bohl, J., Gutmann, L., Hopf, H.C., 1987. Acute trimethyltin limbic-cerebellar syndrome. *Neurology* 37(6):945-950.
- Bird, T.D., 1998. Alzheimer disease overview. [Updated 2018 Dec 20]. In: Adam, M.P., Ardinger, H.H., Pagon, R.A., Wallace, S.E., Bean, L.J.H., Stephens, K., Ememiya, A., editors. GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993-2019. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK1161/>
- Biscaro, B., Lindvall, O., Tesco, G., Ekdahl, C.T., Nitsch, R.M., 2012. Inhibition of microglial activation protects hippocampal neurogenesis and improves cognitive deficits in a transgenic mouse model for Alzheimer's disease. *Neurodegenerative Disease* 9(1):187-198.
- Bouldin, T.W., Goines, N.D., Bagnell, R.C., Krigman, M.R., 1981. Pathogenesis of trimethyltin neuronal toxicity, ultrastructural and cytochemical observations. *American Journal of Pathology* 104(3):237-249.
- Boyce, R., Dorph-Petersen, K., Lyck, L., Gundersen, H.J.G., 2010. Design based stereology: introduction to based concepts and practical approaches for estimation of cell number. *Toxicologic Pathology* 38(1):1011-1025.
- Braak, H. & Braak, E., 1991. Neuropathological staging of Alzheimer's-related changes. *Acta Neuropathologica* 82(1):239-259.
- Brock, T.O. & O'Callaghan, J.P., 1987. Quantitative change in the synaptic vesicle proteins synapsin I and p38 and the astrocyte-specific protein glial fibrillary acidic protein are associated with chemical-induced injury to the rat central nervous system. *The Journal of Neuroscience* 7(4):931-942.
- Brondino, N., Re, S., Boldrini, A., Cuccomarino, A., Lanati, N., Barale, F., Pliti, P., 2014. Curcumin as a therapeutic agent in dementia: a mini systematic review of human studies. *The Scientific World Journal* 2014(1):1-6
- Brown, A.W., Aldridge, W.N., Street, B.W., Verschoyle, R.D., 1979. The behavioural and neuropathologic sequelae of intoxication by trimethyltin compound in the rat. *The American Journal of Pathology* 97(1):59-81.
- Budson, A.E. & Solomon, P.R., 2016. *Memory Loss, Alzheimer's Disease and dementia: A Practical Guide For Clinicians*. 2 ed. London: Elsevier.
- Burns, A., O'Brien, J., Ames, D., 2005. *Dementia*. 3 ed. London: Hodder Arnold.
- Bushnell, P.J. & Evans, H.L., 1985. Effect of trimethyltin on homecage behavior of rats. *Toxicology and Applied Pharmacology* 79(1):134-142.
- Ceccariglia, S., D'Altocolle, A., Del Fa', A., Pizzolante, F., Caccia, E., Michetti, F., Gangitano, C., 2011. Cathepsin d plays a crucial role n the trimethyltin induced hippocampal neurodegeneration process. *Neuroscience* 174(1):160-170.
- Charan, J. & Kantharia, N.D., 2013. How to calculate sampel size in animal studies? *Journal of Pharmacology and Pharmacotherapeutics* 4(4):303-306.
- Chen, M., Du, X.Y., Zheng, X., Li, D.L., Zhou, R.P., Zhang, K., 2017. Use of curcumin in diagnosis , prevention , and treatment of Alzheimer 's disease. *Neural Regeneration Research* 13(4):742-752.
- Chertkow, H., Feldman, H.H., Jacova, C., Massoud, F., 2013. Definitions of dementia and predementia states in Alzheimer's disease and vascular cognitive impairment: consensus from the Canadian conference on

- diagnosis of dementia. *Alzheimer's Research* 5(1):1–8.
- Chu, S. & Downes, J.J., 2000. Long live proust : the odour-cued autobiographical memory bump. *Cognition* 75(1):41–50.
- Cole, G.M., Teter, B., Frautschy, S.A., 2008. Neuroprotective effects of curcumin. *Advances in Experimental Medicine and Biology* 595(1):197–212.
- Corrada, M.M., Brookmeyer, R., Paganini-Hill, A., Berlau, D., Kawas, C.H., 2010. Dementia incidence continues to increase with age in the oldest old the 90+ study. *Annals of Neurology* 67(1):114–121.
- Cunningham, E.L., McGuinness, B., Herron, B., Passmore, A.P., 2015. Dementia. *Ulster Medical Journal* 84(1):79–87.
- Departemen Kesehatan RI., 2018. *Menkes: lansia yang sehat, lansia yang jauh dari demensia*.
- Donev, R., Kolev, M., Millet, B., Thome, J., 2009. Neuronal death in Alzheimer's disease. *Journal for Cellular and Molecular Medicine* 13(11):4329–4348.
- Dong, S., Zeng, Q., Mitchell, E.S., Xiu, J., Duan, Y., Li, C., Tiwari, J.K., Hu, Y., Cao, X., Zhao, Z., 2012. Curcumin enhances neurogenesis and cognition in aged rats : implications for transcriptional interactions related to growth and synaptic plasticity. *Plos One* 7(2):1–12.
- Duong, S., Patel, T., Chang, F., 2017. Dementia : What pharmacists need to know. *Canadian Pharmacists Journal* 150(2):11–14.
- Duvernoy, H.M., 2005. *The Human Hippocampus*. 3 ed. Springer. Germany.
- Earley, B., Burke, M., Leonard, B.E., 1992. Behavioural, biochemical and histological effects of trimethyltin (TMT) induced brain damage in the rat. *Neurochemistry International*. 21(3):352-366.
- Engelhardt, E., 2016. Hippocampus discovery. *Dementia e Neuropsychologia* 10(1):58–62.
- Eriksson, P.S., Perfilieva, E., Björk-Eriksson, T., Alborn, A.M., Nordborg, C., Peterson, D.A., Gage, F.H., 1998. Neurogenesis in the adult human hippocampus neurogenesis in the adult human hippocampus. *Nature Medicine* 4(11):1313–1317.
- Feldman, R.G., White, R.F., Eriator, I.I., 1993. Trimethyltin encephalopathy. *JAMA Neurology* 50(12):1320–1324.
- Fogwe L.A. & Mesfin F.B., 2018. Neuroanatomy, hippocampus. [Updated 2018 Jan 7]. In: StatPearls [Internet]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK482171>
- Francis, P., 2006. Targeting Cell death in dementia. *Alzheimer Disease and Associated Disorders* 20(1):3–7.
- Galasko, D.R., Peskind, E., Clark, C.M., Quinn, J.F., Ringman, J.M., Jicha, G.A., Cotman, C., Cottrell, B., Montine, T.J., Thomas, R.G., Aisen, P., 2013. Antioxidants for Alzheimer's disease : a randomized clinical trial with cerebrospinal fluid biomarker measures. *JAMA Neurology* 69(7):836–841.
- Galati, G., Sabzevari, O., Wilson, J.X., O'Brien, P.J., 2002. Prooxidant activity and cellular effects of the phenoxyl radicals of dietary flavonoids and other polyphenolics. *Toxicology* 177(1):91–104.
- Galeano, P., Adami, P.V.M., do Carmo, S., Blanco, E., Rotondaro, C., Capani, F., Castaño, E.M., Cuello, A.C., Morelli, L., 2014. Longitudinal analysis of the

- behavioral phenotype in a novel transgenic rat model of early stages of Alzheimer's disease. *Frontiers in Behavioral Neuroscience* 8(321):1-15.
- Geloso, M.C., Corvino, V., Michetti, F., 2011. Neurochemistry international trimethyltin-induced hippocampal degeneration as a tool to investigate neurodegenerative processes. *Neurochemistry International* 58(7):729–738.
- Giacomeli, R., Izoton, C.J., Santos, B.D.R., Boeira, P.S., Jesse, R.C., Haas, E.S., 2019. Neuroprotective effects of curcumin lipid-core nanocapsules in a model Alzheimer's disease induced by  $\beta$ -amyloid 1-42 peptide in aged female mice. *Brain Research* 1721(1):1-10.
- Giese, K.P. & Radwanska, K., 2016. *Novel Mechanisms of Memory*.
- Golub, V.M., Brewer, J., Wu, X., Kuruba, R., Short, J., Manchi, M., Swonke, M., Younus, I., Reddy, D.S., 2015. Neurostereology protocol for unbiased quantification of neuronal injury and neurodegeneration. *Frontiers in Aging Neuroscience* 7(1):1–14.
- Gomez, F.D., Apodaca, P., Holloway, L.N., Pannell, K.H., Whalen, M.M., 2007. Effect of a series of triorganotins on the immune function of human natural killer cells. *Environmental Toxicology and Pharmacology* 23(1):18–24.
- Gul, P. & Bakht, J., 2015. Antimicrobial activity of turmeric extract and its potential use in food industry. *Journal Food Science and Technology* 52(4):2272–2279.
- Gupta, S.C., Patchva, S., Aggarwal, B.B., 2013. Review article therapeutic roles of curcumin : lessons learned from clinical trials. *The AAPS Journal* 15(1)195–218.
- Guyton, A.C. & Hall, J.E., 2006. *Textbook of Medical Physiology*. 11 ed.
- Haass, C. & Selkoe, D.J., 2007. Soluble protein oligomers in neurodegeneration: lessons from the Alzheimer's amyloid  $\beta$  –peptide. *Nature Review* 8(1):101–112.
- Hanneman, W.J.P., Sluimer, J.D., Barnes, J., van der Flier, W.M., Sluimer, I.C., Fox, N.C., Scheltens, P., Vrenken, H., Barkhof, F., 2009. Hippocampal atrophy rates in Alzheimer disease added value over whole brain volume measures. *Neurology* 72(1):999–1007.
- Hartati, S.Y., 2013. Khasiat kunyit sebagai obat tradisional dan manfaat lainnya. *Warta Penelitian Dan Pengembangan Tanaman Industri* 19(2):5–9.
- Hayman, L.A., Fuller, G.N., Cavazos, J.E., Pflieger, M.J., Meyers, C.A., Jackson, E.F., 1998. The hippocampus : normal anatomy and pathology. *American Journal of Roentgenology* 171(1):1139–1146.
- Henderson, V.W., Mack, W., Williams, B.W., 1989. Spatial disorientation in Alzheimer's disease. *JAMA Neurology* 46(4):391-394.
- Herz, R.S., 2016. Brain sciences the role of odor-evoked memory in psychological and physiological health. *Brain Science* 6(22):1–13.
- Hewlings, S.J. & Kalman, D.S., 2017. Curcumin : a review of its ' effects on human health. *Foods* 6(92):1–11.
- Hippius, H. & Neundörfer, G., 2003. The discovery of Alzheimer's disease. *Dialogues in Clinical Neuroscience* 5(1):101–108.
- Hoch, M., 2001. Organotin compounds in the environment - an overview. *Applied Geochemistry* 16(1):719–743.

- Howard, C., & Reed, M., 2005. *Unbiased stereology three-dimensional measurement in microscopy*. BIOS Scientific Publisher, New York
- Hügel, H.M. & Jackson, N., 2015. Polyphenols for the prevention and treatment of dementia diseases. *Neural Regeneration Research* 10(11):1756-1758.
- Hyman, B.T., Van Hoesen, G.W., Damasio, A.R., Barnes, C.L., 1984. Alzheimer's disease: cell-specific pathology isolates the hippocampal formation. *Science* 225(4667):1168-1170.
- Jellinek, J.S., 2004. Proust remembered: has proust ' s account of odor-cued autobiographical memory recall really been investigated? *Chemical Senses* 29(5):455–458.
- Jiang, L., Ma, J., Zhang, Y., Zhou, C.N., Zhang, L., Chao, F.L., Chen, L.M., Jiang, R., Wu, H., Tang, Y., 2018. Effect of running exercise on the number of the neurons in the hippocampus of young transgenic APP/PS1 mice. *Brain Research* 1692(1):56-65.
- Josephs, K.A., Dickson, D.W., Tosakulwong, N., Weigand, S.D., Murray, M.E., Petrucelli, L., Liesinger, A.M., Senjem, M.L., Spychalla, A.J., Knopman, D.S., Parisi, J.E., Petersen, R.C., Jack, C.R.Jr., Whitwell, J.L., 2017. Rates of hippocampal atrophy and presence of post-mortem TDP-43 in patients with Alzheimer ' s disease : a longitudinal retrospective study. *The Lancet Neurology* 4422(17):1–8.
- Jurenka, J.S. & ASCP, M., 2009. Anti-inflammatory properties of curcumin , a major constituent of curcuma longa : a review of preclinical and clinical research. *Alternative Medicine Review* 14(2):141–153.
- Kandel, E.R., Dudai, Y., Mayford, M.R., 2014. Review the molecular and systems biology of memory. *Cell* 157(1):163–186.
- Kempermann, G., Song, H., Gage, F.H., 2015. Neurogenesis in the adult hippocampus. *Cold Spring Harbor Perspectives in Biology* 7(1):1–14.
- Khachaturian, Z.S., 1985. Diagnosis of Alzheimer's disease. *JAMA Neurology* 42(1):1097–1105.
- Kim, D.J. & Kim, Y.S., 2015. Trimethyltin-induced microglial activation via NADPH oxidase and MAPKs pathway in BV-2 microglial cells. *Mediators of Inflammation* 2015(2):1-14.
- Kim, J., Son, Y., Kim, J., Lee, S., Kang, S., Park, K., Kim, S.H., Kim, J.C., Kim, J., Takayama, C., Im, H.I., Yang, M., Shin, T., Moon, C., 2015. Developmental and degenerative modulation of GABAergic transmission in the mouse hippocampus. *International Journal of Developmental Neuroscience* 47(1):320–332.
- Kim, S.J., Son, T.G., Park, H.R., Park, M., Kim, M.S., Kim, H.S., Chung, H.Y., Mattson, M.P., Lee, J., 2008. Curcumin stimulates proliferation of embryonic neural progenitor cells and neurogenesis in the adult hippocampus. *The Journal of Biological Chemistry* 283(21):14497–14505.
- Klein, C., Schreyer, S., Kohrs, F.E., Elhamoury, P., Pfeffer, A., Munder, T., Steiner, B., 2017. Stimulation of adult hippocampal neurogenesis by physical exercise and enriched environment is disturbed in a CADASIL mouse model. *Scientific Reports* 7(1):1–10.
- Kodali, M., Hattiangady, B., Shetty, G.A., Bates, A., Shuai, B., Shetty, A.K., 2018.

- Curcumin treatment leads to better cognitive and mood function in a model of Gulf War Illness with enhanced neurogenesis, and alleviation of inflammation and mitochondrial dysfunction in the hippocampus. *Brain, Behavior, and Immunity* 69(1):499-514.
- Korczyn, A.D., Vakhapora, V., Grinberg, L.T., 2013. Vascular dementia. *Journal of the Neurological Sciences* 322(1–2):2–10.
- Kryscio, R.J., Abner, E.L., Caban-Holt, A., Lovell, M., Goodman, P., Darke, A.K., Yee, M., Crowley, J., Schmitt, F.A., 2017. Association of antioxidant supplement use and dementia in the prevention of Alzheimer's disease by vitamin e and selenium trial (PREADVISE). *JAMA Neurology* 74(5):567–573.
- Kuramoto, N., Seko, K., Sugiyama, C., Shuto, M., Ogita, K., 2011. Trimethyltin initially activates the caspase 8/caspase 3 pathway for damaging the primary cultured cortical neurons derived from embryonic mice. *Journal of Neuroscience* 84(4):552-561.
- Labban, L., 2014. Medicinal and pharmacological properties of turmeric (curcuma longa): A review. *International Journal of Pharmaceutical and Biomedical Research* 5(1):17–23.
- LaFerla, F.M. 2002. Calcium dyshomeostasis and intracellular signalling in Alzheimer's disease. *Nature Review* 3(11):862–872.
- Latini, L., Geloso, M.C., Corvino, V., Giannetti, S., Florenzano, F., Viscomi, M.T., Michetti, F., Molinari, M., 2010. TMT intoxication induces expression of NOS in neurons and of P2X2R in astrocytes in the hippocampus. *Journal of Neuroscience Research* 88(3):500–509.
- Lattanzi, W., Corvino, V., Di Maria, V., Michetti, F., Geloso, M.C., 2013. Gene expression profiling as a tool to investigate the molecular machinery activated during hippocampal neurodegeneration induced by trimethyltin (TMT) administration. *International Journal of Molecular Sciences* 14(8):16817–16835.
- Lee, A.Y., 2011. Vascular dementia. *Chonnam Medical Journal* 47(2):66–71.
- Lee, S., Yang, M., Kim, J., Kang, S., Kim, J., Kim, J.C., Jung, C., Shin, T., Kim, S.H., Moon, C., 2016. Trimethyltin-induced hippocampal neurodegeneration : A mechanism-based review. *Brain Research Bulletin* 125(1):187–199
- Li, F., Yan, C.Q., Lin, L.T., Li, H., Zeng, X.H., Liu, Y., Du, S.Q., Zhu, W., Liu, C.Z., 2015. Acupuncture attenuates cognitive deficits and increases pyramidal neuron number in hippocampal CA1 area of vascular dementia rats. *BMC Complementary and Alternative Medicine* 15(1):133.
- Lieberwirth, C., Pan, Y., Liu, Y., Zhang, Z., Wang, Z., 2016. Hippocampal adult neurogenesis: it's regulation and potential role in spatial learning and memory. *Brain Research* 1644(801):127–140.
- Logsdon, R.G., McCurry, S.M., Teri, L., 2007. Evidence-based interventions to improve quality of life for individuals with dementia. *Alzheimers Care Today* 8(4):309–318.
- Luchsinger, J.A., Reitz, C., Honig, L.S., Tang, M.X., Shea, S., Mayeux, R., 2006. Aggregation of vascular risk factor and risk of incident Alzheimer's disease.

*Neurology* 65(4):545–551.

- Matthews, F.E., Arthur, A., Barnes, L.E., Bond, J., Jagger, C., Robinson, L., Brayne, C., 2013. A two-decade comparison of prevalence of dementia in individuals aged 65 years and older from three geographical areas of England : results of the Cognitive Function and Ageing Study I and II. *The Lancet* 382(9902):1405–1412.
- Mayhew, T.M. & Olsen, D.A.G.R., 1991. Magnetic resonance imaging ( MRI ) and model-free estimates of brain volume determined using the cavalieri principle. *Journal of Anatomy* 178(8):33–144.
- McKeith, I., 2004. Dementia with Lewy Bodies. *Dialogues in Clinical Neuroscience* 6(3):33–341.
- McKeith, I.G., Boeve, B.F., Dickson, D.W., Halliday, G., Taylor, J.P., Weintraub, D., Aarsland, D., Galvin, J., Attems, J., Ballard, C.G., Bayston, A., Beach, T.G., Blanc, F., Bohnen, N., Bonanni, L., Bras, J., Brundin, P., Burn, D., Chen-Plotkin A., Duda, J.E., El-Agnaf, O., 2017. Diagnosis and management of dementia with Lewy bodies fourth consensus report of the DLB consortium. *American Academy of Neurology* 89(1):88–100.
- McKhann, G.M., Knopman, D.S., Chertkow, H., Hyman, B.T., Jack, C.R.Jr., Kawas, C.H., Klunk, W.E., Koroshetz, W.J., Manly, J.J., Mayeux, R., Mohs, R.C., Morris, J.C., Rossor, M.N., Scheltens, P., Carrillo, M.C., Thies, B., Weintraub, S., Phelps, C.H., 2012. The diagnosis of dementia due to Alzheimer’s disease : recommendations from the national institute on aging-Alzheimer’s association workgroups on diagnostic guidelines for Alzheimer’s disease. *Alzheimer’s Research & Therapy* 7(3):263–269.
- Medvedeva, Y.V., Ji, S.G., Yin, H.Z., Weiss, J.H., 2017. Differential vulnerability of CA1 versus CA3 pyramidal neuron after ischemia: possible relationship to source of  $zn^{2+}$  accumulation and its entry into and prologed effects on mitochondria. *The Journal of Neuroscience* 37(3):726-737.
- Mendiola-Precoma, J., Berumen, L.C., Padilla, K., Garcia-Alcocer, G., 2016. Therapies for prevention and treatment of Alzheimer’s disease. *BioMed Research International* 2016(1):1-17.
- Menon, V.P. & Sudheer, A.R., 2007. Antioxidant and Anti-inflammatory Properties of Curcumin. *Advances in Experimental Medicine and Biology* 595(1):105–125.
- Mignini, F., Nasuti, C., Artico, M., Giovannetti, F., Fabrizi, C., Fumagalli, L., Iannetti, G., Pompili, E., 2012. Effects of trimethyltin on hippocampal dopaminergic markers and cognitive behavioral. *International Journal of Immunophatology and Pharmacology* 25(4):1107-1119.
- Miki, T., Satriotomo, I., Li, H.P., Matsumoto, Y., Gu, H., Yokoyama, T., Lee, K.Y., Bedi, K.S., Takeuchi, Y., 2005. Application of the physical disector to the central nervous system: Estimation of the total number of neurons in subdivisions of the rat hippocampus. *Anatomical Science International* 80(3):153-162.
- Mishra, S., & Palanivelu, K., 2008. The effect of curcumin (turmeric) on Alzheimer’s disease: an overview. *Annals of Indian Academy of Neurology* 11(1):13–19.

- Mu, Y. & Gage, F.H., 2011. Adult hippocampal neurogenesis and its role in Alzheimer's disease. *Molecular Neurodegeneration* 6(1):85.
- Napper, R.M.A., 2018. Total number is important: using the disector method in design-based stereology to understand the structure of the rodent brain. *Frontiers in Neuroanatomy* 12(16):1-9
- Neha, Sodhi, R.K., Jaggi, A.S., Singh, N., 2014. Animal models of dementia and cognitive dysfunction. *Life Sciences* 109(2):73–86.
- Nelson, K.M., Dahlin, J.L., Bisson, J., Graham, J., Pauli, G.F., Walters, M.A., 2017. The essential medicinal chemistry of curcumin: Miniperspective. *Journal of Medicinal Chemistry* 60(5):1620–1637.
- Nelson, P.T., Alafuzoff, I., Bigio, E.H., Bouras, C., Braak, H., Cairns, N.J., Castellani, R.J., Crain, B.J., Davies, P., Del Tredici, K., Duyckaerts, C., Frosch, M.P., Haroutunian, V., Hof, P.R., Hulette, C.M., Hyman, B.T., Iwatsubo, T., Jellinger, K.A., Jicha, G.A., Kövari, E., Kukull, W.A., Leverenz, J.B., Love, S., Mackenzie, I.R., Mann, D.M., Masliah, E., McKee, A.C., Montine, T.J., Morris, J.C., Schneider, J.A., Sonnen, J.A., Thal, D.R., Trojanowski, J.Q., Troncoso, J.C., Wisniewski, T., Woltjer, R.L., Beach, T.G., 2013. Correlation of Alzheimer disease neuropathologic changes with cognitive status : a review of literature. *Journal of Neuropathology & Experimental Neurology* 71(5):362–381.
- Nishimura, T., Schwarzer, C., Furtinger, S., Imai, H., Kato, N., Sperk, G., 2001. Changes in the GABA-ergic system induced by trimethyltin application in the rat. *Molecular Brain Research* 97(1):1–6.
- Nistiar, F., Racz, O., Lukacinova, A., Hubkova, B., Novakova, J., Lovasova, E., Sedlakova, E., 2012. Age dependency on some physiological and biochemical parameters of male wistar rats in controlled environment. *Journal of Environmental Science and Health, Part A* 47(9):1224-1233.
- Nur'amalia, R., 2019. Pengaruh pemberian kurkumin terhadap memori spasial dan aktivitas enzim superoxide dismutase (SOD) serta glutathione peroxidase (GPX) hippocampus pada tikus wistar model demensia yang diinduksi trimetiltin [tesis]. Yogyakarta. Universitas Gadjah Mada.
- O'Keefe, J. & Nadel, L., 1978. *The Hippocampus as a Cognitive Map*. Oxford University Press, Inc.
- Padurariu, M., Ciobica, A., Mavroudis, I., Fotiou, D., Baloyannis, S., 2012. Hippocampal neuronal loss in the CA1 and CA3 areas of Alzheimer's disease patients. *Psychiatria Danubina* 24(2):152–158.
- Papez, J.W., 1937. A proposed mechanism of emotion. *Archives of Neurology & Psychiatry* 38(4):725–743.
- Park, H.R. & Lee, J., 2011. Neurogenic contributions made by dietary regulation to hippocampal neurogenesis. *Annals of New York Academy of Sciences* 1229(1):23-28.
- Park, W., Amin, A.R., Chen, Z.G., Shin, D.M., 2014. New perspectives of curcumin in cancer prevention. *Cancer Prevention Research* 6(5):387–400.
- Partadiredja, G. & Bedi, K.S., 2010. Undernutrition during either the pre- or immediate post-weaning period does not affect longevity in Quackenbush mice. *Nutritional Neuroscience* 13(1):33-42.

- Patterson, C., 2018. *World Alzheimer Report 2018 ; The state of the art of dementia research : New frontiers, Alzheimer's Disease International*. London.
- Perl, D.P., 2010. Neuropathology of Alzheimer ' s disease. *Mount Sinai Journal of Medicine* 77(1):32–42.
- Perouansky, M. & Pearce, R.A., 2012. How we recall (or don't): the hippocampal memory machine and anesthetic amnesia. *Canadian Journal of Anaesthesia* 58(2):157–166.
- Perretta, G., Righi, F.R., Gozzo, S., 1993. Neuropathological and behavioral toxicology of trimethyltin exposure. *Annali dell'Istituto Superiore di Sanita* 29(1):167–174.
- Peters, R., 2006. Ageing and the brain. *Postgraduate Medical Journal* 82(964):84–88.
- Pizzino, G., Irrera, N., Cucinotta, M., Pallio, G., Mannino, F., Arcoraci, V., Squadrito, F., Altavilla, D., Bitto, A., 2017. Oxidative stress : harms and benefits for human health. *Oxidative Medicine and Cellular Longevity* 2017(3):1-13.
- Pluta, R., Bogucka-Kocka, A., Ułamek-Kozioł, M., Furmaga-Jabłońska, W., Januszewski, S., Brzozowska, J., Jabłoński, M., Kocki, J., 2015. Neurogenesis and neuroprotection in postischemic brain neurodegeneration with alzheimer phenotype: is there a role for curcumin? *Folia Neuropathologia* 53(2):89-99.
- Podcasy, J.L. & Epperson, C.N., 2016. Considering sex and gender in Alzheimer disease and other dementias. *Dialogues in Clinical Neuroscience* 18(4):437–446.
- Poli, G., Leonarduzzi, G., Biasi, F., Chiarpotto, E., 2004. Oxidative stress and cell signalling. *Current Medicinal Chemistry* 11(9):1163–1182.
- Poo, M., Pignatelli, M., Ryan, T.J., Tonegawa, S., Bonhoeffer, T., Martin, K.C., Rudenko, A., Tsai, L.H., Tsien, R.W., Fishell, G., Mullins, C., Gonçalves, J.T., Shtrahman, M., Johnston, S.T., Gage, F.H., Dan, Y., Long, J., Buzsáki, G., Stevens, C., 2016. What is memory ? The present state of the engram. *BMC Biology* 14(40):1–18.
- Povova, J., Ambroz, P., Bar, M., Pavukova, V., Sery, O., Tomaskova, H., Janout, V., 2012. Epidemiological of and risk factors for Alzheimer's disease : A review. *Biomedical Papers of the Medical Faculty of University Palacky Olomouc Czech Republic* 156(2):108–114.
- Prieur, E. A. & Jadavji, N. M., 2019. Assessing spatial working memory using the spontaneous alternation y-maze test in aged male mice. *Bio-protocol* 9(3):1-11
- Prince, M., 2007. Epidemiology of dementia. *Psychiatry* 6(12):488–490.
- Prince, M., Wimo, A., Guerchet, M., Ali, G.C, Wu, Y., Prina, A.M., 2015. *World Alzheimer Report 2015 The Global Impact of Dementia*.
- Prince, M., Ali, G.C., Guerchet, M., Prina, A.M., Albanese, E., Wu, Y., 2016. Recent global trends in the prevalence and incidence of dementia, and survival with dementia. *Alzheimer's Research & Therapy* 8(1):23.
- PubChem, 2018. Compound database; CID=5358116, <https://pubchem.ncbi.nlm.nih.gov/compound/5358116> (accessed Oct. 30,

- 2018).
- PubChem, 2018. Compound database; CID=969516, <https://pubchem.ncbi.nlm.nih.gov/compound/969516> (accessed Oct. 30, 2018).
- Pulungan, Z.S., Sofro, Z.M., Partadiredja, G., 2018. Sodium fluoride does not affect the working memory and number of pyramidal cells in rat medial prefrontal cortex. *Anatomical Science International* 93(1):128-138.
- Purves, D., Augustine, G.J., Fitzpatrick, D., Katz, L.C., LaMantia, A., McNamara, J.O., Williams, S.M., 2001 *Neuroscience*. 2nd edition. Sunderland (MA): Sinauer Associates;. Generation of Neurons in the Adult Brain
- Qiu, C., von Strauss, E., Bäckman, L., Winblad, B., Fratiglioni, L., 2013. Twenty-year changes in dementia occurrence suggest decreasing incidence in central Stockholm, Sweden. *American Academy of Neurology* 80(20):1824–1894.
- Raz, L., Knoefel, J., Bhaskar, K., 2016. The neuropathology and cerebrovascular mechanisms of dementia. *Journal of Cerebral Blood Flow & Metabolism* 36(1):172–186.
- Reuter, S., Gupta, S.C., Park, B., Goel, A., Aggarwal, B.B., 2011. Epigenetic changes induced by curcumin and other natural compounds. *Genes & Nutrition* 6(2):93-108.
- Riepe, M.W., Mittendorf, T., Förstl, H., Frölich, L., Haupt, M., Leidl, R., Vauth, C., von der Schulenburg, M.G., 2009. Quality of life as an outcome in Alzheimer's disease and other dementias-obstacles and goals. *BMC Neurology* 9(47):1–8.
- Robertson, D.G., Gray, R.H., De La Iglesia, F.A., 1987. Quantitative assessment of trimethyltin induced pathology of the hippocampus. *Toxicologic Pathology* 15(1):7–17.
- Rocca, W.A., Petersen, R.C., Knopman, D.S., Hebert, L.E., Evans, D.A., Hall, K.S., Gao, S., Unverzagt, F.W., Langa, K.M., Larson, E.B., White, L.R., 2012. Trends in the incidence and prevalence of alzheimer's disease, dementia and cognitive impairment in United States. *Alzheimers & Dementia* 7(1):80–93.
- Rolls, E.T., 1997. A theory of hippocampal function in memory. *Hippocampus* 6(6):601–620.
- Ross, A., 2006. Industrial applications of organotin compounds. *Annals of New York Academy of Sciences* 125(1):107–123.
- Rössler, M., Zarski, R., Bohl, J., Ohm, T.G., 2002. Stage-dependent and sector-specific neuronal loss in hippocampus during Alzheimer's disease. *Acta Neuropathologica* 103(4):363–369
- Rygiel, K., 2016. Novel strategies for Alzheimer's disease treatment: An overview of anti-amyloid beta monoclonal antibodies. *Indian Journal of Pharmacology* 48(6):629-636.
- Saary, M.J. & House, R.A., 2002. Preventable exposure to trimethyltin chloride : a case report case description. *Occupational Medicine* 52(4):227–230.
- Sandur, S.K, Ichikawa, H., Pandey, M.K., Kunnumakkara, A.B., Sung, B., Sethi, G., Aggarwal, B.B., 2007. Role of prooxidants and antioxidants in the anti-inflammatory and apoptotic effects of curcumin (diferuloylmethane). *Free Radical Biology and Medicine* 43(4):568-580.

- Sanei, M., Demneh, S.A., 2019. Effect of curcumin on memory impairment: A systematic review. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology* 52(3):98-106.
- Sarker, M.R. & Franks, S.F., 2018. Efficacy of curcumin for age-associated cognitive decline : a narrative review of preclinical and clinical studies. *GeroScience* 40(2):73–95.
- Schmidt, W. & Reymann, K.G., 2002. Proliferating cells differentiate into neurons in the hippocampal CA1 region of gerbils after global cerebral ischemia. *Neuroscience Letters* 334(3):153–156.
- Scott, K.R. & Barrett, A.M., 2008. Dementia syndromes : evaluation and treatment. *Expert Review of Neurotherapeutic* 7(4):407–422.
- Sekita, A., Ninomiya, T., Tanizaki, Y., Doi, Y., Hata, J., Yonemoto, K., Arima, H., Sasaki, K., Iida, M., Iwaki, T., Kanba, S., Kiyohara, Y., 2010. Trends in prevalence of Alzheimer's disease and vascular dementia in a Japanese community: the hisayama study. *Acta Psychiatrica Scandinavica* 122(1):319–325.
- Shin, E.-J., Nam, Y., Tu, T.H., Lim, Y.K., Wie, M.B., Kim, D.J., Jeong, J.H., Kim, H.C., 2015. Protein kinase C  $\delta$  mediates trimethyltin - induced neurotoxicity in mice in vivo via inhibition of glutathione defense mechanism. *Archives of Toxicology* 90(4):937-953.
- Squire, L.R., 1987. *Memory and Brain*. San Diego: Oxford University Press, Inc.
- Squire, L.R., 2004. Memory systems of the brain : A brief history and current perspective. *Neurobiology of Learning and Memory* 82(3):171–177.
- Sweatt, D.J., 2010. *Mechanisms of Memory*. 2 ed. Elsevier Inc.
- Taupin, P., 2007. *The Hippocampus, Neurotransmission and Plasticity in The Nervous System*. New York: Nova Biomedical Books.
- Tayyem, R.F., Heath, D.D., Al-Delaimy, W.K., Rock, C.L., 2006. Curcumin content of turmeric and curry powders. *Nutrition and Cancer* 55(2):126–131.
- Teow, S., Liew, K., Ali, S.A., Khoo, A.S., Peh, S.C., 2016. Antibacterial Action of Curcumin against Staphylococcus aureus : a brief review. *Journal of Tropical Medicine* 2016(1):1-10.
- Tiwari, S.K., Agarwal, S., Seth, B., Yadav, A., Nair, S., Bhatnagar, P., Karmakar, M., Kumari, M., Chauhan, L.K., Patel, D.K., Srivastava, V., Singh, D., Gupta, S.K., Tripathi, A., Chaturvedi, R.K., Gupta, K.C., 2014. Curcumin-loaded nanoparticles potentially induce adult neurogenesis and reverse cognitive deficits in Alzheimer's disease model via canonical Wnt /  $\beta$  - catenin pathway. *ACS Nano* 8(1):76–103.
- Toda, T., Parylak, S.L., Linker, S.B., Gage, F.H., 2018. The role of adult hippocampal neurogenesis in brain health and disease. *Molecular Psychiatry* 24(1):67-87.
- Toggas, SM., Krady, J.K., Billingsley, M.L., 1992. Molecular neurotoxicology of trimethyltin: identification of stannin, a novel protein expressed in trimethyltin-sensitive. *Molecular Pharmacology* 42(1):44–56.
- Toots, A., Littbrand, H., Boström, G., Hörnsten, C., Holmberg, H., Lundin-Olsson, L., Lindelöf, N., Nordström, P., Gustafson, Y., Rosendahl, E., 2017. Effects

- of exercise on cognitive function in older people with dementia: a randomized controlled trial. *Journal of Alzheimer's Disease* 60(1):323–332.
- Tortora, G.J. & Derrickson, B., 2009. *Principles of Anatomy and Physiology*. 12 ed.
- Trabucco, A., Di Pietro, P., Nori, S.L., Fulceri, F., Fumagalli, L., Paparelli, A., Fornai, F., 2009. Methylated tin toxicity a reappraisal using rodents models. *Archives Italiennes de Biologie* 147(4):141–153.
- Tulving, E., 2002. Episodic memory: from mind to brain. *Annual Review of Psychology* 53(1):1–25.
- Uğuz, A.C., Öz, A., Nazıroğlu, M., 2015. Curcumin inhibits apoptosis by regulating intracellular calcium release, reactive oxygen species and mitochondrial depolarization levels in SH-SY5Y neuronal cells Curcumin inhibits apoptosis by regulating intracellular calcium release, reactive oxygen species and mitochondrial depolarization levels in SH-SY5Y neuronal cells. *Journal of Receptor and Signal transduction Research* 36(4):395-401.
- Urbán, N. & Guillemot, F., 2014. Neurogenesis in the embryonic and adult brain: same regulators, different roles. *Frontiers in Cellular Neuroscience* 8(396):1–19.
- Wang, X., Zhang, Z.R., Zhang, M.M., Sun, M.X., Wang, W.W., Xie, C.L., 2017. Neuroprotective properties of curcumin in toxin-base animal models of Parkinson's disease: a systematic experiment literatures review. *BMC Complementary and Alternative Medicine* 17(1):412.
- Waxman, S.G., 2010. *Clinical Neuroanatomy*. 26 ed. United State: The McGraw-Hill.
- Wheeler, D.W., White, C.M., Rees, C.L., Komendantov, A.O., Hamilton, D.J., Ascoli, G.A., 2015. Hippocampome.org: a knowledge base of neuron types in the rodent hippocampus. *eLife* 2015(1):1–28.
- WHO, 2010. *The Epidemiology and Impact of Dementia Current State and Future Trends*.
- WHO, 2015. *Dementia, A public health priority*.
- Wilken, R., Veena, M.S., Wang, M.B., Srivatsan, E.S., 2011. Curcumin: A review of anti-cancer properties and therapeutic activity in head and neck squamous cell carcinoma. *Molecular Cancer* 10(12):1–19.
- Willis, S.L., Tennstedt, S.L., Marsiske, M., Ball, K., Elias, J., Koepke, K.M., Morris, J.N., Rebok, G.W., Unverzagt, F.W., Stoddard, A.M., Wright, E., 2010. Long-term effects of cognitive training on everyday functional outcomes in older adults. *JAMA* 296(23):2805–2814.
- Wolf, A., Bauer, B., Abner, E., Ashkenazy-frolinger, T., Hartz, A.M.S., 2016. A comprehensive behavioral test battery to assess learning and memory in 129S6/ Tg2576 mice. *Plos One* 11(1):1-23.
- Young, J.J., Lavakumar, M., Tampi, D., Balachandran, S., Tampi, R.R., 2018. Frontotemporal dementia: latest evidence and clinical implications. *Therapeutic Advances in Psychopharmacology* 8(1):33–48.
- Yu, Y., Shen, Q., Lai, Y., Park, S.Y., Ou, X., Lin, D., Jin, M., Zhang, W., 2018. Anti-inflammatory effects of curcumin in microglial cells. *Frontiers in Pharmacology* 9(1):1–10.
- Yuliani, S., Mustofa, Partadiredja, G., 2017. Turmeric (*Curcuma longa* L.) extract

may prevent the deterioration of spatial memory and the deficit of estimated total number of hippocampal pyramidal cells of trimethyltin-exposed rats. *Drug and Chemical Toxicology* 41(1):62-71.

Yuliani, S., Widyarini, S., Partadiredja, G., 2017. Turmeric extract inhibits apoptosis of hippocampal neurons of trimethyltin-exposed rats. *Bratislava Medical Journal* 118(3):142–148.

Zeinali, R., 2017. Brain volume estimation enhancement by morphological image processing tools. *Journal of Biomedical Physics and Engineering* 7(4):379–388.

Zhang, L., Li, L., Prabhakaran, K., Borowitz, J.L., Isom, G.E., 2006. Trimethyltin-induced apoptosis is associated with upregulation of inducible nitric oxide synthase and Bax in a hippocampal cell line. *Toxicology and Applied Pharmacology* 216(1):34–43.

Zheng, H. & Koo, E.H., 2006. The amyloid precursor protein : beyond amyloid. *Molecular Neurodegeneration* 1(5):1–12.

Zuo, Z., Cai, J., Wang, X., Li, B., Wang, C., Chen, Y., 2009. Acute administration of tributyltin and trimethyltin modulate glutamate and N-methyl-d-aspartate receptor signaling pathway in *Sebastiscus marmoratus*. *Aquatic Toxicology* 92(1):44–49.