

DAFTAR REFERENSI

- Agrawal, S. (2014). Late effects of cancer treatment in breast cancer survivors. *South Asian J Cancer*, 112–115. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4014641/>
- Al Ahmad, M., Al Natour, Z., Mustafa, F., & Rizvi, T. A. (2018). Electrical Characterization of Normal and Cancer Cells. *IEEE Access*, 6, 25979–25986. <https://doi.org/10.1109/ACCESS.2018.2830883>
- Alamsyah, F., Ajrina, I. N., Nur, F., Dewi, A., Prabandari, S. A., & Taruno, W. P. (2015). Antiproliferative Effect of Electric Fields on Breast Tumor Cells In Vitro and In Vivo. *Indonesian Journal of Cancer Chemoprevention*, 6(3), 71–77.
- Alderton, W. K., Cooper, C. E., & Knowles, R. G. (2001). Nitric oxide synthases: structure, function and inhibition. *The Biochemical Journal*, 357(Pt 3), 593–615. <https://doi.org/10.1042/0264-6021:3570593>
- Antoons, G., Mubagwa, K., Nevelsteen, I., & Sipido, K. R. (2002). Mechanisms underlying the frequency dependence of contraction and $[Ca^{2+}]_i$ transients in mouse ventricular myocytes. *The Journal of Physiology*, 543(Pt 3), 889–898. <https://doi.org/10.1113/jphysiol.2002.025619>
- Arend, W. P., Palmer, G., & Gabay, C. (2008). IL-1, IL-18, and IL-33 families of cytokines. *Immunological Reviews*, 223, 20–38. <https://doi.org/10.1111/j.1600-065X.2008.00624.x>
- Asdourian, M. S., Skolny, M. N., Brunelle, C., Seward, C. E., Salama, L., & Taghian, A. G. (2016). Precautions for breast cancer-related lymphoedema: risk from air travel, ipsilateral arm blood pressure measurements, skin puncture, extreme temperatures, and cellulitis. *The Lancet Oncology*, 17(9), e392–e405. [https://doi.org/10.1016/S1470-2045\(16\)30204-2](https://doi.org/10.1016/S1470-2045(16)30204-2)
- Aslam, M. S., Naveed, S., Ahmed, A., Abbas, Z., Gull, I., & Athar, M. A. (2014). Side Effects of Chemotherapy in Cancer Patients and Evaluation of Patients Opinion about Starvation Based Differential Chemotherapy. *Journal of Cancer Therapy*, 05(08), 817–822. <https://doi.org/10.4236/jct.2014.58089>
- Atri, C., Guerfali, F. Z., & Laouini, D. (2018). Role of human macrophage polarization in inflammation during infectious diseases. *International Journal of Molecular Sciences*, Vol. 19. <https://doi.org/10.3390/ijms19061801>
- Balkwill, F. (2003). Chemokine biology in cancer. *Seminars in Immunology*, 15(1), 49–55. [https://doi.org/https://doi.org/10.1016/S1044-5323\(02\)00127-6](https://doi.org/https://doi.org/10.1016/S1044-5323(02)00127-6)
- Banks, T. A., Luckman, P. S. B., Frith, J. E., & Cooper-White, J. J. (2015). Effects of electric fields on human mesenchymal stem cell behaviour and morphology using a novel multichannel device. *Integrative Biology*, 7, 693–712. <https://doi.org/10.1039/C4IB00297K>

- Barnett, G. C., West, C. M. L., Dunning, A. M., Elliott, R. M., Coles, C. E., Pharoah, P. D. P., & Burnet, N. G. (2009). Normal tissue reactions to radiotherapy: towards tailoring treatment dose by genotype. *Nature Reviews Cancer*, 9, 134–142. <https://doi.org/doi.org/10.1038/nrc2587>
- Beatson, R., Maurstad, G., Picco, G., Arulappu, A., Coleman, J., Wandell, H. H., ... Burchell, J. M. (2015). The breast cancer-associated glycoforms of MUC1, MUC1-Tn and sialyl-Tn, are expressed in COSMC wild-type cells and bind the C-type lectin MGL. *PLoS ONE*, 10(5), 1–21. <https://doi.org/10.1371/journal.pone.0125994>
- Biswas, S. K., Gangi, L., Paul, S., Schioppa, T., Saccani, A., Sironi, M., ... Sica, A. (2006). A distinct and unique transcriptional program expressed by tumor-associated macrophages (defective NF- κ B and enhanced IRF-3/STAT1 activation). *Blood*, 107(5), 2112–2122. <https://doi.org/10.1182/blood-2005-01-0428>
- Black, R. A., Rauch, C. T., Kozlosky, C. J., Peschon, J. J., Slack, J. L., Wolfson, M. F., ... Cerretti, D. P. (1997). A metalloproteinase disintegrin that releases tumour-necrosis factor- \emptyset from cells. *Nature*, Vol. 385, pp. 729–733. <https://doi.org/10.1038/385729a0>
- Bogdan, C. (2001). Nitric oxide and the immune response. *Nature Immunology*, 2(10), 907–916. <https://doi.org/10.1038/ni1001-907>
- Brown, Z., Strieter, R. M., Neild, G. H., Thompson, R. C., Kunkel, S. L., & Westwick, J. (1992). IL-1 receptor antagonist inhibits monocyte chemotactic peptide 1 generation by human mesangial cells. *Kidney International*, 42(1), 95–101. <https://doi.org/10.1038/ki.1992.266>
- Burkholder, B., Huang, R. P. R.-Y. R.-P. R. Y., Burgess, R., Luo, S., Jones, V. S., Zhang, W., ... Huang, R. P. R.-Y. R.-P. R. Y. (2014). Tumor-induced perturbations of cytokines and immune cell networks. *Biochimica et Biophysica Acta - Reviews on Cancer*, 1845(2), 182–201. <https://doi.org/10.1016/j.bbcan.2014.01.004>
- Cai, X., Yin, Y., Li, N., Zhu, D., Zhang, J., Zhang, C.-Y., & Zen, K. (2012). Repolarization of tumor-associated macrophages to pro-inflammatory M1 macrophages by microRNA-155. *Journal of Molecular Cell Biology*, 341–343.
- Carey, L. A. (2010). Through a glass darkly: Advances in understanding breast cancer biology, 2000-2010. In *Clinical Breast Cancer* (Vol. 10). <https://doi.org/10.3816/CBC.2010.n.026>
- Carswell, E. A., Old, L. J., Kassel, R. L., Green, S., Fiore, N., & Williamson, B. (1975). An endotoxin-induced serum factor that causes necrosis of tumors. *Proceedings of the National Academy of Sciences of the United States of America*, 72(9), 3666–3670. <https://doi.org/10.1073/pnas.72.9.3666>
- Chang, I. A., & Nguyen, U. D. (2004). Thermal modeling of lesion growth with radiofrequency ablation devices. *BioMedical Engineering Online*, 3, 1–19.

<https://doi.org/10.1186/1475-925X-3-27>

- Chen, H., Liu, R., Liu, J., & Tang, J. (2012). Growth Inhibition of Malignant Melanoma by Intermediate Frequency Alternating Electric Fields , and the Underlying Mechanisms. *The Journal of International Medical Research*, 85–94. <https://doi.org/10.1177/147323001204000109>
- Cochran, B. H., Reffel, A. C., & Stiles, C. D. (1983). Molecular cloning of gene sequences regulated by platelet-derived growth factor. *Cell*, 33(3), 939–947. [https://doi.org/10.1016/0092-8674\(83\)90037-5](https://doi.org/10.1016/0092-8674(83)90037-5)
- Collins, K. K., Liu, Y., Schootman, M., Aft, R., Yan, Y., Dean, G., ... Jeffe, D. B. (2012). Effects of breast cancer surgery and surgical side effects on body image over time. *Breast Cancer Res Treat*, 126(1), 167–176. <https://doi.org/10.1007/s10549-010-1077-7.Effects>
- Costantini, E., Sinjari, B., D'Angelo, C., Murmura, G., Reale, M., & Caputi, S. (2019). Human Gingival Fibroblasts Exposed to Extremely Low-Frequency Electromagnetic Fields: In Vitro Model of Wound-Healing Improvement. *International Journal of Molecular Sciences*, 20(9). <https://doi.org/10.3390/ijms20092108>
- Cushing, S. D., Berliner, J. A., Valente, A. J., Territo, M. C., Navab, M., Parhami, F., ... Fogelman, A. M. (1990). Minimally modified low density lipoprotein induces monocyte chemotactic protein 1 in human endothelial cells and smooth muscle cells. *Proceedings of the National Academy of Sciences of the United States of America*, 87(13), 5134–5138. <https://doi.org/10.1073/pnas.87.13.5134>
- Denda-Nagai, K., Aida, S., Saba, K., Suzuki, K., Moriyama, S., Oo-puthinan, S., ... Irimura, T. (2010). Distribution and function of macrophage galactose-type C-type lectin 2 (MGL2/CD301b): Efficient uptake and presentation of glycosylated antigens by dendritic cells. *Journal of Biological Chemistry*, 285(25), 19193–19204. <https://doi.org/10.1074/jbc.M110.113613>
- Deshmane, S. L., Kremlev, S., Amini, S., & Sawaya, B. E. (2009). Monocyte chemoattractant protein-1 (MCP-1): An overview. *Journal of Interferon and Cytokine Research*, 29(6), 313–325. <https://doi.org/10.1089/jir.2008.0027>
- Dinarello, C. A., Cannon, J. G., Mancilla, J., Bishai, I., Lees, J., & Coceani, F. (1991). Interleukin-6 as an endogenous pyrogen: induction of prostaglandin E2 in brain but not in peripheral blood mononuclear cells. *Brain Research*, 562(2), 199–206. [https://doi.org/10.1016/0006-8993\(91\)90622-3](https://doi.org/10.1016/0006-8993(91)90622-3)
- Durand, D. M., & Bikson, M. (2001). Suppression and control of epileptiform activity by electrical stimulation: a review. *Proceedings of the IEEE*, 89(7), 1065–1082. <https://doi.org/10.1109/5.939821>
- Fabbi, M., Carbotti, G., & Ferrini, S. (2015). Context-dependent role of IL-18 in cancer biology and counter-regulation by IL-18BP. *Journal of Leukocyte Biology*, 97(4), 665–675. <https://doi.org/10.1189/jlb.5ru0714-360rr>

- Fadliansyah, L. G. (2019). *Ekspresi protein pcna dan caspase-3 pada jaringan tumor tikus (*Rattus norvegicus berkenhout, 1769*) setelah pemaparan medan listrik statis frekuensi menengah*. Universitas Gadjah Mada.
- Fang, W. Bin, Yao, M., Brummer, G., Acevedo, D., Alhakamy, N., Berkland, C., & Cheng, N. (2016). Targeted gene silencing of CCL2 inhibits triple negative breast cancer progression by blocking cancer stem cell renewal and M2 macrophage recruitment. *Oncotarget*, 7(31), 49349–49367. <https://doi.org/10.18632/oncotarget.9885>
- Foster, K. R. (2000). Thermal and nonthermal mechanisms of interaction of radio-frequency energy with biological systems. *IEEE Transactions on Plasma Science*, 28(1), 15–23. <https://doi.org/10.1109/27.842819>
- Fujimoto, S., Mochizuki, K., Shimada, M., Murayama, Y., & Goda, T. (2008). Variation in gene expression of inflammatory cytokines in leukocyte-derived cells of high-fat-diet-induced insulin-resistant rats. *Bioscience, Biotechnology and Biochemistry*, 72(10), 2572–2579. <https://doi.org/10.1271/bbb.80259>
- Funk, R. H. W., & Monsees, T. K. (2006). Effects of electromagnetic fields on cells: Physiological and therapeutical approaches and molecular mechanisms of interaction. A review. *Cells Tissues Organs*, 182(2), 59–78. <https://doi.org/10.1159/000093061>
- Gera, N., & Swanson, K. . (2016). *Cell Biological Effects of Tumor Treating Fields*. In: WONG, E. T. (ed.) *Alternating Electric Fields Therapy in Oncology: A Practical Guide to Clinical Applications of Tumor Treating Fields*. Springer International Publishing.
- Gera, Nidhi, Yang, A., Holtzman, T. S., Lee, S. X., Wong, E. T., & Swanson, K. D. (2015). Tumor treating fields perturb the localization of septins and cause aberrant mitotic exit. *PLoS ONE*, 10(5), 1–20. <https://doi.org/10.1371/journal.pone.0125269>
- Gerrick, K. Y., Gerrick, E. R., Gupta, A., Wheelan, S. J., Yegnasubramanian, S., & Jaffee, E. M. (2018). Transcriptional profiling identifies novel regulators of macrophage polarization. *PloS One*, 13(12), e0208602–e0208602. <https://doi.org/10.1371/journal.pone.0208602>
- Giladi, M., Schneiderman, R. S., Voloshin, T., Porat, Y., Munster, M., Blat, R., ... Palti, Y. (2015). Mitotic Spindle Disruption by Alternating Electric Fields Leads to Improper Chromosome Segregation and Mitotic Catastrophe in Cancer Cells. *Scientific Reports*, 5(June), 1–16. <https://doi.org/10.1038/srep18046>
- Globocan. (2015). The Global Burden of Cancer 2013.
- Globocan. (2018). Cancer Today; Indonesia Fact Sheets.
- Haltiwanger, S. G., & Researcher, I. (2014). *The Electrical Properties of Cancer Cells*. (June).

- Handayani, Y. K. (2012). *Efektivitas penggunaan electro capacitive cancer treatment (ECCT) dalam terapi kanker payudara = The effectiveness of using electro capacitive cancer treatment (ECCT) in breast cancer therapy.* Universitas Indonesia.
- Hao, N.-B., Lu, M.-H., Fan, Y.-H., Cao, Y.-L., Zhang, Z.-R., & Yang, S.-M. (2012). Macrophages in tumor microenvironments and the progression of tumors. *Clinical & Developmental Immunology*, 2012, 948098. <https://doi.org/10.1155/2012/948098>
- Haupt, R. C., & Nolfi, J. R. (1984). The effects of high voltage transmission lines on the health of adjacent resident populations. *American Journal of Public Health*, 74(1), 76–78. <https://doi.org/10.2105/AJPH.74.1.76>
- Heitz, F., Harter, P., Lueck, H. J., Fissler-Eckhoff, A., Lorenz-Salehi, F., Scheil-Bertram, S., ... Bois, A. du. (2009). Triple-negative and HER2-overexpressing breast cancers exhibit an elevated risk and an earlier occurrence of cerebral metastases. *European Journal of Cancer*, 45(16), 2792–2798. <https://doi.org/10.1016/j.ejca.2009.06.027>
- Hoare, J. I., Rajnicek, A. M., McCaig, C. D., Barker, R. N., & Wilson, H. M. (2016). Electric fields are novel determinants of human macrophage functions. *Journal of Leukocyte Biology*, 99(6), 1141–1151. <https://doi.org/10.1189/jlb.3a0815-390r>
- Hoare, J., Mccaig, C., Wilson, H. M., Hoare, J. I., Rajnicek, A. M., Mccaig, C. D., ... Wilson, H. M. (2016). Electric fields are novel determinants of human macrophage functions Electric fields are novel determinants of human macrophage functions. *Journal OfLeukocyte Biology*, 99(March 2016), 1–11. <https://doi.org/10.1189/jlb.3A0815-390R>
- Hottinger, A. F., Pacheco, P., & Stupp, R. (2016). Tumor treating fields: A novel treatment modality and its use in brain tumors. *Neuro-Oncology*, 18(10), 1338–1349. <https://doi.org/10.1093/neuonc/nov182>
- Hou, Y., Zhu, L., Tian, H., Sun, H.-X., Wang, R., Zhang, L., & Zhao, Y. (2018). IL-23-induced macrophage polarization and its pathological roles in mice with imiquimod-induced psoriasis. *Protein & Cell*, 9(12), 1027–1038. <https://doi.org/10.1007/s13238-018-0505-z>
- Hualiang, L., Lin, L., Li, L., Zhou, L., Shuai, H., Zhang, Y., & Ding, Z. (2018). Eotaxin-1 and MCP-1 serve as circulating indicators in response to power frequency electromagnetic field exposure in mice. *Molecular Medicine Reports*, Vol. 18, pp. 2832–2840. <https://doi.org/10.3892/mmr.2018.9237>
- Hubisz, J. L. (2014). Exercises for the Feynman Lectures on Physics: The New Millennium Edition Exercises for the Feynman Lectures on Physics: The New Millennium Edition , by Richard Feynman, Robert Leighton, Matthew Sands, et al., edited by Michael A. Gottlieb and Rudolf Pfeif. *The Physics Teacher*, 52(8), 510–510. <https://doi.org/10.1119/1.4897605>
- Iida, S., Yamamoto, K., & Irimura, T. (1999). Interaction of human macrophage C-

- type lectin with O-linked N-acetylgalactosamine residues on mucin glycopeptides. *The Journal of Biological Chemistry*, 274(16), 10697–10705. <https://doi.org/10.1074/jbc.274.16.10697>
- Ji, H., Cao, R., Yang, Y., Zhang, Y., Iwamoto, H., Lim, S., ... Cao, Y. (2014). TNFR1 mediates TNF- α -induced tumour lymphangiogenesis and metastasis by modulating VEGF-C-VEGFR3 signalling. *Nature Communications*, 5. <https://doi.org/10.1038/ncomms5944>
- Kang, J. S., Bae, S. Y., Kim, H. R., Kim, Y. S., Kim, D. J., Cho, B. J., ... Lee, W. J. (2009). Interleukin-18 increases metastasis and immune escape of stomach cancer via the downregulation of CD70 and maintenance of CD44. *Carcinogenesis*, 30(12), 1987–1996. <https://doi.org/10.1093/carcin/bgp158>
- Kerr, D. J., Haller, D. G., Velde, C. J. H. van de, & Baumann, M. (2016). *Oncology* (Third). Oxford University Press.
- Kirson, E. D., Dbalý, V., Tovaryš, F., Vymazal, J., Soustiel, J. F., Itzhaki, A., ... Palti, Y. (2007). Alternating electric fields arrest cell proliferation in animal tumor models and human brain tumors. *Proceedings of the National Academy of Sciences of the United States of America*, 104(24), 10152–10157. <https://doi.org/10.1073/pnas.0702916104>
- Kirson, E. D., Gurvich, Z., Schneiderman, R., Dekel, E., Itzhaki, A., Wasserman, Y., ... Palti, Y. (2004). Disruption of Cancer Cell Replication by Alternating Electric Fields. *Cancer Research*, 64(9), 3288–3295. <https://doi.org/10.1158/0008-5472.CAN-04-0083>
- Kitamura, T., Qian, B., Soong, D., Cassetta, L., Noy, R., Sugano, G., ... Pollard, J. W. (2015). CCL2-induced chemokine cascade promotes breast cancer metastasis by enhancing retention of metastasis-associated macrophages. *The Journal of Experimental Medicine*, 212(7), 1043–1059. <https://doi.org/10.1084/jem.20141836>
- Kostoff, R. N., & Lau, C. G. Y. (2013). Combined biological and health effects of electromagnetic fields and other agents in the published literature. *Technological Forecasting and Social Change*, 80(7), 1331–1349. <https://doi.org/10.1016/j.techfore.2012.12.006>
- Kurihara, T., Warr, G., Loy, J., & Bravo, R. (1997). Defects in macrophage recruitment and host defense in mice lacking the CCR2 chemokine receptor. *Journal of Experimental Medicine*, 186(10), 1757–1762. <https://doi.org/10.1084/jem.186.10.1757>
- Langowski, J. L., Zhang, X., Wu, L., Mattson, J. D., Chen, T., Smith, K., ... Oft, M. (2006). IL-23 promotes tumour incidence and growth. *Nature*, 442(7101), 461–465. <https://doi.org/10.1038/nature04808>
- Lebrecht, A., Grimm, C., Lantzsich, T., Ludwig, E., Hefler, L., Ulbrich, E., & Koelbl, H. (2004). Monocyte chemoattractant protein-1 serum levels in patients with breast cancer. *Tumor Biology*, 25(1–2), 14–17. <https://doi.org/10.1159/000077718>

- Lechner, M., Lirk, P., & Rieder, J. (2005). Inducible nitric oxide synthase (iNOS) in tumor biology: The two sides of the same coin. *Seminars in Cancer Biology*, 15(4), 277–289. <https://doi.org/https://doi.org/10.1016/j.semcancer.2005.04.004>
- Lee, J.-K., Kim, S.-H., Lewis, E. C., Azam, T., Reznikov, L. L., & Dinarello, C. A. (2004). Differences in signaling pathways by IL-1 β and IL-18. *Proceedings of the National Academy of Sciences of the United States of America*, 101(23), 8815 LP – 8820. <https://doi.org/10.1073/pnas.0402800101>
- Lee, J. hyun, Cho, D. H., & Park, H. J. (2015). IL-18 and Cutaneous Inflammatory Diseases.pdf. *International Journal of Molecular Science*, 29357–29369.
- Li, B., Vincent, A., Cates, J., Brantley-Sieders, D. M., Polk, D. B., & Young, P. P. (2009). Low levels of tumor necrosis factor α increase tumor growth by inducing an endothelial phenotype of monocytes recruited to the tumor site. *Cancer Research*, 69(1), 338–348. <https://doi.org/10.1158/0008-5472.CAN-08-1565>
- Li, C. I., Uribe, D. J., & Daling, J. R. (2005). Clinical characteristics of different histologic types of breast cancer. *British Journal of Cancer*, 93(9), 1046–1052. <https://doi.org/10.1038/sj.bjc.6602787>
- Li, X., Yao, W., Yuan, Y., Chen, P., Li, B., Li, J., ... Wang, H. (2015). *Targeting of tumour-infiltrating macrophages via CCL2 CCR2 signalling as a therapeutic strategy against hepatocellular carcinoma .pdf* (pp. 1–11). pp. 1–11. <https://doi.org/doi:10.1136/gutjnl-2015-310514>
- Lim, H. X., Hong, H., Cho, D., & Sung, T. (2014). IL-18 Enhances Immunosuppressive Responses by Promoting Differentiation into Monocytic Myeloid-Derived Suppressor Cells. *The Journal of Immunology*, (193), 5453–5460. <https://doi.org/10.4049/jimmunol.1401282>
- Lin, E. Y., & Pollard, J. W. (2007). *Tumor-Associated Macrophages Press the Angiogenic Switch in Breast Cancer*. (11), 5064–5067. <https://doi.org/10.1158/0008-5472.CAN-07-0912>
- Lisi, L., Ciotti, G. M. P., Braun, D., Kalinin, S., Currò, D., Dello Russo, C., ... Navarra, P. (2017). Expression of iNOS, CD163 and ARG-1 taken as M1 and M2 markers of microglial polarization in human glioblastoma and the surrounding normal parenchyma. *Neuroscience Letters*, 645, 106–112. <https://doi.org/10.1016/j.neulet.2017.02.076>
- Liu, J., García-Cardena, G., & Sessa, W. C. (1995). Biosynthesis and Palmitoylation of Endothelial Nitric Oxide Synthase: Mutagenesis of Palmitoylation Sites, Cysteines-15 and/or -26, Argues against Depalmitoylation-Induced Translocation of the Enzyme. *Biochemistry*, 34(38), 12333–12340. <https://doi.org/10.1021/bi00038a029>
- Livak, K. J., & Schmittgen, T. D. (2001). Analysis of relative gene expression data using real-time quantitative PCR and the 2- $\Delta\Delta$ CT method. *Methods*, 25(4), 402–408. <https://doi.org/10.1006/meth.2001.1262>

- Lo, C.-H., Lee, S.-C., Wu, P.-Y., Pan, W.-Y., Su, J., Cheng, C.-W., ... Tao, M.-H. (2003). Antitumor and Antimetastatic Activity of IL-23. *The Journal of Immunology*, *171*(2), 600–607. <https://doi.org/10.4049/jimmunol.171.2.600>
- Low-Marchelli, J. M., Ardi, V. C., Vizcarra, E. A., Rooijen, N. van, Quigley, J. P., & Yang, J. (2013). Twist1 induces CCL2 and recruits macrophages to promote angiogenesis. *NIH Public Access*, (1), 662–671. <https://doi.org/10.1038/jid.2014.371>
- Lupardus, P. J., & Garcia, K. C. (2008). The Structure of Interleukin-23 Reveals the Molecular Basis of p40 Subunit Sharing with Interleukin-12. *Journal of Molecular Biology*, *382*(4), 931–941. <https://doi.org/10.1016/j.jmb.2008.07.051>
- Madden, N. A., Macdonald, O. K., Call, J. A., Schomas, D. A., Lee, C. M., & Patel, S. (2016). Radiotherapy and Male Breast Cancer. *American Journal of Clinical Oncology: Cancer Clinical Trials*, *39*(5), 458–462. <https://doi.org/10.1097/COC.0000000000000078>
- Mantovani, A., Allavena, P., Sica, A., & Balkwill, F. (2008). Cancer-related inflammation. *Nature*, *454*(7203), 436–444. <https://doi.org/10.1038/nature07205>
- Mantovani, A., Sica, A., Sozzani, S., Allavena, P., Vecchi, A., & Locati, M. (2004). The chemokine system in diverse forms of macrophage activation and polarization. *Trends in Immunology*, *25*(12), 677–686. <https://doi.org/10.1016/j.it.2004.09.015>
- Mantovani, A., Sozzani, S., Locati, M., Allavena, P., & Sica, A. (2002). Macrophage polarization: Tumor-associated macrophages as a paradigm for polarized M2 mononuclear phagocytes. *Trends in Immunology*, *23*(11), 549–555. [https://doi.org/10.1016/S1471-4906\(02\)02302-5](https://doi.org/10.1016/S1471-4906(02)02302-5)
- Markov, M. (2006). Thermal Vs. Nonthermal Mechanisms of Interactions Between Electromagnetic Fields and Biological Systems. *BIOELECTROMAGNETICS Current Concepts*, 1–15. https://doi.org/10.1007/1-4020-4278-7_1
- Martin, M., Wei, H., & Lu, T. (2016). Targeting microenvironment in cancer therapeutics. *Oncotarget*, *7*(32), 52575–52583. <https://doi.org/10.18632/oncotarget.9824>
- Martinez, F. O., & Gordon, S. (2014). The M1 and M2 paradigm of macrophage activation: time for reassessment. *F1000prime Reports*, *6*, 13. <https://doi.org/10.12703/P6-13>
- Matsushima, K., Larsen, C. G., DuBois, G. C., & Oppenheim, J. J. (1989). Purification and characterization of a novel monocyte chemotactic and activating factor produced by a human myelomonocytic cell line. *Journal of Experimental Medicine*, *169*(4), 1485–1490. <https://doi.org/10.1084/jem.169.4.1485>
- Mayer, A. M. S., Rodríguez, A. D., Tagliatela-Scafati, O., & Fusetani, N. (2013).

- Marine pharmacology in 2009-2011: Marine compounds with antibacterial, antidiabetic, antifungal, anti-inflammatory, antiprotozoal, antituberculosis, and antiviral activities; affecting the immune and nervous systems, and other miscellaneous mechanisms of . *Marine Drugs*, 11(7), 2510–2573. <https://doi.org/10.3390/md11072510>
- McArthur, H. L., & Hudis, C. A. (2007). Breast cancer chemotherapy. *Cancer Journal*, 13(3), 141–147. <https://doi.org/10.1097/PPO.0b013e318074dc6f>
- Montfort, A., Colacios, C., Levade, T., Andrieu-Abadie, N., Meyer, N., & Ségui, B. (2019). The TNF paradox in cancer progression and immunotherapy. *Frontiers in Immunology*, 10(JULY), 1–5. <https://doi.org/10.3389/fimmu.2019.01818>
- Mortezai, N., Behnken, H. N., Kurze, A.-K., Ludewig, P., Buck, F., Meyer, B., & Wagener, C. (2013). Tumor-associated Neu5Ac-Tn and Neu5Gc-Tn antigens bind to C-type lectin CLEC10A (CD301, MGL). *Glycobiology*, 23(7), 844–852. <https://doi.org/10.1093/glycob/cwt021>
- Mujib, S. A., Alamsyah, F., & Taruno, W. P. (2017). Cell Death and Induced p53 Expression in Oral Cancer , HeLa , and Bone Marrow Mesenchyme Cells under the Exposure to Noncontact Electric Fields. *Integrative Medicine*, 15143(10), 161–170. <https://doi.org/10.1159/000485186>
- Mycielska, M. E., & Djamgoz, M. B. A. (2004). Cellular mechanisms of direct-current electric field effects: Galvanotaxis and metastatic disease. *Journal of Cell Science*, 117(9), 1631–1639. <https://doi.org/10.1242/jcs.01125>
- Nakamura, K., Kassem, S., Cleynen, A., Chrétien, M. L., Guillerey, C., Putz, E. M., ... Smyth, M. J. (2018). Dysregulated IL-18 Is a Key Driver of Immunosuppression and a Possible Therapeutic Target in the Multiple Myeloma Microenvironment. *Cancer Cell*, 33(4), 634-648.e5. <https://doi.org/10.1016/j.ccell.2018.02.007>
- Nathan, C. (1992). Nitric oxide as a secretory product of mammalian cells. *FASEB Journal*, 6(12), 3051–3064. <https://doi.org/10.1096/fasebj.6.12.1381691>
- Noy, R., & Pollard, J. W. (2014). Tumor-Associated Macrophages: From Mechanisms to Therapy. *Immunity*, 41(1), 49–61. <https://doi.org/10.1016/j.immuni.2014.06.010>
- Nuccitelli, R. (2003). A Role for Endogenous Electric Fields in Wound Healing. *Current Topics in Development Biology*, 58. <https://doi.org/0070-2153/03>
- Ono, M. (2008). Molecular links between tumor angiogenesis and inflammation: inflammatory stimuli of macrophages and cancer cells as targets for therapeutic strategy. *Cancer Science*, 99(8), 1501–1506. <https://doi.org/10.1111/j.1349-7006.2008.00853.x>
- Oppmann, B., Lesley, R., Blom, B., Timans, J. C., Xu, Y., Hunte, B., ... Kastelein, R. A. (2000). Novel p19 protein engages IL-12p40 to form a cytokine, IL-23, with biological activities similar as well as distinct from IL-12. *Immunity*,

13(5), 715–725.

- Osman, R., Tacnet-Delorme, P., Kleman, J.-P., Millet, A., & Frachet, P. (2017). Calreticulin Release at an Early Stage of Death Modulates the Clearance by Macrophages of Apoptotic Cells. *Frontiers in Immunology*, 8, 1034. <https://doi.org/10.3389/fimmu.2017.01034>
- Palma, G., Barbieri, A., Bimonte, S., Palla, M., Zappavigna, S., Caraglia, M., ... Arra, C. (2013). Interleukin 18: Friend or foe in cancer. *Biochimica et Biophysica Acta - Reviews on Cancer*, 1836(2), 296–303. <https://doi.org/10.1016/j.bbcan.2013.09.001>
- Palti, Y. (2008). *Patent No. 10*. United States patent application: 204.
- Parameswaran, N., & Patial, S. (2010). Tumor necrosis factor- α signaling in macrophages. *Critical Reviews in Eukaryotic Gene Expression*, Vol. 20, pp. 87–103. <https://doi.org/10.1615/CritRevEukarGeneExpr.v20.i2.10>
- Park, J. I., Song, K. H., Jung, S. Y., Ahn, J., Hwang, S. G., Kim, J., ... Song, J. Y. (2019). Tumor-Treating Fields Induce RAW264.7 Macrophage Activation Via NK- κ B/MAPK Signaling Pathways. *Technology in Cancer Research & Treatment*, 18, 1–9. <https://doi.org/10.1177/1533033819868225>
- Park, M., & Bertos, N. R. (2011). Breast cancer — one term, many entities? *Journal of Clinical Investigation*, 121(10), 3789–3796. <https://doi.org/10.1172/JCI57100.prognosis>
- Pello, J. I. M. (2017). *Pengaruh Medan Listrik Frekuensi Menengah Dan Intensitas Rendah Terhadap Pertumbuhan Tumor Tikus (*Rattus norvegicus Berkenhout, 1769*) Dengan Induksi Tumor Payudara*. Universitas Gadjah Mada.
- Pollard, J. W. (2004). Tumour-educated macrophages promote tumour progression and metastasis. *Nature Reviews Cancer*, 4(1), 71–78. <https://doi.org/10.1038/nrc1256>
- Poon, K., Abramova, D., Ho, H. T., & Leibowitz, S. (2016). Prenatal fat-rich diet exposure alters responses of embryonic neurons to the chemokine, CCL2, in the hypothalamus. *Neuroscience*, 324, 407–419. <https://doi.org/10.1016/j.neuroscience.2016.03.017>
- Posterino, G. S., Lamb, G. D., & Stephenson, D. G. (2000). Twitch and tetanic force responses and longitudinal propagation of action potentials in skinned skeletal muscle fibres of the rat. *Journal of Physiology*, 527(1), 131–137. <https://doi.org/10.1111/j.1469-7793.2000.t01-2-00131.x>
- Qian, Bin-zhi, Li, J., Zhang, H., Kitamura, T., Zhang, J., Liam, R., ... Pollard, J. W. (2012). *CCL2 recruits inflammatory monocytes to facilitate breast tumor metastasis*. 475(7355), 222–225. <https://doi.org/10.1038/nature10138.CCL2>
- Qian, Binzhi, & Pollard, J. W. (2010). Macrophage Diversity Enhances Tumor Progression and Metastasis. *Cell*, 141(1), 1477–1490. <https://doi.org/10.1161/CIRCRESAHA.116.303790.The>

- Rahat, M. A., & Hemmerlein, B. (2013). Macrophage-tumor cell interactions regulate the function of nitric oxide. *Frontiers in Physiology*, 4 JUN(June), 1–15. <https://doi.org/10.3389/fphys.2013.00144>
- Reale, M., De Lutiis, M. A., Patruno, A., Speranza, L., Felaco, M., Grilli, A., ... Di Luzio, S. (2006). Modulation of MCP-1 and iNOS by 50-Hz sinusoidal electromagnetic field. *Nitric Oxide*, 15(1), 50–57. <https://doi.org/https://doi.org/10.1016/j.niox.2005.11.010>
- Reis-Filho, J. S., Weigelt, B., Fumagalli, D., & Sotiriou, C. (2010). Molecular profiling: Moving away from tumor philately. *Science Translational Medicine*, 2(47). <https://doi.org/10.1126/scitranslmed.3001329>
- Saeland, E., Belo, A. I., Mongera, S., Van Die, I., Meijer, G. A., & Van Kooyk, Y. (2012). Differential glycosylation of MUC1 and CEACAM5 between normal mucosa and tumour tissue of colon cancer patients. *International Journal of Cancer*, 131(1), 117–128. <https://doi.org/10.1002/ijc.26354>
- Saeland, E., Van Vliet, S. J., Bäckström, M., Van Den Berg, V. C. M., Geijtenbeek, T. B. H., Meijer, G. A., & Van Kooyk, Y. (2007). The C-type lectin MGL expressed by dendritic cells detects glycan changes on MUC1 in colon carcinoma. *Cancer Immunology, Immunotherapy*, 56(8), 1225–1236. <https://doi.org/10.1007/s00262-006-0274-z>
- Sancho, D., & Sousa, C. R. e. (2012). Signaling by myeloid C-type lectin receptors in immunity and homeostasis. *Europe PMC Funders Group*, 491–529. <https://doi.org/10.1146/annurev-immunol-031210-101352>. Signaling
- Sattler, A., Wagner, U., Rossol, M., Sieper, J., Wu, P., Krause, A., ... Thiel, and A. (2008). Il 18 cite 10 Cytokine-induced human IFN- γ -secreting effector-memory Th cells in chronic autoimmune inflammation.pdf. *Blood*, 113. <https://doi.org/10.1182/blood-2008-02-139147>
- Schröder, N. W. J., Opitz, B., Lamping, N., Michelsen, K. S., Zähringer, U., Göbel, U. B., & Schumann, R. R. (2000). Involvement of Lipopolysaccharide Binding Protein, CD14, and Toll-Like Receptors in the Initiation of Innate Immune Responses by *Treponema* Glycolipids. *The Journal of Immunology*, 165(5), 2683–2693. <https://doi.org/10.4049/jimmunol.165.5.2683>
- Sennequier, N., & Stuehr, D. J. (1996). Analysis of substrate-induced electronic, catalytic, and structural changes in inducible NO synthase. *Biochemistry*, 35(18), 5883–5892. <https://doi.org/10.1021/bi952844e>
- Senovilla, L., Vitale, I., Martins, I., Tailler, M., Pailleret, C., Michaud, M., ... Kroemer, G. (2012). An immunosurveillance mechanism controls cancer cell ploidy. *Science*, 337(6102), 1678–1684. <https://doi.org/10.1126/science.1224922>
- Shapouri-Moghaddam, A., Mohammadian, S., Vazini, H., Taghadosi, M., Esmaili, S.-A. A., Mardani, F., ... Sahebkar, A. (2018). Macrophage plasticity, polarization, and function in health and disease. In *Journal of Cellular Physiology* (Vol. 233). <https://doi.org/10.1002/jcp.26429>

- Sheng, Y., Li, F., & Qin, Z. (2018). TNF receptor 2 makes tumor necrosis factor a friend of tumors. *Frontiers in Immunology*, 9(MAY), 1–9. <https://doi.org/10.3389/fimmu.2018.01170>
- Sica, A., & Mantovani, A. (2012). *Macrophage plasticity and polarization: in vivo veritas*. *122*(3), 787–795. <https://doi.org/10.1172/JCI59643DS1>
- Sica, A., Schioppa, T., Mantovani, A., & Allavena, P. (2006). Tumour-associated macrophages are a distinct M2 polarised population promoting tumour progression: Potential targets of anti-cancer therapy. *European Journal of Cancer*, 42(6), 717–727. <https://doi.org/https://doi.org/10.1016/j.ejca.2006.01.003>
- Singh, S. K., Streng-Ouwehand, I., Litjens, M., Weelij, D. R., Garcia-Vallejo, J. J., van Vliet, S. J., ... van Kooyk, Y. (2009). Characterization of murine MGL1 and MGL2 C-type lectins: distinct glycan specificities and tumor binding properties. *Molecular Immunology*, 46(6), 1240–1249. <https://doi.org/10.1016/j.molimm.2008.11.021>
- Solinas, G., Schiarea, S., Liguori, M., Fabbri, M., Pesce, S., Zammataro, L., ... Allavena, P. (2010). Tumor-Conditioned Macrophages Secrete Migration-Stimulating Factor: A New Marker for M2-Polarization, Influencing Tumor Cell Motility. *The Journal of Immunology*, 185(1), 642–652. <https://doi.org/10.4049/jimmunol.1000413>
- Song, D., Cui, M., Zhao, G., Fan, Z., Nolan, K., Yang, Y., ... Zhang, D. Y. (2014). Pathway-based analysis of breast cancer. *American Journal of Translational Research*, 6(3), 302–311.
- Song, L., Chau, L., Sakamoto, Y., Nakashima, J., Koide, M., & Tuan, R. S. (2004). Electric field-induced molecular vibration for noninvasive, high-efficiency DNA transfection. *Molecular Therapy*, 9(4), 607–616. <https://doi.org/10.1016/j.ymthe.2004.01.017>
- Soria, G., & Ben-Baruch, A. (2008). The inflammatory chemokines CCL2 and CCL5 in breast cancer. *Cancer Letters*, 267(2), 271–285. <https://doi.org/10.1016/j.canlet.2008.03.018>
- Sree, V. G., Udayakumar, K., & Sundararajan, R. (2011). Electric Field Analysis of Breast Tumor Cells. *International Journal of Breast Cancer*, 2011, 1–8. <https://doi.org/10.4061/2011/235926>
- Standiford, T. J., Kunkel, S. L., Phan, S. H., Rollins, B. J., & Strieter, R. M. (1991). Alveolar macrophage-derived cytokines induce monocyte chemoattractant protein-1 expression from human pulmonary type II-like epithelial cells. *The Journal of Biological Chemistry*, 266(15), 9912–9918.
- Steinberg, H. (2011). Electrotherapeutic disputes: The “Frankfurt Council” of 1891. *Brain*, 134(4), 1229–1243. <https://doi.org/10.1093/brain/awr040>
- Taki, F. A., Abdel-Rahman, A. A., & Zhang, B. (2014). A comprehensive approach to identify reliable reference gene candidates to investigate the link between

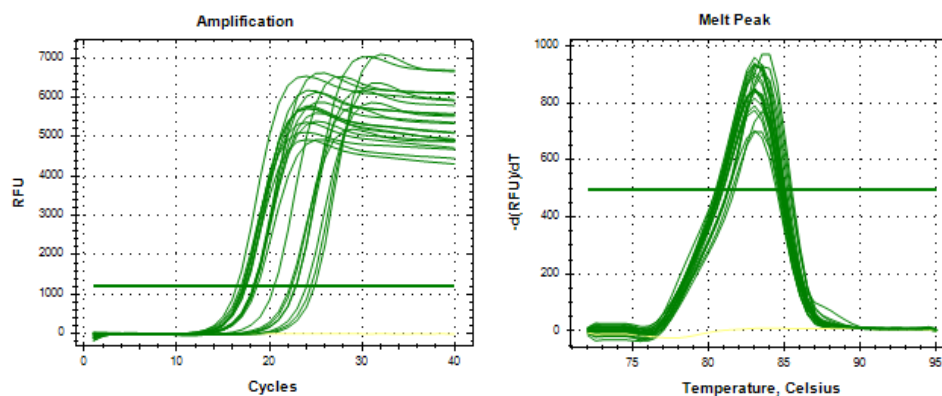
- alcoholism and endocrinology in Sprague-Dawley rats. *PloS One*, 9(5), e94311. <https://doi.org/10.1371/journal.pone.0094311>
- Tao, L.-L., Shi, S.-J., Chen, L.-B., & Huang, G.-C. (2014). Expression of monocyte chemotactic protein-1/CCL2 in gastric cancer and its relationship with tumor hypoxia. *World Journal of Gastroenterology*, 20(15), 4421–4427. <https://doi.org/10.3748/wjg.v20.i15.4421>
- Tse, B. W. C., Russell, P. J., Lochner, M., Förster, I., & Power, C. A. (2011). IL-18 inhibits growth of murine orthotopic prostate carcinomas via both adaptive and innate immune mechanisms. *PLoS ONE*, 6(9). <https://doi.org/10.1371/journal.pone.0024241>
- Tsutsui, S., Ohno, S., Murakami, S., Kataoka, A., Kinoshita, J., & Hachitanda, Y. (2003). *Prognostic significance of the coexpression of p53 protein and c-erbB2 in breast cancer.pdf* (pp. 165–167). pp. 165–167. [https://doi.org/10.1016/S0002-9610\(02\)01203-5](https://doi.org/10.1016/S0002-9610(02)01203-5)
- Tuszynski, J. A., Wenger, C., Friesen, D. E., & Preto, J. (2016). An Overview of Sub-Cellular Mechanisms Involved in the Action of TTFIELDS. *International Journal of Environmental Research and Public Health*, 1–23. <https://doi.org/10.3390/ijerph13111128>
- Ueno, T., Toi, M., Saji, H., Muta, M., Bando, H., Kuroi, K., ... Matsushima, K. (2000). Significance of macrophage chemoattractant protein-1 in macrophage recruitment, angiogenesis, and survival in human breast cancer. *Clinical Cancer Research*, 6(8), 3282–3289.
- van Kooyk, Y., Ilarregui, J. M., & van Vliet, S. J. (2015). Novel insights into the immunomodulatory role of the dendritic cell and macrophage-expressed C-type lectin MGL. *Immunobiology*, 220(2), 185–192. <https://doi.org/10.1016/j.imbio.2014.10.002>
- Vanini, F., Kashfi, K., & Nath, N. (2015). The dual role of iNOS in cancer. *Redox Biology*, 6, 334–343. <https://doi.org/10.1016/j.redox.2015.08.009>
- Verreck, F. A. W., De Boer, T., Langenberg, D. M. L., Hoeve, M. A., Kramer, M., Vaisberg, E., ... Ottenhoff, T. H. M. (2004). Human IL-23-producing type 1 macrophages promote but IL-10-producing type 2 macrophages subvert immunity to (myco)bacteria. *Proceedings of the National Academy of Sciences of the United States of America*, 101(13), 4560–4565. <https://doi.org/10.1073/pnas.0400983101>
- Vignali, D. A. A., & Kuchroo, V. K. (2012). IL-12 family cytokines: immunological playmakers. *Nature Immunology*, 13(8), 722–728. <https://doi.org/10.1038/ni.2366>
- Vliet, S. J. van, Liempt, E. van, Saeland, E., Saeland, E., Aarnoudse, C. A., Appelmeik, B., ... Kooyk, Y. van. (2005). Carbohydrate profiling reveals a distinctive role for the C-type lectin MGL in the recognition of helminth parasites and tumor antigens by dendritic cells.pdf. *International Immunology*, 17(5), 661–669.

- Wang, B., Wei, D., Crum, V. E., Richardson, E. L., Xiong, H. H., Luo, Y., ... Xie, K. (2003). A novel model system for studying the double-edged roles of nitric oxide production in pancreatic cancer growth and metastasis. *Oncogene*, 22(12), 1771–1782. <https://doi.org/10.1038/sj.onc.1206386>
- Wang, X., & Lin, Y. (2008). Tumor necrosis factor and cancer, buddies or foes? *Acta Pharmacologica Sinica*, 29(11), 1275–1288. <https://doi.org/10.1111/j.1745-7254.2008.00889.x>
- Weaver, J. C., & Chizmadzhev, Y. A. (1996). Theory of electroporation: A review. *Bioelectrochemistry and Bioenergetics*, 41(2), 135–160. [https://doi.org/10.1016/S0302-4598\(96\)05062-3](https://doi.org/10.1016/S0302-4598(96)05062-3)
- Weigelt, B., Geyer, F. C., & Reis-filho, J. S. (2010). Histological types of breast cancer: How special are they? *Molecular Oncology*, 4, 192–208. <https://doi.org/10.1016/j.molonc.2010.04.004>
- Wesemann, D. R., & Benveniste, E. N. (2003). *STAT-1 α and IFN- γ as Modulators of TNF- α Signaling in Macrophages: Regulation and Functional Implications of the TNF Receptor 1:STAT-1 α Complex*. 171, 5313–5319. <https://doi.org/10.4049/jimmunol.171.10.5313>
- Wu, Y., & Zhou, B. P. (2010). TNF- α /NF κ -B/Snail pathway in cancer cell migration and invasion. *British Journal of Cancer*, 102(4), 639–644. <https://doi.org/10.1038/sj.bjc.6605530>
- Wynn, T. A., Chawla, A., & Pollard, J. W. (2013). Macrophage biology in development, homeostasis and disease. *Nature*, 496(7446), 445–455. <https://doi.org/10.1038/nature12034>
- Yoshimura, T. (2018). The chemokine MCP-1 (CCL2) in the host interaction with cancer: a foe or ally? *Cellular & Molecular Immunology*, 15(4), 335–345. <https://doi.org/10.1038/cmi.2017.135>
- Yoshimura, T., Yuhki, N., Moore, S. K., Appella, E., Lerman, M. I., & Leonard, E. J. (1989). Human monocyte chemoattractant protein-1 (MCP-1) Full-length cDNA cloning, expression in mitogen-stimulated blood mononuclear leukocytes, and sequence similarity to mouse competence gene JE. *FEBS Letters*, 244(2), 487–493. [https://doi.org/10.1016/0014-5793\(89\)80590-3](https://doi.org/10.1016/0014-5793(89)80590-3)
- Zhao, M., Chalmers, L., Cao, L., Viera, A. C., Mannis, M., & Reid, B. (2012). Electrical signaling in control of ocular cell behaviors. *Prog Retin Eye Res*, 31(1), 65–88. <https://doi.org/10.1016/j.preteyeres.2011.10.001.ELECTRICAL>
- Zuo, Q., Wang, S.-C., Yu, X.-K., & Chao, W.-W. (2018). Response of macrophages in rat skeletal muscle after eccentric exercise. *Chinese Journal of Traumatology*, 21(2), 88–95. <https://doi.org/https://doi.org/10.1016/j.cjtee.2017.12.001>

Lampiran 1. Konsentrasi mRNA total dan kurva hasil qPCR gen GADPH

Tabel 1. Konsentrasi hasil isolasi total mRNA

Kelompok	Ulangan	Nodul	Konsentrasi RNA ng/uL
NINT	1	H2	22,02
	2	H4	26,58
	3	H5	53,91
NIT	1	K1	6,27
	2	K2	11,58
	3	K3	9,93
INT	1	P1 A	353,8
	2	O4 A	78,64
	3	P4 A	192,48
	4	Q2 A	25,05
IT	1	E4 C	103,69
	2	O3 B	488,5
	3	P2 A	140,16
	4	P2 B	106,58



Gambar 1. Hasil qRT-PCR gen internal kontrol GADPH. Kurva amplifikasi (A), kurva *melting temperature* (B)

Lampiran 2. Hasil perhitungan *fold change* tiap gen

Tabel 1. Hasil perhitungan *fold change* tiap gen pada setiap perlakuan

	NINT	NIT	INT	IT
CCL2	1,1	1,16	97,72	15,29
IL18	1,01	0,94	2,08	1,34
IL-23 α	1,09	0,99	1	1,26
TNF- α	1,04	0,74	0,7	0,9
iNOS	1,04	0,67	0,64	0,88
CLEC10A	1,03	1,41	1,53	1,18

Lampiran 3. Sertifikat Kelaikan Etik



UNIVERSITAS GADJAH MADA
LABORATORIUM PENELITIAN DAN PENGUJIAN TERPADU

KETERANGAN KELAIKAN ETIK

(Ethical Clearance)

No. Sertifikat: 00029/04/LPPT/IV/2018

Komisi *Ethical Clearance* untuk penelitian praklinik Laboratorium Penelitian dan Pengujian Terpadu, Universitas Gadjah Mada Yogyakarta, setelah mempelajari dengan seksama rancangan penelitian yang diusulkan, dengan ini menyatakan penelitian:

Judul Penelitian : Uji Praklinis *Electro-Capacitive Cancer Therapy* (ECCT) pada Tikus Model Kanker Payudara

Peneliti Utama : Dra. Rarastoeti Pratiwi, M.Si., Ph.D.

Asal Instansi : Fakultas Biologi, Universitas Gadjah Mada

Lokasi Penelitian : Laboratorium Penelitian dan Pengujian Terpadu (LPPT) Unit IV, Universitas Gadjah Mada

Telah dinyatakan memenuhi persyaratan etik untuk penelitian pada hewan coba. Komisi *Ethical Clearance* mempunyai hak untuk melakukan pemantauan selama penelitian berlangsung. Apabila terjadi perubahan dalam hal jenis dan jumlah hewan coba serta metode perlakuan terhadap hewan coba, peneliti wajib mengajukan permohonan amandemen kepada Komisi *Ethical Clearance*.
Surat Keterangan ini berlaku 1 (satu) tahun sejak ditandatangani.

Yogyakarta, 20 April 2018

Komisi Ethical Clearance

Ketua,



Prof. Dr. drh. Pudji Astuti, MP.