

DAFTAR PUSTAKA

- Akanbi, O. E., Njom, H. A., Fri, J., Otigbu, A. C., & Clarke, A. M. 2017. Antimicrobial susceptibility of *Staphylococcus aureus* isolated from recreational waters and beach sand in eastern cape province of south africa. International journal of environmental research and public health. 14(9), 1001. <https://doi.org/10.3390/ijerph14091001>
- Alfonso, S., Gesto, M., & Sadoul, B. 2021. Temperature increase and its effects on fish stress physiology in the context of global warming. Journal of fish biology, 98(6), 1496–1508. <https://doi.org/10.1111/jfb.14599>
- Anbuezhian, R., Gobinath, C., & Ravichandran, S. 2011. Antimicrobial peptide from the epidermal mucus of some estuarine cat fishes. World Applied Sciences Journal, 12(3), 256–260.
- Andarina, R., & Djauhari, T. 2017. Antioksidan dalam dermatologi. Jurnal Kedokteran dan Kesehatan. 4(1), 39–48.
- AOAC. 2000. *Official Methods of Analysis*, 17th ed.
- Arasu, A., Kumaresan, V., Sathyamoorthi, A., Palanisamy, R., Prabha, N., Bhatt, P., Roy, A., Thirumalai, M. K., Gnanam, A. J., Pasupuleti, M., Marimuthu, K., & Arockiaraj, J. 2013. Fish lily type lectin-1 contains β -prism architecture: Immunological characterization. Molecular Immunology, 56(4), 497–506. <https://doi.org/10.1016/j.molimm.2013.06.020>
- Arockiaraj, J., Kumaresan, V., Bhatt, P., Palanisamy, R., Gnanam, A. J., Pasupuleti, M., Kasi, M., & Chaurasia, M. K. 2014. A novel single-domain peptide, anti-LPS factor from prawn: Synthesis of peptide, antimicrobial properties and complete molecular characterization. Peptides, 53, 79–88. <https://doi.org/10.1016/j.peptides.2013.11.008>
- Astuti Nafsiati. 2009. Konsep Dasar Kimia. UIN Malang Press, Malang.
- Astriaana, W., Dwi Apriani, Y., Rahmawati, N., Fatiqin, A., Islam Negeri Raden Fatah Palembang, U., & Riset Perikanan Perairan Umum dan Penyuluhan Perikanan Kota Palembang, B. 2021. Kebiasaan Makan dan Fekunditas Ikan Lele Lokal (*Clarias batrachus*) Di Perairan Sawah SP. Padang Kab. Ogan Komering Ilir SUM-SEL. Prosiding Seminar Nasional Sains dan Teknologi Terapan, 4(1), 434–445.



- Babu, S. V., Shareef, M. M., Shetty, A. P., & Shetty, K. T. 2002. HPLC method for amino acids profile in biological fluids and inborn metabolic disorders of aminoacidopathies. *Indian journal of clinical biochemistry: IJCB*, 17(2), 7–26.
<https://doi.org/10.1007/BF02867967>
- Badan Pusat Statistik Indonesia. 2014. *Produksi Perikanan Menurut Subsektor (ribu ton), 1999-2020**. Diakses pada 28 Juni 2023, dari <https://www.bps.go.id/id/statistics-table/1/MTcxMSMx/produksi-perikanan-menurut-subsektor--ribu-ton---1999-2020-.html>
- Bahrudin, S. S. A. 2018. Fitokimia dan antioksidan pada buah tome-tome (*Flacourtia inermis*). *Hospital Majapahit*, 10(1), 43–50.
- Baker, M. R., Gobush, K. S., & Vynne, C. H. 2013. Review of factors influencing stress hormones in fish and wildlife. *Journal for Nature Conservation*, 21(5), 309–318.
<https://doi.org/10.1016/j.jnc.2013.03.003>
- Bergsson, G. 2005. Antimicrobial polypeptides and lipids as a part of innate defense mechanism of fish and human fetus. *Medical Biochemistry*.
- Birkemo, G. A., Lüders, T., Andersen, Ø., Nes, I. F., & Nissen-Meyer, J. 2003. Hipposin, a histone-derived antimicrobial peptide in Atlantic halibut (*Hippoglossus hippoglossus* L.). *Biochimica et Biophysica Acta - Proteins and Proteomics*, 1646(1–2), 207–215.
[https://doi.org/10.1016/S1570-9639\(03\)00018-9](https://doi.org/10.1016/S1570-9639(03)00018-9)
- Böcker, L., Rühs, P. A., Böni, L., Fischer, P., & Kuster, S. 2015. Fiber-enforced hydrogels: Hagfish slime stabilized with biopolymers including κ -carrageenan. *ACS Biomaterials Science & Engineering*, 2, 90–95.
- Böni, L., Fischer, P., Böcker, L., Kuster, S., & Rühs, P. A. 2016. Hagfish slime and mucin flow properties and their implications for defense. *Scientific Reports*, 6(June), 1–8.
<https://doi.org/10.1038/srealiran listrik0371>
- BPPI. 2015. *Petunjuk Teknis Budidaya Ikan Lele Mutiara*. Balai Penelitian Pemuliaan Ikan. Sukamandi, 51 hlm.
- Bragadeeswaran, S., Priyadharshini, S., Prabhu, K., & Rani, S. R. S. 2011. Antimicrobial and hemolytic activity of fish epidermal mucus *Cynoglossus arel* and *Arius caelatus*. *Asian*



- Pacific Journal of Tropical Medicine, 4(4), 305–309. [https://doi.org/10.1016/S1995-7645\(11\)60091-6](https://doi.org/10.1016/S1995-7645(11)60091-6)
- Brinchmann, M. F. 2016. Immune relevant molecules identified in the skin mucus of fish using-omics technologies. *Molecular BioSystems*, 12(7), 2056–2063. <https://doi.org/10.1039/c5mb00890e>
- Casadei, E., Wang, T., Zou, J., González Vecino, J. L., Wadsworth, S., & Secombes, C. J. 2009. Characterization of three novel beta-defensin antimicrobial peptides in rainbow trout (*Oncorhynchus mykiss*). *Molecular immunology*, 46(16), 3358–3366. <https://doi.org/10.1016/j.molimm.2009.07.018>
- Chen, W. 2006. Electroconformational denaturation of membrane proteins. *Annals of the New York Academy of Sciences*, 1066(1), 92-105. <https://doi.org/10.1196/annals.1363.028>
- Chervova, L. S. 1997. Pain sensitivity and behaviour of fishes. *J Ichthyo* 37:106–111.x
- Chua, C. E. L., Lim, Y. S., Lee, M. G., & Tang, B. L. 2012. Non-classical membrane trafficking processes galore. *Journal of Cellular Physiology*, 227(12), 3722–3730. <https://doi.org/10.1002/jcp.24082>
- Cian, R. E., Vioque, J., & Drago, S. R. 2015. Structure–mechanism relationship of antioxidant and ACE I inhibitory peptides from wheat gluten hydrolysate fractionated by pH. *Food Research International*, 69, 216-223. <https://doi.org/10.1016/j.foodres.2014.12.036>
- Cone, R. A. 2009. Barrier properties of mucus. *Advanced Drug Delivery Reviews*, 61(2), 75–85. <https://doi.org/10.1016/j.addr.2008.09.008>
- Cunha, M. F., Coscueta, E. R., Brassesco, M. E., Almada, F., Gonçalves, D., & Pintado, M. 2024. Methods for the collection of fish mucus: A systematic review. *Reviews in Fisheries Science & Aquaculture*, 32(2), 334–368. <https://doi.org/10.1080/23308249.2023.2289012>
- Darianto, Amrinsyah, & Sitohang, H. T. S. 2019. Analisa pengaruh waktu dan turbulensi asap pada mesin pengering ikan lele. *Journal of Mechanical Engineering Manufactures Materials and Energy*. 3(2), 130–142. <https://doi.org/10.31289/jmemme.v3i2.3029.g2375>



- Dash, S., Das, S. K., Samal, J., & Thatoi, H. N. 2018. Epidermal mucus, a major determinant in fish health: A review. *Iranian Journal of Veterinary Research*, 19(2), 72–81. <https://doi.org/10.22099/ijvr.2018.4849>
- Díaz-Puertas, R., Adamek, M., Mallavia, R., & Falco, A. 2023. Fish skin mucus extracts: An underexplored source of antimicrobial agents. *Marine Drugs*, 21(6). <https://doi.org/10.3390/md21060350>
- Direktorat Jendral Perikanan Budidaya. 2023. <https://statistik.kkp.go.id>. (Diakses 28 Juli 2023).
- Ebran N, Julien S, Orange N, Auperin B, Molle G. 2000. Isolation and characterization of novel glycoproteins from fish epidermal mucus: correlation between their pore-forming properties and their antibacterial activities. *Biochim Biophys Acta*. 1467(2):271-80. doi: 10.1016/s0005-2736(00)00225-x. PMID: 11030587.
- Ebran N, Julien S, Orange N, Auperin B, Molle G. 2000. Isolation and characterization of novel glycoproteins from fish epidermal mucus: correlation between their pore-forming properties and their antibacterial activities. *Biochim Biophys Acta*. 1467(2):271-80. doi: 10.1016/s0005-2736(00)00225-x. PMID: 11030587.
- Elshaer, A., Hanson, P., Worthington, T., Lambert, P., & Mohammed, A. R. 2012. Preparation and characterization of amino acids-based trimethoprim salts. *Pharmaceutics*, 4(1), 179–196. <https://doi.org/10.3390/pharmaceutics4010179>
- Esteban, M. Á. 2012. An Overview of the Immunological Defenses in Fish Skin. *ISRN Immunology*, 2012, 1–29. <https://doi.org/10.5402/2012/853470>
- Fakih, T. M., & Dewi, M. L. 2020. Identifikasi interaksi molekuler peptida antimikrobal dari lendir kulit ikan lele kuning (*Pelteobagrus fulvidraco*) terhadap penicillin-binding protein 3 (pbaliran listrik) pada *escherichia coli* secara in silico. *BIOEDUSCIENCE: Jurnal Pendidikan Biologi dan Sains*, 4(1), 48–55. <https://doi.org/10.29405/j.bes/4148-554951>
- Fernandes, J. M. O., & Smith, V. J. 2002. A novel antimicrobial function for a ribosomal peptide from rainbow trout skin. *Biochemical and Biophysical Research Communications*, 296(1), 167–171. [https://doi.org/10.1016/S0006-291X\(02\)00837-9](https://doi.org/10.1016/S0006-291X(02)00837-9)



- Fersht, A. 2012. Denaturation (Proteins). *Brenner's Encyclopedia of Genetics (Second Edition)*, 302-303. <https://doi.org/10.1016/B978-0-12-374984-0.00393-4>
- Finkel, T. 2011. Signal transduction by reactive oxygen species. *Journal of Cell Biology*, 194(1), 7–15. <https://doi.org/10.1083/jcb.201102095>
- Foruzani S, Maghsoudloo T, Noorbakhsh HZ. 2015. The effect of freezing at the temperature of -18°C on chemical compositions of the body of *Lutjanus johnii*. *Aquaculture, Aquarium, Conservation and Legislation Bioflux*. 8(3): 431-437.
- Gittings, S., Turnbull, N., Henry, B., Roberts, C. J., & Gershkovich, P. 2015. Characterisation of human saliva as a platform for oral dissolution medium development. *European Journal of Pharmaceutics and Biopharmaceutics*, 91, 16–24. doi:10.1016/j.ejpb.2015.01.007
- Guardiola, F. A., Cuesta, A., Abellán, E., Meseguer, J., & Esteban, M. A. 2014. Comparative analysis of the humoral immunity of skin mucus from several marine teleost fish. *Fish and Shellfish Immunology*, 40(1), 24–31. <https://doi.org/10.1016/j.fsi.2014.06.018>
- Guardiola FA, Cuartero M, Del Mar Collado-González M, Arizcún M, Díaz Baños FG, Meseguer J, Cuesta A, Esteban MA. 2015. Description and comparative study of physico-chemical parameters of the teleost fish skin mucus. *Biorheology*. 52(4):247-56. doi: 10.3233/BIR-15052. PMID: 26484392.
- Gupta, D., Gupta, N., Deopa, M. S., & Goyal, R. K. 2021. Comparison of broth microdilution method vs disk diffusion method for antifungal susceptibility testing in dermatophytosis: A cross-sectional study. *National Journal of Laboratory Medicine*, 10(4), 18–22. <https://doi.org/10.7860/njlm/2021/49833.2539>
- Hanani, H., Ware, I., Yaakob, H., Mukrish, H., & Roji Sarmidi, M. 2015. Antioxidant and anti-cancer activity of standardized extracts of three varieties of *Ficus deltoidea*'s leaves. *Jurnal Teknologi*, 77(3), 19–25. <https://doi.org/10.11113/jt.v77.6000>
- Hemapoojavalli, G., & Bragadeeswaran, S. 2022. Evaluating the antioxidant activity of epidermal mucus extract in marine fishes *Anguilla anguilla* and *Brachirus orientalis*. *International Journal of Veterinary Research*, 2(1), 27–38. <https://doi.org/10.52547/injvr.2.1.27>



- Hernández-Contreras Á, Tovar-Ramírez D, Reyes-Becerril M. 2021. Modulatory effect of *Debaryomyces hansenii* and oregano essential oil on the humoral immunity of skin mucus in Longfin yellowtail *Seriola rivoliana*. *Aquac Res* . 52(2):749–762. <https://doi.org/10.1111/are.14931>
- Hussin, N. M., Ahmad, A. H., & Sulaiman, M. R. 2019. Minerals, amino acids and fatty acids profile of two different species of catfish epidermal mucus. *Transactions on Science and Technology*, 6 (2-2), 175–183.
- Hussin, N. M., Shaarani, S. M., Sulaiman, M. R., Ahmad, A. H., & Vairappan, C. S. 2017. Chemical composition and antioxidant activities of catfish epidermal mucus. *Journal of Advanced Agricultural Technologies*. 4(1), 73–77. <https://doi.org/10.18178/joaat.4.1.73-77>
- Hyldgaard, M., Mygind, T., Vad, B. S., Stenvang, M., Otzen, D. E., & Meyer, R. L. 2014. The antimicrobial mechanism of action of epsilon-poly-l-lysine. *Applied and environmental microbiology*, 80(24), 7758–7770. <https://doi.org/10.1128/AEM.02204-14>
- Idrees, M., Mohammad, A. R., Karodia, N., & Rahman, A. 2020. Multimodal role of amino acids in microbial control and drug development. *Antibiotics*, 9(6), 1–23. <https://doi.org/10.3390/antibiotics9060330>
- Jork. 1990. TLC dan Settle., 1997, Handbook of Techniques for Anal. Chem.
- Junianto. 2003. Teknik Penanganan Ikan. Penebar Swadaya, Jakarta.
- Jurado, J., Fuentes-Almagro, C. A., Guardiola, F. A., Cuesta, A., Esteban, . Á., & Prieto-Álamo, M. J. 2015. Proteomic profile of the skin mucus of farmed gilthead seabream (*Sparus aurata*). *Journal of proteomics*, 120, 21-34.
- Khoei AJ. 2021. EvaluatPhysiolpotential immunotoxic effects of iron oxide nanoparticles (IONPs) on antioxidant capacity, immune responses and tissue bioaccumulation in common carp (*Cyprinus carpio*). *Comp Biochem Physiol Part - C Toxicol Pharmacol*. <https://doi.org/10.1016/j.cbpc.2021.109005>
- Kumar, S. 2011. Free Radicals and Antioxidants: Human and Food System. *Pelagia Research Library*, 2(1), 129–135.



- Kuppulakshmi, C., Prakash, M., Gunasekaran, G., Manimegalai, G., & Sarojini, S. 2008. Antibacterial properties of fish mucus from *Channa punctatus* and *Cirrhinus mrigala*. *European review for medical and pharmacological sciences*, 12, 149–153.
- Lee, Y., Lim, J., Sulaiman, B., Bilung, L., Ngui, S. N., Chong, Y. L. 2023. Antibacterial screening of epidermal mucus protein extract of freshwater Bornean spotted barb *Barbodes sealei*, *International Aquatic Research*, 15(2), pp. 163-179. doi: 10.22034/iar.2023.1980719.1402
- Lei, J., Sun, L. C., Huang, S., Zhu, C., Li, P., He, J., Mackey, V., Coy, D. H., & He, Q. Y. 2019. The antimicrobial peptides and their potential clinical applications. *American Journal of Translational Research*, 11(7), 3919–3931.
- Leksono, T., Mus, S., & Annisa, Z. 2019. Antibacterial potential of chitosan extracted from rama shrimp (*Thalassina anomala*) carapace. *Journal of Physics: Conference Series*, 1351(1). <https://doi.org/10.1088/1742-6596/1351/1/012088>
- León-Buitimea, A., Garza-Cárdenas, C. R., Garza-Cervantes, J. A., Lerma-Escalera, J. A., & Morones-Ramírez, J. R. (2020). The demand for new antibiotics: Antimicrobial peptides, nanoparticles, and combinatorial therapies as future strategies in antibacterial agent design. *Frontiers in microbiology*, 11, 1669. <https://doi.org/10.3389/fmicb.2020.01669>
- Lewis, R. W. 1970. Fish Cutaneous Mucus : A New Source of Skin Surface Lipid. *Lipids*, 947.
- Li, S., Mao, Y., Zhang, Wang, M., Meng, J., Liu, X., Bai, Y., & Guo, Y. 2022. Recent advances in microbial ϵ -poly-L-lysine fermentation and its diverse applications. *Biotechnol Biofuels* 15(65). <https://doi.org/10.1186/s13068-022-02166-2>
- Liang, Y., Guan, R., Huang, W., & Xu, T. 2011. Isolation and Identification of a Novel Inducible Antibacterial Peptide from the Skin Mucus of Japanese Eel, *Anguilla japonica*. *The Protein Journal*, 30(6), 413–421. doi:10.1007/s10930-011-9346-9
- Lingga, N., & Kurniawan, N. 2013. Pengaruh Pemberian Variasi Makanan Terhadap Pertumbuhan Ikan Lele. (*Clarias gariepinus*). 1(3), 114–118.
- Lirio, G. A. C., De Leon, J. A. A., & Villafuerte, A. G. 2019. Antimicrobial activity of epidermal mucus from top aquaculture fish species against medically-important pathogens. *Walailak*



Journal of Science and Technology, 16(5), 329–340.
<https://doi.org/10.48048/wjst.2019.6287>

Liswahyuni, A. M., & Ayyun, Q. 2021. Tingkat kelangsungan hidup dan pola pertumbuhan bibit ikan lele (*Clarias gariepinus*) dalam kepadatan yang berbeda pada sistem budikdamber. *Fisheris and aquatic studies*, 1(2), 051–059.

Lopez M.J., & Mohiuddin S.S. 2023. Biochemistry, Essential Amino Acids. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK557845/>

López-García, G., Dublan-García, O., Arizmendi-Cotero, D., & Gómez Oliván, L. M. 2022. Antioxidant and antimicrobial peptides derived from food proteins. *Molecules (Basel, Switzerland)*, 27(4), 1343. <https://doi.org/10.3390/molecules27041343>

Lüders, T., Birkemo, G. A., Nissen-Meyer, J., Andersen, Ø., & Nes, I. F. 2005. Proline conformation-dependent antimicrobial activity of a proline-rich histone h1 N-terminal Peptide fragment isolated from the skin mucus of Atlantic salmon. *Antimicrobial agents and chemotherapy*, 49(6), 2399–2406. <https://doi.org/10.1128/AAC.49.6.2399-2406.2005>

Lumbantoruan, K. 2008. Suatu Kajian Tentang Pengawetan Ikan Menggunakan Larutan Garam Dingin. Skripsi. Universitas Sumatera Utara. Sumatera Utara.

Magani, A. K., Tallei, T. E., & Kolondam, B. J. 2020. Uji Antibakteri Nanopartikel Kitosan terhadap Pertumbuhan Bakteri *Staphylococcus aureus* dan *Escherichia coli*. *Jurnal Bios Logos*, 10(1), 7. <https://doi.org/10.35799/jbl.10.1.2020.27978>

Manik, R. R. D. S., Handoco, E., Tambunan, L. O., Tambunan, J., & Sitompul, S. 2022. Socialization Of Catfish (*Clarias* Sp.) Using Semi-Artificial Spawning In Aras Village, batu bara regency. *Mattawang: Jurnal Pengabdian Masyarakat*, 3(1), 47–51. <https://doi.org/10.35877/454ri.mattawang822>

Martin-Rubio, Ana S., Patricia Sopelana, Fumie Nakashima, Takahiro Shibata, Koji Uchida, and María D. Guillén. 2019. A Dual Perspective of the Action of Lysine on Soybean Oil Oxidation Process Obtained by Combining 1H NMR and LC–MS: Antioxidant Effect and Generation of Lysine–Aldehyde Adducts. *Antioxidants* 8(9), 326. <https://doi.org/10.3390/antiox8090326>



- Marx, H., Brunner, B., Weinzierl, W., Hoffman, R., & Stolle, A. 1997. Methods Of Stunning Freshwater Fish: Impact On Meat Quality And Aspects Of Animal Welfare. *Zeitschrift für Lebensmitteluntersuchung und-forschung A*, 204(4), 282–286.
- Masso-Silva JA, & Diamond G 2014. Antimicrobial Peptides from Fish. *Pharmaceuticals*, 7(3):265-310. <https://doi.org/10.3390/ph7030265>
- Matthyssen, Tamara & Li, Wenyi & Holden, James & Lenzo, Jason & Hadjigol, Sara & O'Brien-Simpson, Neil. 2022. The Potential of Modified and Multimeric Antimicrobial Peptide Materials as Superbug Killers. *Frontiers in Chemistry*. 9. 10.3389/fchem.2021.795433.
- Ming, L., Xiaoling, P., Yan, L., Lili, W., Qi, W., Xiyong, Y., Boyao, W., & Ning, H. 2007. Purification of antimicrobial factors from human cervical mucus. *Human reproduction*, 22(7), 1810-1815.
- Nowak, M. G., Skwarecki, A. S., & Milewska, M. J. 2021. Amino Acid Based Antimicrobial Agents – Synthesis and Properties. *ChemMedChem*, 16(23), 3513–3544. <https://doi.org/10.1002/cmdc.202100503>
- Olin-Sandoval, V., Yu, J. S. L., Miller-Fleming, L., Alam, M. T., Kamrad, S., Correia-Melo, C., Haas, R., Segal, J., Peña Navarro, D. A., Herrera-Dominguez, L., Méndez-Lucio, O., Vowinkel, J., Müllender, M., & Ralser, M. 2019. Lysine harvesting is an antioxidant strategy and triggers underground polyamine metabolism. *Nature*, 572(7768), 249–253. <https://doi.org/10.1038/s41586-019-1442-6>
- Oluwole, Adebajji Joseph Olasupo, Daniel Imwansi Ikhu-Omoregbe, and Victoria Adaora Jideani. 2020. Physicochemical Properties of African Catfish Mucus and Its Effect on the Stability of Soya Milk Emulsions. *Applied Sciences* 10(3), 916. <https://doi.org/10.3390/apair es0030916>
- Ordóñez-Grande, B, Guerreiro, P.M., Sanahuja, I., Fernández-Alacid, L., Ibarz, A. Environmental Salinity Modifies Mucus Exudation and Energy Use in European Sea Bass Juveniles. *Animals* 2021, 11, 1580. <https://doi.org/10.3390/ani11061580>
- Osinubi, A. D., Asekun, O. T., & FAMILONI, O. B. 2023. N-Aryl Amino Acids as Potential Antibacterial Agents. *Reactions*, 4(2), 286-294.



- Park, I. Y., Park, C. B., Kim, M. S., & Kim, S. C. 1998. Parasin I, an antimicrobial peptide derived from histone H2A in the catfish, *Parasilurus asotus*. *FEBS letters*, 437(3), 258-262.
- Patel, M., Ashraf, M. S., Siddiqui, A. J., Ashraf, S. A., Sachidanandan, M., Snoussi, M., Adnan, M., & Hadi, S. 2020. Profiling and role of bioactive molecules from *puntius sophore* (Freshwater/brackish fish) skin mucus with its potent antibacterial, antiadhesion, and antibiofilm activities. *Biomolecules*, 10(6), 920.
- Patrzykat, A., Friedrich, C. L., Zhang, L., Mendoza, V., & Hancock, R. E. W. 2002. Sublethal concentrations of pleurocidin-derived antimicrobial peptides inhibit macromolecular synthesis in *Escherichia coli*. *Antimicrobial Agents and Chemotherapy*, 46(3), 605–614. <https://doi.org/10.1128/AAC.46.3.605-614.2002>
- Pica, A., & Graziano, G. 2015. On the Effect of Sodium Chloride and Sodium Sulfate on Cold Denaturation. *PLoS ONE*, 10(7). <https://doi.org/10.1371/journal.pone.0133550>
- Puray, J. J. S., & Villaber, R. A. P. 2023. Extraction, characterization, and vascular response of proteins from catfish (*Clarias batrachus* L.) mucus. *Food Chemistry Advances*, 3, 100444. <https://doi.org/10.1016/j.focha.2023.100444>
- Purcell, J.E.; Anderson, P.A.V. 1995, Electrical responses to water-soluble components of fish mucus recorded from the cnidocytes of a fish predator, *Physalia physalis*. *Mar. Freshwater Behav. Physiol.* 26, 149–162.
- Putri, M. D., Arumasi, A., & Kurniaty, N. 2020. Uji Aktivitas Antioksidan Ekstrak Daging Buah Semangka dan Albedo Semangka (*Citrullus Lanatus*) dengan Metode DPPH dan FRAP. *Prosiding Farmasi* ISSN: 2460-6472, 6(2), 992–997. <http://dx.doi.org/10.29313/.v6i2.24206>
- Rahmawati, N., Sudjarwo, E., & Widodo, E. 2014. Uji Aktivitas Antibakteri Ekstrak Herbal terhadap Bakteri *Escherichia coli*. *Jurnal Ilmu-Ilmu Peternakan (Indonesian Journal of Animal Science)*, 24(3), 24–31.
- Rakers S, Niklasson L, Steinhagen D, Kruse C, Schaubert J, Sundell K, Paus R. 2013. Antimicrobial peptides (AMPs) from fish epidermis: perspectives for investigative dermatology. *J Invest Dermatol.* May;133(5):1140-9. doi: 10.1038/jid.2012.503. Epub 2013 Feb 14. PMID: 23407389.



- Reverter, M., Tapissier-Bontemps, N., Lecchini, D., Banaigs, B., & Sasal, P. 2018. Biological and ecological roles of external fish mucus: A review. *Fishes*, 3(4), 1–19. <https://doi.org/10.3390/fishes3040041>
- Ridho, A. A., Wijaya, I., & Tripama, B. 2021. Pembesaran Lele Dalam Drum dan Pemanfaatan Limbah Lele Pada Tanaman Kangkung dan Tabulampot di Desa Tegalboto, Kecamatan Sumber Sari, Kabupaten Jember. *Journal of Community Development*, 2(1), 15–21. <https://doi.org/10.47134/comdev.v2i1.36>
- Ririhena, J. E. 2023. Tingkah Laku Ikan Setelah Pengambilan Lendir Pada Ikan Air Tawar Di Apostolic Campus Training School (ACTS). *Jurnal Biosainstek*, 3(1), 53–57. <https://doi.org/10.52046/biosainstek.v3i1.1433>
- Chayati, I., 2010. Bahan Ajar Pengujian Bahan Pangan. *Prodi Teknik Boga Fakultas Teknik Universitas Negeri Yogyakarta. Yogyakarta.*
- Roques, Jonathan & Abbink, Wout & Chereau, Gaétan & Fourneyron, Aurélie & Spanings, Tom & Burggraaf, Dirk & Bos, Ruud & van de vis, Hans & Flik, Gert. 2012. Erratum to: Physiological and behavioral responses to an electrical stimulus in Mozambique tilapia (*Oreochromis mossambicus*). *Fish physiology and biochemistry*. 38. 10.1007/s10695-012-9636-y.
- Roques JAC, Abbink W, Geurds F, van de Vis H, Flik G 2010 Tailfin clipping, a painful procedure: studies on Nile tilapia and common carp. *Physiol Behav* 101:533–540
- Rosselin, Marie & Meyer, Grégory & Guillet, Pierre & Cheviet, Thomas & Walther, Guillaume & Meister, Annette & Hadjipavlou-Litina, Dimitra & Durand, Grégory. 2016. Divalent Amino-Acid Based Amphiphilic Antioxidants: Synthesis, Self-Assembling Properties and Biological Evaluation. *Bioconjugate Chemistry*. 27. 10.1021/acs.bioconjchem.6b00002.
- Roy, Deboleena. 2024. Denaturation of Proteins. American River Collage. Available at: <https://chem.libretexts.org/@go/page/433017> [Accessed June 26, 2024].
- Ruang Sri, J., Salger, S. A., Caipang, C. M., Kiron, V., & Fernandes, J. M. 2012. Differential expression and biological activity of two piscidin paralogues and a novel splice variant in Atlantic cod (*Gadus morhua* L.). *Fish & Shellfish Immunology*, 32(3), 396–406.



- Rusli, N., & Yeniati, N. 2019. Formulasi Sediaan Gel Lendir Ikan Lele (*Clarias Gariepinus L*) Sebagai Penyembuh Luka Dengan Variasi Basis Carbopol 934. *Medical Sains*, 3(2), 131–138.
- Safaruddin, Safitri, N. A. A., Yuliana, B., & Firman, I. 2019. Formulasi Gel Lendir Ikan Gabus (*Channa Striata*) dan Uji Efektivitas Sebagai Obat Luka Bakar Pada Kelinci (*Oryctolagus Cuniculus*). *Prosiding Seminar Nasional Indonesia Timur*, 1(1), 248–254.
- Saito, K., Jin, D. H., Ogawa, T., Muramoto, K., Hatakeyama, E., Yasuhara, T., & Nokihara, K. 2003. Antioxidative properties of tripeptide libraries prepared by the combinatorial chemistry. *Journal of agricultural and food chemistry*, 51(12), 3668–3674. <https://doi.org/10.1021/jf021191n>
- Sanahuja, I., Fernández-Alacid, L., Sánchez-Nuño, S., Ordóñez-Grande, B., & Ibarz, A. 2019. Chronic Cold Stress Alters the Skin Mucus Interactome in a Temperate Fish Model. *Frontiers in physiology*, 9, 1916. <https://doi.org/10.3389/fphys.2018.01916>
- Schito, A. M., Schito, G. C., & Alfei, S. 2021. Synthesis and Antibacterial Activity of Cationic Amino Acid-Conjugated Dendrimers Loaded with a Mixture of Two Triterpenoid Acids. *Polymers*, 13(4), 521. <https://doi.org/10.3390/polym13040521>
- Seko, M., Sabuna, A. C., & Ngginak, J. 2021. Ajeran Leaves Ethanol Extract (*Bidens pilosa L*) As An Antibacterial *Staphylococcus aureus*. *Jurnal Biosains*, 7(1), 1. <https://doi.org/10.24114/jbio.v7i1.22671>
- Shivanna, V., & Dasegowda, V. 2023. Comparison of Disk Diffusion and Agar Dilution Method for the Detection of Mupirocin Resistance in Staphylococcal Isolates from Skin and Soft Tissue Infections. *Journal of Laboratory Physicians*, 15(03), 372–376. <https://doi.org/10.1055/s-0042-1760672>
- Su, Y. 2011. Isolation and identification of pelteobagrins, a novel antimicrobial peptide from the skin mucus of yellow catfish (*Pelteobagrus fulvidraco*). *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology*, 158(2), 149–154.
- Subramanian, S., MacKinnon, S. L., & Ross, N. W. 2007. A comparative study on innate immune parameters in the epidermal mucus of various fish species. *Comparative Biochemistry and Physiology - B Biochemistry and Molecular Biology*, 148(3), 256–263. <https://doi.org/10.1016/j.cbpb.2007.06.003>



- Subramanian S., Ross N. W., MacKinnon S. L., 2008. Comparison of the biochemical composition of normal epidermis mucus and extruded slime of hagfish (*Myxine glutinosa* L.). *Fish and Shellfish Immunology* 25:625-632.
- Syahrizal, S., & Arifin, Z. 2016. Efektifitas Biodekomposer Saat Pengangkutan Ikan Lele Sangkuriang (*Clarias. gariepinus* Var. Sangkuriang) Dengan Kepadatan Tinggi Pada Transportasi Tertutup Untuk Kebutuhan Budidaya. *Jurnal Akuakultur Sungai dan Danau*, 1(1), 44-52.
- Tacchi, L., Lowrey, L., Musharrafieh, R., Crossey, K., Larragoite, E. T., & Salinas, I. 2015. *Paraninfo Digital. Aquaculture*, 120–127.
<https://doi.org/10.1016/j.earlhumdev.2006.05.022>
- Tagami, M., & Kuwahara, J. 2020. Evaluation of antioxidant activity and amino acids in the mucus of mackerel for cosmetic applications. *Journal of Oleo Science*, 69(9), 1133–1138. <https://doi.org/10.5650/jos.ess20029>
- Tarigan, W. P. L., Tarigan, C. U., Halim, C., Valerie, J., Itanza, V., & Oeintz, R. 2023. Antimicrobial Potential of Catfish (*Clarias batrachus*) and Snakehead Fish (*Chana striata*) Mucus on Bacterial Coliform Growth and its Application as the Organic Face Mask and Lipstick. *Natural Science: Journal of Science and Technology*, 11(02), 58–66.
<https://doi.org/10.22487/25411969.2022.v11.i02.16171>
- Tiralongo, F., Messina, G., Lombardo, B. M., Longhitano, L., Li Volti, G., & Tibullo, D. 2020. Skin Mucus of Marine Fish as a Source for the Development of Antimicrobial Agents. *Frontiers in Marine Science*, 7(September), 1–7.
<https://doi.org/10.3389/fmars.2020.541853>
- Verma, A. K., Chatli, M. K., Kumar, P., & Mehta, N. 2017. Antioxidant and antimicrobial activity of protein hydrolysate extracted from porcine liver. *Indian Journal of Animal Sciences*, 87(6), 711–717.
<http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L616934304>
- Wahyudiati, Dwi. 2017. *Biokimia. LEPPIM MATARAM Jalan Pendidikan 35 Mataram. Cetakan 1. ISBN 978-602-60913-4-5.*



- Wahyuni, Y. S., & Thahir, Z. 2023. Potensi Lendir Ikan Lele (*Clarias gariepinus*) Dan Kolagen Sisik Ikan Bandeng (*Chanos Chanos*) Sebagai Serum Anti Jerawat. *Media Farmasi Poltekkes Makassar*, 19(1), 36–46.
- Warseno, Y., 2018. Budidaya lele super intensif di lahan sempit. *Jurnal Riset Daerah*. 2(7): 3064-3088.
- Wang, W. Dong-F, D. Nicola, DR. Giuseppe, M. Silas S. O. Hung. 2013. Heat Shock Protein 70 (HSP70) Responses in Tissues of White Sturgeon and Green Sturgeon Exposed to Different Stressors, *North American Journal of Aquaculture*, 75:2, 164-169, DOI: 10.1080/15222055.2012.747457.
- Widyowati, H., Ulfah, M., & Sumantri, S. 2014. Uji Aktivitas Antioksidan Ekstrak Etanolik Herba Alfalfa (*Medicago sativa L.*) Dengan Metode DPPH (1,1-difenil-2-pikrilhidrazil).
- Xu, N., Chen, G., & Liu, H. 2017. Antioxidative categorization of twenty amino acids based on experimental evaluation. *Molecules*, 22(12).
<https://doi.org/10.3390/molecules22122066>
- Yazid dan Nursanti. 2006. *Penuntun Praktikum Biokimia Untuk Mahasiswa Analis*. (Yogyakarta: Andi, 2006). Hal. 67.
- Yoretina, Z. S., Djatumurti, D. R., Nasikah, R., Susanto, H., & Yulianto, H. D. K. 2021. Potensi Lendir ikan lele (*Clarias batrachus*) sebagai Saliva Buatan untuk Perawatan Mulut Kering. *Jurnal Perikanan Universitas Gadjah Mada*, 23(2), 127.
<https://doi.org/10.22146/jfs.62569>
- Zhang XH, Sun ZY, Cai JF, Wang JH, Wang GB, Zhu ZL, Cao FL. Effects of dietary fish meal replacement by fermented *Moringa (Moringa Oleifera Lam.)* leaves on growth performance, nonspecific immunity and disease resistance against *Aeromonas Hydrophila* in juvenile gibel carp (*Carassius Auratus Gibelio* Var. CAS III) *Fish Shellfish Immunol*. 2020;102(7):430–439. doi: 10.1016/j.fsi.2020.04.051