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MIKROBIOLOGI MEDIS DALAM PEMERIKSAAN LABORATORIUM

Apt. Imam Taufik, S.Farm., M.Farm., dkk.
Editor: Nurul Rahmadesni, S.Hum.

Mikrobiologi Medis dalam Pemeriksaan Laboratorium

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Mikrobiologi Medis dalam Pemeriksaan Laboratorium

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KATA PENGANTAR

Puji syukur ke hadirat Tuhan Yang Maha Esa atas rahmat dan karunia-Nya, sehingga buku berjudul *Mikrobiologi Medis dalam Pemeriksaan Laboratorium* dapat disusun dan dihadirkan kepada pembaca.

Buku ini membahas dunia mikroorganisme yang berkaitan dengan kesehatan manusia, seperti bakteri, virus, jamur, dan parasit, serta perannya dalam pemeriksaan di laboratorium. Uraian disajikan secara singkat, jelas, dan mudah dipahami agar pembaca dapat mengenal pentingnya mikrobiologi medis dalam membantu memahami berbagai gangguan kesehatan.

Buku ini dijual untuk masyarakat umum dan ditujukan bagi siapa saja yang ingin menambah wawasan tentang pemeriksaan mikrobiologi medis. Semoga buku ini memberikan manfaat, memperluas pengetahuan, serta meningkatkan kepedulian pembaca terhadap pentingnya pemeriksaan laboratorium dalam menjaga kesehatan.

Jakarta, Juli 2026

Tim Penyusun

DAFTAR ISI

DAFTAR PUSTAKA

Abbas, A. K., Lichtman, A. H., & Pillai, S. (2021). *Cellular and Molecular Immunology* (10th ed.). Elsevier.

Abraham, P., Gupta, N., Potdar, V., Praharaj, I., Giri, S., Sapkal, G., ... & Gangakhedkar, R. (2020). Laboratory preparedness for SARS-CoV-2 testing in India: Harnessing a network of Virus Research & Diagnostic Laboratories. *The Indian Journal of Medical Research*, 151(2), 1-11. **https://doi.org/10.4103/ijmr.IJMR_594_20**

Alazazi, EA, Ahmed, S., & Murtey, MD (2023). Pewarnaan negatif: Teknik yang terlupakan dalam mikrobiologi. *Ilmu Hayati Terapan* , 10(3), 1-11. **https://doi.org/10.62940/als.v10i3.1646**

Alghamdi, S. M. S. (2024). Kesalahan pra-analitik, analitik, dan pasca-analitik dalam pengujian laboratorium klinis: Tinjauan sistematis tentang penyebab dan strategi pencegahan. *Jurnal Penyakit Menular dan Penelitian, 6*(2), 3220. https://doi.org/10.63278/jicrcr.vi.3220

Altıntaş F., & Koluman, A. (2024). Meningkatkan biosafety dan biosecurity: Manajemen mutu di laboratorium berkeamanan tinggi. *Eurasian Veterinary Medical Journal* , 1(3), 1–15. **https://doi.org/10.35864/evmd.1366594**

Anahtar, M. N., Yang, J. H., & Kanjilal, S. (2021). Applications of machine learning to the problem of antimicrobial resistance: An emerging model for translational research. *Journal of Clinical Microbiology, 59*(7), e00266-21. https://doi.org/10.1128/JCM.00266-21

Angrup, A., Kanaujia, R., Biswal, M., & Ray, P. (2022). Comparative evaluation of different antimicrobial susceptibility testing methods for clinical isolates of *Elizabethkingia* species. *Journal of Laboratory Physicians, 14*(2), 205–211. https://doi.org/10.1055/s-0041-1740127

Annibaldis, G., Koundouno, F. R., Sibide, Y., Camara, J., Ifono, K., Soropogui, B., ... & Duraffour, S. (2025). Guinea's five-year progress in Lassa fever surveillance: Strengthening diagnostic and genomic surveillance capabilities. *Journal of Infectious Epidemiology*, 5, 00037. **https://doi.org/10.37432/jieph-confpro5-00037**

Arastehfar, A., Fang, W., Pan, W., Liao, W., Badali, H., Hagen, F., et al. (2022). Yeast and mould infections: Challenges and advances in diagnosis and treatment. *Journal of Fungi, 8*(7), 714. https://doi.org/10.3390/jof8070714

Arastehfar, A., Gabaldón, T., Garcia-Rubio, R., Jenks, J. D., Hoenigl, M., Salzer, H. J. F., & Perlin, D. S. (2020). Drug-resistant fungi: An emerging challenge threatening our limited antifungal armamentarium. *Antibiotics, 9*(12), 877.

Arvanitis, M., Anagnostou, T., Fuchs, B. B., Caliendo, A. M., & Mylonakis, E. (2014). Molecular and nonmolecular diagnostic

methods for invasive fungal infections. *Clinical Microbiology Reviews, 27*(3), 490–526. https://doi.org/10.1128/CMR.00091-13

Azizi, M., Hafeznezami, S., Mehraeen, E., & Shahsiah, R. (2021). Microfluidics for rapid antibiotic susceptibility testing: Recent advances and future prospects. *Biosensors, 11*(10), 381. https://doi.org/10.3390/bios11100381

Babaei, P., & Haeili, M. (2021). Analytical evaluation of the agar dilution method for susceptibility testing of *Mycobacterium abscessus* complex. *Journal of Microbiological Methods, 186*, 106234. https://doi.org/10.1016/j.mimet.2021.106234

Baker, J., & Denning, D. W. (2023). The SSS revolution in fungal diagnostics: Speed, simplicity and sensitivity. *British Medical Bulletin, 147*(1), 62–78. https://doi.org/10.1093/bmb/ldad011

Bennett, J. E., Dolin, R., & Blaser, M. J. (2020). Mandell, Douglas, and Bennett's principles and practice of infectious diseases (9th ed.).

Beyanga, M., Gerwing-Adima, L., Jackson, K., Majaliwa, B., Shimba, H., Ezekiel, S., et al. (2018). Implementation of the laboratory quality management system (ISO 15189): Experience from Bugando Medical Centre Clinical Laboratory – Mwanza, Tanzania. *African Journal of Laboratory Medicine, 7*(1), a657. https://doi.org/10.4102/ajlm.v7i1.657

Bongomin, F., Gago, S., Oladele, R. O., & Denning, D. W. (2017). Global and multi-national prevalence of fungal diseases—

Estimate precision. *Journal of Fungi, 3*(4), 57. https://doi.org/10.3390/jof3040057

Borman, A. M., & Johnson, E. M. (2021). Name changes for fungi of medical importance, 2018–2019. *Journal of Clinical Microbiology*.

Bunn, J. D., & Cornish, N. E. (2025). Kontaminasi kultur darah dan tata kelola diagnostik: Dari monitor kualitas laboratorium klinis hingga ukuran keselamatan pasien nasional. *Jurnal Kedokteran Laboratorium Terapan, 10*(1), jfae132. https://doi.org/10.1093/jalm/jfae132

Carey, R., Bhattacharyya, S., Kehl, S., Matukas, L., Pentella, M., Salfinger, M., & Schuetz, A. (2018). Panduan praktis untuk laboratorium mikrobiologi klinis: Menerapkan sistem manajemen mutu di laboratorium mikrobiologi medis. *Clinical Microbiology Reviews* , 31(2), e00062–e00117. **https://doi.org/10.1128/CMR.00062-17**

Carrington, A. M., Manuel, D. G., Fieguth, P. W., Ramsay, T., Osmani, V., Wernly, B., ... & Holzinger, A. (2022). Analisis ROC mendalam dan AUC sebagai akurasi rata-rata seimbang, untuk peningkatan pemilihan, audit, dan penjelasan pengklasifikasi. *Transaksi IEEE tentang Analisis Pola dan Kecerdasan Mesin, 45*(1), 1–17. https://doi.org/10.1109/tpami.2022.3145392

Cassagne, C., Normand, A. C., L'Ollivier, C., Ranque, S., & Piarroux, R. (2016). Performance of MALDI-TOF MS

platforms for fungal identification. *Medical Mycology, 54*(8), 1–10. https://doi.org/10.1093/mmy/myw020

Centers for Disease Control and Prevention, & National Institutes of Health. (2020). *Biosafety in microbiological and biomedical laboratories* (6th ed.). Washington, DC: U.S. Department of Health and Human Services.

Centers for Disease Control and Prevention**.** (2024). *Interim guidelines for collecting and handling of clinical specimens for COVID-19 testing*. U.S. Department of Health and Human Services. **https://www.cdc.gov/covid/hcp/clinical-care/clinical-specimen-guidelines.html**

Chan, L. M., Lok, D. Y. L., Wong, R. C., Lee, A. L., Cheung, I. Y. Y., Lai, C. K., & Chow, V. (2025). Antimicrobial susceptibility testing of aztreonam-avibactam combination against NDM-producing *Enterobacterales*. *Antibiotics, 14*(7), 675. https://doi.org/10.3390/antibiotics14070675

Chen, W., Ho, M., Yuan, S., Chou, H., Chang, C., Chen, C., & Lin, Y. E. (2024). Evaluasi lapisan antibakteri terhadap bakteri patogen yang umum ditemukan di lingkungan: Implikasi untuk keselamatan lingkungan dan pencegahan infeksi. *Pathogens, 14*(1), 13. https://doi.org/10.3390/pathogens14010013

Chung, J. (2023). Introduction to revised international guidelines on breakpoints for antimicrobial susceptibility testing. *Annals of Clinical Microbiology, 26*(3), 2–10. https://doi.org/10.5145/acm.2023.26.3.2

Clinical and Laboratory Standards Institute. (2022). *Performance standards for antifungal susceptibility testing of yeasts* (3rd ed.; CLSI Supplement M60). Clinical and Laboratory Standards Institute.

Corbacolu, Ö. K., & Aksel, G. (2023). Analisis kurva karakteristik operasi penerima dalam studi akurasi diagnostik: Panduan untuk menafsirkan nilai area di bawah kurva. *Jurnal Kedokteran Darurat Turki, 23*(4), 183–192. https://doi.org/10.4103/tjem.tjem_182_23

Craney, A., Stoesser, N., & Peto, T. E. A. (2025). Antibiotic Breakpoint Explorer: A web tool for navigating antimicrobial susceptibility breakpoints across guidelines. *Journal of Antimicrobial Chemotherapy*. Advance online publication. https://doi.org/10.1093/jac/dkae500

D'Urso, F., Paladini, F., Pollini, M., & Broccolo, F. (2025). Penggunaan *chatbot* kecerdasan buatan dalam interpretasi laporan kimia klinis dan kedokteran laboratorium: Pendekatan terstandarisasi. *Ilmu Terapan, 15*(8), 4232. https://doi.org/10.3390/app15084232

Damo, N. Y., Porotuo, J., Rambert, G., & Rares, F. E. S. (2021). Diagnostik Coronavirus Disease 2019 (COVID-19) dengan Pemeriksaan Laboratorium Mikrobiologi Klinik. *Jurnal e-Biomedik*, 9(1), 31899. **https://doi.org/10.35790/ebm.v9i1.31899**

Dass, S., Sushil, K., et al. (2015). Comparative evaluation of Calcofluor White and conventional potassium hydroxide

mount in diagnosis of superficial fungal infections. *Indian Journal of Dermatology*.

Davenport, C. F., Arevalo-Rodriguez, I., Mateos-Haro, M., Berhane, S., Dinnes, J., Spijker, R., ... & Van den Bruel, A. (2024). The effect of sample site and collection procedure on identification of SARS-CoV-2 infection. *Cochrane Database of Systematic Reviews*, 12, CD014780. **https://doi.org/10.1002/14651858.cd014780**

Dhamnetiya, D., Jha, R. P., Shalini, S., & Bhattacharyya, K. (2021). Bagaimana menganalisis kinerja diagnostik tes baru? Dijelaskan dengan ilustrasi. *Indian Journal of Surgery, 83*(5), 1018–1025. https://doi.org/10.1055/s-0041-1734019

Di Bonaventura, G., Angeletti, S., Ianni, A., Petitti, T., & Gherardi, G. (2021). Diagnosis laboratorium mikrobiologi brucellosis manusia: Gambaran umum. *Patogen* , 10(12), 1623. **https://doi.org/10.3390/pathogens10121623**

Dinnes, J., Deeks, J., Adriano, A., Berhane, S., Davenport, C., Dittrich, S., ... & Van den Bruel, A. (2020). Rapid, point-of-care antigen and molecular-based tests for diagnosis of SARS-CoV-2 infection. *Cochrane Database of Systematic Reviews*, 8, CD013705. **https://doi.org/10.1002/14651858.cd013705**

Donnelly, J. P., Chen, S. C., Kauffman, C. A., Steinbach, W. J., Baddley, J. W., Verweij, P. E., et al. (2020). Revision and update of the consensus definitions of invasive fungal disease from the EORTC/MSGERC. *Clinical Infectious Diseases, 71*(6), 1367–1376.

Drzewnioková, P., Brian, I., Mancin, M., Fortin, A., Gourlaouen, M., Angot, A., Niang, M., Dah, I., Berete, K., Diakite, A., Lo, F. T., Meseko, C., Go-Maro, E., D'Amico, V., Valastro, V., Soumare, B., De Benedictis, P., Monne, I., & Panzarin, V. (2025). Validation and multi-site deployment of a lyophilized qRT-PCR reagent for the molecular diagnosis of avian influenza and rabies in Sub-Saharan African regions. *Journal of Clinical Microbiology*, 63(3), e00080-25. **https://doi.org/10.1128/jcm.00080-25**

El Kochri, S., Rhazzar, Z., Ouarab, M., Hemlali, M., Zahafi, H., Elouennass, M., ... & Ennibi, K. (2024). Evaluation of the effectiveness of SARS-CoV-2 molecular diagnostic tests. *World Journal of Advanced Research and Reviews*, 24(2), 2331. **https://doi.org/10.30574/wjarr.2024.24.2.2331**

Elbehiry, A. (2025). Next-Generation Sequencing for bloodstream infections: Shaping the future of rapid diagnostics and precision medicine. *Diagnostics*, 15(23), 2944. **https://doi.org/10.3390/diagnostics15232944**

Eldin, C., Melenotte, C., Mediannikov, O., Ghigo, É., Million, M., Edouard, S., & Raoult, D. (2016). Dari demam Q ke infeksi Coxiella burnetii: Perubahan paradigma. *Clinical Microbiology Reviews* , 29(4), 45-116. **https://doi.org/10.1128/cmr.00045-16**

Evangelista, AJ, & Ferreira, TL (2022). *Spektrometri massa waktu terbang desorpsi/ionisasi laser berbantuan matriks dalam*

diagnosis mikroorganisme . Mikrobiologi Masa Depan, 15(10), 967–982. **https://doi.org/10.2217/fmb-2022-0067**

Fang, W., Wu, J., Cheng, M., Zhu, X., Du, M., Chen, C., Liao, W., Zhi, K., & Pan, W. (2023). Diagnosis of invasive fungal infections: Challenges and recent developments. *Journal of Biomedical Science, 30*(1), 1–35. https://doi.org/10.1186/s12929-023-00926-2

Fang, X., Cai, Y., Mei, J., Huang, Z., Zhang, C., Yang, B., Li, W., & Zhang, W. (2021). Mengoptimalkan metode kultur berdasarkan hasil mNGS praoperatif dapat meningkatkan diagnosis infeksi sendi. *Jurnal Tulang dan Sendi* , 103(1), 39-45. **https://doi.org/10.1302/0301-620X.103B1.BJJ-2020-0771.R2**

Fang, X., Mei, Q., Fan, X., Zhu, C., Yang, T.-J., Zhang, L., ... & Pan, A. (2020). Diagnostic Value of Metagenomic Next-Generation Sequencing for the Detection of Pathogens in Bronchoalveolar Lavage Fluid in Ventilator-Associated Pneumonia Patients. *Frontiers in Microbiology*, 11, 599756. **https://doi.org/10.3389/fmicb.2020.599756**

Fernando, S. S. N., Siriwardena, N. S., & Jayaweera, J. A. A. S. (2020). Evaluation of disk diffusion method for antimicrobial susceptibility testing in a resource-limited setting: Technical challenges. *Journal of Medical Microbiology, 69*(4), 534–540. https://doi.org/10.1099/jmm.0.001157

Gangar, M., Hazen, K. C., & Colangelo, N. H. (2024). Clinical impact of rapid antimicrobial susceptibility testing directly

from positive blood cultures in a community hospital setting. *Open Forum Infectious Diseases, 11*(2), ofae012. https://doi.org/10.1093/ofid/ofae012

Gao, Z., Ding, Y., Sun, Y., & Liu, Z. (2024). Identifikasi cepat patogen bakteri dan jamur berbasis AI pada apusan darah pasien sepsis. *Preprint arXiv arXiv:2503.14542* . **https://doi.org/10.48550/arXiv.2503.14542**

Gaur, P., Hada, V., Rath, R., Mohanty, A., Singh, P., & Rukadikar, A. (2023). Interpretation of antimicrobial susceptibility testing using EUCAST and CLSI breakpoints: An agreement analysis. *Cureus, 15*(3), e36977. https://doi.org/10.7759/cureus.36977

Gieseker, C. M., Miller, R. A., & Reimschuessel, R. (2022). Epidemiological cutoffs versus clinical breakpoints in antimicrobial susceptibility testing. *Microbiology Spectrum, 10*(1), e01537-21. https://doi.org/10.1128/spectrum.01537-21

Goenka, S., Wanswett, W., Sharma, A., Loomba, P., Jain, M., & Tyagi, S. (2025). Evaluasi pola kontaminasi bakteri laboratorium mikrobiologi dalam kaitannya dengan praktik pembersihan dan disinfeksi di rumah sakit super spesialisasi di Delhi, India. *Jurnal Mikrobiologi dan Bioteknologi, 13*(1), 18042. https://doi.org/10.18502/jmb.v13i1.18042

Guan, H., Qian, Y., Zhang, R., & Chen, S. (2025). Multicenter validation of an automated broth microdilution system for antimicrobial susceptibility testing of Gram-negative clinical

isolates. *Journal of Clinical Microbiology, 63*(3), e01744-24. https://doi.org/10.1128/jcm.01744-24

Gyawali, R., Karki, K., Bhandari, R., Neupane, B., Kafle, R. R., Pant, D., & Khadka, R. (2020). Coronaviruses: Diagnostic approaches for COVID-19. *Journal of Experimental Biology and Agricultural Sciences*, 8(spl-1), S09-S20. **https://doi.org/10.18006/2020.8(spl-1-sars-cov-2).s09.s20**

Hager, P., Jungmann, F., Holland, R., Bhagat, K., Hubrecht, I., Knauer, M., ... & Rueckert, D. (2024). Evaluasi dan mitigasi keterbatasan model bahasa besar dalam pengambilan keputusan klinis. *Nature Medicine, 30*(7), 2023–2033. https://doi.org/10.1038/s41591-024-03097-1

Harris, H. T., Stambaugh, H., Jacobs, E. B., Bhalodi, A., Chandrasekaran, S., Cole, N. C., … & Simner, P. (2025). Defining antimicrobial susceptibility testing methods and breakpoints among *Achromobacter* species. *Journal of Clinical Microbiology, 63*(5), e00264-25. https://doi.org/10.1128/jcm.00264-25

Haselbeck, A. H., Im, J., Prifti, K., Marks, F., Holm, M., & Zellweger, R. M. (2022). Serology as a tool to assess infectious disease landscapes and guide public health policy. *Pathogens*, *11*(7), Artikel 732. **https://doi.org/10.3390/pathogens11070732**

Hauner, A. (2026). Assessing the diagnostic performance of clinical, serological and molecular approaches to improve dengue case

detection in the Peruvian Amazon. *PLOS Neglected Tropical Diseases*, 20(2), e0013984. **https://doi.org/10.1371/journal.pntd.0013984**

Havai, A., Vian, S., Cainap, C., Cinap, S., Mihil, A., & Pop, L. (2022). Influenza A, Influenza B, and SARS-CoV-2 similarities and differences—A focus on diagnosis. *Frontiers in Microbiology*, 13, 908525. **https://doi.org/10.3389/fmicb.2022.908525**

He, Y., & Yang, R. (2023). Advances in fungal ITS-based molecular identification. *Frontiers in Microbiology*.

Hilt, EE, & Ferrieri, P. (2022). Generasi berikutnya dan teknologi sekuensing lainnya dalam mikrobiologi diagnostik dan penyakit menular. *Genes* , 13(9), 1566. **https://doi.org/10.3390/genes13091566**

Hoenigl, M., Sprute, R., Egger, M., Arastehfar, A., Cornely, O. A., & Krause, R. (2021). The role of biomarkers in the diagnosis and management of invasive fungal diseases. *Journal of Fungi, 7*(6), 457.

Hong, J. S., Song, W., Kim, H. S., Kim, H., Roh, K. H., Seo, Y. H., & Shin, K. S. (2019). Comparative evaluation of VITEK2, MicroScan, and BD Phoenix for antimicrobial susceptibility testing of clinical Gram-negative bacilli. *Annals of Laboratory Medicine, 39*(6), 559–565. https://doi.org/10.3343/alm.2019.39.6.559

Hoyer, A., & Zapf, A. (2021). Studi untuk evaluasi tes diagnostik: Bagian 28 dari seri evaluasi publikasi ilmiah. *Deutsches*

Ärzteblatt International, 118(33), 552–559. https://doi.org/10.3238/arztebl.m2021.0224

Il, Ç., Koydemir, H., Eryilmaz, M., Haan, K., Pillar, N., Mentesoglu, K., ... & Ozcan, A. (2024). Pewarnaan Gram virtual bakteri tanpa label menggunakan mikroskop medan gelap dan pembelajaran mendalam. *Science Advances* , 10(29), eads2757. **https://doi.org/10.1126/sciadv.ads2757**

Janbon, G., Quintin, J., Lanternier, F., et al. (2019). Studying fungal pathogens of humans and fungal infections: Fungal diversity and diversity of approaches. *Genes & Immunity, 20*, 403–414. https://doi.org/10.1038/s41435-019-0071-2

Jenks, J. D., & Hoenigl, M. (2018). Treatment monitoring of invasive aspergillosis and candidiasis. *Current Fungal Infection Reports, 12*(4), 182–190.

Jenks, J. D., Mehta, S. R., Taplitz, R., et al. (2021). *Aspergillus* galactomannan testing in invasive aspergillosis: Updated clinical utility. *Clinical Infectious Diseases*.

Jummai, M., Abdulsalami, M., Vantsawa, PA, Onuh, K., Ozojiofor, U., Ayodele, SB, ... & Oyong, IA (2023). Isolasi dan identifikasi molekuler *Enterobacter cloacae* dari ibu hamil dengan infeksi saluran kemih di Biu, Nigeria Timur Laut, Negara Bagian Borno. *Jurnal Kemajuan dalam Mikrobiologi* , 23(5), 1-18. **https://doi.org/10.9734/jamb/2023/v23i5721**

Kajumbula, H., Amoako, D., Tessema, S., Aworh, M., Chikuse, F., Okeke, I., ... & Perovic, O. (2024). Meningkatkan mikrobiologi klinis untuk pengawasan genomik implementasi

resistensi antimikroba di Afrika. *Resistensi Antimikroba & Pengendalian Infeksi* , 13, 151. **https://doi.org/10.1186/s13756-024-01472-8**

Kargaltseva, N., Borisova, O., Kocherovets, VI, Mironov, A., Karpova, EI, Danishuk, OI, Sapronova, EV, Petrachkova, EA, Pimenova, AS, Gadua, N., & Chagina, I. (2022). Diagnosis laboratorium infeksi aliran darah yang didapat dari komunitas dalam patologi terapeutik. *Diagnostik Laboratorium Klinis* , 67(10), 581-587. **https://doi.org/10.51620/0869-2084-2022-67-10-581-587**

Kauffman, C. A., Pappas, P. G., Patterson, T. F., & Sobel, J. D. (2020). *Essentials of clinical mycology* (3rd ed.). Springer.

Kidd, S. E., Chow, N. A., Meyer, W., et al. (2023). A rare fungus among us: Emerging and cryptic fungal pathogens. *Clinical Microbiology Reviews*.

Kim, D. H., Kim, D., Moon, J. W., Chae, S. W., & Rhyu, I. J. (2022). Complications of nasopharyngeal swabs and safe procedures for COVID-19 testing based on anatomical knowledge. *Journal of Korean Medical Science*, *37*(11), e88. **https://doi.org/10.3346/jkms.2022.37.e88**

Kintzinger, L., Neidhöfer, C., Igbinigie, E., Parvu, A., Sifri, C., & Schürch, A. C. (2024). Navigating the evolving landscape of automated antimicrobial susceptibility testing platforms. *Clinical Microbiology and Infection, 30*(4), 447–455. https://doi.org/10.1016/j.cmi.2023.11.008

Koehler, P., Bassetti, M., et al. (2023). Defining and managing invasive aspergillosis in the era of non-culture diagnostics. *The Lancet Infectious Diseases*.

Kremser, M., Weiss, N., Kaufmann-Stoeck, A., Vierbaum, L., Kappler, S., Schellenberg, I., ... & Reischl, U. (2024). Analisis longitudinal 20 tahun skema jaminan mutu eksternal untuk deteksi genom bakteri berbasis PCR/NAAT dalam pengujian diagnostik. *Frontiers in Molecular Biosciences* , 11, 1373114. **https://doi.org/10.3389/fmolb.2024.1373114**

Kurstjens, S., van Dam, A. V., Oortwijn, E., den Elzen, W. P. J., Candido, F., Kusters, R., ... & Frasa, M. (2024). Inkonsistensi dalam rentang referensi feritin antar laboratorium: Suatu perhatian utama untuk pengambilan keputusan klinis. *Kimia Klinis dan Kedokteran Laboratorium, 62*(10), 2108–2120. https://doi.org/10.1515/cclm-2024-0826

Kwon, Y. J., Lim, H., Kim, S., Byun, S. A., Lee, G., Kim, G., … & Shin, J. (2025). Comparison of two susceptibility testing methods for quinupristin/dalfopristin using two interpretive criteria for *Enterococcus faecium* bloodstream isolates. *Annals of Laboratory Medicine, 45*(4), 0585. https://doi.org/10.3343/alm.2024.0585

Larone, D. H. (2022). *Medically important fungi: A guide to identification* (7th ed.). ASM Press.

Larsen, K. D., Jensen, M. M., Homøe, A. S., Arndal, E., Samuelsen, B. G., Koch, A., Nielsen, X. C., Homøe, P., & Todsen, T. (2023). Head-to-head comparison of nasopharyngeal,

oropharyngeal and nasal swabs for SARS-CoV-2 molecular testing. *Diagnostics*, *13*(2), 283. **https://doi.org/10.3390/diagnostics13020283**

Lin, Y. T., Lin, H. H., Chen, C. H., Tseng, K. H., Ho, M. W., & Hsueh, P. R. (2025). Susceptibility interpretive agreement between broth microdilution and disk diffusion for cefiderocol. *Journal of Clinical Microbiology, 63*(12), e01255-25. https://doi.org/10.1128/jcm.01255-25

Lin, Y., Mensah, I. K., Doering, M., Shean, R. C., & Spies, N. C. (2025). Deteksi kesalahan berbasis pembelajaran mesin di laboratorium klinis: Tinjauan kritis. *Tinjauan Kritis dalam Ilmu Laboratorium Klinis, 62*(4), 1–15. https://doi.org/10.1080/10408363.2025.2512468

Lin, Y., Spies, N. C., Zohner, K., McCoy, D. G., Zaydman, M., & Farnsworth, C. (2025). Kesalahan fase pra-analitik merupakan mayoritas kesalahan dalam pengujian laboratorium klinis. *Kimia Klinis dan Kedokteran Laboratorium, 63*(4), 0190. https://doi.org/10.1515/cclm-2025-0190

Magklara, E. P. (2026). The silent spillover threat: Nipah virus epidemiology, pathogenesis, clinical manifestations, and advances in therapeutics and vaccine development. *Microorganisms*, 14(5), 1109. **https://doi.org/10.3390/microorganisms14051109**

Martin, RM, & Bachman, MA (2018). Kolonisasi, infeksi, dan genom aksesori Klebsiella pneumoniae. *Frontiers in Cellular*

and Infection Microbiology , 8, 4. **https://doi.org/10.3389/fcimb.2018.00004**

Mendonça, A., Santos, H., Franco-Duarte, R., & Sampaio, P. (2022). Fungal infections diagnosis—Past, present and future. *Research in Microbiology, 173*(3), 103915. https://doi.org/10.1016/j.resmic.2021.103915

Miller, JM, Binnicker, M., Campbell, S., Carroll, K., Chapin, K., Gilligan, P., ... & Yao, J. (2018). Panduan untuk pemanfaatan laboratorium mikrobiologi untuk diagnosis penyakit menular: Pembaruan 2018 oleh Infectious Diseases Society of America dan American Society for Microbiology. *Clinical Infectious Diseases* , 67(6), e1–e94. **https://doi.org/10.1093/cid/ciy584**

Mishra, D., Satpathy, G., Chawla, R., Venkatesh, P., Ahmed, N., & Panda, S. (2018). Manfaat uji PCR 16S rRNA spektrum luas dibandingkan metode konvensional untuk diagnosis laboratorium endoftalmitis bakteri di rumah sakit perawatan tersier. *British Journal of Ophthalmology* , 103(1), 312877. **https://doi.org/10.1136/bjophthalmol-2018-312877**

Montelongo-Jauregui, D., Vila, T., Sultan, A. S., & Jabra-Rizk, M. A. (2023). Point-of-care testing for antimicrobial susceptibility: From concept to clinical implementation. *Journal of Antimicrobial Chemotherapy, 78*(5), 1113–1124. https://doi.org/10.1093/jac/dkad040

Murray, T. Y. (2025). High paediatric HIV viral load rejection rate in South Africa, a retrospective review. *Southern African*

Journal of HIV Medicine, 26(1), 1687. **https://doi.org/10.4102/sajhivmed.v26i1.1687**

Nagura-Ikeda, M., Imai, K., Tabata, S., Miyoshi, K., Murahara, N., Mizuno, T., ... & Kato, Y. (2020). Clinical evaluation of self-collected saliva by quantitative reverse transcription-PCR (RT-qPCR), direct RT-qPCR, reverse transcription-loop-mediated isothermal amplification, and a rapid antigen test to diagnose COVID-19. *Journal of Clinical Microbiology*, 58(9), 01438-20. **https://doi.org/10.1128/JCM.01438-20**

Najwa, A., Lubis, F. M., Ariestine, D. A., & Wahyuni, D. D. (2026). Profil pasien dermatofitosis superfisial di Rumah Sakit Prof. Dr. Chairuddin Panusunan Lubis Universitas Sumatera Utara. *SCRIPTA SCORE Scientific Medical Journal, 7*(2), 155–164. https://talenta.usu.ac.id/scripta/article/view/24157

Nassiri, O., Bousnina, F., & Hami, A. (2024). Ketidaksesuaian pada fase pra-analitik di laboratorium parasitologi-mikologi Rumah Sakit Universitas Mohammed VI di Oujda. *Cureus, 16*(6), 62632. https://doi.org/10.7759/cureus.62632

Ndunda, JM, Sitati, J., Inziani, M., Achieng, RL, Achieng, J., Kennedy, L., ... & Mwau, M. (2023). Akreditasi laboratorium diagnostik HIV molekuler mengikuti pendekatan Strengthening Laboratory Management Towards Accreditation (SLMTA)-Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA) di Kenya: Sebuah studi ilmu implementasi. *Pan African Medical*

Journal , 46(1), 60. **https://doi.org/10.11604/pamj.2023.46.60.39549**

Nicolaidou, V., Nicolaou, PA, & Nicolaou, S. (2019). Mengubah laboratorium mikrobiologi sarjana berbasis buku resep menjadi berbasis penyelidikan menggunakan studi kasus PBL selama satu semester. *Advances in Physiology Education* , 43(2), 202-213. **https://doi.org/10.1152/advan.00167.2018**

Pappas, P. G., Kauffman, C. A., Andes, D. R., Clancy, C. J., Marr, K. A., Ostrosky-Zeichner, L., et al. (2016). Clinical practice guideline for the management of candidiasis. *Clinical Infectious Diseases, 62*(4), e1–e50.

Paquin, P., Durmort, C., Paulus, C., Vernet, T., Marcoux, P., & Morales, S. (2022). Pembelajaran mendalam berbasis spasial-temporal untuk deteksi dan identifikasi cepat koloni bakteri melalui time-lapse mikroskop tanpa lensa. *PLOS Digital Health* , 1(10), e0000122. **https://doi.org/10.1371/journal.pdig.0000122**

Parihar, A., Sharma, P., Kumar, A., et al. (2024). Recent advances in molecular diagnostics for fungal infections: From conventional methods to next-generation sequencing approaches. *Frontiers in Microbiology*.

Patel, M., Patel, D., Patel, G., & Meshram, D. (2024). Tinjauan tentang sistem manajemen mutu dalam pengujian laboratorium. *World Journal of Biology, Pharmacy and Health Sciences* , 19(2), 0460. **https://doi.org/10.30574/wjbphs.2024.19.2.0460**

Patterson, T. F., Thompson, G. R., III, Denning, D. W., Fishman, J. A., Hadley, S., Herbrecht, R., et al. (2016). Practice guidelines for the diagnosis and management of aspergillosis. *Clinical Infectious Diseases, 63*(4), e1–e60.

Pereira, P. (2023). Trends in the accreditation of medical laboratories by ISO 15189. In *Accreditation and Quality Assurance in Laboratory Medicine*. IntechOpen. https://doi.org/10.5772/intechopen.113829

Perovic, O., Yahaya, A., Viljoen, C., Ndihokubwayo, J., Smith, M., Coulibaly, SO, ... & Frean, J. (2019). Penilaian kualitas eksternal identifikasi bakteri dan pengujian kerentanan antimikroba di laboratorium kesehatan masyarakat nasional Afrika, 2011–2016. *Kedokteran Tropis dan Penyakit Menular*, 4(4), 144. **https://doi.org/10.3390/tropicalmed4040144**

Popovici, R., Bei, M., Domocos, D., Todor, P., & Pogan, M. (2021). Diagnosis laboratorium pada infeksi yang disebabkan oleh Clostridium Difficile. *Pengembangan Medis* , 27(1), 1148. **https://doi.org/10.70921/medev.v27i1.1148**

Popovici, R., Bei, M., Popovici, R., Domocos, D., Todor, P., & Pogan, M. (2021). Metode isolasi dan identifikasi Enterobacteriaceae. *Perkembangan Medis* , 27(2), 1135. **https://doi.org/10.70921/medev.v27i2.1135**

Privato, R., Trapani, S., Venturini, E., Moriondo, M., Nieddu, F., Azzari, C., ... & Indolfi, G. (2025). Blood and pharyngeal swab polymerase chain reaction testing: Diagnostic and therapeutic implications in children with acute nonbacterial

encephalitis. *The Pediatric Infectious Disease Journal*, 44(6), 4898. **https://doi.org/10.1097/INF.0000000000004898**

Puechler, A., Haller, S., Schubert, S., & Wicha, S. G. (2023). Gradient strip (E-test) accuracy for MIC determination: A systematic comparison against broth microdilution. *Clinical Microbiology and Infection, 29*(7), 900–907. https://doi.org/10.1016/j.cmi.2023.03.010

Rahman, MT, Sobur, MA, Islam, MS, Ievy, S., Hossain, MJ, El Zowalaty, ME, ... & Ashour, HM (2020). Penyakit zoonosis: Etiologi, dampak, dan pengendalian. *Mikroorganisme* , 8(9), 1405. **https://doi.org/10.3390/microorganisms8091405**

Ramirez-Plascencia, HHF, Colima-Fausto, AG, Licona-Lasteros, K., Díaz-Zaragoza, M., Cazarez-Navarro, G., Macías-Barragán, J., & Rodriguez-Preciado, SY (2025). Kehadiran mikroorganisme di lingkungan: Pendekatan One Health. *Mikroorganisme* , 13(11), 2435. **https://doi.org/10.3390/microorganisms13112435**

Ravi, P., Rao, M., Chitharagi, VB, & Vidyavathi, B. (2025). Meningkatkan akurasi kultur mikrobiologi: Audit klinis tentang peran mikroskopi langsung dan sistem penilaian Bartlett dalam korelasi diagnostik sampel dahak. *Jurnal Internasional Penelitian Ilmu Kedokteran* , 13(8), 1-8. **https://doi.org/10.18203/2320-6012.ijrms20253962**

Robinson, P., Qazi, MS, & Bajare, B. (2026). Profil bakteriologis infeksi aliran darah pada orang dewasa di rumah sakit perawatan tersier di India tengah: Sebuah studi potong lintang

analitik. *Annals of Pathology and Laboratory Medicine* , 3(1), 3740. **https://doi.org/10.21276/apalm.3740**

Salinas, M., Torreblanca, R., Sanchez, E., Blasco, Á., Flores, E., & López-Garrigós, M. (2024). Mengelola pemesanan tes laboratorium: Sebuah tantangan dalam model kedokteran laboratorium baru. *Kemajuan dalam Kedokteran Laboratorium, 5*(2), 54–67. https://doi.org/10.1515/almed-2024-0085

Sanchez, G. V., Fleming-Dutra, K. E., Roberts, R. M., & Hicks, L. A. (2024). Whole-genome sequencing-based antimicrobial resistance prediction for *Enterobacterales*: Accuracy and limitations. *Antimicrobial Agents and Chemotherapy, 68*(1), e01500-23. https://doi.org/10.1128/aac.01500-23

Sande, S., & Rajguru, M. (2025). Transformasi mikrobiologi medis: Peran kecerdasan buatan. *Jurnal Mikrobiologi Murni & Terapan* , 19(3), 36–49. **https://doi.org/10.22207/jpam.19.3.36**

Sciacovelli, L., Padoan, A., Aita, A., Basso, D., & Plebani, M. (2023). Indikator kualitas dalam kedokteran laboratorium: Kondisi terkini, spesifikasi kualitas, dan strategi masa depan. *Kimia Klinis dan Kedokteran Laboratorium* , 61(2), 254–272. **https://doi.org/10.1515/cclm-2022-1143**

Segal, E., & Elad, D. (2021). Human and zoonotic dermatophytoses: Epidemiological aspects. *Frontiers in Microbiology, 12*, 713532. https://doi.org/10.3389/fmicb.2021.713532

Shakthi, K., & Venkatesha, D. (2019). Evaluation of Calcofluor White staining for rapid detection of fungal elements in clinical specimens. *Journal of Clinical and Diagnostic Research*.

Sharma, AK, Sidhu, SS, & Jena, BR (2023). Evaluasi laboratorium pencucian transtrakeal (TTW) pada kerbau yang terinfeksi saluran pernapasan bawah. *Indian Journal of Animal Research* , 57(9), 5099. **https://doi.org/10.18805/ijar.b-5099**

Shen, Y., Zhai, D., Li, Y., Gui, T., & Zuo, D. (2026). Evaluasi dampak manajemen siklus PDCA terhadap tingkat kualitas spesimen antikoagulasi heparin di unit perawatan neurorespirasi. *Pakistan Journal of Pharmaceutical Sciences, 39*(1), 15056. https://doi.org/10.36721/PJPS.2026.39.1.REG.15056.1

Simner, P., Harris, H. T., Jacobs, E. B., Stambaugh, H., Bhalodi, A., Fisher, M. A., … & Humphries, R. M. (2025). Establishing CLSI M45 antimicrobial susceptibility testing methods and breakpoints for non-*aeruginosa Pseudomonas* species. *Journal of Clinical Microbiology, 63*(6), e00368-25. https://doi.org/10.1128/jcm.00368-25

Sirkeck, A., Bhardwaj, V., & Kalia, KK (2022). Jaminan mutu dalam mikrobiologi klinis: Pendahuluan, jenis jaminan mutu, tujuan dan kontrol mutu yang umum digunakan. *Jurnal Internasional untuk Penelitian dalam Ilmu Terapan dan Alam* , 2(2), 1–25. **https://doi.org/10.47310/iarjcr.2022.v02i02.001**

Sosah, FK, Odoom, A., Anim-Baidoo, I., & Donkor, ES (2025). Berapa lama patogen bertahan dan hidup di dalam air? Tinjauan sistematis. *Frontiers in Microbiology* , 16, 1654785. **https://doi.org/10.3389/fmicb.2025.1654785**

Sudhir, TB, Laxmi, B., Meera, M., & Lata, GS (2026). Signifikansi media cair dalam mikrobiologi medis. *Nigerian Journal of Microbiology Research & Reviews* , 12(102), 1–15. **https://doi.org/10.65786/njmrys.2026.12102**

TalbAllah, S. M., Alruwaili, A. M., & Sattam, K. (2024). Kesalahan pra-analitik melalui kolaborasi efektif antara perawat dan profesional laboratorium. *Jurnal Internasional Keterlibatan Komunitas dan Perubahan Sosial*, 4237. https://doi.org/10.22399/ijcesen.4237

Thakur, A., Mikkelsen, H., & Jungersen, G. (2019). Patogen intraseluler: Imunitas inang dan strategi persistensi mikroba. *Jurnal Penelitian Imunologi* , 2019, 1356540. **https://doi.org/10.1155/2019/1356540**

Tian, P. P., Yang, H., Wang, T., Wang, L., Du, M. Y., Su, S. S., … & Yi, H. W. (2025). Evaluation of EUCAST rapid antimicrobial susceptibility testing for Gram-negative bacteria directly from positive blood cultures. *Infectious Diseases and Research*, 514981, 1–15. https://doi.org/10.2147/IDR.S514981

Tishchenko, A., Shumkov, MS, Kazakova, E., Tarasova, I., Karpov, D., Kopyltsov, S., & Goncharenko, AV (2025). Dasar genetik resistensi antibiotik ganda strain Escherichia coli patogen yang

diisolasi dari kompleks peternakan di Krasnodar Krai, Rusia. *Jurnal Internasional Ilmu Molekuler* , 27(1), 305. **https://doi.org/10.3390/ijms27010305**

Todt, S. (2024). Serology tests in virology: A critical tool for diagnosis and surveillance. *Virology & Mycology*, *13*(3), Artikel 1000302. **https://doi.org/10.35248/2161-0517.24.13.302**

Torres-Sangiao, E., & Gestal, MC (2016). Nanobiomaterial canggih: Vaksin, diagnosis dan pengobatan penyakit menular. *Molecules* , 21(7), 867. **https://doi.org/10.3390/molecules21070867**

Urban, K., Chu, S., Scheufele, C., Giesey, R. L., Mehrmal, S., Uppal, P., & Delost, G. R. (2021). The global, regional, and national burden of fungal skin diseases in 195 countries and territories: A cross-sectional analysis from the Global Burden of Disease Study 2017. *JAAD International, 2*, 22–27. https://doi.org/10.1016/j.jdin.2020.10.003

van Balveren, J. A., Verboeket-van de Venne, W. P., Erdem-Eraslan, L., de Graaf, A. D., Loot, A. E., Musson, R. E. A., ... & Hoedemakers, R. (2019). Kesalahan diagnostik akibat interaksi uji obat-laboratorium. *Diagnosa, 6*(1), 27–36. https://doi.org/10.1515/dx-2018-0098

Vasala, A., Hytnen, V., & Laitinen, O. (2020). Alat modern untuk diagnosis cepat resistensi antimikroba. *Frontiers in Cellular and Infection Microbiology* , 10, 308. **https://doi.org/10.3389/fcimb.2020.00308**

Vasconcelos-Martins, A. C., Giovanetti, M., Elias, M. C., Slavov, S. N., & Sampaio, S. C. (2026). Loop-Mediated Isothermal Amplification (LAMP) for the Diagnosis of High-Burden Viral Diseases in Resource-Limited Countries. *Pathogens*, *15*(3), 248. **https://doi.org/10.3390/pathogens15030248**

Vincent, AT, Schiettekatte, O., Goarant, C., Kumari Neela, V., Bernet, È., Thibeaux, R., ... & Picardeau, M. (2019). Meninjau kembali taksonomi dan evolusi patogenisitas genus Leptospira melalui prisma genomik. *PLOS Neglected Tropical Diseases* , 13(5), e0007270. **https://doi.org/10.1371/journal.pntd.0007270**

Vintil, C.-M., Coeriu, R., Mare, A., Ciurea, C., Tognel, R., Simion, A., ... & Man, A. (2024). Development of a triplex endpoint PCR assay for the detection of SARS-CoV-2: Insights on cost-efficiency and method design. *Advances in Virology*, 2024, 542308. **https://doi.org/10.1159/000542308**

Wang, H., Zhang, W., & Tang, Y. (2022). Mikrobiologi klinis dalam deteksi dan identifikasi patogen mikroba yang muncul: Masa lalu, masa kini, dan masa depan. *Emerging Microbes & Infections* , 11(1), 2125-2145. **https://doi.org/10.1080/22221751.2022.2125345**

Wenzler, E., Maximos, M., Asempa, T., Biehle, L. R., Schuetz, A., & Hirsch, E. B. (2023). Antimicrobial susceptibility testing: An updated primer for clinicians in the era of antimicrobial

resistance. *Pharmacotherapy, 43*(2), 127–159. https://doi.org/10.1002/phar.2781

Wiley, M. A., & Reid, J. L. (2024). Peran keperawatan dalam mengurangi kesalahan laboratorium melalui manajemen spesimen: Tinjauan naratif. *Healthcare Professionals*, 202522345. https://doi.org/10.64483/202522345

Wilkendorf, L. S., Bowles, E., Buil, J. B., et al. (2020). Update on MALDI-TOF MS identification of filamentous fungi. *Journal of Clinical Microbiology, 58*(12), e01263-20. https://doi.org/10.1128/JCM.01263-20

Wolk, DM, Parrott, JS, Babady, N., Mochon, AB, Tom, RJ, Diel, C., ... & Wood, R. (2025). Pedoman praktik kedokteran laboratorium berbasis bukti dari American Society for Microbiology untuk diagnosis infeksi aliran darah menggunakan tes cepat: Tinjauan sistematis dan meta-analisis. *Clinical Microbiology Reviews* , 38(6), e00137–e24. **https://doi.org/10.1128/cmr.00137-24**

Woolhouse, ME, & Gowtage-Sequeria, S. (2005). Kisaran inang dan patogen yang muncul dan muncul kembali. *Penyakit Menular yang Muncul* , 11(12), 1050997. **https://doi.org/10.3201/eid1112.050997**

World Health Organization. (2020). *Laboratory biosafety manual* (4th ed.). Geneva: World Health Organization.

World Health Organization. (2022). *World Health Organization fungal priority pathogens list*. World Health Organization.

Zaporojan, N., Negrean, R., Hodian, R., Zaporojan, C., Csep, A., & Zaha, D. (2024). Evolusi diagnosis laboratorium tuberkulosis. *Klinik dan Praktik* , 14(2), 30. **https://doi.org/10.3390/clinpract14020030**

Zhang, H., Wang, M., Ding, B., Hu, F., & Chen, S. (2021). Evaluation of very major error rates in antimicrobial susceptibility testing systems for Gram-negative bacteria. *Journal of Clinical Microbiology, 59*(6), e02982-20. https://doi.org/10.1128/JCM.02982-20

Zhang, W., Sun, H., He, S., Chen, X., Yao, L., Zhou, L., ... & Hong, W. (2022). Mikroskopi Raman majemuk untuk diagnosis cepat dan pengujian kerentanan antimikroba bakteri patogen dalam urin. *Frontiers in Microbiology* , 13, 874966. **https://doi.org/10.3389/fmicb.2022.874966**

Zhao, Y., Zhang, W., & Zhang, X. (2024). Application of metagenomic next-generation sequencing in the diagnosis of infectious diseases. *Frontiers in Cellular and Infection Microbiology*, *14*, 1458316. **https://doi.org/10.3389/fcimb.2024.1458316**

Zhu, W., Xu, Y., Chen, T., & Shi, M. (2025). Karakteristik distribusi mikroorganisme aerosol di ruang bronkoskopi dan penilaian risiko infeksi nosokomial. *Frontiers in Public Health* , 13, 1556364. **https://doi.org/10.3389/fpubh.2025.1556364**

Zorbozan, O., Zorbozan, N., & Turgay, N. (2019). Evaluasi proses pra-analitik dengan indikator kualitas dan metodologi *Six Sigma* di laboratorium parasitologi pusat layanan kesehatan

tersier. *Buletin Mikrobiologi*, 68362. https://doi.org/10.5578/mb.68362

PT Cipta Digital Edukasi

Buku ***Mikrobiologi Medis dalam Pemeriksaan Laboratorium*** membahas dunia mikroorganisme penyebab penyakit serta perannya dalam proses pemeriksaan di laboratorium kesehatan. Pembaca diajak mengenal bakteri, virus, jamur, dan parasit, termasuk cara identifikasi, pengambilan sampel, keamanan kerja, serta makna hasil pemeriksaan bagi penanganan kesehatan.

Disusun dengan bahasa yang jelas dan mudah dipahami, buku ini dijual untuk masyarakat umum yang ingin memahami bagaimana pemeriksaan mikrobiologi membantu mengenali infeksi dan mendukung keputusan kesehatan secara lebih tepat.

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