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DAFTAR PUSTAKA

Aburima, A., Berger, M., Spurgeon, B. E. J., Webb, B. A., Wraith, K. S., Febbraio, M., Poole, A. W., & Naseem, K. M. (2021). Thrombospondin-1 promotes hemostasis through modulation of cAMP signaling in blood platelets. *Blood*, *137*(5), 678–689. https://doi.org/10.1182/blood.2020005382

Ahangar, P., Strudwick, X. L., & Cowin, A. J. (2022). Wound Healing from an Actin Cytoskeletal Perspective. Cold Spring Harbor Perspectives. *Biology*, *14*(8). https://doi.org/10.1101/cshperspect.a041235

Al Madhoun, A., Sindhu, S., Haddad, D., Atari, M., Ahmad, R., & Al-Mulla, F. (2021). Dental Pulp Stem Cells Derived From Adult Human Third Molar Tooth: A Brief Review. *Frontiers in cell and developmental biology*, *9*, 717624. https://doi.org/10.3389/fcell.2021.717624

Al Shammrie, F. F., Alhemshy, L. Z., Althawy, M. M., Alfaraj, M. M., Alotaibi, A. S., Alali, D. S., Alsaggaf, O. H., Alhamashi, L. Z., & Albelowi, L. M. (2025). The Efficacy of MSC-Derived Exosome-Based Therapies in Treating Scars, Aging and Hyperpigmentation: A Systematic Review of Human Clinical Outcomes. *Reports (MDPI)*, *8*(4), 268. https://doi.org/10.3390/reports8040268

Almendros, A., Nekouei, O., Moores, C., Jesky, R., Baiker, K., & Tse, M. (2025). Case Report: Xenogeneic mesenchymal stem cell secretome for the treatment of feline chronic gingivostomatitis. *Frontiers in veterinary science*, *12*, 1603383. https://doi.org/10.3389/fvets.2025.1603383

Alsulaimani, R. S., Ajlan, S. A., Aldahmash, A. M., Alnabaheen, M. S., & Ashri, N. Y. (2016). Isolation of dental pulp stem cells from a single donor and characterization of their ability to differentiate after 2 years of cryopreservation. *Saudi Medical Journal*, *37*(5). https://doi.org/10.15537/smj.2016.5.13615

Amarasinghe, I., Phillips, W., Hill, A. F., Cheng, L., Helbig, K. J., Willms, E., & Monson, E. A. (2023). Cellular communication through extracellular vesicles and lipid droplets. *Journal of extracellular biology*, *2*(3), e77. https://doi.org/10.1002/jex2.77

Barman, S., Sarkar, A., & Mandal, S. (2025). Screening of polymerization effect with Alginate-HPMC-Guar gum on Polymer-Based Interpenetrating Networks in Sodium Alginate Raft System for Sustained Drug Delivery. *International Journal of Pharmaceutical & Biological Archives 2025; 16(2):1-9.* https://doi.org/10.22377/ijpba.v16i02.2181

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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Byrd, A. L., Belkaid, Y., & Segre, J. A. (2018). The human skin microbiome. *Nature reviews. Microbiology*, *16*(3), 143–155. https://doi.org/10.1038/nrmicro.2017.157

Carreira, L. M., Silva, R., Alves, J., Inácio, F., Pires, G., & Azevedo, P. (2024). The Use of Fast-Acting Insulin Topical Solution on Skin to Promote Surgical Wound Healing in Cats. *Animals : an open access journal from MDPI*, *14*(9), 1358. https://doi.org/10.3390/ani14091358

Chalisserry, E. P., Nam, S. Y., Park, S. H., & Anil, S. (2017). Therapeutic potential of dental stem cells. *Journal of tissue engineering*, *8*, 2041731417702531. https://doi.org/10.1177/2041731417702531

Chekol Abebe, E., Tilahun Muche, Z., Behaile T/Mariam, A., Mengie Ayele, T., Mekonnen Agidew, M., Teshome Azezew, M., Abebe Zewde, E., Asmamaw Dejenie, T., & Asmamaw Mengstie, M. (2022). The structure, biosynthesis, and biological roles of fetuin-A: A review. *Frontiers in cell and developmental biology*, *10*, 945287. https://doi.org/10.3389/fcell.2022.945287

Chelmu Voda, C., Stefanopol, I. A., Gurau, G., Hîncu, M. A., Popa, G. V., Mateescu, O. G., Baroiu, L., & Mehedinti, M. C. (2025). Update on the Study of Angiogenesis in Surgical Wounds in Patients with Childhood Obesity. *Biomedicines*. 13 (2). https://doi.org/10.3390/biomedicines13020375

Chen, G. Y., Fu, L. L., Ye, H. P., Cheng, P., Feng, H. C., & Yan, M. (2025). Effects of exosomes from human dental pulp stem cells on the biological behavior of human fibroblasts. *Scientific Reports*, *15*(1), 1134. https://doi.org/10.1038/s41598-024-78388-1

Chen, J., Wang, J., Hart, D. A., Zhou, Z., Ackermann, P. W., & Ahmed, A. S. (2023). Complement factor D regulates collagen type I expression and fibroblast migration to enhance human tendon repair and healing outcomes. *Frontiers in immunology*, *14*, 1225957. https://doi.org/10.3389/fimmu.2023.1225957

Chen, J., Huo, X., Qian, M., Xue, Q., He, Y., Xu, P., Wang, Y., Tang, X., Luo, Q., Bao, H., & Xiong, Y. (2025). Exosomes Derived From Human Mesenchymal Stem Cells Mitigate Follicular Interstitial Cell Ferroptosis via the miR-26a-5p/PTEN/GPX4 Axis in Rats with Chemotherapy-Induced Premature Ovarian Insufficiency. *International journal of nanomedicine*, *20*, 10195–10212. https://doi.org/10.2147/IJN.S532207

Chen, Q., Shou, P., Zheng, C., Jiang, M., Cao, G., Yang, Q., Cao, J., Xie, N., Velletri, T., Zhang, X., Xu, C., Zhang, L., Yang, H., Hou, J., Wang, Y., & Shi, Y. (2016). Fate decision of mesenchymal stem cells: adipocytes or

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

osteoblasts?. *Cell death and differentiation*, *23*(7), 1128–1139. https://doi.org/10.1038/cdd.2015.168

Choi, H. J., Khan, Z. A., Ansari, A., Choi, J., Kim, E. J., Han, S.-H., Song, H.-J., Jeong, O. C., & Hong, Y. (2025). Comparison of Wound Healing Effects of Different Micro-Patterned Hydrogels on the Skin of Secondary Intention Rat Model. *Gels*, *11*(4), 239. https://doi.org/10.3390/gels11040239

Coden, M. E., & Berdnikovs, S. (2020). Eosinophils in wound healing and epithelial remodeling: Is coagulation a missing link? *Journal of Leukocyte Biology.* 108(1). https://doi.org/10.1002/JLB.3MR0120-390R

Corbella, E., Fara, C., Covarelli, F., Porreca, V., Palmisano, B., Mignogna, G., Corsi, A., Riminucci, M., Maras, B., & Mancone, C. (2024). THBS1 and THBS2 Enhance the In Vitro Proliferation, Adhesion, Migration and Invasion of Intrahepatic Cholangiocarcinoma Cells. *International journal of molecular sciences*, *25*(3), 1782. https://doi.org/10.3390/ijms25031782

D'Arrigo, D., Roffi, A., Cucchiarini, M., Moretti, M., Candrian, C., & Filardo, G. (2019). Secretome and Extracellular Vesicles as New Biological Therapies for Knee Osteoarthritis: A Systematic Review. *Journal of clinical medicine*, *8*(11), 1867. https://doi.org/10.3390/jcm8111867

Dinh, P. C., Paudel, D., Brochu, H., Popowski, K. D., Gracieux, M. C., Cores, J., Huang, K., Hensley, M. T., Harrell, E., Vandergriff, A. C., George, A. K., Barrio, R. T., Hu, S., Allen, T. A., Blackburn, K., Caranasos, T. G., Peng, X., Schnabel, L. V., Adler, K. B., Lobo, L. J., Cheng, K. (2020). Inhalation of lung spheroid cell secretome and exosomes promotes lung repair in pulmonary fibrosis. *Nature communications*, *11*(1), 1064. https://doi.org/10.1038/s41467-020-14344-7

Dissanayaka, W. L., Zhu, X., Zhang, C., & Jin, L. (2011). Characterization of dental pulp stem cells isolated from canine premolars. *Journal of endodontics*, *37*(8), 1074–1080. https://doi.org/10.1016/j.joen.2011.04.004

Dominici, M., Le Blanc, K., Mueller, I., Slaper-Cortenbach, I., Marini, F., Krause, D., Deans, R., Keating, A., Prockop, D.j, & Horwitz, E. (2006). Minimal criteria for defining multipotent mesenchymal stromal cells. The International Society for Cellular Therapy position statement. *Cytotherapy*, *8*(4), 315–317. https://doi.org/10.1080/14653240600855905

Eckmann, C., Aghdassi, S. J. S., Brinkmann, A., Pletz, M., & Rademacher, J. (2024). Perioperative Antibiotic Prophylaxis—Indications and Modalities for the Prevention of Postoperative Wound Infection. *Deutsches Arzteblatt*

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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international, *121*(7), 233–242. https://doi.org/10.3238/arztebl.m2024.0037

Espinel-Rupérez, J., Martín-Ríos, M. D., Salazar, V., Baquero-Artigao, M. R., & Ortiz-Díez, G. (2019). Incidence of surgical site infection in dogs undergoing soft tissue surgery: risk factors and economic impact. *Veterinary record open*, *6*(1), e000233. https://doi.org/10.1136/vetreco-2017-000233

Fan Chiang, Y. H., Lee, Y. W., Lam, F., Liao, C. C., Chang, C. C., & Lin, C. S. (2023). Smoking increases the risk of postoperative wound complications: A propensity score-matched cohort study. *International wound journal*, *20*(2), 391–402. https://doi.org/10.1111/iwj.13887

Feng, P., Luo, Y., Ke, C., Qiu, H., Wang, W., Zhu, Y., Hou, R., Xu, L., & Wu, S. (2021). Chitosan-Based Functional Materials for Skin Wound Repair: Mechanisms and Applications. *Frontiers in bioengineering and biotechnology*, *9*, 650598. https://doi.org/10.3389/fbioe.2021.650598

Fernández-Guarino, M., Hernández-Bule, M. L., & Bacci, S. (2023). Cellular and Molecular Processes in Wound Healing. *Biomedicines*. 11 (9). https://doi.org/10.3390/biomedicines11092526

França, C. M., Riggers, R., Muschler, J. L., Widbiller, M., Lococo, P. M., Diogenes, A., & Bertassoni, L. E. (2019). 3D-Imaging of Whole Neuronal and Vascular Networks of the Human Dental Pulp via CLARITY and Light Sheet Microscopy. *Scientific reports*, *9*(1), 10860. https://doi.org/10.1038/s41598-019-47221-5

Friedenstein, A. J., Chailakhjan, R. K., & Lalykina, K. S. (1970). The development of fibroblast colonies in monolayer cultures of guinea-pig bone marrow and spleen cells. *Cell and tissue kinetics*, *3*(4), 393–403. https://doi.org/10.1111/j.1365-2184.1970.tb00347.x

Ganesh, V., Seol, D., Gomez-Contreras, P. C., Keen, H. L., Shin, K., & Martin, J. A. (2023). Exosome-Based Cell Homing and Angiogenic Differentiation for Dental Pulp Regeneration. *International Journal of Molecular Sciences*, *24*(1). https://doi.org/10.3390/ijms24010466

Gerke, V., Gavins, F. N. E., Geisow, M., Grewal, T., Jaiswal, J. K., Nylandsted, J., & Rescher, U. (2024). Annexins—a family of proteins with distinctive tastes for cell signaling and membrane dynamics. *Nature Communications*, *15*(1). https://doi.org/10.1038/s41467-024-45954-0

Gholami Farashah, M. S., Javadi, M., Mohammadi, A., Soleimani Rad, J., Shakouri, S. K., & Roshangar, L. (2022). Bone marrow mesenchymal stem cell's exosomes as key nanoparticles in osteogenesis and bone regeneration:

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

specific capacity based on cell type. *Molecular biology reports*, *49*(12), 12203–12218. https://doi.org/10.1007/s11033-022-07807-1

Gopalarethinam, J., Nair, A. P., Iyer, M., Vellingiri, B., & Subramaniam, M. D. (2023). Advantages of mesenchymal stem cell over the other stem cells. *Acta histochemica*, *125*(4), 152041. https://doi.org/10.1016/j.acthis.2023.152041

Goryunov, K., Ivanov, M., Kulikov, A., Shevtsova, Y., Burov, A., Podurovskaya, Y., Zubkov, V., Degtyarev, D., Sukhikh, G., & Silachev, D. (2024). A Review of the Use of Extracellular Vesicles in the Treatment of Neonatal Diseases: Current State and Problems with Translation to the Clinic. *International Journal of Molecular Sciences, 25(5), 2879*. https://doi.org/10.3390/ijms25052879

Gurung, S., Perocheau, D., Touramanidou, L., & Baruteau, J. (2021). The exosome journey: from biogenesis to uptake and intracellular signalling. *Cell communication and signaling : CCS*, *19*(1), 47. https://doi.org/10.1186/s12964-021-00730-1

Gronthos, S., Mankani, M., Brahim, J., Robey, P. G., & Shi, S. (2000). Postnatal human dental pulp stem cells (DPSCs) in vitro and in vivo. *Proceedings of the National Academy of Sciences of the United States of America*, *97*(25), 13625–13630. https://doi.org/10.1073/pnas.240309797

Han, R., Yang, Z., Hoi Po Hui, J. (2025). Stem Cells: Different Families. In: Gobbi, A., Nakamura, N., Lane, J.G., Dallo, I. (eds) Regenerative Medicine in Sports and Orthopaedics. Springer, Cham. https://doi.org/10.1007/978-3-031-84693-9_8

Hastuti, S., Idroes, R., Imran, I., Ramli, Y., Abas, A. H., & Tallei, T. E. (2022). hUMSC vs. hUMSC-Exosome: Which One Is Better for Epilepsy?. *Pharmaceuticals (Basel, Switzerland)*, *15*(10), 1247. https://doi.org/10.3390/ph15101247

Hoang, D.M., Pham, P.T., Bach, T.Q. *et al.* Stem cell-based therapy for human diseases. *Sig Transduct Target Ther* **7**, 272 (2022). https://doi.org/10.1038/s41392-022-01134-4

Hodgson-Garms, M., Moore, M. J., Martino, M. M., Kelly, K., & Frith, J. E. (2025). Proteomic profiling of iPSC and tissue-derived MSC secretomes reveal a global signature of inflammatory licensing. *NPJ Regenerative medicine*, *10*(1), 7. https://doi.org/10.1038/s41536-024-00382-y

Hong, S., Lee, H. J., Jung, D. S., Erdenebileg, S., Hwang, H., Kwon, H. C., Kwon, J., & Yoo, G. (2025). Exploring the Anti-Osteoporotic Effects of n-Hexane Fraction from Cotoneaster wilsonii Nakai: Activation of Runx2 and

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Osteoblast Differentiation In Vivo. *Pharmaceuticals*, *18*(1). https://doi.org/10.3390/ph18010045

Jakovija, A., & Chtanova, T. (2023). Skin immunity in wound healing and cancer. In *Frontiers in Immunology*. 14. https://doi.org/10.3389/fimmu.2023.1060258

Ji, R.R., Cheng, J., Ji, J.. (2023) Neuroimmune Interactions in Pain: *Mechanisms and Therapeutics*. https://doi.org/10.1007/978-3-031-29231-6.

Jin W., Ren, D., Yu, M., Li, Y., Zhang, W., Guo, S. (2025) Selective Autophagy: A Potential Player in Cutaneous Wound Healing. *Adv Wound Care (New Rochelle)*. https://doi.org/10.1177/21621918251372954.

Kan, C., Yang, J., Fan, H., Dai, Y., Wang, X., Chen, R., Liu, J., Meng, X., Wang, W., Li, G., Zhou, J., Zhang, Y., Zhu, W., Fang, S., Wei, H., Zheng, H., Wang, S., & Ni, F. (2022). Fetuin-A is an immunomodulator and a potential therapeutic option in BMP4-dependent heterotopic ossification and associated bone mass loss. *Bone research*, *10*(1), 62. https://doi.org/10.1038/s41413-022-00232-x

Kashyap, V., Rezende, N. C., Scotland, K. B., Shaffer, S. M., Persson, J. L., Gudas, L. J., & Mongan, N. P. (2009). Regulation of stem cell pluripotency and differentiation involves a mutual regulatory circuit of the NANOG, OCT4, and SOX2 pluripotency transcription factors with polycomb repressive complexes and stem cell microRNAs. *Stem cells and development*, *18*(7), 1093–1108. https://doi.org/10.1089/scd.2009.0113

Kim, S. W., Lim, K. M., Cho, S. G., Ryu, B., Kim, C. Y., Park, S. Y., Jang, K., Jung, J. H., Park, C., Choi, C., & Kim, J. H. (2024). Efficacy of Allogeneic and Xenogeneic Exosomes for the Treatment of Canine Atopic Dermatitis: A Pilot Study. *Animals : an open access journal from MDPI*, *14*(2), 282. https://doi.org/10.3390/ani14020282

Kolios, G., & Moodley, Y. (2013). Introduction to stem cells and regenerative medicine. *Respiration; international review of thoracic diseases*, *85*(1), 3–10. https://doi.org/10.1159/000345615

Kono, H., & Rock, K. L. (2008). How dying cells alert the immune system to danger. *Nature reviews. Immunology*, *8*(4), 279–289. https://doi.org/10.1038/nri2215

Krešić, N., Prišlin, M., Vlahović, D., Kostešić, P., Ljolje, I., Brnić, D., Turk, N., Musulin, A., & Habrun, B. (2021). The expression pattern of surface markers in canine adipose-derived mesenchymal stem cells. *International Journal of Molecular Sciences*, *22*(14). https://doi.org/10.3390/ijms22147476

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Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Lee, Y.S., Lee, H..J, Jo, C. (2026) Integrative Adipogenic Engineering of Cultured Fat for Cell Based Meat. *Comprehensive Reviews in Food Science and Food Safety*;25. https://doi.org/10.1111/1541-4337.70338.

Leung, V. Y. L., Gao, B., Leung, K. K. H., Melhado, I. G., Wynn, S. L., Au, T. Y. K., Dung, N. W. F., Lau, J. Y. B., Mak, A. C. Y., Chan, D., & Cheah, K. S. E. (2011). SOX9 governs differentiation stage-specific gene expression in growth plate chondrocytes via direct concomitant transactivation and repression. *PLoS Genetics*, *7*(11). https://doi.org/10.1371/journal.pgen.1002356

Lin, T. Y., Huang, T. Y., Chiu, H. C., Chung, Y. Y., Lin, W. C., Lin, H. Y., & Lee, S. Y. (2025). 2,3,5,4'-tetrahydroxystilbene-2-O-β-D-glucoside-stimulated dental pulp stem cells-derived exosomes for wound healing and bone regeneration. *Journal of dental sciences*, *20*(1), 154–163. https://doi.org/10.1016/j.jds.2024.09.010

Lin, C. S., Xin, Z. C., Dai, J., & Lue, T. F. (2013). Commonly used mesenchymal stem cell markers and tracking labels: Limitations and challenges. *Histology and histopathology*, *28*(9), 1109–1116. https://doi.org/10.14670/HH-28.1109

Liu, P., An, Y., Zhu, T., Tang, S., Huang, X., Li, S., Fu, F., Chen, J., & Xuan, K. (2023). Mesenchymal stem cells: Emerging concepts and recent advances in their roles in organismal homeostasis and therapy. *Frontiers in cellular and infection microbiology*, *13*, 1131218. https://doi.org/10.3389/fcimb.2023.1131218

Lu, W., & Allickson, J. (2025). Mesenchymal stromal cell therapy: Progress to date and future outlook. *Molecular therapy : the journal of the American Society of Gene Therapy*, *33*(6), 2679–2688. https://doi.org/10.1016/j.ymthe.2025.02.003

Machado, M. G., Patente, T. A., Rouillé, Y., Heumel, S., Melo, E. M., Deruyter, L., Pourcet, B., Sencio, V., Teixeira, M. M., & Trottein, F. (2022). Acetate Improves the Killing of *Streptococcus pneumoniae* by Alveolar Macrophages *via* NLRP3 Inflammasome and Glycolysis-HIF-1α Axis. *Frontiers in immunology*, *13*, 773261. https://doi.org/10.3389/fimmu.2022.773261

Mai, Z., Chen, H., Ye, Y., Hu, Z., Sun, W., Cui, L., & Zhao, X. (2021). Translational and Clinical Applications of Dental Stem Cell-Derived Exosomes. *Frontiers in genetics*, *12*, 750990. https://doi.org/10.3389/fgene.2021.750990

Mamun, A. Al, Shao, C., Geng, P., Wang, S., & Xiao, J. (2024). Recent advances in molecular mechanisms of skin wound healing and its treatments. In

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Frontiers in Immunology (15). https://doi.org/10.3389/fimmu.2024.1395479

Manon-Jensen, T., Kjeld, N. G., & Karsdal, M. A. (2016). Collagen-mediated hemostasis. *Journal of thrombosis and haemostasis : JTH*, *14*(3), 438–448. https://doi.org/10.1111/jth.13249

Mei, R., Wan, Z., Yang, C., Shen, X., Wang, R., Zhang, H., Yang, R., Li, J., Song, Y., & Su, H. (2024). Advances and clinical challenges of mesenchymal stem cell therapy. *Frontiers in immunology*, *15*, 1421854. https://doi.org/10.3389/fimmu.2024.1421854

Min, Q., Yang, L., Tian, H., Tang, L., Xiao, Z., & Shen, J. (2023). Immunomodulatory Mechanism and Potential Application of Dental Pulp-Derived Stem Cells in Immune-Mediated Diseases. *International journal of molecular sciences*, *24*(9), 8068. https://doi.org/10.3390/ijms24098068

Muller-Sloof, E., de Laat, E., Zwanenburg, P., Wijlens, A., Vermeulen, H., Hummelink, S., & Ulrich, D. (2024). Exploring the definition of surgical wound dehiscence in literature: a Scoping Review. *Journal of tissue viability*, *33*(4), 923–929. https://doi.org/10.1016/j.jtv.2024.09.006

Ning, X., Liu, R., Huang, Y., Huang, Z., Li, H., Li, Q., Sheng, Z., & Wu, J. (2024). Dental Stem Cell-Derived Exosomes: A Review of Their Isolation, Classification, Functions, and Mechanisms. *Stem cells international*, *2024*, 2187392. https://doi.org/10.1155/2024/2187392

Ozon, E. A., Burloiu, A. M., Musuc, A. M., Manda, G., Anuta, V., Dinu-Pîrvu, C. E., Lupuliasa, D., Neagoe, I. V., Anastasescu, M., Socoteanu, R. P., Atkinson, I., Mitran, R.-A., Culita, D. C., & Boscencu, R. (2025). Cellulose-Derived Gels for Topical Delivery: HPMC as a Functional Matrix for Porphyrinic Photosensitizers. *Gels, 11(10), 824.* https://doi.org/10.3390/gels11100824

Pamulang, Y. V., Oontawee, S., Rodprasert, W., Padeta, I., Sa-Ard-Lam, N., Mahanonda, R., Osathanon, T., Somparn, P., Pisitkun, T., Torsahakul, C., & Sawangmake, C. (2025). Potential upscaling protocol establishment and wound healing bioactivity screening of exosomes isolated from canine adipose-derived mesenchymal stem cells. *Scientific reports*, *15*(1), 10617. https://doi.org/10.1038/s41598-025-93219-7

Park, S., Yoon, Y. J., Hong, Y., Yu, J., Cho, J. M., Jeong, Y. J., Yu, H., Jeong, H., Lee, H., Hwang, S., Koh, W. G., Yang, J. Y., Hyun, K. A., Jung, H. Il, & Lim, J. Y. (2025). CD9-enriched extracellular vesicles from chemically reprogrammed basal progenitors of salivary glands mitigate salivary gland fibrosis. *Bioactive Materials*, *47*. https://doi.org/10.1016/j.bioactmat.2025.01.019

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Peña, O.A., Martin, P. (2024). Cellular and molecular mechanisms of skin wound healing. *Nat Rev Mol Cell Biol* **25**, 599–616. https://doi.org/10.1038/s41580-024-00715-1

Pilbauerova, N., Schmidt, J., Soukup, T., Koberova Ivancakova, R., & Suchanek, J. (2021). The Effects of Cryogenic Storage on Human Dental Pulp Stem Cells. *International journal of molecular sciences*, *22*(9), 4432. https://doi.org/10.3390/ijms22094432

Piperigkou, Z., Bainantzou, D., Makri, N., Papachristou, E., Mantsou, A., Choli-Papadopoulou, T., Theocharis, A. D., & Karamanos, N. K. (2023). Enhancement of mesenchymal stem cells' chondrogenic potential by type II collagen-based bioscaffolds. *Molecular Biology Reports*, *50*(6). https://doi.org/10.1007/s11033-023-08461-x

Poliwoda, S., Noor, N., Downs, E., Schaaf, A., Cantwell, A., Ganti, L., Kaye, A. D., Mosel, L. I., Carroll, C. B., Viswanath, O., & Urits, I. (2022). Stem cells: a comprehensive review of origins and emerging clinical roles in medical practice. *Orthopedic reviews*, *14*(3), 37498. https://doi.org/10.52965/001c.37498

Purbantoro, S. D., Osathanon, T., Nantavisai, S., & Sawangmake, C. (2022). Osteogenic growth peptide enhances osteogenic differentiation of human periodontal ligament stem cells. *Heliyon*, *8*(7), e09936. https://doi.org/10.1016/j.heliyon.2022.e09936

Purwaningrum, M., Giachelli, C. M., Osathanon, T., Rattanapuchpong, S., & Sawangmake, C. (2023). Dissecting specific Wnt components governing osteogenic differentiation potential by human periodontal ligament stem cells through interleukin-6. *Scientific Reports*, *13*(1). https://doi.org/10.1038/s41598-023-35569-8

Purwaningrum, M., Haryanto, A., Kayanaveda, Y., & Sawangmake, C. (2025). Osteogenic Differentiation Potential of Equine Dental Pulp vs. Periodontal Ligament Stem Cells: A Comparative In Vitro Study. *Jurnal Medik Veteriner*, *8*(2), 262-272. https://doi.org/10.20473/jmv.vol8.iss2.2025.262-272

Qiao, X., Tang, J., Dou, L., Yang, S., Sun, Y., Mao, H., & Yang, D. (2023). Dental Pulp Stem Cell-Derived Exosomes Regulate Anti-Inflammatory and Osteogenesis in Periodontal Ligament Stem Cells and Promote the Repair of Experimental Periodontitis in Rats. *International Journal of Nanomedicine*, *18*, 4683–4703. https://doi.org/10.2147/IJN.S420967

Qu, G., Li, Y., Chen, L., Chen, Q., Zou, D., Yang, C., & Zhou, Q. (2021). Comparison of Osteogenic Differentiation Potential of Human Dental-Derived Stem Cells Isolated from Dental Pulp, Periodontal Ligament,

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Dental Follicle, and Alveolar Bone. *Stem Cells International*, *2021*. https://doi.org/10.1155/2021/6631905

Ramirez, K., Witherden, D. A., & Havran, W. L. (2015). All hands on DE(T)C: Epithelial-resident γδ T cells respond to tissue injury. *Cellular immunology*, *296*(1), 57–61. https://doi.org/10.1016/j.cellimm.2015.04.003

Rigby, B. E., Malott, K., Hetzel, S. J., & Soukup, J. W. (2021). Incidence and Risk Factors for Surgical Site Infections Following Oromaxillofacial Oncologic Surgery in Dogs. *Frontiers in veterinary science*, *8*, 760628. https://doi.org/10.3389/fvets.2021.760628

Shah, S., Ghosh, D., Otsuka, T., & Laurencin, C. T. (2024). Classes of Stem Cells: From Biology to Engineering. *Regenerative engineering and translational medicine*, *10*(3), 309–322. https://doi.org/10.1007/s40883-023-00317-x

Shen, Y., & Gleghorn, J. P. (2025). Class III Phosphatidylinositol-3 Kinase/Vacuolar Protein Sorting 34 in Cardiovascular Health and Disease. *Journal of cardiovascular translational research*, *18*(2), 392–407. https://doi.org/10.1007/s12265-024-10581-z

Shuhaibar, N., Hand, A. R., & Terasaki, M. (2021). Odontoblast processes of the mouse incisor are plates oriented in the direction of growth. *Anatomical record (Hoboken, N.J. : 2007)*, *304*(8), 1820–1827. https://doi.org/10.1002/ar.24570

Sober SA, Darmani H, Alhattab D, Awidi A. (2023) Flow cytometric characterization of cell surface markers to differentiate between fibroblasts and mesenchymal stem cells of different origin. *Archives of Medical Science*;19. https://doi.org/10.5114/aoms/131088.

Stefańska, K., Volponi, A. A., Kulus, M., Waśko, J., Farzaneh, M., Grzelak, J., Azizidoost, S., Mozdziak, P., Bukowska, D., Antosik, P., Zabel, M., Podhorska-Okołów, M., Dzięgiel, P., Szcześniak, M., Woszczyk, M., & Kempisty, B. (2024). Dental pulp stem cells - A basic research and future application in regenerative medicine. *Biomedicine & pharmacotherapy = Biomedecine & pharmacotherapie*, *178*, 116990. https://doi.org/10.1016/j.biopha.2024.116990

Sung, S. E., Seo, M. S., Kang, K. K., Choi, J. H., Lee, S. J., Lim, J. H., Yang, S. Y., Kim, S. K., & Lee, G. W. (2022). Isolation and Characterization of Extracellular Vesicle from Mesenchymal Stem Cells of the Epidural Fat of the Spine. *Asian Spine Journal*, *16*(2). https://doi.org/10.31616/asj.2021.0129

UNIVERSITAS
GADJAH MADA
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Szczepanik, A. M., Scislo, L., Scully, T., Walewska, E., Siedlar, M., Kolodziejczyk, P., Lenart, M., Rutkowska, M., Galas, A., Czupryna, A., & Kulig, J. (2011). IL-6 serum levels predict postoperative morbidity in gastric cancer patients. *Gastric cancer : official journal of the International Gastric Cancer Association and the Japanese Gastric Cancer Association*, *14*(3), 266–273. https://doi.org/10.1007/s10120-011-0039-z

Tan, F., Li, X., Wang, Z., Li, J., Shahzad, K., & Zheng, J. (2024). Clinical applications of stem cell-derived exosomes. *Signal transduction and targeted therapy*, *9*(1), 17. https://doi.org/10.1038/s41392-023-01704-0

Théry, C., Witwer, K. W., Aikawa, E., Alcaraz, M. J., Anderson, J. D., Andriantsitohaina, R., Antoniou, A., Arab, T., Archer, F., Atkin-Smith, G. K., Ayre, D. C., Bach, J. M., Bachurski, D., Baharvand, H., Balaj, L., Baldacchino, S., Bauer, N. N., Baxter, A. A., Bebawy, M., Beckham, C., … Zuba-Surma, E. K. (2018). Minimal information for studies of extracellular vesicles 2018 (MISEV2018): a position statement of the International Society for Extracellular Vesicles and update of the MISEV2014 guidelines. *Journal of extracellular vesicles*, *7*(1), 1535750. https://doi.org/10.1080/20013078.2018.1535750

Trajkovic, G., Watanabe, M., & Natsuga, K. (2025). Basement membrane zone proteins in wound healing: Insights from epidermolysis bullosa models. *Dermatologica Sinica*, *43*(4), 277-284. https://doi.org/10.4103/ds.DS-D-25-00149

Utumi, P. H., Fracaro, L., Senegaglia, A. C., Fragoso, F. Y. I., Miyasaki, D. M., Rebelatto, C. L. K., Brofman, P. R. S., & Villanova Junior, J. A. (2021). Canine dental pulp and umbilical cord-derived mesenchymal stem cells as alternative sources for cell therapy in dogs. *Research in veterinary science*, *140*, 117–124. https://doi.org/10.1016/j.rvsc.2021.08.006

Valcl, N., & Lavrenčič, A. (2024). Effect of hydroxypropyl methylcellulose (HPMC) hard capsules on in vitro rumen fermentation kinetics of commonly used feeds in ruminant feeding. *Veterinary medicine and science*, *10*(2), e1349. https://doi.org/10.1002/vms3.1349

Villatoro, A. J., Martín-Astorga, M. D. C., Alcoholado, C., Sánchez-Martín, M. D. M., & Becerra, J. (2021). Proteomic Analysis of the Secretome and Exosomes of Feline Adipose-Derived Mesenchymal Stem Cells. *Animals : an open access journal from MDPI*, *11*(2), 295. https://doi.org/10.3390/ani11020295

Vlad, R. A., Pintea, A., Pintea, C., Rédai, E. M., Antonoaea, P., Bîrsan, M., & Ciurba, A. (2025). Hydroxypropyl Methylcellulose-A Key Excipient in Pharmaceutical Drug Delivery Systems. *Pharmaceutics*, *17*(6), 784. https://doi.org/10.3390/pharmaceutics17060784

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Walker, J. L., Bleaken, B. M., Romisher, A. R., Alnwibit, A. A., & Menko, A. S. (2018). In wound repair vimentin mediates the transition of mesenchymal leader cells to a myofibroblast phenotype. *Molecular Biology of the Cell*, *29*(13). https://doi.org/10.1091/mbc.E17-06-0364

Wang, G., Yang, F., Zhou, W., Xiao, N., Luo, M., & Tang, Z. (2023). The initiation of oxidative stress and therapeutic strategies in wound healing. *Biomedicine & pharmacotherapy = Biomedecine & pharmacotherapie*, *157*, 114004. https://doi.org/10.1016/j.biopha.2022.114004

Wang, Y., Zhao, Y., Jia, W., Yang, J., & Ge, L. (2013). Preliminary study on dental pulp stem cell-mediated pulp regeneration in canine immature permanent teeth. *Journal of endodontics*, *39*(2), 195–201. https://doi.org/10.1016/j.joen.2012.10.002

Wang Y, Xiao T, Zhao C, Li G. (2024) The Regulation of Exosome Generation and Function in Physiological and Pathological Processes. *Int J Mol Sci.*;25. https://doi.org/10.3390/ijms25010255.

Wei, J., Xu, F., Wei, X., Zhao, J., & Liu, J. (2025). PIK3C3 influences immune cell function by modulating autophagy to exert anti-inflammatory effects in sepsis. *Gene.* Vol. 968. https://doi.org/10.1016/j.gene.2025.149732

Welsh, J. A., Goberdhan, D. C. I., O'Driscoll, L., Buzas, E. I., Blenkiron, C., Bussolati, B., Cai, H., Di Vizio, D., Driedonks, T. A. P., Erdbrügger, U., Falcon-Perez, J. M., Fu, Q. L., Hill, A. F., Lenassi, M., Lim, S. K., Mahoney, M. G., Mohanty, S., Möller, A., Nieuwland, R., Ochiya, T., … Witwer, K. W. (2024). Minimal information for studies of extracellular vesicles (MISEV2023): From basic to advanced approaches. *Journal of extracellular vesicles*, *13*(2), e12404. https://doi.org/10.1002/jev2.12404

Xu, D., Zhuang, S., Chen, H., Jiang, M., Jiang, P., Wang, Q., Wang, X., Chen, R., Tang, H., & Tang, L. (2024). IL-33 regulates adipogenesis via Wnt/β-catenin/PPAR-γ signaling pathway in preadipocytes. *Journal of Translational Medicine*, *22*(1). https://doi.org/10.1186/s12967-024-05180-0

Xu, G., Jin, J., Fu, Z., Wang, G., Lei, X., Xu, J., & Wang, J. (2025). Extracellular vesicle-based drug overview: research landscape, quality control and nonclinical evaluation strategies. *Signal transduction and targeted therapy*, *10*(1), 255. https://doi.org/10.1038/s41392-025-02312-w

Xu, M., Ji, J., Jin, D., Wu, Y., Wu, T., Lin, R., Zhu, S., Jiang, F., Ji, Y., Bao, B., Li, M., Xu, W., & Xiao, M. (2022). The biogenesis and secretion of exosomes and multivesicular bodies (MVBs): Intercellular shuttles and implications in human diseases. *Genes & diseases*, *10*(5), 1894–1907. https://doi.org/10.1016/j.gendis.2022.03.021

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Yang, Y., Huang, Y., Yang, J., Hu, Z., Wu, S., Yuan, Q., Meng, S., Li, D., Jiang, M., Liao, Y., & Cai, C. (2025). Umbilical cord mesenchymal stem cell-derived exosomes promote wound healing and skin regeneration via the regulation of inflammation and angiogenesis. *Frontiers in bioengineering and biotechnology*, *13*, 1641709. https://doi.org/10.3389/fbioe.2025.1641709

Yi, C., Wu, W., Zheng, D., Peng, G., Huang, H., Shen, Z., & Teng, X. (2020). Targeted inhibition of endothelial calpain delays wound healing by reducing inflammation and angiogenesis. *Cell death & disease*, *11*(7), 533. https://doi.org/10.1038/s41419-020-02737-x

Yılmaz, Z. E. K. İ., Varlık, T., Levent Karabarut, P., Ünlüişler, Ş., & Canikyan, S. (2024). Topical Xenogeneic Exosome Therapy in a Dog with Toxic Epidermal Necrolysis. *Kafkas Universitesi Veteriner Fakultesi Dergisi*, *30*(6). https://doi.org/10.9775/kvfd.2024.32935

Yuan, M., Hu, X., Yao, L., Jiang, Y., & Li, L. (2022). Mesenchymal stem cell homing to improve therapeutic efficacy in liver disease. *Stem cell research & therapy*, *13*(1), 179. https://doi.org/10.1186/s13287-022-02858-4

Zakrzewski, W., Dobrzyński, M., Szymonowicz, M., & Rybak, Z. (2019). Stem cells: past, present, and future. *Stem cell research & therapy*, *10*(1), 68. https://doi.org/10.1186/s13287-019-1165-5

Ziauddin, S. M., Nakashima, M., Watanabe, H., Tominaga, M., & Iohara, K. (2022). Biological characteristics and pulp regeneration potential of stem cells from canine deciduous teeth compared with those of permanent teeth. *Stem cell research & therapy*, *13*(1), 439. https://doi.org/10.1186/s13287-022-03124-3

Zhang, K., & Cheng, K. (2023). Stem cell-derived exosome versus stem cell therapy. *Nature reviews bioengineering*, 1–2. Advance online publication. https://doi.org/10.1038/s44222-023-00064-2

Zhang, L., Shi, C., Yan, L., Zhang, X., Ji, X., Li, L., He, X., Tan, Y., Zhao, N., & Lu, C. (2025). The Application of Exosomes From Different Sources Loaded with Natural Small-Molecule Compounds in Disease. In *International Journal of Nanomedicine*. Vol. 20. https://doi.org/10.2147/IJN.S542641

Zhang, Y., Lan, M., & Chen, Y. (2024). Minimal Information for Studies of Extracellular Vesicles (MISEV): Ten-Year Evolution (2014–2023). *Pharmaceutics*. 16 (11). https://doi.org/10.3390/pharmaceutics16111394

Zhou, C., Zhang, B., Yang, Y., Jiang, Q., Li, T., Gong, J., Tang, H., & Zhang, Q. (2023). Stem cell-derived exosomes: emerging therapeutic opportunities

UNIVERSITAS
GADJAH MADA
Exosome Dental Pulp Stem Cells Anjing: Isolasi, Karakterisasi, Profil Proteomik, dan Potensi Terapi Xenogenik untuk Kesembuhan Luka Pascaoperasi
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

for wound healing. *Stem cell research & therapy*, *14*(1), 107. https://doi.org/10.1186/s13287-023-03345-0

Zhou, Y., Zhang, X. L., Lu, S. T., Zhang, N. Y., Zhang, H. J., Zhang, J., & Zhang, J. (2022). Human adipose-derived mesenchymal stem cells-derived exosomes encapsulated in pluronic F127 hydrogel promote wound healing and regeneration. *Stem cell research & therapy*, *13*(1), 407. https://doi.org/10.1186/s13287-022-02980-3