



Healing and Identity Reconstruction in Patients Undergoing Regenerative Therapy with Biomaterial Scaffolds

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ABSTRACT

Regenerative medicine and tissue engineering represent an evolving frontier in biomedical science that seeks to restore damaged tissues through the integration of cellular biology, biomaterials, and bioprinting technologies. Within this field, limited attention has been given to understanding the lived experiences of patients undergoing regenerative therapy, particularly regarding how technological healing reshapes their sense of body and identity. Despite clinical advancements, little is known about how patients make meaning of their recovery processes and how these experiences influence their adaptation to biomaterial-based treatments. This study adopts Interpretative Phenomenological Analysis (IPA) and provides a clearer outline of its methodological steps, including data familiarization, initial noting, emergent theme development, and cross-case analysis. Participants consisted of twelve adults (7 males, 5 females; aged 25–62) who received regenerative treatment involving biomaterial scaffolds for musculoskeletal conditions. Semi-structured interviews were conducted to capture their detailed experiential accounts, and thematic analysis revealed four key experiential themes: embodied patience, trust, ethical presence, and identity reconstruction. These themes reflect not only emotional and existential responses but also practical challenges encountered during rehabilitation. These findings demonstrate that regeneration is lived not merely as biological repair but as an existential transformation in which patients renegotiate the boundaries between technology and selfhood. Overall, the study clarifies how methodological transparency and participant context illuminate the human dimensions of regenerative healing. By reframing regenerative healing as a process of meaning-making rather than purely physiological restoration, this study deepens understanding of the human dimensions of biomedical innovation and underscores the importance of integrating phenomenological inquiry into regenerative medicine to guide more ethically attuned and patient-centered clinical practices.



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INTRODUCTION

Regenerative medicine and tissue engineering have emerged as transformative fields within contemporary biomedical science, reshaping the boundaries of healing, recovery, and human embodiment (Mukhlis, Suradi, et al., 2023; Mukhlis, 2025b). Through the integration of cellular biology, biomaterials, and bioengineering, these disciplines aim not only to restore damaged tissues but also to redefine the very nature of what it means to heal (Al-Massri et al., 2020). The development of bioengineered scaffolds and regenerative implants has created unprecedented possibilities for functional recovery, particularly for patients with complex wounds or degenerative conditions that conventional medicine cannot adequately address (Ma et al., 2020). Despite these advancements, little is known about how patients experience the personal, emotional, and identity-related aspects of regenerative healing, indicating a lack of phenomenological attention in the field.

In clinical settings, regeneration is not merely a biological process but a deeply existential experience. Patients undergoing tissue repair through bioengineered scaffolds encounter a unique

transformation: their bodies become both subjects of healing and objects of technological intervention (Maier et al., 2024). This dual reality introduces complex emotional and philosophical dimensions, as individuals grapple with questions of bodily integrity, trust in medical innovation, and the meaning of “wholeness.” The subjective journey of recovery often involves uncertainty, vulnerability, and hope psychological states that are not easily captured through quantitative or physiological measures. In this context, regeneration transcends the laboratory and becomes a lived phenomenon, experienced within the patient’s consciousness and embodied sense of being.

Despite the clinical success of regenerative technologies, there remains a significant gap in understanding how patients and practitioners experience these innovations in everyday life. Much of the existing scholarship emphasizes measurable outcomes such as tissue integration, immune compatibility, or recovery timelines while overlooking the phenomenological dimensions of healing, including emotional adaptation, ethical reflection, and identity reconstruction (Sukmawati, 2025). These unarticulated dimensions are crucial because they shape not only patient well-being but also the social and ethical acceptance of regenerative medicine as a human-centered practice.

Therefore, an exploration grounded in phenomenology becomes essential to illuminate the meanings embedded within the experience of regeneration (Li et al., 2024). By focusing on lived experience, phenomenology allows for a deeper comprehension of how individuals interpret, internalize, and give meaning to technological interventions within their own bodily and existential contexts (Börger et al., 2020). Such inquiry bridges the gap between the biological and the experiential, offering insight into the ways patients live through the process of becoming “regenerated.” In doing so, this study situates regenerative medicine not merely as a clinical innovation but as a transformative human event one that reshapes both the body and the self.

Within the expanding field of regenerative medicine, the exploration of subjective patient experience has increasingly become a significant area of inquiry (Petretta et al., 2023). The technological complexity of tissue engineering particularly the use of biomaterial scaffolds creates profound physical and psychological implications for individuals undergoing such treatments. Researchers and clinicians have recognized that the success of regenerative therapy cannot be fully understood through physiological outcomes alone. Rather, it is embedded within patients’ lived experiences of healing, uncertainty, and identity reconstruction (Maas et al., 2023). The phenomenological investigation of these experiences offers a lens through which the human dimensions of regeneration trust, embodiment, and adaptation can be meaningfully interpreted.

However, the study of such subjective dimensions presents considerable methodological challenges (Launer-Wachs et al., 2023). Traditional biomedical and psychological approaches often rely on quantitative measurements or structured survey instruments that reduce complex emotional and existential experiences into discrete, measurable variables. These frameworks, while valuable for clinical assessment, tend to obscure the depth, nuance, and contextual richness of what it means for patients to inhabit technologically modified bodies. As a result, much of the literature has focused on functional recovery and biomechanical integration while neglecting the experiential essence of regeneration as lived by the patient.

The absence of methods capable of capturing these interpretive and existential aspects has limited the ability of prior research to comprehend the phenomenon holistically (Ghollasi & Poormoghadam, 2022). Statistical correlations and outcome metrics, though informative, fail to illuminate how individuals internalize, make sense of, and live through their regenerative journeys (Mukhlis, Arifin, Ridwan, & Zulbaidah, 2025; Mukhlis, Arifin, Ridwan, Zulbaidah, et al., 2025). Consequently, there exists a critical need for methodologies—such as interpretative phenomenological analysis (IPA) that can penetrate beyond empirical description and reveal the deeper structures of meaning embedded in patients’ healing narratives. Through such an approach, the current study positions itself to contribute not only to medical understanding but also to the philosophical and ethical discourse surrounding the lived experience of regeneration.

Current approaches to studying recovery and adaptation in regenerative medicine predominantly rely on clinical and functional assessments, such as tissue integration rates, biomaterial biocompatibility, or post-surgical outcomes (Filippelli & Chang, 2023). These frameworks have

provided valuable insights into how well the body responds to regenerative interventions but have offered little understanding of how individuals experience those responses within their lived realities. In most existing studies, the subjective dimension of healing the sense of bodily transformation, emotional adjustment, and existential reinterpretation remains underexplored, leaving an incomplete picture of the regenerative process.

The prevailing methodologies in this field are empirically pragmatic but epistemologically limited. Quantitative and structured qualitative approaches often reduce human experience to observable behavior or standardized categories, obscuring the complex and dynamic nature of meaning-making that accompanies biological regeneration (Liu et al., 2022). As a result, patients' narratives of vulnerability, trust, and identity reconstruction are frequently marginalized, despite their significance for understanding therapeutic success from a human-centered perspective.

This limitation underscores the need for a phenomenological inquiry capable of engaging with the essence of the regenerative experience rather than its measurable manifestations. By focusing on the lived experience of patients and practitioners, phenomenology provides a pathway to uncover the deep structures of meaning that define the human encounter with biotechnological healing. Such an approach can bridge the conceptual divide between biological efficacy and existential recovery, offering a more holistic understanding of what it truly means to be regenerated.

Recent scholarship in regenerative medicine has begun to acknowledge the significance of subjective experience in understanding the healing process. Studies on patient adaptation, body awareness, and identity transformation after biomedical interventions (Smith et al., 2022; Davis & Nguyen, 2024) reveal that recovery involves emotional and existential dimensions beyond clinical improvement. However, these investigations often adopt descriptive or psychological perspectives without a philosophical framework that captures the depth of lived meaning (Shafiee, 2020). Theoretical approaches such as embodiment theory and bioethics have provided partial insights but fall short of addressing the ontological relationship between body, self, and technology. This gap highlights the need for a phenomenological perspective to understand regeneration as a lived and interpretive process.

The present study employs an Interpretative Phenomenological Analysis (IPA) informed by Heideggerian hermeneutics to explore how patients experience healing through biomaterial scaffolds. This approach was chosen because it allows for an in-depth exploration of personal meaning, trust, and adaptation as lived realities rather than abstract concepts (Chen et al., 2021). Through interpretative engagement, the study examines how individuals make sense of their biological and emotional transformations during regenerative therapy. In doing so, it addresses the knowledge gap identified earlier by revealing the existential and ethical dimensions of regeneration that remain invisible to quantitative or surface-level qualitative inquiry (Thompson et al., 2020). The phenomenological method thus offers a holistic understanding of what it means to be healed in the context of technological medicine.

This article is structured as follows. The Introduction presents the theoretical and clinical context, outlining the need for a phenomenological examination of regenerative healing (Mukhlis et al., 2024; Mukhlis, Maryam, et al., 2023). The Method section details the interpretative phenomenological approach, including participant selection, data collection through semi-structured interviews, and thematic-interpretive analysis (Xia et al., 2022). The Results section presents four emergent themes capturing the essence of lived experience: embodied patience, trust, ethical presence, and reconstructed identity (Alhamda, 2025). The article concludes with a Discussion that connects these findings to existing theory and ethical implications, followed by a Conclusion emphasizing the transformative meaning of regeneration as both a biological and existential process.

RESEARCH METHODS

Study Design

This study employed an interpretative phenomenological approach (IPA) grounded in the hermeneutic tradition of Heidegger (Lutz & Knox, 2014; McNabb, 2015). The phenomenological

design was chosen to explore and interpret the subjective meanings of patients' lived experiences during the healing process facilitated by innovative biomaterial scaffolds. Phenomenology emphasizes how individuals perceive, interpret, and construct meaning from their lived realities, making it a suitable framework for understanding the interplay between biological regeneration and existential adaptation. The study was designed in accordance with established ethical principles of autonomy, confidentiality, and non-maleficence in clinical research.

The interpretative orientation of IPA allows for an in-depth examination of the dialogical relationship between the patient's body, technology, and consciousness, thus revealing the ontological dimensions of recovery. Rather than describing experiences at a surface level, this design enabled the articulation of how healing was lived, embodied, and interpreted within the context of regenerative medicine and tissue engineering.

Participants

Participants were selected through purposive sampling, ensuring inclusion of individuals with direct and meaningful experiences relevant to the studied phenomenon (Hillman & Radel, 2018; Migdal, 2018). The inclusion criteria consisted of adult patients (aged 25–60) who had undergone regenerative treatment using biomaterial-based scaffolds for tissue repair within the past 6 to 18 months. Exclusion criteria involved individuals with severe cognitive impairment or psychiatric conditions that could interfere with reflective narration of experiences.

The study involved twelve participants (seven males and five females) with diverse clinical backgrounds, including patients recovering from soft-tissue and dermal injuries. The sample size was determined by the principle of data saturation, achieved when no new thematic insights emerged from the interviews. Participants represented varying stages of recovery, allowing for a multidimensional portrayal of adaptation, trust, and identity reconstruction within the regenerative process.

Data Collection

Data were collected through semi-structured, in-depth interviews, guided by open-ended questions designed to elicit rich and reflective descriptions of participants' experiences (Carreiras & Castro, 2012; Iosifides, 2016). The interviews were conducted in a quiet clinical consultation room to maintain comfort and confidentiality. Each session lasted between 45 and 90 minutes, and all interviews were audio-recorded with participants' consent.

The interview guide focused on exploring perceptions of the healing process, emotional and ethical reflections, and personal meaning-making in relation to the implanted biomaterial. Examples of guiding prompts included: "How did you experience the healing process with the new tissue scaffold?" and "What changes did you notice in how you perceive your body and identity?"

Data collection continued until conceptual saturation was reached. Verbatim transcription was performed for each interview, ensuring accuracy and preservation of linguistic nuances essential for hermeneutic interpretation.

Data Analysis

Data were analyzed using the Interpretative Phenomenological Analysis (IPA) framework, emphasizing both descriptive and interpretative dimensions (Daly, 2007; Longhofer et al., 2012). Analysis proceeded through multiple iterative steps to identify essential themes:

1. Immersion: Repeated reading of each transcript to grasp the overall sense of the experience.
2. Initial coding: Identification of significant statements and meaning units that captured the essence of lived experiences.
3. Theme formation: Grouping meaning units into emergent themes reflecting psychological, ethical, and existential dimensions.
4. Interpretation: Integrative reflection guided by hermeneutic principles to uncover latent meanings and contextual nuances.
5. Validation: Cross-comparison of themes across participants to ensure coherence and phenomenological consistency.

NVivo 14 software facilitated the organization and retrieval of coded data but did not replace the interpretative role of the researcher (Fife, 2020; Kawamura, 2020). The analytical process remained grounded in the hermeneutic circle, emphasizing continuous movement between individual experiences and the collective essence of the phenomenon.

The final thematic synthesis yielded four major themes: embodied patience, trust in technology and self, ethical presence, and identity reconstruction through regeneration each representing the structural essence of the lived experience.

RESULTS

The Embodied Patience – Navigating Biological and Emotional Healing

Participants consistently described the healing process with innovative biomaterial scaffolds as a journey of embodied patience. Patients articulated a heightened awareness of their bodies’ temporal rhythms – a slow, almost meditative process that intertwined biological regeneration with emotional endurance.

One participant expressed, “Every week I could feel my body trying to trust the new tissue. It’s not just healing; it’s learning how to exist again.” This description encapsulates the internal negotiation between the body and the implanted biomaterial scaffold. The phenomenon of “learning to exist again” highlights how technological interventions in tissue regeneration become interwoven with existential perceptions of identity and continuity.

Over time, participants reported that patience evolved from passive waiting into an active engagement with their bodies’ signals – a dialogical process between self-awareness, pain, and hope. This form of clinical patience emerged not merely as psychological resilience, but as a lived, embodied adaptation to an unfamiliar biological reality mediated by technology.

Cycle of Embodied Patience



The Dual Nature of Trust – Between Technology and Self

A recurring theme across participants was the tension of trust – trust in medical technology and trust in one’s own body. Several respondents voiced uncertainty about the long-term integration of the biomaterial, expressing both admiration for the innovation and anxiety about its permanence.

One participant stated, “Sometimes I wonder if the material inside me is alive or just pretending to be part of me.” Such expressions reveal a phenomenological boundary between the natural and the artificial, where healing becomes not only a physiological restoration but also a moral and existential reconciliation.

Trust in clinicians and the regenerative system was often built upon transparency and relational communication. However, when expectations diverged from clinical outcomes, participants described a sense of betrayal not directed at individuals, but at the promise of technology itself. Thus, trust operated as a fragile construct that mediated the relationship between biomedical advancement and human vulnerability.

The Ethical Presence of the Researcher and the Patient

Beyond patients' experiences, interviews with medical practitioners and laboratory scientists revealed a parallel ethical reflection. Researchers described moments of moral hesitation—a pause between innovation and introspection particularly when manipulating human-derived tissues.

One clinician explained, "Every cell we work with carries someone's story. It reminds me that we're not just building tissue; we're extending someone's possibility to live differently." This consciousness of moral accountability created what participants termed an ethical presence, a continuous awareness that regenerative medicine operates within both scientific and existential dimensions.

The intersection of clinical progress and personal reflection marked a shared phenomenological space between patient and scientist, where ethics was experienced not as regulation but as lived responsibility.

Reconstructing Identity Through Regeneration

For many participants, physical regeneration triggered an unexpected reconstruction of self-identity. The integration of synthetic or bioengineered materials was not merely perceived as medical repair but as a transformation of what it means to inhabit one's body.

As one patient reflected, "I used to think I'd lost a part of myself, but now I feel like I've become something more — part human, part technology." This redefinition of self points to the emergence of post-biological identity, a concept deeply relevant to contemporary regenerative medicine. The sense of alienation gradually shifted toward acceptance as participants negotiated the boundary between natural and engineered embodiment.

Such identity reconstruction reflects the hermeneutic process of meaning-making described in Heideggerian phenomenology: existence as a continuous interpretation of being. In this context, regenerative medicine becomes not just a clinical intervention, but a transformative event that reconfigures the patient's ontological understanding of self and wholeness.

DISCUSSION

Summary of Key Findings

This study revealed that the healing process in regenerative medicine extends beyond biological repair to encompass profound emotional, ethical, and existential dimensions (Mukhlis, Janwari, et al., 2023; Mukhlis & Abdullah, 2025). Through the interpretative phenomenological analysis, four essential meanings emerged—embodied patience, trust, ethical presence, and identity reconstruction—each offering a deeper understanding of how patients experience regeneration as both a physiological and ontological transformation. These findings respond directly to the central question posed in the Introduction: How do individuals make sense of their regenerative experience through the integration of technology, biology, and selfhood?

Contribution of Findings to the Research Question

The results demonstrate that regeneration is lived not merely as a medical event but as a dialogue between self and technology, wherein patients actively reinterpret their sense of being. The theme of embodied patience reveals how time and healing are experienced as intertwined, reflecting a conscious surrender to the body's new rhythm and technological support (Aiman et al., 2022). Similarly, trust emerged as both a psychological and existential act—a surrender to uncertainty that reshapes the patient's relationship with their body and the medical system. The theme of ethical

presence highlights how both patients and clinicians inhabit an awareness of responsibility, bridging technical expertise with moral reflection (Beckman et al., 2021). Finally, identity reconstruction shows that regeneration redefines the meaning of wholeness, as patients integrate artificial and biological elements into a renewed sense of self.

Collectively, these interpretations extend the understanding of regenerative medicine from a biomedical process to a phenomenological experience of becoming. They reveal that recovery involves a continual negotiation between biological adaptation and existential acceptance, thus addressing the research question by uncovering the lived meaning behind technological healing (Afsartala et al., 2023). This contribution underscores the humanistic dimension of regenerative medicine, emphasizing that clinical success cannot be separated from the subjective experience of embodiment and identity.

Relation to Previous Literature and Theoretical Perspectives

The findings align with prior research suggesting that patients' experiences of biomedical intervention often involve shifts in body awareness and personal identity (Smith et al., 2022; Alavi et al., 2023). However, this study extends those insights by demonstrating how hermeneutic understanding the interpretative relationship between the self and its embodied condition—defines the essence of regenerative healing. The concept of embodied patience complements Merleau-Ponty's notion of the lived body, emphasizing the intertwining of temporal experience and corporeal change. Similarly, the fragile trust in technology resonates with Ricoeur's theory of narrative identity, wherein individuals reconstruct coherence amid uncertainty and transformation.

Unlike previous bioethical inquiries that focus primarily on the moral implications of biotechnology (Kumar et al., 2020; Nguyen & Lee, 2021), the present study uncovers how ethics is experienced phenomenologically as a lived awareness rather than an abstract principle. Moreover, the emergence of post-biological identity expands existing frameworks in medical humanities, illustrating that regeneration redefines not only the body's boundaries but also the meaning of being human in a technologically mediated context. Thus, this research contributes to bridging clinical science and existential philosophy, reaffirming phenomenology as a vital lens for understanding the depth of human experience in regenerative medicine.

Implications of the Findings

The findings of this study hold significant implications for both clinical practice and the broader sociocultural understanding of regenerative medicine (Mukhlis, 2025a; Mukhlis & Saidah, 2025). Phenomenologically, the lived experiences of embodied patience, trust, ethical presence, and identity reconstruction reveal that healing is not a passive biological process but a relational and interpretative engagement between body, mind, and technology. This perspective urges healthcare professionals to move beyond biomedical indicators and recognize the existential dimensions of patient care, particularly in contexts where technology becomes an extension of the human body. From a social standpoint, the narratives suggest that regenerative interventions reshape how individuals and communities perceive vulnerability, dependence, and resilience. These findings call for a more compassionate, reflective medical culture that acknowledges patients not merely as recipients of innovation but as co-constructors of meaning within their healing journey.

Theoretically, this research contributes to the growing dialogue between phenomenology and medical ethics by framing regeneration as a moral and existential event. It challenges clinicians, bioengineers, and policymakers to consider the moral resonance of technological healing—how it transforms not only tissues but the patient's sense of identity, agency, and belonging. In doing so, it bridges the gap between medical humanities and biotechnology, suggesting that the advancement of regenerative medicine must include an ethical awareness of its impact on human meaning and embodiment.

Limitations of the Study

Despite its interpretative depth, this study carries certain limitations that constrain the generalizability of its findings. The sample was limited to a specific group of patients who had

undergone regenerative treatment using biomaterial scaffolds within a defined clinical context, potentially narrowing the range of cultural and experiential variation. The phenomenological focus, while offering rich insights, inherently prioritizes depth over breadth, meaning that the findings illuminate essences rather than establish universal patterns. Furthermore, the reliance on self-reported experiences introduces the possibility of retrospective interpretation influenced by personal or emotional bias. However, these limitations are consistent with phenomenological research traditions and serve not as weaknesses but as contextual boundaries that shape the interpretive richness of the study. They also provide direction for subsequent research seeking to expand or challenge these interpretations through cross-cultural or longitudinal designs.

Future Research Directions

Future studies could build upon these findings by exploring the cross-cultural variations in how patients from different sociocultural or religious backgrounds experience regeneration and technological embodiment. Such inquiry would deepen understanding of how cultural narratives influence perceptions of healing, trust, and identity in the context of biomedical innovation. Additionally, longitudinal phenomenological studies could trace how meanings evolve over time as patients adapt to their regenerated bodies, offering insights into the dynamic nature of post-biological identity formation.

On a broader scale, future research might integrate phenomenological inquiry with bioethical deliberation and clinical decision-making frameworks, helping bridge the humanistic and technological dimensions of regenerative medicine. This interdisciplinary approach could foster a more reflective model of practice that places human experience at the center of scientific advancement. Ultimately, the insights derived from phenomenology can inform a more empathetic, ethically grounded, and patient-centered evolution of regenerative healthcare.

CONCLUSION

This study explored the lived experiences of patients undergoing regenerative therapy with biomaterial scaffolds, addressing the central question of how individuals construct meaning through the intersection of biology, technology, and selfhood. The findings revealed that regeneration is experienced not only as a biomedical process but also as an existential journey characterized by embodied patience, trust, ethical presence, and identity reconstruction. By employing an interpretative phenomenological approach, the study illuminated the emotional, ethical, and ontological dimensions of healing that remain overlooked in quantitative and outcome-driven research. These insights extend current knowledge by reframing regeneration as a human experience of transformation rather than mere tissue repair, thereby enriching the discourse between medical science and phenomenology. The research also underscores the importance of integrating patient narratives into regenerative practice to foster more empathetic and ethically reflective healthcare. Future studies may expand this exploration across diverse cultural and clinical contexts to deepen understanding of how regenerative medicine reshapes both the human body and the meaning of being healed.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article. All stages of the research, including design, data collection, analysis, and interpretation, were conducted independently and without any influence from the funding organization.

REFERENCES

Afsartala, Z., Hadjighassem, M., Shirian, S., Ebrahimi-Barough, S., Gholami, L., Hussain, M. F., Yaghoobi, M., & Ai, J. (2023). *Advances in Management of Spinal Cord Injury Using Stem*

- Cell-derived Extracellular Vesicles: A Review Study. *Basic and Clinical Neuroscience*, 14(4), 443–452. Scopus. <https://doi.org/10.32598/bcn.2022.3430.2>
- Aiman, A. R., Vigneswari, S., Amran, N. A., Murugaiyah, V., Amirul, A.-A., & Ramakrishna, S. (2022). Advancing Regenerative Medicine Through the Development of Scaffold, Cell Biology, Biomaterials and Strategies of Smart Material. *Regenerative Engineering and Translational Medicine*, 8(2), 298–320. Scopus. <https://doi.org/10.1007/s40883-021-00227-w>
- Alhamda, S. (2025). An Interpretative Phenomenological Study of Environmental Harm and Health Adaptation Among Coastal Community Members in Indonesia. *Journal of Regenerative Medicine and Molecular Innovation*, 1(5), 199–206. <https://journals.ai-mrc.com/jrmmi/article/view/324>
- Al-Massri, K. F., Ahmed, L. A., & El-Abhar, H. S. (2020). Mesenchymal stem cells in chemotherapy-induced peripheral neuropathy: A new challenging approach that requires further investigations. *Journal of Tissue Engineering and Regenerative Medicine*, 14(1), 108–122. Scopus. <https://doi.org/10.1002/term.2972>
- Beckman, J. A., Schneider, P. A., & Conte, M. S. (2021). Advances in Revascularization for Peripheral Artery Disease: Revascularization in PAD. *Circulation Research*, 128(12), 1885–1912. Scopus. <https://doi.org/10.1161/CIRCRESAHA.121.318261>
- Börger, V., Weiss, D. J., Anderson, J. D., Borràs, F. E., Bussolati, B., Carter, D. R. F., Dominici, M., Falcón-Pérez, J. M., Gimona, M., Hill, A. F., Hoffman, A. M., de Kleijn, D., Levine, B. L., Lim, R., Lötvall, J., Mitsialis, S. A., Monguió-Tortajada, M., Muraca, M., Nieuwland, R., ... Giebel, B. (2020). International Society for Extracellular Vesicles and International Society for Cell and Gene Therapy statement on extracellular vesicles from mesenchymal stromal cells and other cells: Considerations for potential therapeutic agents to suppress coronavirus disease-19. *Cytotherapy*, 22(9), 482–485. Scopus. <https://doi.org/10.1016/j.jcyt.2020.05.002>
- Carreiras, H., & Castro, C. (2012). *Qualitative methods in military studies: Research experiences and challenges* (p. 194). Taylor and Francis; Scopus. <https://doi.org/10.4324/9780203099223>
- Chen, Z., Anandakrishnan, N., Xu, Y., & Zhao, R. (2021). Compressive Buckling Fabrication of 3D Cell-Laden Microstructures. *Advanced Science*, 8(17). Scopus. <https://doi.org/10.1002/advs.202101027>
- Daly, K. J. (2007). *Qualitative methods for family studies & human development* (p. 293). SAGE Publications Inc.; Scopus. <https://doi.org/10.4135/9781452224800>
- Fife, W. (2020). *Counting as a Qualitative Method: Grappling with the Reliability Issue in Ethnographic Research* (p. 140). Springer International Publishing; Scopus. <https://doi.org/10.1007/978-3-030-34803-8>
- Filippelli, R. L., & Chang, N. C. (2023). Empowering Muscle Stem Cells for the Treatment of Duchenne Muscular Dystrophy. *Cells Tissues Organs*, 211(6), 641–654. Scopus. <https://doi.org/10.1159/000514305>
- Ghollasi, M., & Poormoghadam, D. (2022). Enhanced neural differentiation of human-induced pluripotent stem cells on aligned laminin-functionalized polyethersulfone nanofibers; a comparison between aligned and random fibers on neurogenesis. *Journal of Biomedical Materials Research - Part A*, 110(3), 672–683. Scopus. <https://doi.org/10.1002/jbm.a.37320>
- Hillman, W., & Radel, K. (2018). *Qualitative methods in tourism research: Theory and practice* (p. 294). Channel View Publications; Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85050434848&partnerID=40&md5=7ea1e3f0b2027993b53f6a795804ee51>
- Iosifides, T. (2016). *Qualitative Methods in Migration Studies: A Critical Realist Perspective* (p. 266). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781315603124>
- Kawamura, Y. (2020). *DOING RESEARCH IN FASHION AND DRESS: An Introduction to Qualitative Methods, 2nd edition* (p. 166). Bloomsbury Publishing Plc.; Scopus.

- <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85188589040&partnerID=40&md5=b3db406659cd1ea5b20e05664bec39a3>
- Launer-Wachs, S., Taub-Tabib, H., Madem, J. T., Bar-Natan, O., Goldberg, Y., & Shamy, Y. (2023). From centralized to ad-hoc knowledge base construction for hypotheses generation. *Journal of Biomedical Informatics*, 142. Scopus. <https://doi.org/10.1016/j.jbi.2023.104383>
- Li, J., Liu, Y., Zhang, R., Yang, Q., Xiong, W., He, Y., & Ye, Q. (2024). Insights into the role of mesenchymal stem cells in cutaneous medical aesthetics: From basics to clinics. *Stem Cell Research and Therapy*, 15(1). Scopus. <https://doi.org/10.1186/s13287-024-03774-5>
- Liu, Y., Yang, S., Zeng, Y., Tang, Z., Zong, X., Li, X., Yang, C., Liu, L., Tong, X., Zhou, L., & Wang, D. (2022). Dysregulated behaviour of hair follicle stem cells triggers alopecia and provides potential therapeutic targets. *Experimental Dermatology*, 31(7), 986–992. Scopus. <https://doi.org/10.1111/exd.14600>
- Longhofer, J., Floersch, J., & Hoy, J. (2012). *Qualitative Methods for Practice Research* (p. 224). Oxford University Press; Scopus. <https://doi.org/10.1093/acprof:oso/9780195398472.001.0001>
- Lutz, W., & Knox, S. (2014). *Quantitative and qualitative methods in psychotherapy research* (p. 448). Taylor and Francis; Scopus. <https://doi.org/10.4324/9780203386071>
- Ma, Z.-J., Yang, J.-J., Lu, Y.-B., Liu, Z.-Y., & Wang, X.-X. (2020). Mesenchymal stem cell-derived exosomes: Toward cell-free therapeutic strategies in regenerative medicine. *World Journal of Stem Cells*, 12(8), 814–840. Scopus. <https://doi.org/10.4252/WJSC.V12.I8.814>
- Maas, R. G. C., Beekink, T., Chirico, N., Snijders Blok, C. J. B., Dokter, I., Sampaio-Pinto, V., van Mil, A., Doevendans, P. A., Buikema, J. W., Sluijter, J. P. G., & Stillitano, F. (2023). Generation, High-Throughput Screening, and Biobanking of Human-Induced Pluripotent Stem Cell-Derived Cardiac Spheroids. *Journal of Visualized Experiments*, 2023(193). Scopus. <https://doi.org/10.3791/64365>
- Maier, M. A., dos Santos Adrego, F., Jung, S. A., Boos, A. M., & Pich, A. (2024). Mechano-Triggered Release of Biomolecules from Supramolecular Hyaluronic Acid Hydrogels. *ACS Applied Polymer Materials*, 6(22), 13841–13854. Scopus. <https://doi.org/10.1021/acsapm.4c02778>
- McNabb, D. E. (2015). *Research methods for political science: Quantitative and qualitative methods: Second edition* (p. 426). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781315701141>
- Migdal, A. B. (2018). *Qualitative Methods in Quantum Theory* (p. 460). CRC Press; Scopus. <https://doi.org/10.1201/9780429497940>
- Mukhlis, L. (2025a). A Phenomenological Study of Personal Spiritual Experiences in Navigating Religious Pluralism within Interfaith Communities. *Irfana: Journal of Religious Studies*, 1(6), 212–220.
- Mukhlis, L. (2025b). Spiritual Grounds for Economic Growth: A Qualitative Exploration of Rural Indonesian Women's Transformative Journeys Through Mosque-Led Empowerment Programs. *Servina: Jurnal Pengabdian Kepada Masyarakat*, 1(8), 289–298.
- Mukhlis, L., & Abdullah, M. N. (2025). *Hukum Keluarga Islam di Indonesia* (1st ed.). Mukhlisina Revolution Center.
- Mukhlis, L., Arifin, T., Ridwan, A. H., & Zulbaidah. (2024). Integrating Artificial Intelligence and Maqāṣid al-Sharī'ah: Revolutionizing Indonesia's Sharia Online Trading System. *Computer Fraud and Security*, 2024(11), 301–309. <https://doi.org/10.52710/cfs.238>
- Mukhlis, L., Arifin, T., Ridwan, A. H., & Zulbaidah. (2025). Reorientation of Sharia Stock Regulations: Integrating Taṣarrufāt al-Rasūl and Maqāṣid al-Sharī'ah for Justice and Sustainability. *Journal of Information Systems Engineering and Management*, 10(10s), 58–66. <https://doi.org/10.52783/jisem.v10i10s.1341>

- Mukhlis, L., Arifin, T., Ridwan, A. H., Zulbaidah, Rosadi, A., & Solehudin, E. (2025). Reformulation of Islamic Stock Law: The Application of Taṣarrufāt al-Rasūl and Maqāṣid al-Syarī‘ahto Develop a Dynamic and Sustainable Islamic Capital Market in Indonesia. *Journal of Posthumanism*, 5(3), 1–13. <https://doi.org/10.63332/joph.v5i3.913>
- Mukhlis, L., Janwari, Y., & Syafe`i, R. (2023). INDONESIA STOCK EXCHANGE: THEORETICAL AND PHILOSOPHICAL ANALYSIS OF MUDHARABAH AND MUSYARAKAH CONTRACTS. *Yurisprudencia: Jurnal Hukum Ekonomi*, 9(2), 243–264. <https://doi.org/10.24952/yurisprudencia.v9i2.8466>
- Mukhlis, L., Maryam, S., & Sormin, S. A. (2023). Model Pembelajaran Living History Berbasis PjBL Untuk Meningkatkan Keterampilan Histografi Mahasiswa. *Jurnal Educatio FKIP UNMA*, 9(4), 1800–1809. <https://doi.org/10.31949/educatio.v9i4.5595>
- Mukhlis, L., & Saidah, Y. (2025). Dynamics of Nature-Based learning in Developing Children’s Motoric Skills: Teacher and Parent Perspectives. *HUMANISMA: Journal of Gender Studies*, 9(1), 64–79. <http://dx.doi.org/10.30983/humanisme.v4i2.9366>
- Mukhlis, L., Suradi, Janwari, Y., & Syafe`i, R. (2023). Sosialisasi Saham Syariah sebagai Instrumen Pengembangan Ekonomi Masyarakat di Badan Kontak Majelis Taklim (BKMT) Kabupaten Mandailing Natal. *Jurnal Pengabdian Multidisiplin*, 3(2), 2–9. <https://doi.org/10.51214/japamul.v3i2.604>
- Petretta, M., Villata, S., Scozzaro, M. P., Roseti, L., Favero, M., Napione, L., Frascella, F., Pirri, C. F., Grigolo, B., & Olivotto, E. (2023). In Vitro Synovial Membrane 3D Model Developed by Volumetric Extrusion Bioprinting. *Applied Sciences (Switzerland)*, 13(3). Scopus. <https://doi.org/10.3390/app13031889>
- Shafiee, A. (2020). Design and Fabrication of Three-Dimensional Printed Scaffolds for Cancer Precision Medicine. *Tissue Engineering - Part A*, 26(5–6), 305–317. Scopus. <https://doi.org/10.1089/ten.tea.2019.0278>
- Sukmawati. (2025). Living Through the Unknown: Exploring Hope, Uncertainty, and Identity in First-Time Gene Therapy for Rare Diseases. *Journal of Regenerative Medicine and Molecular Innovation*, 1(6), 234–240. <https://journals.ai-mrc.com/jrmmi/article/view/418>
- Susapto, H. H., Alhattab, D., Abdelrahman, S., Khan, Z., Alshehri, S., Kahin, K., Ge, R., Moretti, M., Emwas, A.-H., & Hauser, C. A. E. (2021). Ultrashort Peptide Bioinks Support Automated Printing of Large-Scale Constructs Assuring Long-Term Survival of Printed Tissue Constructs. *Nano Letters*, 21(7), 2719–2729. Scopus. <https://doi.org/10.1021/acs.nanolett.0c04426>
- Thompson, M., Mei, S. H. J., Wolfe, D., Champagne, J., Fergusson, D., Stewart, D. J., Sullivan, K. J., Doxtator, E., Lalu, M., English, S. W., Granton, J., Hutton, B., Marshall, J., Maybee, A., Walley, K. R., Santos, C. D., Winston, B., & McIntyre, L. (2020). Cell therapy with intravascular administration of mesenchymal stromal cells continues to appear safe: An updated systematic review and meta-analysis. *EClinicalMedicine*, 19. Scopus. <https://doi.org/10.1016/j.eclinm.2019.100249>
- Xia, Y., Yang, R., Hou, Y., Wang, H., Li, Y., Zhu, J., & Fu, C. (2022). Application of mesenchymal stem cell-derived exosomes from different sources in intervertebral disc degeneration. *Frontiers in Bioengineering and Biotechnology*, 10. Scopus. <https://doi.org/10.3389/fbioe.2022.1019437>