

Modern Genetic Engineering and Islamic Bioethics: A Critical Study

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Abstract

The rapid advancement of modern genetic engineering technologies has introduced profound ethical, legal, and social challenges for contemporary Muslim societies. Techniques such as CRISPR-Cas9, gene therapy, genetic screening, cloning, and embryonic manipulation raise critical questions about human dignity, the sanctity of life, the boundaries of permissible intervention in creation, and the moral status of the human embryo. This study critically examines these emerging biotechnologies through the lens of Islamic bioethics, drawing upon foundational sources of Islamic law including the Qur'an, Sunnah, consensus (ijmā'), analogical reasoning (qiyās), and the higher objectives of Islamic law (maqāṣid al-sharī'ah). The research explores key areas of genetic engineering, including therapeutic applications for treating genetic disorders, reproductive genetic technologies (preimplantation genetic diagnosis), human enhancement, cloning, and xenotransplantation. It analyzes classical Islamic legal principles governing bodily integrity, lineage (nasab), intention (niyyah), harm (ḍarar), and public interest (maṣlaḥah) to assess the permissibility or prohibition of specific genetic interventions. The study also addresses the ethical implications of genetic engineering concerning privacy, justice, equity, and potential discrimination. Findings indicate that while therapeutic genetic interventions aimed at curing diseases are generally permissible within Islamic bioethical frameworks, enhancement technologies, reproductive cloning, and interventions that threaten lineage or human dignity are subject to severe restrictions or prohibition. The research emphasizes the necessity of collective ijtihad involving Muslim jurists, medical ethicists, genetic scientists, and policymakers to develop comprehensive Shariah-compliant guidelines for genetic engineering applications. Ultimately, this study concludes that Islamic bioethics offers a balanced, nuanced, and principled approach to genetic engineering, safeguarding human dignity, preserving lineage, promoting public welfare, and ensuring that biotechnological advancements serve humanity without transgressing divinely ordained moral boundaries.

Keywords: Genetic engineering, Islamic bioethics, CRISPR-Cas9, gene therapy, cloning, maqāṣid al-sharī'ah, human dignity, lineage (nasab), therapeutic intervention, enhancement

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Introduction

Modern genetic engineering represents one of the most transformative and ethically challenging scientific advancements of the contemporary era. Techniques enabling precise modification of the human genome have opened unprecedented possibilities for treating genetic disorders, preventing hereditary diseases, and potentially enhancing human capabilities. However, these same technologies raise profound moral, theological, and legal questions regarding the nature of human identity, the limits of human intervention in creation, and the ethical boundaries of manipulating the fundamental building blocks of life. For Muslim societies, these challenges necessitate a rigorous, principled, and contextually grounded response rooted in the rich ethical and legal tradition of Islam. Islamic bioethics, derived from the Qur'an, Sunnah, and the accumulated wisdom of centuries of jurisprudential reasoning, provides a comprehensive framework for evaluating emerging biotechnologies. Central to this framework are the higher objectives of Islamic law (*maqāṣid al-sharī'ah*), which prioritize the preservation of life, lineage, intellect, faith, and property. Genetic engineering interventions must be assessed against these objectives, ensuring that they promote human welfare, prevent harm, respect human dignity, and align with divinely ordained moral boundaries. This study critically examines modern genetic engineering technologies, including gene editing (CRISPR-Cas9), gene therapy, preimplantation genetic diagnosis (PGD), cloning, and human enhancement, from the perspective of Islamic bioethics. It explores classical legal principles governing bodily integrity, the prohibition of tampering with creation (*taghyīr khalq Allāh*), the sanctity of human life, and the ethical status of the human embryo. By synthesizing classical jurisprudential rulings with contemporary biomedical insights, this research aims to provide clear, practical, and Shariah-compliant guidance for Muslim individuals, families, medical professionals, and policymakers navigating the complex ethical landscape of genetic engineering.

Research Background

The emergence of genetic engineering technologies has transformed biomedical research, clinical medicine, and agricultural biotechnology over the past several decades. The development of recombinant DNA technology in the 1970s, followed by the Human Genome Project (completed in 2003), and most recently the discovery of CRISPR-Cas9 gene editing (2012) have progressively expanded human capacity to read, analyze, and modify genetic material with increasing precision, efficiency, and affordability. These technologies offer tremendous potential for treating and preventing thousands of monogenic disorders, including cystic fibrosis, sickle cell anemia, Huntington's disease, and muscular dystrophy. They also hold promise for developing novel cancer immunotherapies, generating disease-resistant crops, and controlling vector-borne diseases through gene drive technologies. Concurrently, these same technologies raise significant ethical concerns, including the possibility of germline modifications that pass heritable changes to future generations, the potential for eugenic selection and enhancement, issues of informed consent and privacy regarding genetic information, risks of unintended off-target effects, and concerns about equitable access to expensive genetic therapies. For Muslim societies, these questions are further complicated by the need to align biotechnological practices with Islamic legal and ethical norms. Historically, Muslim jurists and ethicists have addressed related questions in biomedicine, including organ transplantation, assisted reproductive technologies (IVF), abortion, and end-of-life care, developing sophisticated legal frameworks based on principles of necessity (*ḍarūrah*), public interest (*maṣlaḥah*), harm prevention (*darar*), and the higher objectives of Shariah. However, genetic engineering introduces unique challenges that require

extending classical legal principles to unprecedented scenarios involving direct manipulation of the human germline, the moral status of the embryo at various stages of development, and the permissibility of interventions that blur the line between therapy and enhancement. This research background traces the historical development of genetic engineering technologies, identifies key areas of ethical tension, and situates the inquiry within the broader tradition of Islamic biomedical ethics.

Research Significance

The significance of this research lies in its timely and critical engagement with one of the most pressing ethical issues of the contemporary era. As genetic engineering technologies move rapidly from research laboratories to clinical applications, Muslim communities face urgent questions about the permissibility, limits, and governance of these powerful tools. Without clear, authoritative, and contextually relevant guidance, Muslim patients, families, and medical professionals may be left to navigate complex ethical dilemmas without adequate support, potentially leading to practices that violate Islamic ethical norms or, conversely, to the rejection of beneficial therapeutic interventions. This research is significant for several reasons. First, it provides a comprehensive, systematic, and principled analysis of genetic engineering technologies from the perspective of Islamic bioethics, drawing on classical legal sources, contemporary jurisprudential discourse, and modern biomedical science. Second, it addresses critical gaps in the existing literature, which often focuses narrowly on specific applications (e.g., cloning or IVF) without developing a unified ethical framework applicable across the spectrum of genetic technologies. Third, it emphasizes the importance of collective *ijtihad* (*al-ijtihad al-jamā'ī*) involving interdisciplinary collaboration between Muslim jurists, medical ethicists, genetic scientists, and policymakers, recognizing that no single discipline possesses all the expertise required to address these multifaceted challenges. Fourth, the research provides practical, actionable guidance for various stakeholders, including individual Muslims seeking fertility treatment or genetic testing, medical professionals offering genetic services, religious scholars issuing fatwas, and policymakers drafting national bioethics guidelines. Fifth, by engaging with both classical Islamic legal theory and contemporary Western bioethics discourse, this study facilitates cross-cultural dialogue and contributes to global efforts to develop ethically responsible governance frameworks for genetic engineering. Ultimately, the research significance lies in its potential to help Muslim societies harness the benefits of genetic engineering while safeguarding fundamental Islamic values and protecting human dignity in the face of unprecedented technological power.

Review of Literature

The intersection of genetic engineering and Islamic bioethics has received increasing scholarly attention over the past two decades, reflecting both the rapid advancement of biotechnologies and growing awareness within Muslim communities of the need for ethical guidance. The existing literature can be categorized into several thematic areas: foundational studies on Islamic bioethics, analyses of specific genetic technologies, comparative studies between Islamic and Western bioethics, and institutional resolutions issued by international Islamic jurisprudence bodies.

Foundational works in Islamic bioethics, such as those by Abdulaziz Sachedina (*Islamic Biomedical Ethics*, 2009), Omar Hasan Kasule (*Principles of Islamic Bioethics*, 2011), and Mohammad Hashim Kamali (*Shariah and the Ethical Dimensions of Biotechnology*, 2002), establish the theoretical and methodological frameworks for evaluating biomedical technologies. These works emphasize the centrality of *maqāṣid al-sharī'ah*, the role of collective *ijtihad*, and the importance of integrating empirical medical knowledge with

normative jurisprudential reasoning. Sachedina argues for a contextualized, compassionate approach to Islamic bioethics that prioritizes patient welfare, informed consent, and the preservation of human dignity, while Kamali stresses the need to balance public interest (maṣlaḥah) with the prohibition of harm (ḍarar).

Studies specifically addressing genetic engineering include analyses of cloning (e.g., Moosa, 2005; Al-Matrouk, 2018), preimplantation genetic diagnosis (PGD) and sex selection (e.g., Serour & Dickens, 2005; Ghaly, 2013), gene therapy (e.g., Aksoy, 2005), and CRISPR-Cas9 (e.g., Ghaly, 2019). These studies generally distinguish between therapeutic applications (treating or preventing disease) and enhancement applications (improving human capacities beyond normal healthy functioning). There is broad consensus among Muslim scholars that therapeutic genetic interventions, including somatic gene therapy and PGD for serious genetic disorders, are permissible (jā'iz) based on principles of necessity (ḍarūrah) and harm prevention. However, significant disagreement persists regarding germline modification (heritable genetic changes), reproductive cloning, and enhancement technologies. Some scholars argue that germline modifications violate the prohibition on tampering with divine creation (taghyīr khalq Allāh) and could have unpredictable consequences for future generations, while others suggest limited permissibility under strict conditions, including clear medical necessity, rigorous safety testing, and oversight by qualified authorities.

Reproductive cloning has been almost universally condemned by Islamic jurisprudence bodies, including the International Islamic Fiqh Academy (IIFA) and the Islamic Fiqh Academy of the Muslim World League, which have issued resolutions prohibiting human reproductive cloning on grounds that it violates lineage (nasab), undermines human dignity, and circumvents legitimate means of procreation. Therapeutic cloning (somatic cell nuclear transfer for stem cell research) remains more controversial, with some scholars permitting it for research purposes under strict oversight and others prohibiting it due to concerns about embryo destruction.

Research Questions

1. How does Islamic bioethics, grounded in maqāṣid al-sharī'ah and classical legal principles, evaluate the permissibility and limits of modern genetic engineering technologies?
2. What are the critical distinctions between therapeutic and enhancement applications of genetic engineering from an Islamic perspective, and how do these distinctions affect jurisprudential rulings?
3. How do Islamic legal principles regarding lineage (nasab), human dignity (karāmah), and the prohibition of tampering with creation (taghyīr khalq Allāh) apply to germline gene editing, reproductive cloning, and embryonic manipulation?
4. What roles should collective ijtihad (al-ijtihād al-jamā'ī) and interdisciplinary collaboration play in developing Shariah-compliant guidelines for emerging genetic technologies?
5. What practical recommendations can be derived from Islamic bioethical principles to guide Muslim individuals, families, medical professionals, and policymakers in navigating the ethical challenges of genetic engineering?

Research Methodology

This study employs a qualitative, interdisciplinary research methodology combining doctrinal legal analysis, critical ethical inquiry, and systematic review of biomedical literature. The research is structured into several methodological phases.

First, doctrinal legal analysis is conducted to examine primary sources of Islamic law, including relevant Qur'anic verses (e.g., those affirming human dignity, prohibiting harm, and addressing creation) and authentic Sunnah (hadith), as well as classical works of uṣūl al-fiqh

(principles of jurisprudence) and *furū' al-fiqh* (substantive law). Key legal concepts analyzed include *ḍarūrah* (necessity), *ḍarar* (harm), *maṣlaḥah* (public interest), *istiṣḥāb* (presumption of continuity), and the five essential objectives of *maqāṣid al-sharī'ah* (preservation of religion, life, intellect, lineage, and property).

Second, a systematic review of contemporary Islamic jurisprudence is conducted, including resolutions and recommendations issued by international collective *ijtihād* bodies, notably the International Islamic Fiqh Academy (IIFA) based in Jeddah and the Islamic Fiqh Academy of the Muslim World League in Mecca. These institutional decisions represent significant scholarly consensus on bioethical issues and serve as authoritative references for Muslim communities worldwide.

Third, an analytical review of biomedical literature on genetic engineering technologies is performed, covering the scientific principles, technical capabilities, current and emerging clinical applications, potential risks, and ethical controversies associated with techniques such as CRISPR-Cas9, gene therapy, preimplantation genetic diagnosis, cloning, and mitochondrial replacement therapy.

Fourth, comparative ethical analysis is employed to identify convergences and divergences between Islamic bioethics and Western secular bioethical frameworks (e.g., principlism, utilitarianism, care ethics), highlighting areas where Islamic perspectives may offer unique insights or alternative approaches.

Fifth, case studies are developed to illustrate the application of Islamic ethical principles to specific genetic engineering scenarios. Case studies include (1) preimplantation genetic diagnosis for preventing a serious genetic disorder, (2) germline gene editing to correct a disease-causing mutation, (3) reproductive cloning, and (4) genetic enhancement for non-therapeutic traits (e.g., eye color, height, intelligence).

Finally, expert consultation and interdisciplinary synthesis are employed to integrate insights from Islamic jurisprudence, biomedical science, medical ethics, and public policy, leading to the development of practical, actionable recommendations for Muslim individuals, medical professionals, religious scholars, and policymakers.

The research is descriptive, analytical, and prescriptive, aiming not only to describe existing jurisprudential positions but also to critically evaluate, synthesize, and extend them to address emerging challenges.

Aims and Objectives

- To examine and elucidate the foundational principles of Islamic bioethics relevant to the evaluation of modern genetic engineering technologies, including *maqāṣid al-sharī'ah*, *uṣūl al-fiqh*, and classical fatwas on biomedical issues.
- To analyze the scientific basis, clinical applications, and ethical implications of key genetic engineering technologies, including CRISPR-Cas9 gene editing, gene therapy, preimplantation genetic diagnosis, cloning, and human enhancement.
- To critically assess the permissibility and limits of specific genetic interventions from the perspective of Islamic legal and ethical norms, distinguishing between therapeutic, preventive, and enhancement applications.
- To identify the ethical tensions and potential harms associated with genetic engineering, including threats to lineage, human dignity, justice, privacy, and the natural order of creation.
- To evaluate the adequacy and applicability of existing Islamic jurisprudential rulings (including institutional resolutions) for addressing novel genetic technologies and to propose updates or extensions where necessary.

- To explore the role of collective ijthad, interdisciplinary collaboration, and public deliberation in developing comprehensive, contextually relevant, and authoritative Shariah-compliant guidelines for genetic engineering.
- To provide practical, evidence-based, and ethically grounded recommendations for Muslim individuals, families, medical professionals, religious scholars, policymakers, and international organizations navigating genetic engineering applications.
- To contribute to global bioethics discourse by articulating Islamic perspectives on genetic engineering and fostering cross-cultural dialogue on ethically responsible governance of emerging biotechnologies.

Foundational Principles of Islamic Bioethics for Genetic Engineering

Islamic bioethics, like Islamic law more broadly, is grounded in the Qur'an, the Sunnah of the Prophet Muhammad (peace be upon him), consensus of qualified scholars (ijmā'), and analogical reasoning (qiyās). Several foundational principles are particularly relevant to the evaluation of genetic engineering technologies.

1. **The Sanctity and Dignity of Human Life (Karamāt al-Insān):** The Qur'an explicitly affirms the dignity and sanctity of human life, declaring that Allah honored the children of Adam. This principle forms the basis for prohibiting any intervention that unjustly harms, commodifies, or degrades human life, including the human embryo, which is accorded moral respect and protection from trivial or harmful manipulation. Any genetic engineering intervention must respect the inherent dignity of the human person and avoid treating human beings as mere objects of technological manipulation.
2. **The Prohibition of Harm (Ḍarar) and the Principle of Public Interest (Maṣlaḥah):** The well-known legal maxim "Harm must be eliminated" (al-ḍarar yuzāl) requires that any medical or technological intervention be assessed for potential harms and benefits. Interventions that cause net harm are prohibited, while those that prevent or alleviate significant harm may be permissible under conditions of necessity (ḍarūrah). Therapeutic genetic interventions aimed at curing or preventing serious genetic diseases generally satisfy this criterion, provided risks are minimized. Conversely, interventions that pose significant unknown risks to future generations (as in germline modification) or that commodify human embryos raise serious concerns.
3. **The Preservation of Lineage (Ḥifẓ al-Nasl):** One of the five essential objectives of maqāṣid al-sharī'ah is the preservation of lineage (nasab), which includes protecting the integrity of family relationships, legitimate parentage, and the natural means of procreation. Genetic engineering interventions that disrupt legitimate lineage, such as reproductive cloning (which bypasses the need for a father), or that create confusion about parentage through anonymous gamete donation, are generally prohibited. Conversely, interventions that help married couples conceive biological offspring (e.g., IVF with their own gametes) may be permissible.
4. **The Prohibition of Tampering with Creation (Taghyīr Khalq Allāh):** The Qur'an mentions Satan's promise to command humans to alter Allah's creation, which classical scholars interpreted as a prohibition against unnecessary and harmful modifications of the natural human form and function. This principle is frequently invoked against enhancement technologies and reproductive cloning. However, scholars distinguish between permissible interventions that restore or preserve normal functioning (therapy) and impermissible interventions that exceed this boundary (enhancement). Therapeutic gene editing to correct a disease-causing mutation falls within permissible restoration, while enhancing genetic traits beyond normal human functioning may violate this principle.

5. The Principle of Intention (Niyah): In Islamic law, the morality of an action is judged by the intention behind it. Genetic interventions motivated by genuinely therapeutic or preventive goals (e.g., saving a child from a painful disease) are viewed more favorably than those motivated by vanity, eugenic preference, or a desire to create "perfect" children. This principle allows for nuanced case-by-case assessment rather than blanket permission or prohibition.

6. Collective Deliberation and Consultation (Shūrā): Given the complexity and far-reaching implications of genetic engineering, individual jurists are ill-equipped to issue definitive rulings without interdisciplinary input. The principle of consultation (shūrā) and the institutionalization of collective ijtihad (al-ijtihād al-jamā'ī) require that decisions on genetic engineering involve Muslim jurists, medical scientists, bioethicists, and public health experts working collaboratively. [1], [2], [3], [4], [5], [6]

Scope of Genetic Engineering Technologies and Their Ethical Implications

Genetic engineering encompasses a diverse array of technologies, each with distinct scientific characteristics, clinical applications, and ethical implications. This study focuses on four major categories of genetic interventions.

1. Somatic Gene Therapy: Somatic gene therapy involves modifying the genes of somatic (non-reproductive) cells to treat or prevent disease in an individual patient. These modifications are not heritable and do not affect future generations. Somatic gene therapy holds promise for treating monogenic disorders, various cancers, and infectious diseases (e.g., HIV). From an Islamic perspective, somatic gene therapy is generally considered permissible as a form of medical treatment, provided it meets standard ethical requirements (informed consent, risk-benefit assessment, avoidance of harm). The principle of necessity (ḍarūrah) and the preservation of life (ḥifẓ al-naḥs) support its permissibility for serious conditions. However, concerns about off-target effects, long-term safety, and equitable access require ongoing oversight. [7], [8]

2. Germline Gene Therapy: Germline gene therapy involves modifying the genes of reproductive cells (sperm, eggs) or early embryos, resulting in heritable genetic changes that pass to future generations. While germline modification could theoretically eliminate hereditary diseases from a family line, it raises profound ethical concerns, including unpredictable off-target effects on future generations, the potential for eugenic applications, and the risk of exacerbating social inequalities. The overwhelming scientific consensus favors a moratorium on clinical germline editing pending further safety research and broad societal deliberation. Islamic ethical analysis must weigh potential benefits (prevention of suffering) against risks (harm to future generations without their consent) and the prohibition of tampering with creation (taghyīr khalq Allāh). Most Muslim scholars and jurisprudence bodies consider germline modification impermissible (ḥarām) or at least strongly discouraged (makrūh) due to unknowns and the violation of the principle of non-harm (al-ḍarar yuzāl). Some scholars, however, suggest extremely limited permissibility for preventing devastating genetic disorders, subject to rigorous safety protocols, multidisciplinary oversight, and case-by-case authorization by a national or international Islamic bioethics committee. [9], [10]

3. Preimplantation Genetic Diagnosis (PGD): PGD involves screening embryos created through in vitro fertilization (IVF) for specific genetic disorders before implantation in the mother's womb. Embryos free of the targeted disorder are selected for transfer. PGD is widely used for couples at risk of passing on serious genetic conditions. Islamic perspectives on PGD generally permit its use for screening serious genetic disorders, based on principles of harm prevention (izālat al-ḍarar) and the preservation of life and health. However, PGD raises

concerns when used for non-medical sex selection (gender preference, often for sons) or for selecting embryos based on non-medical traits (e.g., eye color, height), which many scholars consider impermissible as it reduces reproduction to a consumer choice and risks reinforcing discriminatory social biases. PGD for medical purposes (e.g., selecting an embryo that can serve as a stem cell donor for an existing sick sibling) remains controversial, with some scholars permitting it under strict conditions. [11], [12]

4. Reproductive Cloning: Reproductive cloning aims to create a genetically identical copy of an existing human being through somatic cell nuclear transfer (SCNT). The cloned embryo would be implanted into a woman's uterus and brought to term. Almost all international ethical guidelines prohibit human reproductive cloning due to serious safety concerns, high rates of developmental abnormalities, threats to human dignity, and concerns about commodification and identity confusion. Islamic jurisprudence bodies, including the International Islamic Fiqh Academy (IIFA Resolution No. 142, 2003), have unanimously prohibited human reproductive cloning on multiple grounds, including violation of lineage (nasab), circumvention of legitimate procreation (marriage), undermining human dignity, and the prohibition of tampering with creation. Reproductive cloning is considered categorically impermissible (ḥarām). Therapeutic cloning (creating cloned embryos for stem cell research or regenerative medicine) remains more controversial, with some scholars prohibiting it due to embryo destruction and others permitting it under strict oversight for life-saving research purposes. [13], [14]

5. Human Enhancement: Human enhancement technologies aim to modify genetic traits beyond normal, healthy functioning to improve capacities such as intelligence, physical strength, memory, or longevity. Enhancement raises profound ethical concerns about fairness, coercion, the medicalization of normal human variation, and the potential for creating genetic underclasses. From an Islamic perspective, genetic enhancement for non-therapeutic traits is generally considered impermissible (ḥarām) as it violates the principle of acceptance of divine creation (riḍā bi-khalq Allāh), constitutes unnecessary tampering with creation (taghyīr khalq Allāh), and risks promoting pride, vanity, and social inequality. The precautionary principle suggests that absent compelling medical necessity and clear evidence of safety and equity, enhancement technologies should not be pursued. However, enhancing immunity or other traits to prevent disease (rather than to exceed normal functioning) may be considered therapeutic rather than enhancement. [15], [16]

The Role of Collective Ijtihad and Interdisciplinary Collaboration

Given the complexity, novelty, and far-reaching implications of genetic engineering technologies, individual jurists lack the specialized scientific knowledge required to issue authoritative rulings. Classical legal reasoning assumed a reasonably stable set of natural and social facts, but genetic engineering rapidly transforms these facts, generating unprecedented ethical scenarios. Therefore, contemporary Islamic jurisprudence must adopt a collective ijtihad (al-ijtihād al-jamā'ī) model that integrates multiple disciplines.

Collective ijtihad brings together qualified Muslim jurists (fuqahā'), biomedical scientists, clinical geneticists, bioethicists, public health experts, and policymakers in a structured deliberative process. This interdisciplinary approach serves several functions. First, it ensures that legal rulings are informed by accurate, up-to-date scientific knowledge about the capabilities, limitations, and risks of genetic technologies. Second, it enables nuanced assessment of risk-benefit trade-offs, harm probabilities, and uncertainties that are inherently technical and probabilistic. Third, it incorporates diverse perspectives on ethical values, including those of affected communities (patients, families, genetic professionals), ensuring

that rulings reflect lived realities rather than abstract principles alone. Fourth, it facilitates the development of practical guidelines and operational protocols, not merely abstract permissibility rulings. Fifth, collective *ijtihad* enhances the legitimacy and authority of rulings by demonstrating broad scholarly consultation and reducing the risk of individual error or bias. Contemporary institutions such as the International Islamic Fiqh Academy (IIFA, Jeddah) and the Islamic Fiqh Academy of the Muslim World League (Mecca) exemplify this collective approach. These bodies have issued influential resolutions on related biomedical issues (e.g., organ transplantation, assisted reproduction, end-of-life care, cloning), drawing on multidisciplinary expertise. However, the rapidly evolving pace of genetic engineering necessitates more dynamic, ongoing mechanisms for collective deliberation, perhaps including standing bioethics committees, expert working groups, rapid-response advisory panels, and public consultation processes. [17], [18], [19]

Conclusion

This critical study has examined modern genetic engineering technologies and their ethical implications from the perspective of Islamic bioethics, grounded in foundational principles derived from the Qur'an, Sunnah, *uṣūl al-fiqh*, and *maqāṣid al-sharī'ah*. The research demonstrates that Islamic bioethics offers a rich, nuanced, and principled framework for evaluating genetic interventions, balancing the imperative to prevent and treat suffering (preservation of life) with the duties to protect lineage, maintain human dignity, avoid unnecessary harm, and respect the created order as a divine trust.

The study establishes several key conclusions. First, a clear moral and legal distinction must be maintained between therapeutic genetic interventions (aimed at curing or preventing serious disease) and non-therapeutic enhancement interventions (aimed at improving capacities beyond normal functioning). Therapeutic interventions are generally permissible (*jā'iz*) under conditions of medical necessity, informed consent, risk minimization, and equitable access, while enhancement interventions are generally impermissible (*ḥarām*) based on the prohibition of tampering with creation, the principle of acceptance of divine creation, and concerns about justice and social harms.

Second, somatic gene therapy, applied to non-reproductive cells and affecting only the treated individual, is broadly permissible as a form of medical treatment, analogous to other therapeutic interventions (surgery, pharmaceuticals, radiotherapy). Provided standard ethical requirements are met (safety, efficacy, informed consent, oversight), somatic gene therapy should be considered *jā'iz*.

Third, germline gene therapy, which introduces heritable modifications passed to future generations, is currently impermissible (*ḥarām*) due to significant uncertainties about long-term risks, the impossibility of obtaining consent from future generations, the violation of the principle of non-harm, and concerns about eugenic applications. A moratorium on clinical germline editing is ethically warranted until such time as safety and efficacy can be demonstrated and broad societal consensus, including authoritative Islamic legal guidance, is established. Even then, permissibility would likely be limited to extreme cases of devastating monogenic disorders, subject to rigorous oversight.

Fourth, preimplantation genetic diagnosis (PGD) for screening serious genetic disorders is permissible as a means of harm prevention and may be encouraged for couples at high risk of transmitting severe, untreatable conditions. However, PGD for non-medical sex selection (gender preference) or for selecting non-medical traits is impermissible, as it reduces reproduction to consumer choice, undermines the principle of acceptance of divine creation, and risks reinforcing discriminatory biases. Uses for medical purposes (e.g., selecting a

compatible embryo to serve as a stem cell donor for an existing sibling) remain controversial but may be permitted under strict conditions, including the severity of the sibling's condition, absence of alternative donors, and avoidance of commodification.

Fifth, human reproductive cloning is categorically impermissible (*ḥarām*) based on multiple grounds: violation of lineage (*nasab*), circumvention of legitimate procreation (marriage), threats to human dignity and identity, unacceptable safety risks, and the prohibition of tampering with creation. There is no credible justification for human reproductive cloning, and it should be explicitly prohibited by national and international law.

Sixth, genetic enhancement for non-therapeutic traits (i.e., improving capacities beyond normal healthy functioning) is generally impermissible (*ḥarām*). While the boundary between therapy and enhancement requires careful case-by-case assessment, the presumption should be against enhancement unless clear medical justification exists. The precautionary principle, the prohibition of unnecessary harm, and the value of accepting the diversity of divine creation all weigh against enhancement.

Seventh, the governance of genetic engineering requires collective *ijtihād* (*al-ijtihād al-jamā'ī*) involving interdisciplinary collaboration among Muslim jurists, biomedical scientists, clinical geneticists, bioethicists, public health experts, and policymakers. No individual scholar possesses the requisite expertise across law, theology, science, and ethics. Institutional mechanisms for ongoing, dynamic, transparent, and accountable collective deliberation are urgently needed at national and international levels.

Results

The study's findings reveal that Islamic bioethics provides a comprehensive, principled, and adaptable framework for addressing the ethical challenges of modern genetic engineering. Key results include the following.

First, the distinction between therapeutic and enhancement applications is ethically and jurisprudentially significant and should guide permissibility rulings. Therapeutic interventions (somatic gene therapy, PGD for serious disorders) are generally permissible, while enhancement interventions and reproductive cloning are generally impermissible.

Second, there is broad consensus among Islamic jurisprudence bodies (IIFA, MWL) on the prohibition of human reproductive cloning and the requirement for strict oversight of genetic technologies affecting lineage and human dignity.

Third, emerging technologies such as germline gene editing remain highly controversial, with most scholars favoring a precautionary moratorium pending further safety research and ethical deliberation, while a minority permit extremely limited therapeutic applications under rigorous conditions.

Fourth, the principle of lineage (*nasab*) functions as a critical boundary marker, prohibiting interventions that disrupt legitimate parentage, anonymous gamete donation, and reproductive cloning.

Fifth, the principle of harm (*ḍarar*) requires rigorous risk-benefit assessment, informed consent, and post-market surveillance for any genetic intervention, proportionality between benefits and risks, and special caution regarding interventions affecting future generations without their consent.

Sixth, the principle of public interest (*maṣlaḥah*) permits genetic interventions that promote broad societal welfare, prevent suffering, and reduce the burden of genetic disease, while prohibiting interventions that primarily benefit commercial interests, reinforce social inequalities, or undermine communal values.

Seventh, collective ijihad and interdisciplinary collaboration are not merely optional recommendations but essential methodological requirements for authoritative Islamic legal guidance on genetic engineering in the twenty-first century.

Suggestions and Recommendations

- Establish national and international standing committees on Islamic bioethics and genetic engineering, composed of qualified Muslim jurists, biomedical scientists, genetic counselors, bioethicists, and public health experts, to provide ongoing, authoritative, and contextually relevant guidance.
- Develop comprehensive, accessible, and evidence-based educational resources for Muslim patients, families, and healthcare professionals on genetic testing, genetic counseling, gene therapy, and other genetic technologies, including their risks, benefits, and Islamic ethical considerations.
- Mandate genetic counseling and informed consent procedures that specifically address the Islamic ethical dimensions of genetic interventions, respecting patient autonomy while providing guidance grounded in Islamic values.
- Prioritize public funding and equitable access to therapeutic genetic interventions for serious diseases, ensuring that benefits are not limited to wealthy individuals or communities, in accordance with Islamic principles of justice (‘adl) and public interest (maṣlaḥah).
- Maintain a strong precautionary moratorium on human germline gene editing and reproductive cloning, while supporting somatic gene therapy research and carefully regulated clinical trials for serious diseases where no effective treatments exist.
- Prohibit non-medical genetic enhancement and non-medical sex selection through PGD, as these violate Islamic principles of acceptance of divine creation, equity, and the prohibition of unnecessary harm.
- Regulate direct-to-consumer genetic testing services to protect privacy, prevent discrimination, and ensure that test results are interpreted accurately and communicated with appropriate genetic counseling support.
- Promote international collaboration among Muslim-majority countries and Islamic scholarly bodies to harmonize guidelines for genetic engineering, facilitate knowledge sharing, and prevent regulatory arbitrage (i.e., seeking more permissive jurisdictions).
- Integrate Islamic bioethics into medical and nursing curricula, as well as into the training of religious scholars (‘ulamā’), ensuring that future healthcare professionals and religious leaders are equipped to address genetic engineering questions competently and compassionately.
- Encourage empirical research on Muslim attitudes toward genetic technologies, the decision-making processes of Muslim patients, and the needs and challenges of Muslim healthcare providers, to inform evidence-based policy and practice.
- Engage in global bioethics discourse by articulating Islamic perspectives in international forums, fostering respectful dialogue, and contributing to the development of ethically responsible international governance frameworks for genetic engineering.

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