

THE CONSTRUCTION OF HADITH ADDRESSING GENETIC ENGINEERING OF HUMANS

Tasmim Tangngareng
Universitas Islam Negeri Alauddin, Makassar, Indonesia
*e-mail: tangngarengtasmin@gmail.com

Irwan Abdullah
Universitas Islam Negeri Sunan Kalijaga, Yogyakarta, Indonesia
e-mail: irwanabdullah6@gmail.com

Rahman
Universitas Islam Negeri Sultan Syarif Kasim Riau, Indonesia
e-mail: rahman@uin-suska.ac.id

Sawaluddin
Sekolah Tinggi Agama Islam Rokan, Indonesia
e-mail: regarsawaluddin@gmail.com

Abstract

This paper explores positions of hadith and ethics in discussing the genetic engineering of humans by departing from the following questions: a) how do hadith contribute to constructing various aspects of human genetics? b) how did the social context around Prophet Muhammad affect the construction of the hadith? c) how do hadith addressing human genetics relate to scientific development? This paper reveals that the ethics and process of genetic engineering are prescribed in the hadith, illuminating the contextual debates of its time. Issues of genetics that arise in the discourse of human existence, particularly regarding sex and skin color, show a contestation of values related to the position of genetic factors as undeniable. Scientific development provides answers to the increasingly complex and contestatory discourse on genetics and necessitates a paradigm shift in the Muslim community, which often places hadith as a believed and practiced textual truth.

Keywords: *hadith construction; genetic engineering; contestation; ethic*

Abstrak

Tulisan ini mengeksplorasi posisi hadis dan etika dalam membahas rekayasa genetika manusia dengan berangkat dari pertanyaan-pertanyaan berikut: a) bagaimana hadis berkontribusi dalam mengkonstruksi berbagai aspek genetika manusia? b) bagaimana konteks sosial di sekitar Nabi Muhammad mempengaruhi konstruksi hadits? c) bagaimana hadis yang membahas genetika manusia berhubungan dengan perkembangan ilmu pengetahuan? Makalah ini mengungkapkan bahwa etika dan proses rekayasa genetika diatur dalam hadits, menerangi perdebatan kontekstual pada masanya. Isu-isu genetika yang muncul dalam wacana eksistensi manusia, khususnya mengenai jenis kelamin dan warna kulit, menunjukkan adanya kontestasi nilai-nilai yang berkaitan dengan posisi faktor genetik sebagai hal yang tak terbantahkan. Perkembangan keilmuan memberikan jawaban atas wacana genetika yang semakin kompleks dan kontroversial serta

* Corresponding author, email: tangngarengtasmin@gmail.com

Citation: Tangngareng, Tasmim, Irwan Abdullah, Rahman and Sawaluddin. "THE CONSTRUCTION OF HADITH ADDRESSING GENETIC ENGINEERING OF HUMANS" *Jurnal Ilmiah Islam Futura* 23, no. 1 (2023): 20-37.

[10.22373/jiif.v23i1.14716](https://doi.org/10.22373/jiif.v23i1.14716)

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menuntut adanya perubahan paradigma dalam masyarakat muslim yang seringkali menempatkan hadis sebagai kebenaran tekstual yang diyakini dan diamalkan.

Kata kunci: *konstruksi hadits; rekayasa genetika; kontestasi; etika.*

مستخلص

هذا البحث يستكشف موقف الحديث والأخلاق في مناقشة الهندسة الوراثية البشرية من خلال الأسئلة التالية: أ) كيف يساهم الحديث في بناء جوانب علم الوراثة البشرية؟ ب) كيف يؤثر السياق الاجتماعي المحيط بالنبى محمد صلى الله عليه وسلم في بناء الحديث؟ ج) كيف ترتبط الأحاديث التي تناقش علم الوراثة البشرية بتطور العلم؟ يكشف هذا البحث أن أخلاقيات وعملية الهندسة الوراثية تحكمها الأحاديث النبوية مما يضيء المناقشات السياقية حينئذ. إن القضايا الوراثية التي تنشأ في خطاب الوجود البشري، خاصة فيما يتعلق بالجنس ولون البشرة وهي تشير إلى أن منافسة القيم المتعلقة بموقف العوامل الوراثية موثوقة أي غير منكرات. التطورات العلمية تجيب على الحوار حول الوراثة المعقدة والمثيرة للجدل بشكل متزايد، وتتطلب تغيير النوعية في المجتمع الإسلامي الذي يضع الحديث بوصفه الحقائق النصية التي تم تصديقها والعمل بها.

الكلمات الرئيسية: *بناء الحديث؛ الهندسة الوراثية؛ المنافسة؛ الأخلاق*

A. INTRODUCTION

The relationship between hadith and science has been unequal. Hadith is often perceived as indisputable regardless of opposing arguments made through scientific findings. Likewise, in studying genetics, hadith is often regarded as the absolute truth by Muslims. As a result, findings in genetic engineering research often appear contradictory to textual narratives in the Qur'an and hadith. Meanwhile, research on human genetics also has its long-standing history, dating back to the study of quantitative traits in the 19th Century and Mendelian traits in the first decades of the 20th Century.

Hadith addressing human genetics are largely discussed within two aspects: at the level of Islamic law, and within the relationship between science and Islam. Hence, studies specifically exploring the construction of a hadith's emergence and its relationship with genetics development are widely unexplored in the field.

This paper complements the shortcomings of existing studies that view hadith one-dimensionally and fail to examine the discursive aspects of hadith in constructing human genetics. Accordingly, three questions are formulated: (a) how do hadith contribute to constructing various aspects of human genetics?; (b) how did the social context around Prophet Muhammad affect the construction of the hadith?; (c) how do hadith addressing

human genetics relate to scientific development? These three questions are the main topics of this paper.

This paper deduces that the ethics and process of genetic engineering are prescribed in the hadith, illuminating the contextual debates of its time. Issues of genetics that arise in the discourse of human existence, particularly regarding sex and skin color, show a contestation of values related to the position of genetic factors as undeniable. At the same time, genetic discourse holds absolute power over humans in matters like biological sex and skin color. Thus, the development of science provides answers to the increasingly complex and contestatory discourse on genetics, especially in the domain of ethics.

B. DISCUSSION

Results

1. *Human Genetics*

Genetics is the science dealing with information stored in cells, its transmission from generations, and variations between individuals within a population¹. The human genome is a set of instructions in the body. Two copies of the genome are tightly woven within each cell, acting as the microscopic building blocks of the human body². The genome contains three information-carrying molecules: DNA, RNA, and protein. Genes are information in the sequence of the DNA building blocks that are transcribed (copied) into RNA molecules, then translated into (used to build) proteins. Proteins are responsible for or contribute to traits or diseases associated with genes³. About 20,000 genes in the human genome encode various proteins that perform different activities: blood clotting, muscle contraction, food digestion, nutrient absorption, and communication between cells. Lewis (2017) argued that DNA is a clock and a compass, as it can trace where today's groups of people originate. Human genetics has a long-standing history, dating back to the study of quantitative traits in the 19th Century and Mendelian traits in the first decades of the 20th Century⁴.

Equipped with faster and more affordable technologies to sequence DNA and assess genome variation on scales ranging from one to millions of bases, researchers are discovering

¹ Betty S. Pace, "The Human Genome Project," *Renaissance of Sickle Cell Disease Research in the Genome Era*, 2007, 27–44, https://doi.org/10.1142/9781860947964_0003.

² S.R. BURGE, *Introduction: Words, Hermeneutics, and the Construction of Meaning*, 2015.

³ Poirot Estelle, "La Relation Entre Deux Compréhensions Du Monde : Science et Théologie . Conditions , Modalités . Estelle Poirot Betting To Cite This Version : HAL Id : Tel-01754677 M Me Estelle Poirot-Betting Science et Théologie . Conditions , Modalités .," 2017.

⁴ Ahmet Suerdem et al., "PUS in Turbulent Times II - A Shifting Vocabulary That Brokers Inter-Disciplinary Knowledge," *Public Understanding of Science* 22, no. 1 (2013): 2–15, <https://doi.org/10.1177/0963662512471911>.

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how vastly different we are from one another.⁵ Appreciation of this distinction and its implications for genetic diseases and personality traits began in 2007. The discovery aroused great interest in academics and gained popularity in human genetics literature in contemporary discussions. Traditionally, geneticists hunt for genes by tracing genetic diseases in extended families or identifying suspected problematic genes among patients (Pennisi, 2007). On the other hand, as spiritual identity and religious beliefs are central to human's everyday life and are often intended to provide life guidance, the religious framework is also often used in discussing human genetics (Harris et al., 2004). Studies linking human genetics with religion have been done by academics, such as Kerr et al.⁶ Cole-Turner (1999), and Harris et al. (2004). For example, Cole-Turner (1999) argued that "Ideally, genetic counselors and clergy should be in communication with each other and should work together in a way that complements each other's work."⁷

2. Religion and Science

The relationship between science and religion has historically been one of the most central interdisciplinary problems globally.⁸ Conflicts between science and religion have received considerable attention in various public discourses.⁹ These discussions often gravitate to philosophical, abstract, or polemical issues rather than empirical questions. According to Byers (2000), the "war" between religion and science creates new opportunities for fruitful dialogues. Meanwhile, Barbour¹⁰ divides this relationship into four categories: (a) contradiction and conflict; (b) independence; (c) interaction or dialogue; and (d) unity and integration. In the first relationship, religion and science seek knowledge through their respective foundations, logic and sensory data; therefore, its nature remains contradictory. The second relationship, independence, is based on the premise that the two must be completely independent and autonomous to avoid conflict between science and religion. Meanwhile, interaction or dialogue interrogates the indirect interaction between science and religion, which involves questioning the boundaries and methods of the two fields. Finally, a

⁵ Eberhard Passarge, "Origins of Human Genetics. A Personal Perspective," *European Journal of Human Genetics* 29, no. 7 (2021): 1038–44, <https://doi.org/10.1038/s41431-020-00785-7>.

⁶ Yongsheng Liu and Xiuju Li, "Darwin's Pangenesis and Molecular Medicine," *Trends in Molecular Medicine* 18, no. 9 (2012): 506–8, <https://doi.org/10.1016/j.molmed.2012.07.002>.

⁷ Henry A Virkler and Karelynn Gerber Ayayo, "Hermeneutics," 2007.

⁸ Mohd Yakub et al., "Islam and the Relation of Science and the Qur'an," *International Conference on Humanities, Society and Culture* 20 (2011): 53–57.

⁹ Joseph O. Baker, "Public Perceptions of Incompatibility between 'Science and Religion,'" *Public Understanding of Science* 21, no. 3 (2012): 340–53, <https://doi.org/10.1177/0963662511434908>.

¹⁰ Ian G Barbour, "Religion and the Methods of Science," *Issues in Science and Religion* 2237, no. 1 (1966).

group of academics is thinking through the framework of unity and integration, arguing that a form of integration is possible between theology and science.¹¹

In Islamic literature, various scholars are known to have evaluated the relationship between science and the Qur'an, such as al-Jahiz, al-Ghazali, al-Meresi, Zarkeshi, Soyouti, Feyz Kashani, and others. Al-Ghazali, for example, argued that the Qur'an is a source of both inner knowledge (*ma'rifa*) and general knowledge. Agreeing with al-Ghazali, but with a touch of an extremist point of view, al-Meresi added that "all knowledge from the first to the last is contained in the Qur'an"¹². According to Urbi et al.¹³, Islam as a religion is a Complete Code of Life. The teachings of the Qur'an and hadith are closely related to science; therefore, the contestation between religion and science should be bridged.^{14, 15, 16} The Qur'an and hadith are appraised as references for numerous scientific problems, such as the use of plants to treat various diseases,^{17, 18} the secrets of the universe,¹⁹ medicine, and human biology.²⁰

Hermeneutics comes from the Greek verb *hermeneuien*, "to interpret," or the noun *hermenia*, which means "interpretation." Thus, interpretation can be conveyed in words, statements, or affirmations (Fateh, 2010). Hermeneutics is the study of interpretation theories. In the context of religion, it refers to the study of sacred texts and their interpretation, particularly related to theology and law²¹. The outcome of this process—the determinacy of meaning—is governed by the following factors: (1) the nature of the reader; (2) (intention) of

¹¹ Vita Fitria and Haekal Adha Al Giffari, "The Language of Science and Religion: An Approach to Understand the Encounter between Science and Religion According to Ian G. Barbour," *Humanika* 21, no. 1 (2021): 55–68, <https://doi.org/10.21831/hum.v21i1.40453>.

¹² Yakub et al., "Islam and the Relation of Science and the Qur'an."

¹³ Zannat Urbi et al., "Grape: A Medicinal Fruit Species in the Holy Qur'an and Its Ethnomedical Importance," *World Applied Sciences Journal* 30, no. 3 (2014): 253–65, <https://doi.org/10.5829/idosi.wasj.2014.30.03.81114>.

¹⁴ Sayid Qutub, "Dalam Al Qur'an Dan Hadits," *Humaniora* 2, no. 9 (2011): 1339–50.

¹⁵ Yasmeen Mahnaz Faruqi, "Islamic View of Nature and Values: Could These Be the Answer to Building Bridges between Modern Science and Islamic Science," *International Education Journal* 8, no. 2 (2007): 461–69.

¹⁶ Edi Daenuri Anwar Soebahar, Moh. Erfan, R. Arizal Firmansyah, "Mengungkap Rahasia Buah Kurma Dan Zaitun Dari Petunjuk Hadits Dan Penjelasan Sains," *Ulul Albab* 16, no. 2 (2015): 191–214.

¹⁷ Mohd Zohdi et al., "Integration of Naqli and Aqli Through New Medical Classification of Hadith From Sahih Al-Bukhari," *Journal of Hadith Studies* 3, no. 1 (2018): 79–81.

¹⁸ Urbi et al., "Grape: A Medicinal Fruit Species in the Holy Qur'an and Its Ethnomedical Importance."

¹⁹ Heru Juabdin Sada, "ALAM SEMESTA DALAM PERSEPEKTIF AL- QUR'AN DAN HADITS Heru Juabdin Sada (Dosen PAI FTK IAIN Raden Intan Lampung)" 7, no. November (2016): 259–76.

²⁰ Urbi et al., "Grape: A Medicinal Fruit Species in the Holy Qur'an and Its Ethnomedical Importance."

²¹ Estelle, "La Relation Entre Deux Compréhensions Du Monde : Science et Théologie . Conditions , Modalités . Estelle Poirot Betting To Cite This Version : HAL Id : Tel-01754677 M Me Estelle Poirot-Betting Science et Théologie . Conditions , Modalités ."

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the author; (3) the nature of the text (such as context and language mechanisms)²². Thus, hermeneutics focuses not only on the statement but also on its subject. Vedder²³ believed that it creates problems in interpreting religious texts because the connection between meaning and reference appears to have been removed—contrary to the interpretation of scientific or historical texts. However, the poetic or religious texts claim that it also has references, i.e., that it can be true. This can be understood as 'hermeneutic truth.'²⁴

The intended meaning of words in the Qur'an is undoubtedly essential for its comprehension. Therefore, before trying to understand the Quranic worldview, its theology, and its ethical values, there is a demand to engage with the words contained within (Burge, 2015). Furthermore, there is the concept of the hermeneutic circle. In the context of Islamic studies, for example, the concept implies that the meanings that interpreters give to the words of the Qur'an are influenced by, and they themselves influence, their interpretation of the Qur'an as a whole.²⁵ However, Nasr Hamid Abu Zayd's *The Concept of Text*, which discusses the text of the Qur'an from the perspective of "text as a cultural product," or Abu Zayd and Muhammad Arkoun's use of hermeneutics in their method, raised controversies.²⁶ Similarly, the use of hermeneutics in hadith interpretation also evokes debates among academics. According to Rohmansyah,²⁷ the opposition occurs because hermeneutics is considered to have originated in the West and is used in the Bible. However, some writers attempt to draw hermeneutical conclusions from various hadith scholars. For example, Rohmansyah²⁸ stated that examining hadith textually and contextually is part of the hermeneutical process of hadith. According to him, Ali Mustafa Yaqub—one of the hadith scholars in Indonesia—explained that contextual understanding of hadith is done by looking at its reasons of emergence (*asb b al-Wur d*), local and temporal background (*zam ni wa mak ni*), sentence causality (*'illat al-Kalam*), and socio-cultural background (*taq lid*).

²² Philippe Van Haute and Gert-Jan van der Heiden, *Hermeneutics between Faith and Reason: Essays in Honor of Ben Vedder*, 2014.

²³ Michael R Hill, "Centennial Bibliography On The History Of American Sociology," 2005.

²⁴ Pace, "The Human Genome Project."

²⁵ Suerdem et al., "PUS in Turbulent Times II - A Shifting Vocabulary That Brokers Inter-Disciplinary Knowledge."

²⁶ Rob Hogendoorn, "Caveat Emptor: The Dalai Lama's Proviso and the Burden of (Scientific) Proof," *Religions* 5, no. 3 (2014): 522–59, <https://doi.org/10.3390/rel5030522>.

²⁷ Rohmansyah, "Hadits Hermeneutic Of Ali Mustafa Yaqub," *Kalam* 11, no. 1 (2017): 17–18.

²⁸ Rohmansyah.

3. Construction of hadith addressing various aspects of human genetics

Studies on hadith addressing genetics from various hadith literature cover many topics. Specifically, this paper limits only three hadith as a reference.

1. The differences in skin color between parents and children

The first is the hadith that alludes to differences in skin color. The following hadith suggests that skin color is influenced by heredity (Hadith 1).

Narrated by Abu Hurairah (RA): A man said, "O Allah's Messenger, my wife has given birth to a black son." He asked, "Have you any camels?" He replied, "Yes." He asked, "What is their color?" He replied, "They are red." He asked, "Is there a dusky (dark) one among them?" He replied, "Yes." He asked, "How has that come about?" He replied, "It is perhaps a strain to which it has reverted (i.e., heredity)." He said, "It is perhaps a strain to which this son of yours has reverted." (al-Bukhari 1422: 53).

2. Children's resemblance to their parents

The second is the hadith addressing the determinants to a child's resemblance. The resemblance of children to their father or mother is determined by the quality of the sperm or ovum. The following hadith answers many questions about the possible sex of a child, as narrated by Imam al-Bukhari (Hadith 2).

Narrated by Anas (RA): When `Abdullah bin Salam heard the arrival of the Prophet at Medina, he came to him and said, As for the resemblance of the child to its parents: If a man has sexual intercourse with his wife and gets discharge first, the child will resemble the father, and if the woman gets discharge first, the child will resemble her." (al-Bukhari 1422: 132)

3. Engineering of children's biological sex

Rasulullah PBUH said (in a longer hadith), *"The reproductive substance of man is white and that of woman is yellow. When they have sexual intercourse and the male's substance prevails upon the female's substance, it is a male child that is created by Allah's decree. When the substance of the female prevails upon the substance contributed by the male, a female child is formed by the decree of Allah."* (Muslim, Hadith No. 473).

The three hadith addressing genetic aspects of skin color and biological sex contain a 'history of birth' that explains the rationality behind its emergence. They illustrate that the discourse surrounding genetics (genes) was present in Prophet Muhammad's era. One significant example is the hadith transmitted by al-Bukhari about a man who came to the Prophet about his son who was born black, unlike himself. The man refused to recognize the child due to the differences in physical characteristics. In the dialogue between the Prophet and the man, the Prophet explained that the genes of his ancestors influence the black skin color. Ibn Hajar al-Asqalani (1379) added in *Fath al-Bari'* that an investigation was carried

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out at that time due to the news, and they found that one of the grandmothers of the newborn child was black (al-Shafi'i, 1379 H). Muhammad ibn Salih al-'Usaimin believed that the hadith indicates that genetic factors affect offspring. Therefore, it is indubitable that genetic influences the moral and physical condition of one's descendants.

The hadith discussing the resemblance of children and parents begins with the news of the Prophet's arrival in Medina, which was heard by Abdullah bin Salam, a prominent Jewish figure. It is narrated that Abdullah Salam asked Prophet Muhammad three questions which, according to him, could only be answered by a true Prophet. After announcing that Jibril (Gabriel)—an angel whom the Jews consider hostile—had just breathed him the answers, the Prophet responded to every question satisfactorily, thus making Abdullah bin Salam convert to Islam and take the *shahada* in front of him. (Narrated by Bukhari, No. 3082). Likewise, the *asb b al-wur d* (circumstances of emergence) of the hadith about the engineering of children's biological sex also stems from the question and dialogue between a Jewish rabbi with Prophet Muhammad.

4. *Commentary and linguistic aspects of hadith addressing genetics*

In the three hadith discussed, three keywords require further examination. (a) The word *al-'Irq* in the hadith etymologically means the origin of something (Ibn Faris, tt, 283). Imam al-Nawawi in *Al Minhaj bi Sharh Sahih Muslim* explained, "the hadith clarifies that the child is still attributed to the husband even though the skin color is different—even if the father is white and the child is black or vice versa. It is not permissible for the father to reject the child based merely on the difference in skin color. Even though the husband and wife are white, and the child is born black, or the other way around, it is possible that the child inherits genes from the parents' ancestors" (An-Nawawi, 1392:133). (b) Ibn Faris (415) noted in *Mu'jam Maqayis al-Lughah* that the word in the hadith has the basic meaning of 'to revoke' or 'to gouge' something. Everything that is revoked will lose its position or identity. Children are the of their parents. As explained further, children are *tajalli* (manifestation) or a reflection of the parents' characters. This hadith relates to the science of genetics which had not been widely formulated at that time. Indeed, a fetus that acquires and inherits the characteristics of both parents who contribute to these traits in different percentages is an empirical fact. (c) Furthermore, Ibn Faris (112) explained that the word has the meanings of, among others, glory, greatness, and dominance. These basic meanings also infer the dominant nature of one of the parents' characters in the children. Parental traits and

characteristics are carried by reproductive cells (stored in DNA), which in principle will not all appear in a child. The combination of parental traits results in characteristics that are dominant (visible in a child) and recessive (hidden). Hence, the "dominant" character within the meaning of the hadith can also include this interpretation.

Ibn Hajar argued that the term in the third hadith means *'al sabaq* (preceding), because every that precedes has "overcome" or "defeated" in the sense of meaning. According to Ibn Faris (129), at first, the word *'al sabaq* had the basic meaning of "that which puts precedence." In addition, some aspects are difficult to understand (dubious) in the hadith addressing the resemblance of children to the parents. For example, the hadith states that if the male reproductive cell "precedes," then child born should resemble the father's family, and vice versa. In reality, sometimes boys resemble the mother's family more than the father's side. Based on the above discussion, al-Qurtubi (1964:50) said that the meaning of *al-'Alu* in the hadith discussing children's biological sex is *al-Sabaq* (preceding). Likewise, Ibn Hajar al-Asqalani (1379) stated that the meaning of *al-'Alu* contained in the hadith addressing children's resemblance can be understood as dominant.

Thus, *al-Sabaq* can mean 'precede' when understood within the hadith addressing the engineering of children's biological sex, both for males and females. Meanwhile, *al-Sabaq* no longer means 'to precede' but 'to dominate' or 'defeat'.

5. The social context around Prophet Muhammad's which influence the construction of *hadith addressing genetics*

Although in the understanding and theological beliefs of Muslims, Muhammad receives divine revelations behind his every utterance—even in hadith literatures; it is indicated that Jibril inspires Muhammad behind many hadith—we try to place the discourse around genetics within Muhammad's position as a human being who interacts with the society and world around him. Muhammad lived when there were two great powers in the world, the Romans and the Persians. Roman power covered several Greek territories, including where Hippocrates, a medical expert, resided (370 BC). Hippocrates developed a theory of inherited traits from parents to children known as the Pangenesis theory²⁹.

The knowledge continued to be passed down for generations until it fell into the hands of Jews and Christians, known as *ahl al-kit b* (The People of the Book) in Islamic tradition. Arabs living in Mecca and Medina have frequently interacted with the People of The Book—

²⁹ Liu and Li, "Darwin's Pangenesis and Molecular Medicine."

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Jews and Christians^{30, 31}. Evidence of the interaction between the Prophet with *ahl al-kitab* is widely recorded in the prophetic biographies (*as-Sirah an-Nabawiyyah*) (ibn Hisham al-Muarifi, 2002). For example, The Prophet met the Jewish Rabbi, Bukhara, when he was invited to trade with Abu Talib. The Prophet also met with Waraqah bin Naufal, the uncle-in-law of the Prophet (uncle of Khadijah).

Based on historical literature, the pre-Islamic Arabians practiced the tradition of improving offspring quality by asking wives to consummate with men who were more respected and superior to the husband (al-Mawardi, 1994). For generations, they had understood that a child's genetics could be engineered better through sexual intercourse. The Qur'an also prohibits marriage with close relatives such as uncles, aunts, brothers, sisters, mothers, fathers (Surah An-Nisa: 23)—known as *mahram*—because it will damage the lineage held in high esteem in the Arab tradition of the time, even today. It exhibits knowledge of the decline in gene quality that occurs when parents come from closely related lineage. In addition, in the *Jahiliya* tradition, patriarchal construction authorizes sons to inherit their mothers like an object following the passing of their fathers, which includes the right to engage in intercourse with them (incest). It can result in adverse genetic changes in the next generation due to accumulations of problematic genes, resulting in the feeble brain, genetic disorders, and developmental and intellectual delays (Fuad, 2010:14). This tradition was later banned in Islam.

6. The relationship of human genetics hadith with the development of science

The mentioned knowledge of genetic engineering found in the early Islamic period became partial guides for further research. The classical genetic sciences developed by Hippocrates and Aristotle, in turn, were explored by Islamic scientists. One renowned scholar is al-Jahiz, a scientist who lived in the 9th century AD during the Abbasid Caliphate in al-Hayawan, who contributed to modern genetics with *Tathawwur* theory. The theory argued that to survive, animals adapt by changing their bodies (which begins with changes at the gene level) over a long period of time due to environmental stress factors (Zirkle, 1941: 85). Charles Darwin later developed this theory into the theory of evolution. According to Darwin, natural selections have forced animals to make continuous genetic changes (gene mutations),

³⁰ Fitria and Al Giffari, "The Language of Science and Religion: An Approach to Understand the Encounter between Science and Religion According to Ian G. Barbour."

³¹ Dragos Constatin Sanda, Luana Alexandra Smarandoiu, and Costea Munteanu, "The Dialogue between Science and Religion: A Taxonomic Contribution," *Religions* 8, no. 3 (2017), <https://doi.org/10.3390/rel8030035>.

from generation to generation, for thousands of years to preserve their species. Thus, species that fail to adapt will eventually become extinct due to natural selection pressures—a concept known as evolution.

In its subsequent development, the theory of evolution, which was based on gradual changes spanning thousands of years, gave rise to a racist political ideology that believes in the superiority of a particular race: Eugenics. Eugenics is an effort to improve humanity by multiplying healthy offspring and "throwing out" the weak and disabled (Osborn, 1937). For example, Hitler built a racial ideology around the belief that the Aryans are pure and superior, thus committing a massacre of the Jews because they are considered inferior. Some countries even implement policies that enforce sterilization, abortion, prohibition of marriage, and genocide against certain races³².

The science behind genetic engineering continues to evolve from what has initially been an evolutionary process (requiring a long time) to a revolutionary one (happening at a quick rate). Due to the latest developments in genetic engineering, gene editing in humans is made possible by removing disease-carrying genes or DNA and creating immunity to certain diseases from the embryonic stage. The method used is CRISPr-cas9 technology³³.

CRISPr-cas9 is a combination of two specific terms in molecular biology. The first word, Crispr, stands for *Clusters of Regularly Interspaced Short Palindromic Repeats*, a point in the DNA sequence targeted for editing. Meanwhile, Cas9 is a type of enzyme protein that cuts and connects the DNA sequence (<http://www.zeclinics.com/crispr-cas9/>). The gene-editing process with CRISPr-cas9 can be seen in Figure 1.

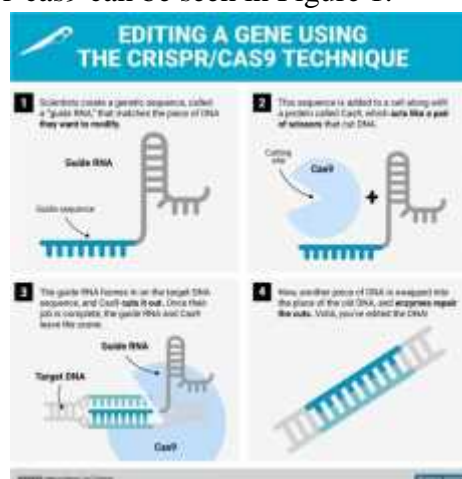


Figure 1: DNA editing process with CRISPr-cas9
(Source: <http://www.zeclinics.com/crispr-cas9/>)

³² Catherine Bronson and Sean Anthony, "RQR | Review of Qur'anic Research RQR | Review of Qur'anic Research" 1, no. 1 (2015): 36–40.

³³ Hogendoorn, "Caveat Emptor: The Dalai Lama's Proviso and the Burden of (Scientific) Proof."

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The method was initially applied in limited laboratory settings on plants and animals but is now increasingly considered for application in humans despite various controversies (Fridovich-Keil, Gene editing, <https://www.britannica.com/science/gene-editing>).

In a recent development, a Chinese scientist, He Jiankui, claimed to have successfully applied the CRISPr-cas9 method to edit the DNA of Lulu and Lana, a pair of twins born to parents with HIV/AIDS. Targeted codes in the twin’s DNA sequence were edited using the CRISPr-cas9 technique while still in embryonic form. As a result, the gene carrying HIV was removed so that once they were born, they no longer carry AIDS. (<http://www.vox.com/science-and-health/2018/11/30/18119589/crispr-gene-editing-he-jiankui>).

Table 1: Timeline of the Development of Genetic Engineering Sciences

No	Era/Thinkers	Contribution in Genetical Engineering
Evolutionary genetic changes (happen in a long time)		
1	Ancient Greek Era (4th-3rd Century BC)/Hippocrates and Aristotle	Pangenesis theory: traits inherited from parents to children
2	Islamic Golden Age (9th Century AD)/al-Jahiz	<i>Tathawwur</i> theory: to survive, animals adapt by changing specific parts in their bodies (which recently discovered to begin with changes at the gene level) over a long time due to environmental stress factors
3	10th Century AD / Abu Qasim al-Zahrawi (Albucasis)	In-depth exploration of the hereditary nature of hemophilia
4	19 th Century/Gregor Mendel	Mendelian Principle of Heredity (parental traits are passed on to their offspring)
5	19 th Century /Darwin	The theory of Evolution and new Pangenesis
Revolutionary genetic changes (happen in a short time)		
6	1923/Frederick Griffith	Bacteria transform through DNA mutation, which has a massive effect on its body
10	1910/ Davenport; and 1933/ Nazi Germany	Davenport established the Eugenics Record Office (ERO) in New York, calling for marriage control and the sterilization of the lower classes to break the chain of “bad” genes. ERO also promoted sterilization laws in the US targeting socially unfit individuals. As a result, sterilization laws were enforced in 30 US states, and 60,000 people were forcibly sterilized. In 1933, the Government of Nazi Germany issued a law aimed to prevent hereditary diseases, in which 400,000 citizens were forced to sterilize because they were accused of inheriting mental illness, epilepsy, or physical disability.
9	1950/Erwin Chargaff	Chargaff’s Rules: DNA is composed of specific codes consisting of Adenine, Guanine, Cytosine, and Thymine (AGTC).
11	2017/Jennifer Doudna, Samuel Sternberg	DNA editing using the CRISPR-Cas9 method is like editing text on a computer screen; it can be applied to plants, animals, even humans

Looking at the historical development of genetic engineering sciences, genetic engineering during the Prophet’s era could be categorized as *Sunnah Taqririyyah* (the Prophet’s silent approval), as Prophet Muhammad simply explained the reasons behind the

child's resemblance to his parents, and he was silent regarding approval—neither forbidding nor ordering. *Sunnah Taqririyyah* was formulated by hadith scholars when the Prophet noticed a particular matter and was silent about it. Philosophically, it is regarded as impossible that the Prophet excuses wrongdoings considering that he was sent to guide humans on the path of righteousness. So, what the Prophet is silent on is not fundamentally wrong—even in nature correct. It also applies to the genetic engineering implied in the above hadith, which was not considered wrong at that time.

Discussion

1. Differences in gender and skin color genes

As discussed in the literature review and results, genetics is a long-standing field decorated with extensive discussions, spanning until today. It is also established that the skin color and sex differences in hadith illustrate the reasoning and knowledge prevailing at that time. The Arabian structure of thought inspired the Prophet to reveal this information so that—in theological language—Jibril came to whisper to Muhammad at that historical juncture. As has also been exhibited in the results, Arab society shows familiarity with the engineering of superior genes, one of which by ordering the wife to consummate with other men who have excellent physical conditions to produce superior offspring. This was then prohibited during the Islamic period because it damages the lineage held and glorified by Arab society. In addition, the desire of married couples in Arabia to have a son is significant (Munfarida, 2015), given the exceedingly dominant patriarchal mindset, where men work while women only engage in the domestic sphere. Thus, traditionally, the Arabs were most interested in the ways to produce sons, considering that it was regarded as more beneficial.

On the other hand, the information provided by the Prophet through the hadith narrated by Abu Hurairah shows that differences in skin color are influenced by the ancestors' genes present in the child. Even though the father and mother are physically white, the parents may still carry black skin genes. As the black skin gene is "inactive" (in the biological term, recessive), and the white skin gene is more active (dominant), the black skin color does not appear in both parents. However, when the father's sperm and mother's egg meet, this black gene is transmitted. Therefore, in the following generations, brown-skinned children may appear as a combination of black and white skin genes—even black children may be born.

Likewise, the sex of a child is also influenced by the genes of both parents. As known, in a man's body, there are XY chromosomes, while in a woman's body exist XX chromosomes. When the Y chromosome in the father's body "loses," the offspring with the

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female sex (XX) are produced. On the other hand, if the Y chromosome carried by the father is stronger and more dominant, a male offspring (XY) will be born.

2. How the Qur'an and hadith explain the differences

The Qur'an and hadith reveal that in every human being, there are genetic differences. For example, variations in skin color, blood type, and facial resemblance are based on heredity. The hadith explaining genetic differences have also been scientifically studied and corroborated by scientists who found that the genes stored in sperm and ovum are different for every human.

Up to this point, it is evident that in the social space when the Prophet lived, the concept of genetic engineering was present, although it was very limited due to the development of science at that time. On the other hand, the Qur'an often discusses the creation of humans (QS. Al-Hajj: 5), which is then detailed in the hadith, including skin color, biological sex, and ways to produce offspring with preferred biological sex. In another hadith, it is also warranted that men should choose women who can bear many children and have a motherly nature. However, little can be said about how the hadith explain the process behind differences in skin color and how to get the desired biological sex due to the limited knowledge and the absence of data about the people of the Prophet's era, particularly concerning this topic.

Some Islamic scholars, such as Ibn Khaldun, argued that the Prophet's knowledge regarding medicine is not part of divine revelation but a mastered knowledge from the social environment at that time, which was passed down for several generations. Furthermore, Ibn Khaldun believed that Muhammad was not sent to become a doctor but rather a carrier of prophetic messages³⁴. Thus, the information pronounced by the Prophet may initially be absorbed from his surrounding environment.

3. How religion explains the debate around genetic engineering

Currently, with the discovery of CRISPR-Cas9 technology, scientific developments in genetic engineering have significantly advanced. Based on previous discussions, the Islamic community should support the development of genetic engineering technology that brings positive benefits and has objectives that are in line with the sharia (*maq id al-shar a*), such

³⁴ Sawaluddin Sawaluddin and Sainab Sainab, "THE INTELLIGENT MEANING IN THE QUR'AN: Nalysis Of The Sure Potential In The Al-Qur'an As A Dimension Of Human Psychic Insaniah," *Madania: Jurnal Ilmu-Ilmu Keislaman*, 2019, <https://doi.org/10.24014/jiik.v9i2.8388>.

as *hifdz al-nafs* (Protection of Life) and *hifdz al-nasl* (Protection of Lineage) (Hadi, 2017). Rejection of scientific progress in genetic engineering only results in backwardness in the Islamic tradition.

Genetic engineering with the CRISPR-Cas9 technology can be carried out when the engineered gene is still incomplete as an independent organism or is still in an embryonic development stage. Additionally, alterations can also be done when the engineered organism is already in its final form as a new organism or already born³⁵.

The three hadith above at least provide the initial form of knowledge about genetic engineering at that time. Engineering to produce good offspring is done by way of marriage between men and women. Moreover, the hadith prescribing to marry a woman who is fertile (*al-walud*) and good at raising children (*al-wadud*) implies that engineering of "descendants" before the formation phase of a living organism is permissible, even while it is far from the embryonic form, as long as no harm is left³⁶.

Furthermore, the emergence of QS. An-Nisa, verse 23, gives rise to the concept of *mahram*. It contains the prohibition of marriages between people who are genetically close. The verse suggests that Islam does not encourage genetic modifications that lead to weak offspring due to the meeting of recessive "problematic" genes in both parents. Although men and women who are genetically close appear to have a superior appearance from the outside³⁷ (e.g., both are intelligent, beautiful, and appear perfect physically), they may carry recessive defective genes in their bodies (e.g., mental retardation, blood cell disorders) that are not visible, which are inherited from their ancestors. When the marriage between the two occurs, the recessive gene will appear in the next generation. To reduce this possibility, Allah forbids this practice in the QS. An-Nisa: 23.

Forbidden to you (for marriage) are: your mothers, and your daughters, and your sisters; and your father's sisters and your mother's sisters, and your brother's daughters and your sister's daughters and your foster mothers, and your foster-sisters, and your mothers-in law, and your step-daughters who are under your protection (born) of your women unto whom you have gone in-but if you have not gone in to them, then it is no sin for you (to marry their daughters). And the wives of your sons who (spring) from your own loins, and that you should have two sisters together, except what had already happened in the past. Surely Allah is Oft-Forgiving, Most Merciful. (QS al-Nisa': 23)

³⁵ Jonathon McPhetres, Jonathan Jong, and Miron Zuckerman, "Religious Americans Have Less Positive Attitudes Toward Science, but This Does Not Extend to Other Cultures," *Social Psychological and Personality Science* 12, no. 4 (2021): 528–36, <https://doi.org/10.1177/1948550620923239>.

³⁶ Bronson and Anthony, "RQR | Review of Qur ' Anic Research RQR | Review of Qur ' Anic Research."

³⁷ Sawaluddin Siregar, "Hubungan Potensi Indra, Akal, Dan Kalbu Dalam Al-Qur'an Menurut Para Mufassir," *Al-Banjari : Jurnal Ilmiah Ilmu-Ilmu Keislaman* 19, no. 1 (2020): 134, <https://doi.org/10.18592/al-banjari.v19i1.2185>.

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This preventive attitude is in line with the theory of medical science. In *al-Qanun fi al-Thib* (The Canon of Medicine), Ibn Sina (1999:13) broadly divided medical sciences into two main branches: preventive medicine (*al-thibb al-wiqa'i*) and therapeutic medicine (*al-thibb al-'ilaji*). Preventive medicine is a branch of medical sciences that deals with methods to prevent diseases from occurring, while therapeutic medicine discusses how to treat a body that has already been infiltrated by diseases.

Evaluating this issue using Ibn Sina's theory, genetic engineering that prevents a specific disease from being hereditarily transmitted to a new generation should therefore be permitted³⁸. Moreover, it is in accordance with the purpose of the Qur'an revelation, especially QS al-Nisa': 23, which is to prevent the birth of a vulnerable generation due to the transmission of hereditary diseases. In another verse in the Qur'an:

وَلْيَخْشَ الَّذِينَ لَوْ تَرَكَوْا مِنْ خَلْفِهِمْ ذُرِّيَّةً ضِعَافًا خَافُوا عَلَيْهِمْ فَلْيَتَّقُوا اللَّهَ وَلْيَقُولُوا قَوْلًا سَدِيدًا

And let those fear as if they had left weak offspring behind and feared for them (that they would be exposed to injustice). So let them fear Allah and speak words of justice (righteousness). (QS al-Nisa': 9)

C. CONCLUSION

This paper confirms the existence of prophetic hadith discussing genetic engineering, such as the hadith covering differences of a child's skin color influenced by hereditary genes of the ancestors. In biological studies, children born with different skin colors from their parents indicate genes hidden in both parents and inherited from long inactive (recessive) ancestral genes. Thus, in the generations that follow, these inactive genes may turn active and dominant. The same principle applies to sex determination. XY chromosomes are present in males, and XX chromosomes exist in females. If the Y chromosome in the male body loses, then the female sex (XX) will appear in a child. The emergence of hadith on this topic corroborates a particular discourse in Prophet Muhammad's social space. Based on the exploration in the results section, the religious response to genetic engineering exhibits an acceptability that is critical in preventing the birth of a disease-ridden generation, which is also in line with the message contained in Surah al-Nisa: 23.

³⁸ Sawaluddin Sawaluddin et al., "The Potential of the Senses in Al-Quran as the Basic Elements of the Human Physic and Its Application in Learning," 2018, <https://doi.org/10.2991/icie-18.2018.28>.

These hadith also perform as a gateway for contemporary studies today, such as the CRISPR-Cas9 method. Research in genetic engineering has reached a point that positions humans as active agents in determining a generation's quality by eliminating disease-carrying cells and even engineering biological sex. The emergence of this technology is a breakthrough in genetics that also poses a new challenge. It creates the potential in humans to create a strong generation that is immune to diseases, as in the case of twin babies Lulu and Lana, but at the same time, the human can now play God by deciding the birth of new generations.

This paper is limited to the study of hadith addressing genetics, so there is still room for further research. Furthermore, the study of bioethics has not been widely investigated and is in critical need of examination, especially in the contemporary discourse of gene editing. Islamic bioethics appropriately responds to this development and places the advancement of genetic engineering as scientific progress in line with the principle of *hifdz al-nafs* (Protection of Life) emphasized in *u 1 al-fiqh* (principles of Islamic jurisprudence).

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