Transformation of the Concept of the Family in the Wake of Genomic Sequencing: An Islamic Perspective

Ayman Shabana¹

The twentieth century witnessed many life-changing scientific and technological achievements that touch almost all aspects of human life both at the individual and collective levels.² One of the most fascinating and impactful discoveries has been the identification of the human genetic structure in the form of deoxyribonucleic acid (DNA). Subsequent efforts aimed to decipher the entire human genetic makeup, which was successfully achieved with the completion of the Human Genome Project. The human DNA has become the main marker of personal identity, if not even destiny, with its ability to reveal important information about one's current as well as future health conditions. Consequently, it has opened up a new chapter in the history of medicine with the introduction of personalized medicine, which aims to evaluate individuals' healthcare needs on the basis of their genetic structures. It has also acquired a metaphysical status with its comparison with the soul and its identification as the locus of human personhood, although unlike a soul it has a physical existence (Chadwick 2006, 256).

On the other hand, the availability of this genetic information has raised serious ethical, legal and social questions that concern not only the individuals whose DNA is being examined but also their families. Increasingly physicians and life scientists are trying to come to terms with the fact that having a genetic condition (disease or mutation) is a family experience, rather than an individual one. To what extent then does this new medical and scientific state

1 Associate Research Professor at Georgetown University's School of Foreign Service in Qatar (SFS-Q), as2432@georgetown.edu

2 This publication was made possible by NPRP grant # NPRP8-1478-6-053 from the Qatar National Research Fund (a member of Qatar Foundation). The statements made herein are solely the responsibility of the author.

of affairs change/challenge our perception of family relationships and the very concept of the family itself? What does it mean to be related to someone? Does this rest solely on biological or genetic factors? And finally, to what extent does this biological revolution impact relationship with future family members?

Modern genomic technology has inspired many technical applications that have forced reconsideration of many aspects of the family. The most striking feature of these applications is not only their ability to impact existing family relationships but also, more poignantly, to influence important traits and characteristics in prospective offspring. This chapter aims to highlight some of the numerous vexing questions that these applications raise for both existing as well as prospective family relationships and to explore the range of Islamic responses to these questions. More particularly, it discusses the extent to which these technologies challenge an ideal Islamic model of the family as well as the distinctive characteristics of such a model. At the core of these discussions lies a central question on the permissibility/desirability of utilizing these new technologies. In other words, should they be celebrated as a gift of the God-given human intellect or avoided due to their involvement of uncalculated risks that threaten to disrupt the original order of divine creation? The chapter examines the extent to which various applications of genetic technology are transforming some of the most important aspects governing the structure of the family in terms of its formation through marriage and also individuals' ability to control the reproductive process by influencing basic genetic characteristics of their prospective children. In exploring Islamic discourses on these issues, particular focus is placed on the normative pronouncements as well as related discussions of several transnational institutions such as the Islamic Organization for Medical Sciences, the Islamic Fiqh Council of the Muslim World League, and the International Islamic Fiqh Academy of the Organization of Islamic Cooperation. Several recent studies aimed to provide Islamic perspectives and guidelines on cutting edge genetic and genomic research but they have not paid close attention to this normative body of literature that was generated by these institutions (Al Aqeel 2007; El Shanti et al 2015). This chapter, therefore, aims to contribute to existing scholarship by highlighting the potential role that this literature can play in this regard.

Genetic Revolution and Genetic Testing

The history of modern genetic testing goes back to 1953, when Francis Crick and James Watson identified the basic genetic structure (the deoxyribonucleic acid or DNA) in the form of a double helix, which comprises the chemical

compounds responsible for the production and maintenance of all living organisms. This major scientific discovery was the prelude to the successful completion of the Human Genome Project in 2003. This major scientific achievement is said to have ushered a transition from an industrial age to a biotech age (Rifkin 2006, 46). Enthusiastic depictions characterize the human genome as the book of life, the code of codes, or the human blueprint (Rose 2006, 252). The entire human genetic repository (genome) consists of 20,000-25,000 genes, which exist in the form of extended segments (of varying length) on the base pairs that make up the spiral staircase or double helix. A human genome consists of a total of 3 billion base pairs within the nucleus of each cell, which are bundled into 46 chromosomes. They are arranged into 23 pairs, out of which 22 are the same for both males and females and only one (the sex chromosome) varying between a male and a female. Sequencing of the entire human genome has inspired scientists to develop various types of tests to screen genetic disorders and devise means to fix them or preempt their occurrence. Genetic disorders occur as a result of mutations or alteration in one's genetic structure, which can then be passed down to subsequent generations. Genetic alterations are responsible for as many as 4000 hereditary diseases and genetic tests are now available for over 1000 diseases, which are expected to increase in the future (Vaughn 2010, 460-1). Some of the most common types of genetic tests include: newborn screening for detection and early treatment of certain diseases; carrier testing to determine whether a person is a carrier of a particular disease; predictive testing, especially in case of family history; diagnostic testing for confirmation purposes; prenatal testing to screen fetuses for certain disorders such as the Down Syndrome; and pre-implantation genetic diagnosis (PGD) to screen IVF embryos prior to implantation into the mother's uterus (Vaughn 2010, 462). Despite their immense potentials, these tests are quite complex to the extent that some researchers question their utility. Part of this complexity is due to the nature of their results, which are usually probabilistic rather than conclusive.³ Moreover, tests can hardly confirm whether a particular genetic disorder is linked to a single gene mutation, multiple mutations, or yet as a combination of gene mutations and other environmental factors. Scientists cannot identify all possible mutations responsible for a particular disease (apart from available tests) or even potential mutations that may occur in the future. Also, severity of symptoms may vary from one case to another depending on interaction with other factors. Finally, the most challenging aspect about genetic testing is availability of effective treatment. Testing can

3 On the probability rather than certainty of genetic test results, see Emslie and Hunt 2006, 104.

only confirm a particular diagnosis but this does not mean that there is a cure for every (known) disorder.⁴

Impact of Genetic Technology on Existing and Prospective Family Relationships

Many researchers note that genomic technology is changing medicine in significant ways. For the purpose of this chapter, one remarkable feature of these genomics-driven changes is the growing realization of one's biological ties and connections with family members. With reference to the different types of genetic testing mentioned above, it is often noted that revelation of test results is not always a blessing because the process usually comes with a psychological toll regardless of the outcome of the testing process. Most importantly, these results often do not pertain to the individual being tested but they may be relevant to family members as well, thereby raising the question whether it would be necessary to share this information with related family members who are likely to be affected. For individual patients, the situation may vary depending on availability of a cure. In other words, one's decision to share testing results with family members who are expected to develop similar symptoms may depend on whether a medical treatment already exists or not. Some may find that revelation of distressing information in the form of susceptibility to develop an untreatable condition such as Alzheimer's disease would be of little use if not outright harmful. On the other hand, treating physicians may find themselves torn between a patient's right to autonomy (in case they do not wish to reveal test results to family members who are likely to be affected) and the duty to prevent harm to others (by sharing such information) (Vaughn 2010, 464-5). While some may argue that the revelation of testing results should be the norm, others argue that revelation of test results is not always useful especially when susceptibility to genetic disorder may lead to genetic discrimination in the form of bias by an employer or an insurance company.⁵ From another perspective incidental or inadvertent findings during the testing process could have serious social implications as is the case with

4 For example a 2002 study showed that 81 percent of respondents wanted to undertake genetic testing when a cure is available. See Vaughn 2010, 463.

5 In the United States, the Genetic Information Nondiscrimination Act (2008) prohibits discrimination by an employer or an insurance agency on the basis of genetic information. Undocumented cases of discrimination, however, are difficult to account for. See Vaughn 2010, 466

misattributed paternity (Reilly 2006, 67). The use of genetic testing for paternity verification is particularly interesting in light of the fact that it has been adopted in many jurisdictions as the main method for the legal ascertainment of paternity. Within the Muslim context it has stirred heated debates due to significant ramifications on Islamic family regulations.

Modern advances in genetic technology have not only impacted existing family relationships but they have also allowed the possibility of predetermining the nature and shape of these relationships. For example, recent genomic advances have given rise to a wide array of procedures that aim at screening and even manipulating human genetic structure for therapeutic or non-therapeutic enhancement purposes through various types of genetic testing and genetic engineering. The outcome of these procedures could have lasting consequences for prospective family members. Some of the most important examples include carrier or predictive genetic testing, which can be undertaken to ensure proper matching for marital purposes. Prospective couples may undergo these tests to circumvent certain genetic disorders in future offspring, especially in societies where consanguineous marriages are common. In these cases, testing aims to screen couples to determine whether one or both individuals are carriers of a genetic disorder.⁶ Carriers possess one copy of a gene mutation and this does not mean that they do or will have the disease but when two carriers get married their children will inherit two copies of the mutated gene responsible for a particular disease (e.g. cystic fibrosis or Tay-Sachs), which will significantly increase their chance of having the disease. Apart from legal enforceability of these tests, which would depend on particular jurisdictions, these tests pose a series of moral concerns for these prospective couples and also for their families such as necessity to submit to these tests, sharing test results, possibility of concluding marriage despite positive test results, and finally impact on and responsibility towards future offspring (Vaughn 2010, 462).

Another example of tests that affect prospective family members is prenatal testing, which is undertaken during pregnancy to screen fetuses for particular diseases such as the Down Syndrome, which is found to be common when pregnancy occurs after the age of 35. While these tests can be useful in assuring parents about the health status of a fetus they raise the problem of moral de-

6 Premarital genetic screening has been used in places like Cyprus, where Thalassemia is a major public health issue, to reduce birth rate of affected babies. Some studies show that a large percentage of prospective couples who learn that they are both carriers before marriage continue with marriage. The majority of those couples use prenatal diagnosis in every pregnancy and resort to abortion when fetuses are affected. See Modell 2006, 119.

cision-making in case an abnormality is detected, for which the main solution is often abortion. Legality of abortion would depend on several factors such as the age of the fetus, the moral-religious perspective, and also the legal jurisdiction in question. This particular case of selective abortion, however, raises several additional ethical questions pertaining to perception of and attitude towards disability and disabled persons. Another problem has to do with the certainty of diagnosis or even percentage of accuracy. Ultimately this testing raises a question about the extent to which it can be used to screen for common disorders that can be treated with drugs? (Vaughn 2010, 466-7) Similarly, pre-implantation genetic diagnosis (PGD) shares a great deal with prenatal testing because it also aims to screen embryos or pre-embryos for genetic disorders prior to implantation into the uterus. While this type of testing also highlights the two issues of sanctity of human life and moral status of embryos, it also poses a set of additional moral concerns associated with the nature and objective of this testing. Equally problematic is preimplantation genetic screening (PGS), when it is undertaken for fetal sex selection to ensure pregnancy with a fetus of a desired sex, as it raises questions of gender discrimination and natural gender balance.

In the same vein, different applications of genetic engineering raise similar questions pertaining to prospective offspring. Ability to decipher human genes and identify their functions inspired efforts to repair mutated or faulty genes through gene therapy or genetic engineering. This could take the form of replacing, fixing, or activating particular genes. Gene therapy may target regular body (somatic) cells or germline (ovum or sperm) cells. While somatic gene therapy aims to fix a disorder within a person's body, germline gene therapy impacts one's offspring. Although this latter type of gene therapy is not yet available, it raises the question of manipulating the genetic structure of prospective children, which is sometimes referred to as "designer babies." While somatic gene therapy undertaken for therapeutic purposes is usually praised as a commendable undertaking, germline gene therapy, similar to PGD and PGS, raises a question about the merit of enhancement as well as the boundaries of legitimate and illegitimate intervention. Most importantly, it also raises a question about making important and lasting decisions on behalf of future generations and whether this is warranted or even desirable (Vaughn 2010, 468; Barry 2012, 254). Finally, stem cell research also raises questions about enhancement and boundaries of proper and improper use of stem cells. Stem cells are particularly important due to their high therapeutic potential and also their ability to develop into any type of body cells. The main ethical problem associated with stem cell research has been the need to destroy embryos in the process of extracting them. Although this problem has been resolved after the

development of a technique to reprogram adult cells to function as embryonic stem cells, some argue that it is premature to judge the extent to which this technique can actually match or replace the need for embryonic stem cells. Prior to the emergence of this technique in 2007, the two main sources to extract stem cells were IVF surplus embryos and embryos specifically created for research. Two main methods are used for the creation of embryos for research: parthenogenesis (stimulation of unfertilized eggs from which stem cells can be extracted); and somatic cell nuclear transfer (SCNT), which is also known as cloning. The latter process involves the extraction of the nucleus of an egg and replacing it with the nucleus of a regular somatic cell (Barry 2012, 266). Therapeutic cloning involves the creation of embryos just for the purpose of research. On the other hand, reproductive cloning involves implantation of the created embryo in the uterus, consequently resulting in a copy of the nucleus donor. The birth of Dolly the sheep in 1997 marked the success of the procedure in animals, although to date the procedure has not been tried in humans. This scientific feat, however, stirred reverberating waves of anxiety worldwide, which inspired global consensus on the prevention of human reproductive cloning and the need to develop appropriate research guidelines on these procedures. Nonetheless, the scientific possibility of developing human clones raises important questions not only about human exceptionalism but also about the integration of such clones within families and the social order in general (Barry 2012, 282-5).

Islamic Family Regulations and Genomic Technology

Since the emergence of the various applications of modern genetic technology, ethicists worldwide, both religious and secular, have been grappling with the moral quandaries that they have engendered. Within the Muslim context, responses have come mainly from Muslim jurists, which reflects the continuing influence of Sharia law for the definition of Islamic normativity. The Islamic legal corpus includes detailed regulations on various aspect of family affairs, which continue to inform related legislation in most Muslim majority countries. In light of the remarkable diversity and plurality within the Islamic legal tradition, these juristic regulations were often debated and even contested among jurists of the various legal schools. With the development of biomedical technology, however, Muslim jurists have been forced to revisit certain legal opinions and doctrines that were based mainly on pre-modern medical knowledge and experience. One of the earliest examples is the ruling pertaining to the maximum duration of a viable pregnancy. In the modern period it

has been fixed to one single year instead of the extended periods that classical jurists accommodated in order to preserve, to the extent possible, the sanctity of marriage and reputation of married women. It is important to keep in mind that legal integration of technical applications or revision of legal opinions and doctrines in light of advances in scientific knowledge remains subject to a process of negotiation that often requires extensive deliberation and scrutiny by both legal and scientific experts within a particular social and cultural context. Each of the above-mentioned procedures is already being subjected to this process of deliberation and scrutiny. Below I explore Islamic discourses on three main issues: premarital genetic testing, fetal sex selection, and germline genetic modification.

Islamic Law and Medical Suitability for Marriage

Contemporary juristic deliberations on premarital genetic testing are often placed within the context of classical juristic discussions on health-related concerns and their role in either facilitating the conclusion of marriage or warranting its termination.⁷ This includes different rules, principles, and general injunctions that aim to prevent diseases or to encourage their treatment. For example, this would cover criteria for the choice of marital partners; pronouncements on guarding against diseases in general and avoiding their causes; and health-related defects sanctioning dissolution of marriage.⁸

Islamic injunctions pertaining to marriage often emphasize the choice of marital partners on the basis of their moral character. Several pronouncements also address physical suitability for marriage. In this context explicit warning against consanguineous marriage is meant to avoid any negative impact on the health of future children, which has been confirmed by modern genetic research. The Islamic tradition includes several references discouraging this practice on the basis of the observation that consanguineous marriages often result in weaker offspring. The most important reference is attributed to the second Caliph 'Umar who advised the clan of al-Sā'ib to marry outside close family circles (Abū Ghuddah 2000, 1:585; Mahrān 2002, 226-7). Several

7 Both this section on premarital genetic testing and the following one on fetal sex selection draw heavily on an earlier publication, see Shabana 2017, 201-213.

8 Researchers often distinguish between general premarital medical testing, which screens for particular viral or contagious diseases and premarital genetic testing, which screens for genetic conditions that are likely to affect prospective children. While the first type is not contested due to its immediate benefits for the couples themselves, the second is debated due to its hypothetical or inconclusive nature. See 'Abd Allāh 2007, 9-13; 'Ibādah 2010, 17.

Prophetic narratives are also reported but their authenticity have been questioned. The ban on marriage with the prohibited degrees mentioned in the Qur'ān (4:23) supports this attitude favoring strangers as marital partners over close family members, which is said to be rooted in both physical and psychological considerations (al-Muḥammadī 2005, 321-3).

Apart from these general injunctions on the selection of the marital partner, the Islamic normative tradition includes numerous references emphasizing the importance of taking preventive measures to avoid diseases either by contagion or any other means. The issue of contagion has been particularly problematic due to several competing references that seem to give different connotations on the exact relationship between contagion and actual occurrence of particular diseases. This causal connection between contagion and illness has often triggered larger theological questions pertaining to the efficacy of independent causes and the extent to which a belief in such efficacy would conflict with God's omnipotence.⁹

With few exceptions, contemporary jurists often do not oppose premarital genetic testing but they disagree, however, on the extent to which it can be enforced.¹⁰ In general scholars can be divided into two main groups: those who argue for the enforcement of premarital genetic testing and those who argue that it should remain optional. Jurists who argue for enforceability emphasize physical fitness as an important condition for the achievement of the ideal objectives of marriage, which include sexual gratification and emotional fulfillment. They also emphasize the right of progeny to a healthy life, which involves protecting them against harmful or dysfunctional genes (al-Muḥammadī 2005, 321; al-Zuhaylī 2000; Shabihunā 2000). Jurists who argue for optionality, on the other hand, link their attitude to the question of medical treatment in general which, according to this line of reasoning, is considered permissible rather than obligatory ('Uthmān 2000).

Supporters of the enforcement of premarital testing point out the importance of exercising discretion when it comes to the choice (*takhayyur*) of the marital partner as indicated in several Prophetic reports. These injunctions on the proper selection of marriage partners can lend support to premarital genetic testing, which would equip prospective couples with valuable information regarding their own health as well as the health of their children (Abū

9 For a discussion on the question of contagion in the Islamic tradition, see Stearns 2011.

10 Some scholars, such as the late Saudi jurist 'Abd al-'Azīz bin Bāz, argued against premarital genetic testing on the grounds that results can be inaccurate. It is also argued that in principle couples are presumed to be free from genetic diseases, which obviates the need for genetic testing. See al-Shuwayrakh 2007, 128-9.

Ghuddah 2000, 1:583).¹¹ In this regard statements against consanguineous marriages are read in light of modern biomedical findings linking consanguineous marriage with increased likelihood for genetic disorders in the second generation. For example, the Syrian jurist Muḥammad al-Zuḥaylī argues that if tests show more than 50% chance of serious genetic disorders, legal action can be taken to prevent marriage in this case (al-Zuḥaylī 2000, 2:784; Abū Ghuddah 2000, 1:584; ‘Abd Allāh 2000, 2:740–1).¹² With regard to the issue of physical health, supporters of this attitude highlight the importance of guarding against all types of diseases, whether by contagion or any other means.¹³ On the issue of contagion, they rarely question its influence and they largely do not think that such influence would imply contradiction with religious faith. In this regard textual references supporting the influence of contagion are emphasized and other competing references are interpreted. For example, the text of the famous Prophetic ḥadīth negating the influence of contagion is said to mean either no contagion can be effective without God’s permission or no one should cause contagion to befall others. In this context genetic testing is seen as an important preventive measure to avoid contagion by protecting offspring against potential genetic disorders (Abū Ghuddah 2000, 1:582). With regard to the legal status of medical treatment, although it is recognized that the general ruling is permissibility, this ruling may change to recommendation and even obligation if it affects others as is the case with communicable or genetic diseases (al-Zuḥaylī 2000, 2:779–80).

One of the important contexts within which premarital genetic testing is often placed is the premodern discussions on health defects that justify annulment of marriage (Abū Ghuddah 2000, 1:582–4; Shabihunā 2000, 2:944).¹⁴ These discussions address the reproductive function of marriage but they also address other aspects such as mental capacity as well as medical conditions affecting one’s ability to interact normally with others.¹⁵ Supporters of

11 For an overview of this issue in Arabic culture and literature, see Van Gelder 2005.

12 Supporters of enforcing premarital testing argue that it is permissible for the governing authority to enforce these tests in order to protect progeny, which is one of the main objectives of shari‘ah, see also Buḥālāh 2010, 301–2.

13 For example, according to the Syrian jurist ‘Abd al-Sattār Abū Ghuddah, premarital genetic testing can be subsumed under a general principle that can be referred to as guarding against all types of diseases. See Abū Ghuddah 2000, 1:582.

14 Subsequent studies often adopt this approach as well. See, for example, Shubayr 2001.

15 This list includes conditions that are common for men and women such as madness (*junūn*) and different types of skin diseases such as leprosy (*baraṣ* and *judhām*); two conditions specific for men, which are castration (*jabb*) and impotence (*‘unnah*); and three conditions specific for women, which are *fatq*, *qaran*, and *‘afal*. Some jurists note that

the enforcement of genetic testing do not see the list of defects that pre-modern jurists discuss as exhaustive, which means that any other condition that jeopardizes the continuity of marriage can be added as well (Shabīhunā 2000, 2:952-3).¹⁶ In general, while the discussion on the possibility of enforcing premarital testing presumes that such enforcement is to be done by the government, some also indicate that prospective couples may stipulate such testing if they wish.¹⁷

While supporters of the enforceability of premarital genetic testing emphasize the reproductive function of marriage, supporters of optionality of genetic testing insist that procreation is not the sole objective of marriage. They also discuss other objectives such as lawful fulfilment of the sexual desire as well as establishment of loving and merciful cohabitation (Mahrān 2002, 227). Similarly, while they do not question the considerable advantages of genetic testing, they also emphasize its limitations. After all, genetic testing does not

these three terms refer to a blockage in the female genital part that obstructs normal sexual relationship. Other jurists make further distinctions between them. See Ibn Qudāmah 1997, 10: 57. Some jurists expand the list to include up to 18 conditions while others argue that any defect that would defeat the original purposes of marriage could be included, see Ibn al-Qayyim, 1998, 5: 166; al-Qaradāghī and al-Muḥammadī 2008, 276-8.

- 16 By way of analogy to the health conditions that pre-modern jurists list as sanctioning the dissolution of marriage, several jurists argue that a genetic disease can serve as a valid reason for the annulment of marriage provided that such a disease was not known or confirmed before the conclusion of the marital contract, see al-Shuwayrah 2007, 202-4. Some researchers, therefore, suggest premarital genetic testing as a precautionary preventive measure that should be undertaken by prospective couples. For example, Shubayr notes that undertaking premarital testing does not conflict with sharī'a or with the objectives of marriage because marriage of healthy couples is likely to last more than that of ill couples. He argues that such tests should be facilitated and administered by the government without charge. He also suggests that such tests should be a standard procedure for all individuals once they reach 15 years of age. This medical statement should then be submitted at the time of concluding the marriage contract, see Shubayr 2001, 336. Some researchers suggest that AIDS can be one of the diseases that may warrant annulment of marriage, see al-Qaradāghī and al-Muḥammadī 2008, 279.

- 17 The European Council for Fatwa and Research supports this opinion, see al-Qaradāghī and al-Muḥammadī 2008, 297; Mahrān 2002, 212. Classical jurists discuss the possibility of adding an additional stipulation (*shart zā'id*), which is neither prohibited nor permitted under the rubric of *al-shart al-ja'li*. The majority of jurists admit such stipulations as long as they accord with the intent of the contract in question. The Ḥanbalis in particular are known for their acceptance of this type of stipulations as long as they do not violate the intent of the contract. Including premarital genetic testing as a precondition for the marital contract would then depend on whether it is deemed in support of the overall intent of the marital contract, see al-Luda'mī 2011, 262-3; Buḥālāh 2010, 230-5.

by itself involve any therapeutic value and all it does is reveal existing, latent, or potential risks. Some actually question its utility in case of incurable conditions. They note that negative results in genetic testing do not necessarily mean that the tested individuals are free from genetic diseases in general, but only from the particular genetic diseases for which they are tested. In light of the increasing number of genetic disorders, it is almost impossible to find out one's status regarding all possible genetic diseases. But, apart from these immediate and direct disadvantages that genetic testing may involve, it can also result in several adverse moral, legal, and also economic consequence that may affect not only the person being tested but also other members of the family (al-Bārr 2000, 2:630-1).¹⁸ For example, they argue that enforcing genetic testing would open the door for corruption in case someone wants to obtain a certificate without being tested. Moreover, they denounce general condemnation of consanguineous marriage as the percentage of genetic disorders that can be linked directly and exclusively to this type of marriage can hardly be determined beyond any doubt. Even in the case of genetic disorders, the role of the environment as well as other causal factors cannot be excluded (al-Bārr 2000, 644-9).¹⁹ After all, the Qur'ān includes references to marriage with first cousins (33:50).

Apart from the two main attitudes mentioned above (supporters of enforceability and optionality), some scholars argue that in principle premarital genetic testing should not be made compulsory unless there is a dire necessity for it, in which case the government should take appropriate action (al-Qaradāghī and al-Muḥammadī 2008, 285-8; al-Maymān 2000, 2:821; al-Madḥajī 2011, 2:935). Otherwise, it should be left to individual discretion and more efforts should be made to raise public awareness about its importance.²⁰ On the

18 See also al-Shuwayrakh 2007, 92-5 (speaking about the false impression that genetic testing may give and also possible adverse consequences). These considerations prompted some religious scholars to question the benefit of genetic testing and argue against it.

19 Moreover, supporters of this attitudes argue that ascertainment of the medical condition of a prospective spouse is not one of the conditions of a valid marriage. They also note that marriage is not necessarily meant for reproduction. See Buḥālāh 2010, 308.

20 Islamic organizations and juristic councils issued different statements on this topic. For example, the Kuwait-based Islamic Organization for Medical Sciences supported the attitude to keep premarital genetic testing optional. This is included in the statement that was issued at the conclusion of its seminar on this and related issues in 1998. With regard to genetic testing and counseling, the statement called for: raising public awareness about the importance of genetic counseling, especially for prospective couples; preserving the privacy of individuals and confidentiality of their test results; ensuring that the process remains optional; and raising awareness about genetic risks associated with consanguin-

other hand, non-genetic regular medical tests can be enforced under certain conditions. First, tests should aim to screen for a particular list of dangerous or contagious diseases. Second, failure to submit to testing should not affect the validity of the marital contract. This condition is meant to avoid the possibility of changing the stipulated Sharia-based conditions for the validity of a marital contract either by addition or deletion. Alternatively, non-compliance can be penalized by the payment of a fee or any other similar means but it should not affect the validity of the marital contract (al-Qaradāghī and al-Muḥammadi 2008, 285-8; ‘Abd Allāh 2007, 95, 125). In light of the increasing significance of premarital testing in general and genetic testing in particular they have often been incorporated within family law legislation throughout Muslim-majority countries. However, while some countries make them compulsory, others keep them only optional.²¹

eous marriage, see *Ruʿyah Islāmīyyah*, 2:1050-2. The topic was also addressed by both the Islamic Fiqh Council, IFC (affiliated with the Muslim World League in Mecca) and the International Islamic Fiqh Academy, IIFA (affiliated with the Organization of Islamic Cooperation in Jeddah). The IFC decision, which was issued in its 17th session (held in Mecca in 2003), focused on the possibility of stipulating premarital medical testing as a precondition for the conclusion or authentication of the marital contract. It declared that this would be impermissible (*al-ilzām bi al-fuḥūṣ al-ṭibbiyyah wa rabṭ tawthīq al-ʿaqd biḥā amr ḡhayr jāʿiz*). It still called for raising public awareness about premarital tests; encouraging them; and facilitating them for those who wish to undertake them. Finally, it also noted that test results should remain confidential. See *Majallat al-Majmaʿ al-Fiqhī al-Islāmī* 15: 17(2004), 305. On the other hand, the IIFA decision, which was issued in its 21st session (held in Riyadh in November 2013), emphasized the permissibility of premarital genetic testing and also included a statement giving authorities the power to enforce it if this is deemed of a considerable public interest (*maṣlaḥah muʿtabarah ʿammah*), see <http://www.iifa-aifi.org/2416.html> (accessed March 2017). A similar indication was also included in IIFA's decision with regard to the rights of the disabled in its 22nd session that was held in Kuwait in March 2015. This decision emphasized the importance of methods that can remove causes of disability such as premarital medical testing and vaccination against polio, see <http://www.iifa-aifi.org/3998.html> (accessed March 2017).

- 21 Some Muslim-majority countries already require premarital medical testing but these tests are generally perceived as routine and ineffective. See, for example, Abū Ghuddah 2000, 1:584 (noting that these tests often do not include genetic testing); al-Bārr 2000, 2:631 (noting that in most cases formal medical statement certifying physical fitness for marriage can be obtained easily without actual testing); Mahrān 2002, 213 (noting that in Egypt marriage registrars are required to obtain a written statement from the couples indicating that they do not suffer from concealed diseases, *amrād sirriyyah*. This statement, however, does not have any legal impact and its absence does not have any effect); ʿIbādah 2010, 46 (referring to an Egyptian law that was issued in 2008 requiring premarital medical and genetic tests for the registration of marriage. Many observers, however, com-

Genetic testing is often discussed in relationship to the larger process of genetic counseling, which aims to provide detailed information about the tests being undertaken as well as advice on possible options in light of test results according to best practices. In the Muslim context this also includes elucidating possible implications and consequences of medical decisions in light of Islamic norms and regulations (al-Ḥāzimī 2000, 682). In case of positive results genetic counseling can provide possible options depending on the exact circumstances of the couple and whether both of them carry the same copies of mutated genes. These options range from cautioning them against marriage in severe circumstances to detailed advice on further steps if they choose to proceed with marriage indicating recommended procedures after marriage, whether before pregnancy, during pregnancy, or after birth (al-Ḥāzimī 2000, 680-1). In these cases they would be in a better position when it comes to anticipation of potential disorders as well as necessary arrangements to address them.

Possible options for couples whose offspring are at great risk for genetic disorders prior to pregnancy include preimplantation genetic diagnosis (PGD). This is one of the techniques that assisted reproductive technologies have made possible and by means of which IVF embryos can be tested for potential genetic disorders prior to implantation in the mother's womb. Apart from the high cost of the procedure as well as the limited success rate, the technique raises other ethical questions regarding the moral status of the embryo as well as proper disposal of surplus embryos (al-Bārr 2000, 2:634-5). A range of other options can also be explored during the process of genetic counseling along with related moral as well as religious evaluation of these options (e.g. tempo-

plain that it is usually implemented in a formalistic and routine manner. Several media reports indicate that a statement can be issued easily without undergoing any type of testing, see for example <http://www.almasryalyoum.com/news/details/42427> (accessed April 2017). Some countries made pre-marital genetic testing compulsory such as Jordan (2004), Algeria (2005), Qatar (2006), and Kuwait (2008), see Buḥālāh 2010, 53, 313-32; al-Qaradāghī and al-Muḥammādī 2008, 269. It is also worth mentioning that legislations that make premarital testing mandatory emphasize the confidentiality of the testing results and also freedom of prospective couples to conclude their marriage regardless of the testing results. For example the Algerian law indicates that the certificate issued to the prospective couples only indicates that the prospective couple completed the testing (without including the testing results), see Buḥālāh 2010, 75. In Saudi Arabia a ministerial decree was issued in 2004 to enforce premarital testing however, without any limitation on the freedom of prospective couples to conclude the marital contract regardless of the testing results, see al-Madḥājī 2011, 2:936; al-Yābis 2012, 1:220.

rary or permanent prevention of pregnancy or aborting deformed or defective fetuses).

Islamic Reproductive Ethics and Boundaries of Genetic Intervention: Case of Fetal Sex Selection

One of the options that a couple may explore after PGS is fetal sex selection, particularly when a genetic disorder is associated with one sex more than the other. In this case this technique is proposed as a therapeutic procedure rather than an exercise of preference for a particular sex over the other. Apart from the technical possibility of the procedure, fetal sex selection often raises two main theological questions: potential conflict with God's will; and potential risk of unsettling original balance of male and female distribution. The first question emanates from several scriptural sources indicating that knowledge of embryonic life belongs solely to God.²² These scriptural references imply that this divine knowledge controls one's sex during the early stages of embryonic life.

Juristic discussions on the possibility of fetal sex selection can be traced back to a seminar that the Islamic Organization for Medical Sciences organized under the general theme of "reproduction in light of Islam" held on May 24, 1983 (al-Jindi 1983). Within this seminar the discussion centered around a brief paper that the late Egyptian physician Ḥassān Ḥaṭḥūt presented in order to explain the medical and scientific nature of the procedure and how it can be implemented. According to Ḥaṭḥūt, two methods could be used. The first involves extracting a sample of the amniotic fluid surrounding the fetus and analyzing it in order to find out its sex. A decision then can be made either to retain the embryo or to get rid of it depending on the desired sex, which would raise the question of (im)permissibility of abortion as well. The second method, which at the time was undertaken only in animal breeding, depends on sperm sorting by subjecting extracted semen to a technical process by means of which Y-chromosome (male) and X-chromosome (female) are separated and then later injected in order to increase the likelihood of obtaining an embryo with the desired sex (Ḥaṭḥūt 1983, 37-8).

22 For example, see "God knows what each female carries (whether male or female) and what the wombs decrease or increase (of the pregnancy term) and everything with him is according to a (precise) measure." [Q 13:8] and "with God is knowledge of the Hour (Day of Judgment), He causes rain to descend, He knows what is in the wombs, no single soul knows what it will acquire the following day or where it will perish" [31:34]

In general the opinions expressed during the seminar were indicative of three main orientations, which could be termed as liberal, restrictive, and intermediary. The liberal orientation emphasized the religious merit of discovering the secrets of the universe, which is the explicit goal of science. Ultimately this search for the hidden secrets of the universe cannot escape divine knowledge and this remains a matter of theological belief. For example, in his commentary, the Egyptian jurist Yūsuf al-Qaraḍāwī questioned the possibility that such a procedure would place limitation on God's comprehensive knowledge, which includes every aspect of one's life. He argued that whatever man knows (e.g. in the case of fetal sex determination) is facilitated in the first place by God's knowledge, not despite it. Moreover, human ability to control fetal sex is no different because this also cannot escape God's will or command. As much as human knowledge is facilitated by divine knowledge, so also is human will, which is facilitated by the divine will.²³ As far as the question whether humans should interfere, al-Qaraḍāwī argued that they should not unless in cases of necessity, which should be treated on an individual rather than collective basis. According to this argument, humans are better off maintaining natural gender distribution, which has always been established from the beginning of human existence in the universe (al-Jindī 1983, 94-5).²⁴ Scientists will continue to explore all types of natural phenomena and Muslims should participate in this effort and explain the boundaries of the permissible and impermissible. In this example, one of the main restrictions would be total ban on the mixing of the gametes of unmarried couples.

Several normative precedents are used to bolster this argument such as the example of Prophet Zakariyya (Zechariah) and his appeal to God to bless him with a baby boy. Another precedent believed to be supportive of this attitude is the Prophet's remark concerning coitus interruptus (*al-ʿazl*). While the Proph-

23 Similarly, the Syrian scholar ʿAbd al-Sattār Abū Ghuddah refers to a distinction that the famous theologian and jurist Ibn Taymiyyah (d. 1328) made between two types of divine will: cosmic and legislative. The former governs what happens in the universe independently of human will or action while the latter leaves room for human voluntary action. Regardless of what man chooses, divine cosmic will ultimately reflects and manifests what God wants. See Abū Ghuddah 1983, 162.

24 This is with reference to this Qurʾānic verse "and you can only will what God has willed" Q 76:30 and 81:29. In support of this argument some participants also elaborated on the notion of ultimate supremacy of the divine will by pointing out the role of the original God-given condition into which man is created (*fiṭrah*). Part of this original condition is individual inclination towards a particular sex, which differs from one person to another and which, even in case of human intervention, would eventually maintain even distribution of the sexes, see Ibid, 96.

et did not forbid his companions, he noted that if a pregnancy is decreed it would occur regardless whether coitus interruptus is practiced or not (al-Jindī 1983, 97). Some reports also urge prospective couples to keep in mind future offspring while choosing marital partners (*takhayyarū li nuṭafikum*) (al-Jindī 1983, 112). One of the main religious concerns that fetal sex selection raises is that it may involve changing the original form of God's creation (*taghyīr khalq Allah*). Proponents of this attitude, however, retort by noting that this process does not entail changing the original nature of either the sperm or the ovum. All what it does is to facilitate the merger of certain gametes, not refashioning them in order to modify their basic characteristics. As long as Sharia rules are observed (e.g. preservation of the marital framework), the process should be subject to *ijtihād* (al-Jindī 1983, 103). Moreover, in certain individual circumstances the procedure could be quite helpful in satisfying the need for a baby of a particular gender. Such would be the case, for example, of spouses who have four or five girls and they want to have a baby boy. This need should not be dismissed as trivial or insignificant (al-Jindī 1983, 104).

On the other hand, a more restrictive orientation was expressed, mainly by some of the participating physicians in light of practical experience with the early phases of the fetal sex detection technology. They noted that this technology was used almost always to facilitate aborting female fetuses (even in the West), which demonstrates a global trend of anti-female bias.²⁵ This technology, therefore, raises the risk of facilitating modern forms of female infanticide (*maw'ūdah*), in comparison to the pre-Islamic Arabian practice. Accordingly, Islam's attitude on this issue, should be total rejection of technical intervention in fetal sex selection. Any form of explicit or implicit bias against women would conflict with the original spirit of Islamic legislation and should therefore be condemned, whether before or after birth. Some proponents of technical intervention argue that it could assist in the process of readjusting the balance of gender distribution in certain circumstances such as post-war situations, during which the male-female ratio is usually disturbed in favor of the female side due to the fact that more men are killed during wartime. Opponents, however, refer to some demographic studies indicating that in these circumstances gender balance is usually readjusted through natural means, obviating, therefore, the need for human or technical intervention (al-Jindī 1983, 101). While the proponents of the liberal attitude deemphasized the theological implications of fetal sex selection, proponents of the restrictive attitude insisted that this issue has clear theological implications on the grounds that scriptural

25 For a discussion on how the technology is used to reinforce anti-female attitudes in India, see also Davis 2006, 291-5.

references relegate choice of the gender of babies exclusively to God (e.g. Q 42: 49-50). Moreover, fetal sex selection involves changing God's creation, which covers any type of intervention in the natural process (al-Jindī 1983, 109-11). In particular, this procedure opens the door for more questionable procedures, especially those involving messing with human sperm.

This exchange of views shows that one of the main grounds for disagreement between proponents of the restrictive and liberal orientations is whether fetal sex selection is fundamentally a theological or merely a legal/jurisprudential question. While the former emphasized the theological implications of the issue, the latter insisted that this should be pursued as a regular legal/jurisprudential question. Between these two main orientations, a third attitude also emerged, which urged caution and advised against rushing into premature conclusions. Proponents of this attitude noted that more time was needed in order to be able to judge on the basis of actual results in the real world, in light of the fact that up until then technical means for sex selection had not yet been implemented in human reproduction (al-Jindī 1983, 102). The recommendations issued at the conclusion of the seminar included a statement on the question of fetal sex selection indicating its impermissibility at the collective level. On the other hand while some participants argued for permissibility at the individual level to satisfy the need for gender balancing, others argued for impermissibility lest this should lead to unsettling natural gender balance (al-Jindī 1983, 349).

Following this collective discussion on the issue during the IOMS seminar, normative Islamic discussions usually distinguish two main methods for sex selection: natural and technical.²⁶ The natural methods include a range of procedures that are meant to increase the likelihood of pregnancy with a fetus of the desired gender such as: timing of the intimate relationship relative to the ovulation process; following a specific diet; or use of special types of herbal or chemical solutions.²⁷ While these natural methods are generally considered

26 This distinction can be traced back to the initial discussions during the seminar that the IOMS organized in 1983, see al-Jindī 1983, 114. See also al-Rashīdī 2011, 567-624; al-Qaradāghī and al-Muḥammadi 2008, 556-62.

27 For example, some studies indicate that sexual intercourse during the early phase of ovulation increases the chance of obtaining a male fetus in comparison to later phases, which increase the possibility of obtaining a female fetus. Similarly some studies point out the connection between certain types of food and pregnancy with a fetus of a particular gender. Accordingly, a diet rich in potassium and sodium increases the chance of obtaining a male fetus while a diet rich in magnesium and calcium increases the chance of obtaining a female fetus. The sex of a fetus may also depend on the acidic or alkaline environment within the uterus. While an acidic environment is said to be more likely for obtaining a

permissible, some scholars include certain stipulations for their permissibility such as: pursuing such methods should not conflict with belief in divine omnipotence, they should not result in greater harm either for the man or the woman; and they should not involve uncovering of the private parts of the body. The technical methods also include several procedures that are meant to achieve pregnancy with a fetus of the desired gender, which require artificial insemination either internally through direct injection of properly sorted sperm or externally through in vitro fertilization (al-Rashīdī 2011, 590).²⁸ In general, juristic opinions on the use of technical means to achieve fetal sex selection can be divided into three main attitudes: permissibility as long as there is a justified psychological, social, or medical need; total prohibition; and restricted permissibility in cases of necessity for therapeutic purposes only. The third attitude, representing the majoritarian view, captures the view of the Islamic Fiqh Council of the Muslim World League. Its resolution on this issue during its 19th session, held in Mecca in November 2007, indicates that natural methods for sex assignment are permissible as long as they do not include any questionable procedure from the Sharia perspective. Technical methods, on the other hand, could be used only for medical necessity as is the case with genetic diseases affecting a particular gender. Cases of medical necessity should be evaluated individually on the basis of a consensus evaluation of a specialized committee consisting of a minimum of three physicians.²⁹

Fetal sex selection is just one example that illustrates the extent to which the interaction between assisted reproduction and genetic technologies may pose considerable challenges to the traditional structure of the nuclear family. Other examples include use of DNA fingerprinting for paternity verification and also use of gamete donation as well as surrogate motherhood to overcome infertility problems. While DNA paternity testing questions the utility and continuity of the marital presumption, gamete donation and surrogacy arrangements question the traditional definitions of both paternity and maternity.

male fetus, and alkaline environment is more likely for obtaining a female fetus. See al-Rashīdī 2011, 583-6.

28 Some researchers refer to another technical procedure involving genetic intervention to change the sex of the fetus during pregnancy, which has been experimented on animals. In light of the various complications that such a procedure results in, it is deemed impermissible, see Mahrān 2002, 374.

29 See *Majallat al-Majma' al-Fiqhī al-Islāmī* 20:23 (2008): 359-360.

Between Genetic Intervention and Genetic Enhancement: Case of Germline Modification

The unlimited capabilities of the genetic revolution has inspired scientific efforts not only to treat complex and untreatable conditions but also to modify human genetic structure to influence the outcome of the reproductive process. With the development of synthetic biology and its goal to modify and engineer living organisms, scientists are not only trying to understand or explain these living organisms but also to shape them (Lustig 2013, 15). From a religious perspective this explains why genetic manipulation raises the question of “playing God,” which has been one of the most commonly used metaphors in bioethical literature with regard to issues ranging from reproductive technologies, genetics, and end of life issues. Within this context, it is used to signify several connotations but at the most basic level it stands for the notion that certain boundaries should not be crossed because they are believed to belong to God’s domain (Lustig 2013, 24). From the perspective of Islamic foundational sources, creation is one of the divine acts, which is also captured in the divine names and attributes, one of which is the creator (*al-khāliq*). Islamic scriptural sources often place creation within a restrictive list of actions such as provision (*rizq*), death (*mawt*), and resurrection (*ba’th*) that are usually attributed to God. (e.g. 30:39; 45:26). This exclusive ascription of the act of creation to God within the Islamic moral universe explains the theological as well as ethical-legal problems associated with the notion of changing God’s creation. In part, changing God’s creation implies a challenge to divine will. Also, the Qur’ān draws a connection between efforts aiming at changing God’s creation and the evil plots of the devil (4:119), which is also reinforced in several Prophetic reports characterizing such efforts as deserving divine curse.

In light of its impact on the constitution of future offspring, germline genetic modification often invokes religious reservations associated with the notion of changing God’s creation. Moreover, similar to procedures such as reproductive cloning, germline genetic modification raises serious concerns about potential impact on the structure of the family as well as larger social order in the future. Although these procedures have not yet been tested in humans, many researchers argue that it may only be a matter of time.

Muslim discussions on these questions often address potential scenarios, associated ethical-legal implications, and also guidelines that should govern research in this area. Germline genetic modification was already highlighted in some of the collective discussions mentioned above, especially within the

various IOMS meetings since the 1980s.³⁰ In 2006 IOMS convened an international seminar to address the ethical implications of modern genetic and reproductive technologies from an Islamic but also secular as well as interreligious perspectives. The seminar touched on several applications of genetic and reproductive technologies with a particular focus on the family and social institutions.³¹ Germline genetic modification was one of the issues that the seminar identified and it featured in different papers as well as group discussions following the main panels. This collective and interdisciplinary discussion revealed the range of theological, legal, or larger social questions that genetic modification raises.

From a theological perspective, germline genetic modification inspires reflections on the concept of creation (*khalq*) and whether such genetic intervention can challenge the exclusive attribution of this act to God. In general, contributions by Muslim scholars during the seminar emphasized the Islamic conception of creation as a divine act. They also emphasized the special place that man occupies within the divinely created universe in his capacity as a vicegerent of the creator, entrusted with the responsibility to develop it following divine instructions and guidelines. Man is created in the best shape and is also endowed with honor and dignity. Other creatures are made subservient to man, who is instructed to interact with them in a careful and conscientious manner. On the basis of this theological background, human scientific efforts should not aim to change this original order of divine creation (al-Saḥmarānī 2008, 1:245-57). Consequently, one of the important guidelines that several participants emphasized with regard to genetic research is the distinction between preventive and therapeutic intervention on the one hand and purely enhancing intervention on the other. Genetic research involving humans should concentrate on preventive and therapeutic purposes only. As far as enhancement efforts are concerned, another distinction is made between enhancement in agricultural and animal research and enhancement involving humans. The first type is considered acceptable in light of its anticipated benefit in improving the quantity and quality of food products. Such research, however, has to comply with standard regulations and research ethics concerning proper treatment of animals and environmental balance. In the case of humans, genetic intervention to manipulate specific characteristics such as

30 See, for example, Sharaf al-Dīn 1983, 136-147; Abū Ghuddah 1983, 148-163 (published also in *Majallat Majma' al-Fiqh al-Islāmī*, 8:3 (1994), 165-178).

31 The seminar had four main themes: humanity and creation; genes, reproductive technologies and the family; social implications of genetic and reproductive technologies; and where boundaries should be drawn. See the summary report in al-Jindī 2008, 115-75.

sex type or skin color would not be acceptable (al-Saḥmarānī 2008, 1:266; Wāṣil 2008, 1:337-55; al-Salāmī 2008, 1:509-30; al-ʿAwaḍī 2008, 605).

Another relevant theological concept that the issue of genetic modification raises is human nature and its uniqueness. Genetic modification raises important questions on possible impact on the original God-created human nature and on the boundaries of acceptable and unacceptable enhancement. For example, the Sudanese scholar Jaʿfar Shaykh Idrīs argues that human nature, as created by God, is both distinct and unmalleable. Genetic modification, if it is implemented in humans for non-therapeutic purposes, would not tamper with this God-created human nature but would end up developing different types of beings (*kāʾināt jadīdah*) (Idrīs 2008, 2:472).³² The question that he asks is whether it would be of the best interest of humans to allow this to happen. He answers in the negative by exploring all the distinctive features of human nature, which, similar to other creatures in the universe, instinctively recognizes its creator through devotional submission and glorification. Most importantly, the distinctive human nature is marked by its combined (material-spiritual) composition of a body and a spirit, which defines the beginning and end of human life both in this world and the next. This metaphysical dimension of human nature is coded in the inborn disposition (*fitrah*) with which all humans are created and which in essence is inclined towards what is good. In other words, this inborn disposition is not created as neutral but its initial positive inclination is either reinforced or altered through social factors and influences. Although the human body shares many features of the animal nature, it remains also distinct due to its endowment by God with dignity and sanctity, which should be protected and preserved against all types of manipulation. With regard to genetic engineering, a fundamental difference, therefore, should be emphasized between possible therapeutic efforts and non-therapeutic enhancement efforts. While the former should be encouraged, similar to regular medical treatment, the latter, similar to all types of unnecessary tampering with nature, should be banned. Not only these enhancement efforts signify unjustified affront against God but experience shows that such efforts tend to cause more harm than good (Idrīs 2008, 2:479).³³ In addition to common defi-

32 On the other hand the Algerian scholar ʿAmmār al-Ṭalībī argues that genetic enhancement could be accommodated as long as it does not result in distorting God's creation. For example, enhancement that aims to improve stamina or immunity should be celebrated, see al-Ṭalībī 2008, 1:423.

33 Some scholars had issues with the notion of challenging divine will and whether man is actually capable of that. For example, the former Muftī of Tunisia Muḥammad Mukhtār al-Salāmī denies this possibility and cites the statement of the second Caliph ʿUmar when he was accused of fleeing from God's decree after his refusal to enter the city afflicted by

inition of *fiṭrah* as a set of inborn characteristics, the Moroccan thinker Ṭāha ‘Abd al-Raḥmān argues that the term can also signify values (*qiyam*) in light of his interpretation of the Qur’ānic verse indicating the original ability that God endowed Adam with (to know all the names, 2:31). ‘Abd al-Raḥmān notes that the etymological root of the term *name* and its meaning in Arabic could refer not only to the ability to distinguish (*tumayyiz*) things but also to evaluate (*tuqayyim*) them. In other words, this original knowledge includes the moral values that are incorporated within the inborn state in which man is created (al-Ṭālibī 2008, 1:423).

From a legal perspective, Muslim scholars often place questions pertaining to reproductive issues within the context of the ultimate objectives of Sharia. Preservation and protection of progeny is considered one of the five essential values that Sharia aims to protect and preserve, along with religion, life, intellect and property (al-Bārr 2008, 1:653-4; Abū Ghuddah 2008, 1:687). On the other hand, with the availability of the various applications of genetic technology, jurists point out a distinction between two types of a Sharia-based ruling (*al-ḥukm al-sharī*): *al-ḥukm al-taklīfī* and *al-ḥukm al-waḍī* (Abū Ghuddah 2008, 1:688; Abū Ghuddah 1983, 162). While the former delineates assessment of a particular issue along the continuum of the five main categories: obligation, recommendation, neutrality, reprehensibility, and prohibition, the latter specifies relevant causes, conditions, or stipulations. In particular, jurists point out the importance of the second type of rulings regardless of its status on the continuum of the five main categories, which is usually the case with procedures that are deemed prohibited or even reprehensible. They argue that in case a prohibited act is undertaken, this type of ruling will still regulate the implications and consequences of the prohibited act in order to preserve the rights of all parties concerned. This becomes clear in juristic discussions on issues such as reproductive cloning and surrogacy. From an ethical-legal perspective, genetic modification raises the question of guardianship and the boundaries of prospective parents’ authority over their prospective children. In other words, would parental guardianship in this case include the ability of parents to manipulate the genetic structure of future children? Would such authority ultimately have implications on the identity of these children and their character? And, to what extent would it change the perception of prospective children as unique and idiosyncratic individuals rather than being another type of consumer goods? In light of these questions, jurists also emphasize the distinction between a preventive or therapeutic intervention, which is seen as warranted and permitted and a non-therapeutic intervention, which is seen as unwar-

the plague “we flee from God’s decree to God’s decree.” See al-Jindī 2008, 2:496.

ranted and unpermitted (Abū Ghuddah 2008, 1:698-703).³⁴ One important point that scholars use to judge the propriety or morality of a particular procedure is the intended objective that it aims to achieve. This criterion is used to distinguish therapeutic or corrective efforts from other non-therapeutic ones. Morality of an objective is also extended to the means through which it will be achieved (Abū Ghuddah 1983, 153). In other words, a moral objective has to be pursued only through moral means. A clear example would be an objective to overcome infertility through artificial insemination. This objective, however, cannot be achieved through a religiously questionable procedure such as gamete donation due to its conflict with the sanctity of the marital relationship.

From a social perspective, genetic modification raises several issues pertaining to social justice and accessibility. If such an option becomes available, critics argue, it would widen the gap between those who can afford it and those who cannot. Moreover, on the long run, enhancement, or at least certain types of it, may even become a standard procedure for the economically privileged, which would further put poorer segments of the society at a disadvantage (Athar 2008, 2:280). The most concrete social implication that many participants raise is the risk of rejuvenating eugenic tendencies and the impact this may have on the definition of what is normal or average, let alone perception of disability and the disabled persons (Badrān and Shāhīn 2008, 2:459; Ebrahim 2008, 2:689). With this new version of eugenics, however, the aspiration to order or design one's babies would not be a far-fetched imagination (Fatah Allāh 2008, 2:719). Ultimately, enhancement procedures, similar to other procedures such as reproductive cloning, would seriously impact conventional understanding of family ties and wider social relationships (Haṭhūt 2008, 1:198).³⁵ At the conclusion of the seminar a declaration of principles was issued, which included several points with regard to genetic modification. First, it emphasized the distinction between preventive and therapeutic applications and enhancement applications. Second, another distinction is emphasized between non-human applications and others involving humans. Third, it proscribed any effort aiming at manipulating the human genetic structure, which would adversely affect human personality or distinctive characteristics.³⁶

34 Abū Ghuddah uses the term *istibdāl* (replacement) to refer to genetic modification that aims to change basic human qualities or characteristics. See Abū Ghuddah 1983, 154.

35 From another perspective genetic modification also raises all types of speculations about transhumanism and hybrid combinations, see Moazzam 2008, 2:389-408.

36 al-Jindī 2008, 2:747-9. Over the past few decades a number of similar resolutions and statements were also issued to clarify Muslim perspectives on genetic research and various applications of genetic technology. Important examples include the following: recommendations of the 21st IOMS seminar, which was held in 1998 on the theme of ge-

Concluding Remarks: Structure of the Family between Genetic Determinism and Genetic Manipulation

The above analysis shows the power of the genetic technology and its various applications in influencing both existing and prospective family relationships. Such power is expected to only increase in the future, thereby necessitating careful moral evaluation of these various applications. Within the Muslim context, the process of moral assessment is highly dependent on the Islamic normative framework, which is often dominated by the juristic discourses. The examples explored in this chapter, however, reveal the theological vision underlying these juristic discourses. Any systematic effort to provide answers to the questions that the various applications of genetic technology raise would, therefore, need to address the theological assumptions associated with issues such as divine creation, human nature, original disposition, and also scope of human freedom. Moral assessment of the various genetic applications involves meticulous balancing of their anticipated benefits against their potential harms. At this stage of scientific research, genetic testing offers remarkable diagnostic advantages with only limited therapeutic options. The unprecedented diagnostic power of genetic testing is sometimes invoked to support arguments promoting genetic essentialism, determinism, or reductionism, which often ignore environmental as well as other types of factors. On the other hand, genetic applications can enable greater levels of intervention and manipulation of living organisms, as the above discussions concerning impact on prospective family members clearly illustrate. As much as the genetic technology is constantly evolving, resulting in ever increasing number of applications and capabilities, Muslim discourses seek to keep up with these developments by offering at least tentative assessments, most notably as a result of collective deliberations within transnational institutions such as the ones covered in this chapter. Judging from the sizeable volume of publications citing these deliberations (mostly in Arabic), this cumulative body of moral insights would

netic engineering and genetic therapy from the Islamic perspective (published in 2000); a decision by the International Islamic Fiqh Academy (of the Organization of Islamic Cooperation, Jeddah) on cloning in its 10th session in 1997, see *Majallat Majma' al-Fiqh al-Islāmī* 10:3 (1997), 417-32; a decision by the Islamic Fiqh Council (of the Muslim World League, Mecca) on genetic engineering in its 15th session in 1998, see *Qarārāt al-Majma' al-Fiqhī al-Islāmī*, 313-5; a decision by the Islamic Fiqh Council on genetic fingerprinting in its 16th session in 2002, see *Qarārāt al-Majma' al-Fiqhī al-Islāmī*, 345-8; a decision by the Islamic Fiqh Council on genetic blood diseases in its 17th session in 2003, see *Qarārāt al-Majma' al-Fiqhī al-Islāmī*, 345-6; a decision by the International Islamic Fiqh Academy on genetics, genetic engineering and human genome in its 21st session in 2013.

be indispensable for exploring Islamic perspectives on these new questions. Already some broad lines can be identified in light of this literature. For example, on the issue of premarital genetic testing, Muslim scholars are unanimous on the importance of educating the public and raising awareness about this procedure, especially in places where consanguineous marriage is a common practice. Jurists, however, are divided on whether it should be enforced but even those who argue for its enforceability insist that this should not impact prospective couples' decision to proceed with marriage even in case of positive results. With regard to fetal sex selection, most jurists approve it for medical purposes. They disagree, however, when the procedure is undertaken for family balancing. Finally, with regard to germline genetic modification, another distinction is made between preventive and therapeutic intervention on the one hand and non-therapeutic enhancement on the other. A near consensus exists on the permissibility of the former case only.

References

- ‘Abd Allāh, ‘Abd Allāh Muḥammad. 2000. “*Nazarāt Fiqhiyyah fī al-Jinūm al-Basharī, al-Handasah al-Wirāthiyyah, al-‘Ilāj al-Jinī.*” In *Ru’yah Islāmiyyah li-ba’d al-Mushkilāt al-Ṭibbiyyah al-Mu’āṣirah, Thabt Kāmil li-A’māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jinūm al-Basharī wa al-‘Ilāj al-Jinī – Ru’yah Islāmiyyah*, edited by ‘Abd al-Raḥmān al-‘Awaḍī and Aḥmad Rajā’ī al-Jundī, 2 vols., 2:727–70. Kuwait: al-Munazzamah al-Islāmiyyah li al-‘Ulūm al-Ṭibbiyyah.
- ‘Abd Allāh, Ḥasan Ṣalāḥ al-Ṣaghīr. 2007. *Madā Mashrū’iyyat al-Ilzām bil-Faḥṣ al-Ṭibbī qabl al-Zawāj, Dirāsah Muqāranah*. Alexandria: Dār al-Jāmi’ah al-Jadīdah.
- Abū Ghuddah, ‘Abd al-Sattār. 1983. “*Madā Shar’iyyat al-Taḥakkum fī Mu’tayāt al-Wirāthah.*” In *al-Islām wa al-Mushkilāt al-Ṭibbiyyah al-Mu’āṣirah, al-Injāb fī daw’ al-Islām*, edited by Aḥmad Rajā’ī al-Jundī. Kuwait: al-Munazzamah al-Islāmiyyah li al-‘Ulūm al-Ṭibbiyyah.
- Abū Ghuddah, ‘Abd al-Sattār. 2000. “*al-Muwākabah al-Shar’iyyah li-Mu’tayāt al-Handasah al-Wirāthiyyah.*” In *Ru’yah Islāmiyyah li-ba’d al-Mushkilāt al-Ṭibbiyyah al-Mu’āṣirah, Thabt Kāmil li-A’māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jinūm al-Basharī wa al-‘Ilāj al-Jinī – Ru’yah Islāmiyyah*, edited by ‘Abd al-Raḥmān al-‘Awaḍī and Aḥmad Rajā’ī al-Jundī, 2(1):573–94. Kuwait: al-Munazzamah al-Islāmiyyah li al-‘Ulūm al-Ṭibbiyyah.
- Abū Ghuddah, ‘Abd al-Sattār. 2008. “*al-Wirāthah al-Bashariyyah (wa al-Jināt) wa Tuknulūjiyā al-Takāthur wa Mawqif al-Sharī’ah al-Islāmiyyah minhā.*” In *al-Nadawah al-‘Ālamīyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In’ikāsātuhā, Ru’yat al-Adiyyān al-Samāwiyyah wa wijhat nazar al-‘Almāniyyah*, edited by Aḥmad

- Rajā'ī al-Jundī, (2), 1:685-714. Kuwait: Islamic Organization for Medical Sciences.
- Al Aqeel, Aida. 2007. "Islamic Ethical Framework for Research into and Prevention of Genetic Diseases." *Nature Genetics* 39: 1293-8.
- Athar, Shahid. 2008. "Tiqniyāt al-Tanāsul al-Basharī wa al-Handasah al-Wirāthiyyah min al-Manzūr al-'Almānī." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Ālmāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(2): 271-80. Kuwait: Islamic Organization for Medical Sciences.
- al-'Awaḍī, Şiddīqah. 2008. "al-Wirāthah al-Bashariyyah wa Tuknūlūjiyā al-Takāthur wa In'ikās dhalika 'alā al-Usrah." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Ālmāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(1): 603-10. Kuwait: Islamic Organization for Medical Sciences.
- Badrān, Ibrāhīm and Muḥammad 'Abd al-Ḥamīd Shāhīn. 2008. "Khalq al-Insān wa Insāniyyatuh: al-Khuṭūṭ al-Ḥamrā' matā wa ayna Tuḍā'." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Ālmāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(2): 449-60. Kuwait: Islamic Organization for Medical Sciences.
- al-Bārī, Muḥammad 'Alī. 2000. "Naẓrah Fāḥiṣah lil-Fuḥūṣāt al-Ṭibbiyyah al-Jīniyyah: al-Faḥṣ qabla al-Zawāj wa al-Istishārah al-Wirāthiyyah." In *Ru'yah Islāmiyyah li-ba'ḍ al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, Thabt Kāmil li-'Amāl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jīnūm al-Basharī wa al-'Ilāj al-Jīnī – Ru'yah Islāmiyyah*, edited by 'Abd al-Raḥmān al-'Awaḍī and Aḥmad Rajā'ī al-Jundī, 2(2): 621-62. Kuwait: al-Munazzamah al-Islāmiyyah li al-'Ulūm al-Ṭibbiyyah.
- al-Bārī, Muḥammad 'Alī. 2008. "Baḥth 'an Tiqniyāt al-Wirāthah wa al-Takāthur al-Basharī min al-Manzūr al-Islāmī." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Ālmāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(1): 651-82. Kuwait: Islamic Organization for Medical Sciences.
- Barry, Vincent. 2012. *Bioethics in a Cultural Context*. Boston: Wadsworth.
- Buḥālāh, al-Ṭayyib. 2010. *al-Fuḥūṣāt al-Ṭibbiyyah qabla al-Zawāj*. Manṣurah: Dār al-Fikr wa al-Qānūn.
- Chadwick, Ruth. 2006. "Personal Identity: Genetics and Determinism." In *Living with the Genome: Ethical and Social Aspects of Human Genetics*, edited by Angus Clarke and Flo Ticehurst, 255-8. New York: Palgrave.
- Davis, Dena. 2006. "Sex Selection." In *Living with the Genome: Ethical and Social Aspects of Human Genetics*, edited by Angus Clarke and Flo Ticehurst, 291-5. New York: Palgrave.
- Ebrahim, Abou El-Fadl Muhsin. 2008. "al-Ḥaml al-Badil min al-Manzūr al-Akhlaqī al-Qānūnī al-ljtimā'ī wa al-Islāmī." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa*

- al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Almāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(2): 669-93. Kuwait: Islamic Organization for Medical Sciences.
- El Shanti, Hatem, Lotfi Chouchane, Ramin Badii, Imed Eddine Gallouzi, and Paolo Gasparini. 2015. "Genetic Testing and Genomic Analysis: a Debate on Ethical, Social, and Legal Issues in the Arab World with a Focus on Qatar." *Journal of Translational Medicine* 13: 358-68
- Emslie, Carol and Kate Hunt. 2006. "Genetic Susceptibility." In *Living with the Genome: Ethical and Social Aspects of Human Genetics*, edited by Angus Clarke and Flo Ticehurst, 102-7. New York: Palgrave.
- Fataḥ Allāh, Maḥmūd. 2008. "Tiqniyyāt al-Injāb wa al-Jinūm al-Basharī wa al-Urah." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Almāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(2): 697-723. Kuwait: Islamic Organization for Medical Sciences.
- Ḥaṭḥūt, Ḥassān. 1983. "al-Taḥakkum fi Jins al-Janīn." In *al-Islām wa al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, al-Injāb fi ḍaw'* al-Islām, edited by Aḥmad Rajā'ī al-Jundī, 37-8. Kuwait: al-Munazzamah al-Islāmiyyah li al-'Ulūm al-Ṭibbiyyah.
- Ḥaṭḥūt, Ḥassān. 2008. "Tiqniyyāt 'Ilm al-Wirāthah wa al-Tanāsul 'inda al-Insān bayna al-Manzūr al-Dīnī wa al-Manzūr al-'Almānī." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Almāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(1): 179-206. Kuwait: Islamic Organization for Medical Sciences.
- al-Ḥazimī, Muḥsin bin 'Alī Fāris. 2000. "al-Istirshād al-Wirāthī: Ahammiyyat al-Taw'iyyah al-Wiqā'iyyah wa Maḥādhiruh al-Ṭibbiyyah wa al-Akhlaqiyyah." In *Ru'yah Islāmiyyah li-ba'd al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, Thabt Kāmil li-A'māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jinūm al-Basharī wa al-'Ilāj al-Jinī – Ru'yah Islāmiyyah*, edited by 'Abd al-Raḥmān al-'Awaḍī and Aḥmad Rajā'ī al-Jundī, 2(2): 665-700. Kuwait: al-Munazzamah al-Islāmiyyah li al-'Ulūm al-Ṭibbiyyah.
- 'Ibādah, Ḥatīm Amīn Muḥammad. 2010. *al-'Ilāj al-Jinī wa al-Fuḥūṣ al-Wirāthiyyah*. Alexandria: Dār al-Fikr al-Jāmi'ī.
- Ibn al-Qayyim. 1998. *Zād al-Ma'ād fi Hady Khayr al-'Ibād*, 6 vols., edited by Shu'ayb al-Arna'ūṭ and 'Abd al-Qādir al-Arna'ūṭ. Beirut: Mu'assasat al-Risālah.
- Ibn Qudāmah, 'Abd Allāh ibn Aḥmad. 1997. *al-Mughnī*, edited by 'Abd Allāh ibn 'Abd al-Muḥsin al-Turkī and 'Abd al-Fattāḥ Muḥammad al-Ḥulw, 15 vols. Riyadh: Dār 'Alam al-Kutub.
- Idris, Ja'far Shaykh. 2008. "Insāniyyatunā Jawhar Thābit wa Wāqī' Yataghayyar." In *al-Nadawah al-'Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-'Almāniyyah*, edited

- by Aḥmad Rajā'ī al-Jundī, 2(2): 471-80. Kuwait: Islamic Organization for Medical Sciences.
- al-Jundī, Aḥmad Rajā'ī, ed. 1983. *al-Islām wa al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, al-Injāb fī ḍaw' al-Islām*. Kuwait: al-Munazzamah al-Islāmiyyah li al-'Ulūm al-Ṭibbiyyah.
- al-Jundī, Aḥmad Rajā'ī, ed. 2008. *al-Nadawah al-Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-Ālmāniyyah*, 2 vols. Kuwait: Islamic Organization for Medical Sciences.
- al-Luda'mī, Tamām Muḥammad. 2011. *al-Jināt al-Bashariyyah wa Taṭbiqātuhā*. Herndon, VA: The International Institute of Islamic Thought.
- Lustig, Andrew. 2013. "Appeals to Nature and the Natural in Debates about Synthetic Biology." In *Synthetic Biology and Morality* edited by Gregory E. Kaebnick and Thomas H. Murray. Cambridge, MA: MIT Press.
- al-Madḥajī, Muḥammad ibn Hā'il ibn Ghaylān. 2011. *Aḥkām al-Nawāzil fī al-Injāb*. 3 vols. Riyadh: Dār Kunūz Ishbiyā lil-Nashr wa al-Tawzī'.
- Mahrān, Al-Sayyid Maḥmūd 'Abd al-Raḥīm. 2002. *al-Aḥkām al-Shar'īyyah wa al-Qānūniyyah lil-Tadakhkhul fī 'Awāmil al-Wirāthah wa al-Takāthur*. Cairo: NP.
- al-Maymān, Nāṣir ibn 'Abd Allāh. 2000. "al-Irshād al-Jinī: Ahmiyyatuh, Āthāruh, Maḥādhiruh." In *Ru'yah Islāmiyyah li-ba'ḍ al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, Thabt Kāmil li-A'māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jinūm al-Basharī wa al-Ilāj al-Jinī – Ru'yah Islāmiyyah*, edited by 'Abd al-Raḥmān al-'Awaḍī and Aḥmad Rajā'ī al-Jundī, 2(2): 797-824. Kuwait: al-Munazzamah al-Islāmiyyah li al-'Ulūm al-Ṭibbiyyah.
- Moazzam, Farhat. 2008. "al-Handasah al-Wirāthiyyah wa al-'Adālah al-Ijtimā'iyyah wa Mustaqbal al-Insāniyyah: Iltiqā' al-Makhāwif al-Dīniyyah wa al-Ālmāniyyah." In *al-Nadawah al-Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adiyān al-Samāwiyyah wa wijhat naẓar al-Ālmāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(2): 389-408. Kuwait: Islamic Organization for Medical Sciences.
- Modell, Bernadette. 2006. "Carrier Screening for Inherited Hemoglobin Disorders in Cyprus and the United Kingdom." In *Living with the Genome: Ethical and Social Aspects of Human Genetics*, edited by Angus Clarke and Flo Ticehurst, 114-21. New York: Palgrave.
- al-Muḥammadī, 'Alī Muḥammad Yūsuf. 2005. *Buḥūth Fiqhiyyah fī Masā'il Ṭibbiyyah Mu'āṣirah*. Beirut: Dār al-Bashā'ir al-Islāmiyyah.
- al-Qaradāghī, 'Alī Muḥyī al-Dīn and 'Alī Yūsuf al-Muḥammadī. 2008. *Fiqh al-Qaḍāyā al-Ṭibbiyyah al-Mu'āṣirah*. Beirut: Dār al-Bashā'ir al-Islāmiyyah.
- Qarārāt al-Majma' al-Fiqhī al-Islāmī bi-Makkah al-Mukarramah: *al-Dawarāt min al-Ūlā ilā al-Sādisah 'Ashrah, al-Qarārāt min al-Awwal ilā al-Khāmis wa al-Tis'in – 1398-1422/1977-2002* (Mecca: Rābiṭat al-Ālam al-Islāmī, n.d.).

- al-Rashīdī, Fahd Sa'd. 2011. "Ikhtiyār Jins al-Janīn bi al-Wasā'il al-Ṭabī'iyyah wa al-Mikhibariyyah, Dirāsah Fiqhiyyah Ṭibbiyyah." *Majallat al-Sharī'ah wa al-Dirāsāt al-Islāmiyyah* 26: 567-624.
- Reilly, Philip R. 2006. "Informed Consent in Human Genetic Research." In *Living with the Genome: Ethical and Social Aspects of Human Genetics*, edited by Angus Clarke and Flo Ticehurst, 64-9. New York: Palgrave.
- Rifkin, Jeremy. 2006. "Patenting of Genes: A Personal View." In *Living with the Genome: Ethical and Social Aspects of Human Genetics*, edited by Angus Clarke and Flo Ticehurst, 46-8. New York: Palgrave.
- Rose, Steven P. R. 2006. "Genetic Reductionism and Autopoiesis." In *Living with the Genome: Ethical and Social Aspects of Human Genetics*, edited by Angus Clarke and Flo Ticehurst, 251-4. New York: Palgrave.
- al-Saḥmarānī, As'ad. 2008. "al-Insāniyyah wa al-Khalq, al-Ālam 'alā al-Fiṭrah." In *al-Nadawah al-Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adīyān al-Samāwīyyah wa wijhat naẓar al-Ālmāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(1): 245-77. Kuwait: Islamic Organization for Medical Sciences.
- al-Salāmī, Muḥammad al-Mukhtār. 2008. "al-Wirāthah al-Bashariyyah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adīyān al-Kitābiyyah al-Thalāthah wa al-Taṣawwur al-Ālmānī." In *al-Nadawah al-Ālamiyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In'ikāsātuhā, Ru'yat al-Adīyān al-Samāwīyyah wa wijhat naẓar al-Ālmāniyyah*, edited by Aḥmad Rajā'ī al-Jundī, 2(1): 509-30. Kuwait: Islamic Organization for Medical Sciences.
- Shabana, Ayman. 2017. "Empowerment of Women Between Law and Science: Role of Biomedical Technology in Enhancing Equitable Gender Relations in the Muslim World." *Hawwa: Journal of Women of the Middle East and the Islamic World* 15:193-218.
- Shabihunā, Ḥamdātī Mā' al-Aynayn. 2000. "al-Amrāḍ al-Latī yajibū an yakuna al-Ikhtibār al-Wirāthī fihā Ijbāriyan." In *Ru'yah Islāmiyyah li-ba'd al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, Thabt Kāmil li-A'māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jīnūm al-Basharī wa al-Ilāj al-Jīnī – Ru'yah Islāmiyyah*, edited by 'Abd al-Raḥmān al-'Awaḍī and Aḥmad Rajā'ī al-Jundī, 2(2): 943-56. Kuwait: al-Munazzamah al-Islāmiyyah li al-'Ulūm al-Ṭibbiyyah.
- Sharaf al-Dīn, Aḥmad. 1983. "Asālib Diktāturiyyat al-Bayūlūjiā fī al-Mizān al-Shar'ī." In *al-Islām wa al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, al-Injāb fī daw'* al-Islām, edited by Aḥmad Rajā'ī al-Jundī, 136-47. Kuwait: al-Munazzamah al-Islāmiyyah li al-'Ulūm al-Ṭibbiyyah.
- al-Sharīf, Muḥammad 'Abd al-Ghaffār. "Ḥukm al-Kashf al-Ijbārī 'an al-Amrāḍ al-Wirāthiyyah." In *Ru'yah Islāmiyyah li-ba'd al-Mushkilāt al-Ṭibbiyyah al-Mu'āṣirah, Thabt Kāmil li-A'māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jīnūm al-Basharī wa al-Ilāj al-Jīnī – Ru'yah Islāmiyyah*, edited by 'Abd al-Raḥmān al-'Awaḍī and Aḥmad Rajā'ī al-Jundī, 2(2): 959-74. Kuwait: al-Munazzamah al-Isl-

- lāmiyyah li al-‘Ulūm al-Ṭibbiyyah.
- Shubayr, Muḥammad ‘Uthmān. 2001. “Mawqif al-Islām min al-Amrāḍ al-Wirāthiyyah.” In *Dirāsāt Fiqhiyyah fī Qaḍāyā Ṭibbiyyah Mu‘āṣirah*, 2(1) :333-47. Ammān: Dār al-Nafā’is.
- al-Shuwayrakh, Sa’d ibn ‘Abd al-‘Azīz ibn ‘Abd Allāh. 2007. *Aḥkām al-Handasah al-Wirāthiyyah*. al-Riyad: Dār Kunūz Ishbīlīyā lil-Nashr wa al-Tawzī’.
- Stearns, Justin. 2011. *Infectious Ideas: Contagion in Pre-modern Islamic and Christian Thought in the Western Mediterranean*. Baltimore: John Hopkins University Press.
- al-Ṭalībī, Ammar. 2008. “al-Insān, al-Fitrah, al-Ṭabī’ah wa la-Tiqniyyah.” In *al-Nadawah al-‘Ālamīyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In‘ikāsātuhā*, *Ru’yat al-Adiyān al-Samāwiyyah wa wīḥat naẓar al-‘Almāniyyah*, edited by Aḥmad Rajā’ī al-Jundī, 2(1) :371-430. Kuwait: Islamic Organization for Medical Sciences.
- ‘Uthmān, Muḥammad Rāfat. 2000. “Naẓrah Fiqhiyyah fī al-Amrāḍ al-Latī Yajibu an yakuna al-Ikhtibār al-Wirāthī fihā Ijbāriyan kama tara ba’d al-Hay’āt al-Ṭibbiyyah.” In *Ru’yah Islāmīyyah li-ba’d al-Mushkilāt al-Ṭibbiyyah al-Mu‘āṣirah*, *Thabt Kāmil li-A’māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jinūm al-Basharī wa al-‘Ilāj al-Jinī – Ru’yah Islāmīyyah*, edited by ‘Abd al-Raḥmān al-‘Awaḍī and Aḥmad Rajā’ī al-Jundī, 2(2) :915-39. Kuwait: al-Munazzamah al-Islāmīyyah li al-‘Ulūm al-Ṭibbiyyah.
- Van Gelder, Geert Jan. 2005. *Close Relationships: Incest and Inbreeding in Classical Arabic Literature*. London: I.B. Tauris.
- Vaughn, Lewis. 2010. *Bioethics: Principles, Issues, and Cases*. Oxford: Oxford University Press.
- Wāṣil, Naṣr Farīd. 2008. “Khalq al-Insān bi-Ṣuratihi al-Ṭabī’iyyah,” In *al-Nadawah al-‘Ālamīyyah ḥawla al-Wirāthah wa al-Takāthur al-Basharī wa In‘ikāsātuhā*, *Ru’yat al-Adiyān al-Samāwiyyah wa wīḥat naẓar al-‘Almāniyyah*, edited by Aḥmad Rajā’ī al-Jundī, 2(1) :337-55. Kuwait: Islamic Organization for Medical Sciences.
- al-Yābis, Haylah bint ‘Abd al-Raḥmān ibn Muḥammad. 2012. *al-Amrāḍ al-Wirāthiyyah: Ḥaqīqatuhā wa Aḥkāmuhā fī al-Fiqh al-Islāmī*. 2 vols. Ryadh: Dār Kunūz Ishbīliyyā.
- al-Zuhayli, Muḥammad. 2000. “al-Irshād al-Jinī.” In *Ru’yah Islāmīyyah li-ba’d al-Mushkilāt al-Ṭibbiyyah al-Mu‘āṣirah*, *Thabt Kāmil li-A’māl Nadwat al-Wirāthah wa al-Handasah al-Wirāthiyyah wa al-Jinūm al-Basharī wa al-‘Ilāj al-Jinī – Ru’yah Islāmīyyah*, edited by ‘Abd al-Raḥmān al-‘Awaḍī and Aḥmad Rajā’ī al-Jundī, 2(2) :773-93. Kuwait: al-Munazzamah al-Islāmīyyah li al-‘Ulūm al-Ṭibbiyyah.