

# Human Embryonic Stem Cell Science in Muslim Context: “Ethics of Human Dignity” and “Ethics of Healing”

Mansooreh Saniei<sup>1\*</sup>, Hossein Baharvand<sup>2</sup>

<sup>1</sup> School of Social Science and Public Policy, King's College London, United Kingdom <sup>2</sup> Department of Stem Cells, Faculty of Developmental Biology, Royan Institute, Iran

## Abstract

The governance of innovative bioscience could extensively influence the growth of science, economy, society and law of every country. Similar to many countries, Muslim nations are experiencing a variety of socio-cultural and political conflicts relating to emerging bioscience, including human embryonic stem (hES) cell research and therapy. Among Muslims, the discussion of the ethics and regulatory policy related to hES cell research is mostly seen as a restrictive position, however, some Muslim nations take an intermediate stance, e.g. Iran as a leading country among Muslim nations. Islam, similar to other religions, significantly influences the moral, social and legal debates around hES cell science. The main argument is about the level of protection of the human embryo as it is used to obtain stem cells and then destroyed. This essay broadly portrays the fundamental moral constructions of Islamic deliberations on bioscience and technology in general, and particularly hES cell science in Shi'a tradition. The paper helps us to understand how scientific knowledge, bioethical discourses and legal deliberations are produced in the Muslim countries. After introducing some background information, it delves into the core themes framing the discussion, with reference to the moral controversy surrounding hES cell science and Islamic faith. This account is intended to present the main highlighted debates and controversial questions. The essay concludes that given continuing conflicts between science, politics and religion in many countries, in some countries, for example in the Shi'a Iran, hES cell science converges with religious beliefs and government policies.

**Keywords:** Human embryonic stem cell science, Ethics; Islam, *Shi'a*, Policy

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\*E-mail: mansooreh.l.saniei@kcl.ac.uk

## Introduction

Human embryonic stem (hES) cell science is one of the critical points of interface for the scientific and socio-political worlds. Since the successful isolation and cultivation of hES cells in 1998, two typical features of these cells, their self-renewal and differentiation capacity, have attracted the interest of numerous scholars from a variety of disciplines [1,2]. The ability to grow hES cells leaves the door open for creation of cell-based remedies which might be useful for treating those with degenerative, debilitating, and so far incurable disorders, such as diabetes, Parkinson's and Alzheimer's diseases, and spinal cord injury [3]. This area of bioscience also offers the potential for deeper understanding of the process of early human development and creation of a successful model for discovering drugs and testing their toxicity, efficacy,

and safety without needing to involve human subjects [4]. As hES cell science has proceeded, it has provoked unavoidable moral debates about the creation, use, and destruction of human embryos in the process of isolating stem cells (SCs) [1,5]. As Beatrix Rubin noted, “the quest for research and therapy has particularly rendered the human embryo accessible as an object of experimental manipulation in research; as an object of ethical debate and as the subject of regulation” [6].

The religious deliberations about research on the embryo posit a variety of opinions and epistemic inquiries about its moral status, respect for human dignity and the advantage of hES cells for progress of biomedical science and therapy. Proponents maintain the view that there is a moral obligation to help patients suffering from incurable diseases and desperate for a treatment. Opponents believe that it is morally wrong to

utilise human embryos for research purposes that cause them to be destroyed. The former group presumes that in the early stage of their development the embryos are usually left-over from IVF procedures and can morally be utilised in this research. The latter group sees the embryo as a human being from the moment of fertilisation which deserves the full protection similar to any individual [1,7]. As Sarah Parry observed, usage of human embryos has thus been one of the most debatable and scrutinised features of hES cell science, in which it has received continuing ethical, social, political, legal, and religious consideration since 1998 [8]. In this process boundaries between science and such considerations are often blurred [9].

## Ethics of hES Cell Science

The application of hES cells offers health and biomedical benefits, and shows a great promise for society; nonetheless, the progress of this field of bioscience caused fresh moral debates in association with creating in vitro embryos and discarding them for research purposes. Indeed, the embryo debates are currently considered as one of the most controversial bioethical subjects. It is therefore important to consider how these promises may contribute to the development of human beings, and helps us to understand what kinds of ethical principles and virtues should be sought. It is essential to find out how people's moral reasoning in bioscientific research can deliberate about and form their character and individuality as human beings and as a society. The following subsections describe two main ethical claims and debates surrounding hES cell science and the use of human embryo for research.

### *Moral status of the embryos: "Ethics of Human Dignity"*

Over the last few decades, issues surrounding the moral status of the human embryo have been addressed in the context of increasing scientific advances in biomedicine and technology, such as abortion, *in vitro* fertilisation (IVF) treatment, embryo research, embryo banking, SC research and genetic engineering. In this context, opposition to hES cell science looks to the principle of human dignity as the protection of embryonic life at its early stage of development. According to this position, the creation and destruction of embryos must

be forbidden. In this term, therefore, the foundational question is "At what point is a human being entitled to dignity and the protection?. At other times, the moral and legal status of the human embryo (i.e. the embryo debate) is discussed in terms of whether human rights apply to embryos, a debate which often focuses on whether the concept of human dignity applies to the subjects of research, for instance, embryos and women who donate eggs for SC research. The embryo debate ultimately boils down to another question: should a human embryo be awarded the same protection of life as a born human being? or, it is just a bunch of cells without any moral status and human dignity?

Some cultures and religions award a "special status" to embryos which lies between these two extremes. A way to weaken this question is to set up a timeline for the embryo which describes certain periods and turning points of development. Religious bodies have generally been the front-line associations establishing this timeline and speaking out for or against any form of embryo research. The conservative Christian viewpoint maintains that human life begins at the moment of fertilisation and embryos should then be treated as living human beings. They note that no research-related use of embryos, which is not for the benefit of those particular embryos, should be allowed. In contrast, the Jewish tradition believes that an embryo does not become human until 40 days after conception, and Muslim faith considers human life to begin when the soul meets the developing embryo or foetus, which takes place weeks or months after fertilisation [10]. Although different religious traditions present varying levels of flexibility as to when life begins, hES cells are currently recognised as a key scientific, social, economic and political advancement among many nations.

### *Promise of hES cell science: "Ethics of Healing"*

Since the successful derivation of hES cells in 1998, this type of SCs has been faced with tremendous expectations, which are closely connected to its therapeutic promise – hope of alleviating human suffering and curing disorders. This therapeutic possibility is generally classified as a real therapeutic method and as a pathway to model disorders to devise treatments. Most parts of SC therapies are situated in

the regenerative capabilities of these cells to generate a range of tissues in the human body and *in vitro*. As hES cells are pluripotent, theoretically they are able to develop into any cell type, and through any procedure of cell differentiation and then to produce just that cell we may wish [11]. This bioscientific knowledge might help to grow specific tissues or even entire organs. The promise of hES cell lines is that they can promote the regenerative medicine and provide the healthy replacement or supplement for damaged organs and tissue, although SC therapies are presently limited to adult SCs. In addition, scientists have started clinical trials for generating induced pluripotent stem (iPS) cells to study various human disorders [12]. Hence, pluripotency of hES cells is at the centre of therapeutic expectations and hope for curing degenerative diseases. Therefore, societal discussions about uses of the human embryo usually oscillate between “embryo debate” and “therapeutic promise” [6]. In terms of the opposition, hES cell research should be restricted because the embryo is destroyed; as for advocate of hES cell research, the therapeutic hope offered by these cells and the needs of ill people outweigh moral concern about the status of the human embryo. However, such moral decision is not limited to the realm of science and bioethics, and policy deliberation is required in each society, including the Muslim nations. What follows is a general overview of the main arguments of Muslim scholars about how embryos could be used for research purposes.

## Scientific Innovation and Ethical Deliberations in Islam

### Sources and methods

Islam is a monotheistic Abrahamic religion. Its teachings offer a broad pathway of life for its believers, encompassing all dimensions of individual, social, moral, spiritual and material life as well as political, economic, and national and international plans [13]. *Shari'a* (Islamic Law) regulates day-to-day Muslim life everywhere and at all times, including emerging bioscience and technologies like hES cell research. Some Muslim scholars believed that bioethical deliberations and religion are inseparable, and bioethics in the Islamic context is interpreted in the light of *Shari'a* [14].

In Islam, moral debates draw on a large number of sources. For *Sunni* schools of thought, the *Holy Qur'an* (The Muslims' holy book), *Sunnah* (the Prophet's life and narrations), and *hadiths* (the Prophet's sayings and actions) are the constitutional and main sources used by clerics and religious scholars in concluding what is *halal* (permitted) and *haram* (prohibited) in Islam. *Shi'a* intellectuals also utilise these three major sources for making moral discussions, but apply them to the broader collection of *hadiths*, such as narrations of the *Shi'a* imams (the Prophet's offspring, who were leaders in *Shi'a* tradition). The *Holy Qur'an* is the first source of reference, and then the *Sunnah*, which is supposed to complete what the *Holy Qur'an* has not specified about the religious guidelines. The *hadith* establishes the third source of reference dictating Islamic codes of practice. Contemporary Muslim scholars apply these three major sources to find what is religiously legitimate and what is not [15]. Furthermore, for the *Shi'a*, *ijtihad* (to put forth effort, a methodology of reasoning and an independent interpretation of a matter in hand) and *'aql* (reason) are used in moral deliberations and to create *fatwas*. The *fatwas* guide the *mughaleeds* (followers) of different *mujtahids* (*Shi'a* religious authorities) about how to live as good Muslims. Most religious scholars consider *ijtihad* to simply mean reason [13,15]. In *Shi'a*, only *mujtahids* can decree *fatwa* and all *Shi'a mughaleeds* must follow these religious teachings and draw upon *ijtihad* and *'aql* in their day-to-day lives. In *Sunni* traditions, they are urged to read Islamic teachings and texts more strictly.

These different approaches within Islamic schools of thought have a close association with policy on health and medical care as well as science. National and local *mujtahids* translate and interpret Islamic values and principles to define Islamic law and generate religious decrees. In Islam, there is no central institution governing regulation; instead, several organisations act as facilitators in these processes for *mujtahids*: for instance, there are two leading institutions for the *Sunni* branches: the *Mojamaa Al-Behooth Al-Islamaya* (Islamic Research Foundation) and *Dar Al-Iftah* (House of Fatwas) in Egypt; and several seminaries for *Shi'a* in Qom in Iran, and Karbala and Najaf in Iraq. Indeed, *fatwas* introduce the guidelines for bioscience and medical treatment and offer a broad range of descriptions about the meaning

of the beginning and end of life, modern assisted reproductive technologies, abortion, women's health and rights, sexual reassignment surgery and other health and medical policies [16,17]. *Sunni* and *Shi'a* similarly select their sources of emulation according to their closeness to a particular *mujtahid's* interpretation and religious philosophy. Though all Islamic schools of thought pursue more and less the same methods of reasoning and the processes through which science and biotechnologies can be accepted, adapted or rejected, Islam does not have absolute specifications for practice. The integration of Islamic codes and scientific innovations varies among schools of thought and from one Muslim society to another. Each school of thought also has various branches, particularly in *Sunni*.

### ***The moral status of the embryos in Islamic context***

All monotheistic religions agree that "personhood" is the most crucial issue in hES cell research, and there is a wide range of viewpoints. As noted earlier, at one end of the spectrum, the view is that human life and personhood begin when the gametes are combined; at the other end, the view is that for the first few days the embryo is merely a "ball of cells" [10]. It therefore cannot be considered fully human and does not deserve a special moral status. Between these extremes, there is the opinion that acknowledges the embryo as being unique in its nature but from a legal and theological standpoint it is only a potential human being, and full personhood and the rights connected with it are acquired during its gradual development [18]. These views tend to differ by nation and culture (e.g., social norms and religion). For instance, countries strongly influenced by Catholicism favour the first viewpoint, while most Muslim and Jewish communities tend toward the other pole.

Islamic passages and verses take an interest in the details of how the human develops inside the woman's uterus, talking about the breathing-in of *ruh* (soul), although there is no specific description of that moment as the starting point of life either in the *Holy Qur'an* or in the *Sunnah* [19]. Hence, there are opposite perspectives about the onset of life and the moment when ensoulment (infusion of the soul into the body of the foetus) occurs. Different interpretations of the *Qur'anic* verses related to the time of ensoulment cause a cleavage between

Muslim jurists that leads them to rule on the beginning of life and related issues differently. Determination of the moment of ensoulment is based on how the following *Qur'anic* scripture is interpreted:

"He Who created all things in the best way and He began the genesis of man from clay; then made his progeny from a quintessence of despised liquid; then He created him in due proportion, and breathed into him of His spirit. And He gave you [the faculties of] hearing and sight and hearts. Little thanks do ye give!" [20]

Another verse tells us about ensoulment during intrauterine life:

"We created man [*khalaqna*] of an extraction of clay, then We set him, a drop [*nutfa*] in a safe lodging [i.e., the womb], then We created of the drop a clot ('*alaqah*), then We created of the clot a tissue [*mudgha*], then We created of the tissue bones ('*azm*), then we covered the bones in flesh [*yaksu lahman*]; thereafter We produced it as another creature [*khalaqan akhar*]. So blessed be God, the Best of creators [*khaliqin*]." [21]

This passage has been interpreted to mean that an embryo is considered a human being after several stages of biological growth since "thereafter We produced it as another creature." This verse passage classifies the process of the beginning of life into three main stages. First is the moment when egg and sperm merge and generate a zygote. This drop phase (*nutfa*) forms the genetic code for a singular person which will emerge as the fertilised egg develops. The second, as the blood phase ('*alaqa*), commences when the fertilised egg (the embryo) lodges inside a woman's womb. The third step, the flesh phase (*mudgha*), ends when the *ruh* meets the body of the embryo. Although the *Holy Qur'an* explains the embryonic journey to the personhood, it does not specify any actual and exact moment when the *ruh* meets the body [19]. However, one *hadith* gives the following indication:

"Verily your creation is on this wise. The constituents of one of you are collected for forty days in his mother's womb; it becomes something that clings ['*alaqa*] in the same [period] [*mithla dhalik*], then it becomes a chewed lump of flesh [*mudgha*] in the same [period] [*mithla dhalik*]. And the angel is sent to him with

instructions concerning four things, so the angel writes down his provision [sustenance], his death, his deeds, and whether he will be wretched or fortunate. Then the soul is breathed into him” [22].

According to this *hadith* each of the first three stages (lodging *nutfa* in the woman’s womb, *‘alaqa* and *mudgha*) takes up forty days, for a total of 120 days [1]. Another *hadith* shows how an angel by God starts to make a distinction between the foetal organs on the forty-second night after ejaculation in the womb; however, this saying makes no mention of ensoulment [13]. Other *hadiths* differ and give forty days as the total of the four stages:

“After the zygote [*nutfa*] has been established in the womb for forty or forty-five nights, the angel comes and says: ‘My Lord, will he be wretched or fortunate?’ And both these things would be written. Then the angel says: ‘My Lord, would he be male or female?’ And both these things are written. And his deeds and actions, his death, his livelihood; these are also recorded. Then his document of destiny is rolled and there is no addition to and subtraction from it.” [22].

However, a clear majority of scholars view ensoulment as occurring at the 120th day of pregnancy [23,24].

The *Qur’anic* position on embryological development and the creation of humans presents a focal point for discussion of embryonic sanctity. Also, reasoning from different *hadiths*, some schools of jurists have determined that until the stages are complete, the foetus has no soul—God has not breathed His spirit into it and therefore it has not yet been created [1]. In other words, creation of the human being happens just after it has reached a certain stage of embryonic or foetal development rather than at the moment of conception [25]. Moreover, many religious intellectuals note that life at the early stage of embryonic growth occurs in two steps, the biological and the human. These scholars generally support the idea that ensoulment makes a distinction between biological life, which begins at the moment of fertilisation, and human life [25]. In the Islamic tradition, ensoulment is therefore assumed to be a central value in the discourse about the embryo debate or even the foetus. Ensoulment thus grants the foetus a special moral status [19], which is decisive

to the moral evaluation of bioscientific research and practices influencing the embryo. Ensoulment seems to be associated with personhood which evidently provides a clear definition of time at which human moral status is applied.

When assessing ethical debates in accordance with *Shari’a*, Muslim intellectuals apply case-based arguments and reasoning. These scholars then utilise the constitutional codes and principles of Islamic law as well as take into account similar cases; in other words, they draw an analogy (*qias*). Thus, before dealing with the debate over embryo research it is necessary to consider related subjects that have already been ruled upon, e.g. clinical abortion and the new ARTs, including the third-party donation of embryo, egg and sperm and surrogacy [1,26]. By discussing the interlinking of abortion, new ARTs and the hES cell research debates, it can be demonstrated that any regulation adopted will depend on the position taken regarding the protection of life. Because this interrelationship is synergistic, the legal position on one aspect, e.g. abortion or embryo donation, will be crucial in determining whether a platform for regulating hES cell science can be built.

### ***Clinical abortion in the Shi’a and Sunni schools of thought***

Most of Muslim scholars see abortion as forbidden. Moreover, on the basis of classical jurisprudence and contemporary scholarship, all intellectuals from the different Islamic schools of thought agree that an abortion cannot be performed after the fourth month (120 days) of fertilisation except to save the woman’s life [27]. The arguments are associated with the moral and religious status of the foetus before the fourth month of gestation [28]. In this debate *Sunni* intellectuals have taken three main stances:

(1) The *Maliki Sunni* and Al-Ghazali of the *Shafi’i Sunni* see the foetus as a sacrosanct complete human being from the time of conception. Any violence to the embryo at any time during pregnancy is deemed an offence. The reason for this strictness is that the embryo is considered “creature waiting to receive its soul from God.” [13] For this reason, the zygote should not be touched when it is implanted “into the uterus in the form of a clot adhering to the wall” [27].

(2) The *Shafi'i* and some *Hanbali* and *Hanafi* Sunni allows abortion only until the foetus shows the first signs of human form, which, according to a *hadith*, happens on the 42nd night of pregnancy. They consider the embryo to obtain its sacrosanct human character when it begins forming human features, such as eyes, ears, limbs, flesh, bones, and skin. For them, abortion before the phase of ensoulment is seen merely as unethical, but aborting a post-ensoulment foetus is considered illegal and fully unacceptable [28].

(3) Some *Hanbalis* and *Hanafi* regard the embryo as a sacred living being 120 days after conception. Indeed, this is the moment when the embryo receives the *ruh* and becomes a human being [29,30].

According to *Shi'a* teaching, conception starts when the *nutfah* (the fertilised egg) is implanted in the womb, and whatever aborts the implanted *zygote* is *haram*. Contemporary *Shi'a* ayatollahs (high-ranking religious intellectuals in *Shi'a*) generally agree about abortion before ensoulment, at 120 days after conception. Grand Ayatollah Ali Al-Sistani, the highest-ranking *Shi'a* religious scholar, stated that abortion is not allowed unless continuation of the pregnancy unbearably endangers a woman's health [31]. Ayatollah Ruhollah Khomeini (an Iranian religious intellectual and politician, and leader of Iranian Revolution, 1979) stated, "Termination of pregnancy even at the earliest possible stage under normal circumstances without any reason is not allowed" [32]. Ayatollah Ali Khamenei (an Iranian religious intellectual and politician, and Iran's Supreme Leader) also stated that "The *Shari'a* does not permit the abortion of a foetus. In the consideration of the honourable *Shari'a*, there is no difference between a foetus less than or greater than four months gestation with regard to this matter" [33]. This is accepted by all *Shi'a* scholars, although Ayatollah Yousef Saanei considered certain social aspects and affirmed that "Any foetal or maternal condition that brings extreme difficulties [*'usr va haraj*] for the mother or the family allows for abortion" [34]. Another scholar, Ayatollah Makarim-Shirazi, considers it permitted in cases of "extreme difficulty" [35].

With respect to the termination of pregnancy, Islamic intellectuals have reached consensus that after ensoulment abortion should be permitted only

when the woman's life is in severe risk, otherwise it is considered as homicide. Furthermore, current intellectuals have considered the impact of some severe foetal malformations on the women, the families and society [36]. In 2005 the Iranian parliament ratified the Therapeutic Abortion Act, which permits clinical abortion after a definite diagnosis by three experts and confirmation by the Iranian Legal Medicine Organisation. Accordingly, abortion is allowed if the consequence of the pregnancy would be intolerable for the parents, including growing the foetus or birth of a child with such genetic abnormalities as major thalassemia or haemophilia [37]. This has persuaded other religious intellectuals in Muslim nations to rethink the prohibition of abortion under certain conditions. Muslims are invited to analyse and interpret classic religious texts and sources to find answers to current problems, which differ from country to country [36]. It is noteworthy that every Muslim country has chosen its own regulatory policy (Table 1).

**Table 1.** Grounds for Abortion in Predominantly Muslim Countries.

Grounds	Countries
Risk to woman's life	All countries
Risk to physical health	Jordan, Kuwait, Morocco, Qatar, Saudi Arabia
Risk to physical and mental health	Algeria
Foetal impairment	Kuwait, Qatar, Saudi Arabia
Genetic disorder	Iran
Rape	Sudan, Egypt
All grounds in the first trimester	Tunisia, Turkey

### *Assisted reproductive technologies and the fate of spare embryos*

In the 1970s, the IVF technique for treating human infertility marked the beginning of a revolution in making possible what is naturally impossible. The technique basically involves collecting the eggs, fertilising them in a Petri dish and then implanting embryos into the woman's womb. Beyond the two to three embryos that are implanted for gestation, surplus embryos are frozen for use in future attempts. One of the major ethical and social concerns about IVF is the fate of frozen embryos no longer needed for infertility treatment – also known as "spare" or "surplus" embryos. They are sometimes donated to other infertile couples or for scientific purposes, such as SC research.

Some Muslim countries prohibit surrogate parenting and adoption of human embryos because of the importance of *nasab* (kinship), descent and inheritance, which shape the moral issues of [third-party] gamete and embryo donation. It is argued that because donation destroys a child's kinship and violates the right of inheritance, those countries forbid donating embryos to other couples [38]. There are also cases in which for religious reasons couples cannot use their own frozen embryos. In *Shari'a*, for instance, any form of IVF implying procreation outside an existing legal marriage would be forbidden. Therefore, the embryo cannot be implanted after divorce or if the donor of either the egg or the sperm has died [27]. Accordingly, spare frozen embryos would suffer no legal harm by being destroyed because they could not have developed into a human being. This reasoning would free up the spare embryos for research as well as for being discarded. In practice, a few Muslim countries, for instance, Iran allows donation of embryos to both third parties and researchers. Based on the *fatwa* of Ayatollah Khamenei, Iran's Supreme Leader, donor technologies have been permitted since 1989. Based on this *fatwa*, the Iranian parliament in 2003 ratified the Act for Embryo Donation to Infertile Spouses. While embryo donation is legal in Iran, however, gamete donation as well as gestational surrogacy are still controversial and practice depends on religious permission. It is noteworthy that these regulations and bylaws allow transfer of both fresh and frozen embryos to infertile couples [39], but the Act is silent about how many embryos may be donated and about the fate of spare embryos that are not donated to other couples.

### ***“Therapeutic promise” of hES cells and “ethics of healing”***

In Islam, saving lives is of paramount importance because the *Holy Qur'an* stresses that “If any one saves the life of one [human], it would be as if he saved the life of all human kind” [40]. Some Islamic injunctions specifically encourage education and research as ways to relieve suffering. Indeed, it is conceived to be *fard kifayah* or an absolute moral obligation [41]. Accordingly, scientists and scholars have a duty to undertake biomedical research that may result in beneficial treatments for currently incurable debilitating diseases and to assist those in society who

might benefit from that scientific knowledge. Islam encourages exploration of “new horizons”, seeking “cure for disease”, and providing for the “welfare of people” [25]. Promoting good actions is in accordance with the principles of *zarurat* (necessity) and *maslahat* (general good).

To this end, Islamic viewpoints on hES cell science revolve around the notion of the sanctity of life, which is considered to begin later in foetal life, when the ensoulment occurs, and then the foetus becomes subject to the ethics of human dignity. The obligation to save lives via hES cell research also strongly supports ethics of hES cell science, and the ethics of healing in Islamic context. Therefore, when hES cell research can be conducted on spare IVF embryos still in the early stage of the development that otherwise would be discarded, and if the research has the goal of alleviating suffering, doing such research would not be controversial [42]. Leaving the surplus embryo to die without utilising them when their use might save human life is itself considered a form of killing [18].

### ***Islamic Organisations, embryo research and policy***

In 1989, debate about the surplus IVF embryos was discussed by a committee of physicians and religious thinkers from the Islamic Organisation of Medical Science (IOMS). This committee subsequently issued a guidance that clearly permitted the use of the frozen embryos for research purposes on the basis of the *Shari'a* [43]. One of the main assertions of this guidance was that:

“The opinion of the majority (with which some disagreed) is that the destruction of the fertilised egg before their *nidation* [implantation] in the uterus is allowed, no matter how this destruction is brought about. So according to this opinion there is no reason to forbid scientific experiments in accordance with the *shari'a*. During these experiments, the egg cells must not be multiplied. Some disagreed entirely with this view” [44].

After the IOMS guidance was issued, the *majma' al-fiqh al-islami* (Islamic *Fiqh* [Jurisprudence] Association, IFA) held a similar meeting in 1990. The IFA examined several research projects using frozen embryos which were almost equal to those studies assessed at the IOMS

meeting a year before. However, the IFA disagreed with the usage of frozen embryos for research goals. Its decree emphasised that:

“In view of what has become reality concerning the possibility to store non- fertilised oocytes for later use, it is necessary to restrict the number of fertilised eggs to the number necessary for a single treatment, in order to avoid a surplus of fertilised eggs [embryos]. If for any reason such a surplus of fertilised eggs is brought about, they are supposed to be left without medical help, so that the life of this surplus may end in a natural way” [45].

Later, one Muslim scholar explained that this statement was based on “fear of the ‘misuse’ of embryos rather than on theological or philosophical reasoning”. He also argued that “allowing the embryo to die constitutes killing the embryo, but this time by means of not taking any steps to save the potential human being” [18, p. 402]. In 2003, the decree issued by the International Islamic Fiqh Academy (IIFA) in Jaddah allowed use of embryos for research on the condition that they should not be implanted for impermissible pregnancies. In the same year, a fatwa of the Fiqh Council for the Muslim World League permitted researchers to use SCs for therapeutic reasons if their source is legitimate [13], and said:

“It is permissible to use stem cells for either legitimate scientific research or for therapy as long as its sources are legitimate, for example, adults if they give permission as long as it does not inflict harm on them; children with their guardian’s permission for a legal benefit without inflicting harm on them; placenta or umbilical cord blood with the permission of the parents; spontaneously aborted embryos or those aborted for a legally acceptable cause and with the permission of the parents; excess fertilised eggs [embryos] produced during the course of IVF and donated by the parents with assurance that they are not to be used to produce an illegal pregnancy. It is forbidden to obtain or use stem cells if the source is illegitimate as, for example, intentionally aborted foetuses (abortion without a legal medical reason); intentional fertilisation between a donated ovum and sperm; and therapeutic cloning” [25, p. 132).

Three years later, an IOMS meeting in Cairo concluded that embryonic research for therapeutic purposes (non-reproductive cloning) is Islamically acceptable [46]. Moreover, Muslim organisations elsewhere in the world, such as the *Fiqh* Council of North America, the Malaysian National Fatwa Council and the Islamic Institute of Turkey, have approved the use of human embryos for SC research [25]. *Shi’a* scholars have generally supported SC research, including hES cell science and technology. In 2002, Ayatollah Khamenei, Iran’s Supreme Leader, issued the “stem cell fatwa” and has publicly supported and encouraged human embryo research [1, 47].

In their empirical study, Engeli and Allison affirmed that “no one single regulatory path leads to permissive or restrictive frameworks for ESCR [embryonic stem cell research], but in any of these trajectories, whether in the secular or the religious world.” [48, p. 420] Instead, bioscientific and technological growth, religious backgrounds, ethical standards may play the significant role in forming and reforming hES cell research policies. The finding of this study is along the same line as works conducted by Isasi and Knopper and they contributed to the debates about the factors behind the divergence of hES cell regulatory policy across the world [9]. Even the discussion of the United Nation Declaration on Human Cloning in 2005 illustrated the pluralisation of world views on this subject. As noted earlier, individual countries have adopted various policies to the usage of embryos for SC research for socio-cultural, political, religious, and even economic reasons [1]. As Isasi and Knoppers observed that:

“The historical, cultural and sociological context, the institutional framework, and the mobilisation of stakeholders are factors that help explain why countries that seemingly share similar socio-religious beliefs [and perhaps scientific interest] have adopted diametrically opposite public policies” [9, p.9].

During 2001, German and French members of the United Nation (UN) drafted a proposal which suggested the countries around the world to forbid reproductive cloning. Later, in 2002, the United State (US) introduced a plan to the UN to ban all form of human cloning including hES cell research. Nonetheless, in November 2003, Iran invited nations

to join a coalition which suggested a two-year deferral of debates about the UN International Convention against Human Cloning. The Iranian proposal passed by 80 votes, with 15 abstentions. Many members of the Organisation of Islamic Cooperation (OIC) also supported this group [49]. In the same year, a *fatwa* issued by a *Sunni* Egyptian scholar supported hES cell research, as Al-Tayyeb explained in 2003, “Cloning parts of the human body so as to replace parts that ill and sick people have lost or as a therapeutic tool to treat some diseases would be considered lawful” [50, p.98]. This *fatwa*, which the OIC disseminated, might help to clear up issues related to human cloning [51].

Later, in 2004, the World Health Organisation – the Eastern Mediterranean Regional Office (WHO-EMRO) called on all Muslim nations to come to a consensus on improving the regional viewpoint on human cloning before voting on the UN convention to address human cloning. Although this statement considered cloning positive for research into its therapeutic applications, a considerable number of Muslim countries voted for a ban on all forms of hES cell science and technology in the UN General Assembly for the United Nations Declaration on Human Cloning in 2005 [52,53].

Since 2005, some Muslim countries both within and beyond the Middle East have seen rapid development in SC science and technology in general, and hES cell research in particular. Although in some countries (e.g. Italy), policy on the use of embryos for research and human cloning is unchanged, many - even among Muslim nations - increasingly carry out research on therapeutic cloning which is considered to override the possible harm due to its potential benefits for biology, medicine, etc. [53]. The following section briefly describes ethical, social and legal positions for hES cell research in several Muslim countries, those have published one or more papers on the various fields of hES cell science and policy.

### Status of the Embryo and SC Research in Selected Muslim Countries

In general, constructive views about scientific and technological research and development seem to be dominant in Muslim countries; nevertheless, there are critical variations of opinion among individual Muslim

intellectuals. Over the last decade, SC science and therapy have been evolving in some of the Muslim states in the Middle East and North Africa (MENA). In an invaluable review, Flynn and Matthews showed that 11 Muslim nations—Iran, Turkey, Lebanon, Egypt, Pakistan, Saudi Arabia, Jordan, Kuwait, Morocco, Tunisia, and Emirates—have published at least one paper on SC science [54]. Turkey has published 23 per cent of total MENA papers on SC science, followed by Iran with 12 per cent and then about 7 per cent from each of the other nations. Iran and Turkey were also the first in the MENA to set up ethical and religious frameworks for hES cell science [54,55], and Saudi Arabia and some other countries are now formulating policy for SC research.

At the 2012 SC research conference in Qatar, scientists, sociologists, ethicists, and policy makers from the MENA region—mainly Iran, Turkey, Qatar, Egypt, and Saudi Arabia—presented their work. They also described their national policies and highlighted moral, social, legal, and political discussions connected to this region [55]. The following subsections briefly present the legal, ethical, and policy situation of SC science and embryo research in these Muslim states, as evidenced by their hES cell science and policy.

#### Iran

In 2002, Iran expressed one of the most clear-cut positions when its Supreme Leader, Ayatollah Khamenei, issued the “Stem Cell *Fatwa*” and then publicly supported hES cell research:

“Tell [scientists] to pursue the great objectives of this [stem cell] research with diligent efforts, and to achieve that human enormous wealth for themselves and the country [and] to be careful that producing identical parts of human beings does not lead to producing a human being.” [56]

While Catholics in some Western nations, including US, Germany, and Italy effectively blocked most funding of hES cell science; in *Shi’a* Iran, it was a religious duty to carry out this type of research in order to identify treatments that can benefit humanity [57]. The “Stem Cell *Fatwa*” by Iran’s Supreme Leader on the acceptability of the destruction of surplus IVF cycle in order to generate stem cells (SCs) for research

purposes was considered as permission for hES cell science in the country [58]. This positive *fatwa* was issued in response to the religious question on using a human embryo for research, asked by Dr Kazemi Ashtiani, a scientist and founder of the Royan Institute (a leading research institute for hES cell research) in Iran. According to this *fatwa*, experimentation with a human embryo was compatible with *Shi'a* faith in Islam. Following this positive decree, the Department of Stem Cells in the Royan Institute, Tehran, Iran, was established in the same year with the aim of producing, cultivating and freezing hES cell lines and developing effective methods to differentiate these lines into different mature cell types, such as neural cells, cardiomyocytes, etc. [59]. Iran's clerics and political leaders have also actively promoted this field of bioscience and technology, in an attempt to enhance the country's international status [60].

In 2003, the Islamic Republic News Agency, the official Iranian press agency, reported that Iran was among the first ten nations in the world, which could establish hES cell lines. Moreover, Iran was the first Muslim state to create these cells in the Middle East and North Africa [13 47]. Since then, Iranian scientists have conducted many activities in various fields of hES cell science, including the establishment of 6 lines of human embryonic SCs and 8 lines of mouse embryonic SCs, as well as registration of one hES cell line in the International Society of Stem Cell Research [59,60]. In addition, Iran has announced the first hES cell proteomics in the world [61]. In 2008, the Royan Institute researchers claimed that they could successfully reprogramme human skin cells to an embryonic-like state to generate iPS cells [62].

Iran's Supreme Leader often cites the *Holy Qur'an* emphasis on preventing human illness and suffering as evidence that SC research and Islam are compatible. Limits do exist: Iran's Supreme Leader has warned Iranian scientists to "be careful that producing identical parts of human beings does not lead to producing a human being," as human cloning is not accepted [63,64]. With regard to the legality and regularity aspects, the Ministry of Health and Medical Education (MOHME) is in charge of supervising hESC research in Iran. The first set of procedures is based on the decentralised decisions of the in-house ethics committees that are

established at all research and development centres and in universities in compliance with the directives of the MOHME. The members of these committees are selected from the internal scientific staff and invited religious consultants. They fulfilled their duties on relying on unified guidelines that are drafted and approved under the general title, "Specific National Ethical Guidelines for Biomedical research". The separated parts of the guidelines provided working models on "Clinical Trial", "Genetic Research", "Gamete and Embryo research", and "Research on Animals" [47,65]. These guidelines were compiled in 2005 by a task force, including in religion, law, ethics, medicine, and related fields of science, initiated by the MOHME, in collaboration with Centre for Medical Ethics and History in Tehran University of Medical Sciences. The guidelines have been developed to put into effect ethical codes in research and to protect different stakeholders' rights (e.g. patient research participants or vulnerable groups). Then, these guidelines were communicated to universities and research centres after their adoption by the Policy-Making Council of the MHME, and several committee workshops and educational sessions, which was supposed to be held by universities and research centres, through which the members become familiar with the guidelines [66]. Later, the guidelines developed in 2005 was brought up to date in 2013 in the Iranian Guidelines for Stem Cell Research and Therapy [64,67]. However, the governance of hES cell science and therapy in Iran is based on the stem cell *fatwa* and these guidelines, rather than any parliamentary law.

### Turkey

With a population that is over 95 per cent Muslim, Turkey has a secular governance system, but Islam is still important in addressing and interpreting personal points of view on debatable subjects in the modern era [19]. In the field of SC science and technology, Turkey mainly does research on adult SCs, although there is some evidence of research being conducted on hES cells [68,69]. The country has taken a permissive approach which allows researchers both to work on existing hES cell lines and to create embryos via IVF specifically for research purposes. It has also adopted national policies to regulate this field of research, while some other Muslim nations still use *fatwa* (religious

decree) for that purpose [54]. Moreover, both the Turkish Ministry of Health and the Turkish Bioethics Association have prepared guidelines and reports on various aspects of hES cell research [70].

In 2008, the Turkish Academy of Sciences (TÜBA: Türkiye Bilimler Akademisi) published the report “Current Concepts in Stem Cell Research” which was drafted by a multidisciplinary group. This report endorsed working on human cloning only under the umbrella of SC science and regulation [19]. Also, the Turkish Religious High Council, part of the Directorate of Religious Affairs, published a series on Islamic viewpoints related to assisted reproductive technologies (ARTs), SC research, and foetal rights, and emphasised that IVF clinics should create a minimum number of embryos for treating infertility. On the basis of this report, embryos would be considered human beings; therefore, destruction of leftover IVF embryos is problematic from a religious point of view. Accordingly, it is better to preserve surplus IVF embryos for SC research rather than dispose of them. It concludes that use of embryos in the early stage of development is permissible if there is no any alternative source, for instance, adult SCs, for a particular research purpose [54].

### *Egypt*

Egypt noticeably dominates the whole Sunni world. Its Islamic institutions are highly influential, and it tends to lead international Islamic meetings. Moreover, it is the residence of the main Sunni religious authorities, whose decrees most Sunni associations follow strictly [71]. In Cairo, private IVF clinics mostly use umbilical cord blood (UCB) for SC research rather than hES cells because the Egyptian Medical Syndicate opposes the use of embryos for experimentation [25]. Indeed, most of the debates in Egypt deal with human cloning, which is not permitted anywhere in the Muslim world. The mufti of Egypt states that human cloning “contradicts Islamic legislation and is prohibited in all its forms” [71].

In 2005, when SC research first began in Egypt, Hamdy Al-Sayed, head of the Egyptian Medical Syndicate, approved of adult SC research but opposed the use of embryonic cells. He said: “[Destroying embryos for research] is not ethically right, it's not morally right,

and it does not conform to our Islamic religion as it stands now” [72]. However, it now seems that religious authorities in Egypt tend to accept hES cell research: in 2007 the Egyptian Fatwa Council said in Dar AlIftaa (the House of Fatwa), chapter 4, “Stem Cell Transfer in Egypt”:

“It is allowed to obtain and use stem cells for research or therapeutic purposes provided that no damage is inflicted on the person from whom the stem cells originated. It is, for example, permitted to use stem cells from surplus embryos and legally aborted fetuses, provided that the parents’ consent is obtained” [73].

Similarly, the Academy of Scientific Research and Technology and Gamal Serous, director of the International Islamic Centre for Population Studies and Research at Al-Azhar University, supported use of surplus IVF embryos for SC research. Thus there is a possibility that hES cell research might ultimately be adopted [19]. According to UNESCO, Egypt does not presently have any official policy or law on hES cell science [73].

### *Saudi Arabia*

Saudi Arabia is the Arab state most prominently involved in SC science and technology. This country opened the Stem Cell Therapy Program at King Faisal Specialist Hospital and Research Centre in 2007 and in 2009 invested heavily to establish King Abdullah University of Science and Technology. At the moment, the main sources for SC research are umbilical cord blood and aborted fetuses [25]; according to Abdulaziz Alswailem of the National Committee of Bioethics at the King Abdulaziz City for Science and Technology, hES cell research is forbidden in Saudi Arabia [74].

Saudi Arabia has successfully established reproductive medicine, regulating it under the In vitro Fertilisation Act (No. 2870/1/12). Indirectly, the act regulates embryo research and allows embryos and gametes to be stored with permission of the couple [26]. However, religious views on using a human embryo for research purposes vary. In reference to Islamic guidance, Saudi Arabia in 2002 established the National Committee of Medical and Bioethics and addressed the debates about SC research. The committee has held workshops about SC research, biobanking, genetic information,

and clinical trials, and has also drafted the national code of ethics, established local ethics committees, and conducted online ethics courses [55]. According to the Baker Institute, it is believed that Saudi Arabia recently developed hES cell lines to treat genetic metabolic disorders—a major cause of disability among children in the region [55].

### ***Qatar***

Qatar is currently launching hES cell research. Cornell Medical College has recently built an SC research laboratory there in order to expand, maintain, and validate the hES cells currently available and develop new SC lines, a signal that its researchers are preparing to carry on hES cell research [75]. According to the Qatar Supreme Council of Health (SCH), hES cell research is permissible if the cells are obtained from spare IVF embryos no older than six days, and the embryos are donated voluntarily [74]. Faleh Mohamed Hussein Ali, assistant to the SCH general secretary for policy affairs, has drawn attention to the fact that Qatar policy has recently approached the progressive and encourages “the conduct of responsible and scientifically worthy” human SC research, including work on hES cells [55, p.10]. Ethical sourcing of hES cell research uses surplus IVF embryos donated by couples who have given voluntary informed consent, without any commercial incentive. Ali also believed that Qatar’s SC policy is flexible enough to allow the SCH to draw up regulations and standards for any innovative scientific field [55].

### ***Jordan***

In January 2014, although not currently active in hES cell research, Jordan passed a law on hES cell science and therapy. The law allows governmental organisations and academic institutions to work in this area, but not private companies. The new rules also ban the use of modified and manipulated cells for human reproduction and any payment for eggs, embryos, and SC donations [76]. This law has been approved by the Majlis *Al-Iftaa*, the Jordanian council of Muslim scholars.

### **Conclusion**

Each religion believes in the sacredness of human

life and the moral duty not to harm a human being. While the hES cell research itself is seen as good in view of its overriding aim to seek cures for diseases, the nature of research that entails the destruction of human embryos has generated ethical controversies. The question of when an embryo is entitled full moral protection has been discussed in this work, which also explained how Islam frames the moral issues prevailing in hES cell debates and briefly reflected on how such notions as “pre-implantation” and “ensoulment” may be accommodated in effective policies to prevent wrongdoing and protect embryos.

Bioethics in Islamic context endorses efforts to save human lives. In reviewing the ethical viewpoints of Muslim scholars, it appears that donation of IVF embryos for research that may lead to saving lives is accepted; while permissibility of hES cell science is conditioned on the fact that these embryos are not produced specifically for research. Moreover, the notion of donation is applied in arguing for the permissibility of using “spare” or “surplus” IVF embryos. Islam also holds knowledge-seeking in high regard. This tradition considers good intentions driving hES cell research and science as a knowledge-seeking endeavor to be noble and highly esteemed. Islam expands the arguments that in special circumstances allow abortion, for example, danger to the the mother’s life must be given greater weight than the life of the foetus. This review illustrated that the Islamic texts and *Shi’a* religious scholars take a remarkably flexible stance for any new matter in hand.

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