

Issues in Development

Evolutionary, Biological Origins of Morality: Implications for Research with Human Embryonic Stem Cells

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ABSTRACT

Medical research with human embryonic stem cells, despite its enormous potential to reduce human suffering, is banned in many countries and heavily restricted in others. “Moral reasons” are invoked to justify bans and restrictions on this promising research. Rather surprisingly, while those moral reasons have been extensively discussed and hotly debated in several papers, not a single article on the moral aspects of that research has attempted to answer this fundamental question: What is morality? Considering that a scientifically objective definition of morality is essential to determine whether those moral reasons are justified or groundless, this article focuses on the evolutionary origins of morality and its biological basis. Morality arose as a selectively advantageous product of evolution and preceded all religions and philosophies by millions of years. For the 99% of humankind’s evolution, morality was axiomatically aimed at reducing the sufferings of the social members, because pains and afflictions, as expressions of diseases and impairments, tended to hasten the extinction of the small ancestral groups, which characteristically consisted of a few tens of members. Had the therapeutic use of human embryos been available in remote times, our ancestors would have deemed it unquestionably immoral to save amorphous and microscopic agglomerates of insensitive cells representing neither parental nor social investment, at the expense of the lives of the suffering members of their little communities. Unless we venture the untenable thesis that the unlikelihood of extinction of our immense societies entitles us to overturn the meaning of morality, we cannot but conclude that bans and restrictions on research with human embryonic stem cells are patently immoral.

INTRODUCTION

HUMAN EMBRYONIC STEM CELLS (HESC) are early, “universal” (1) cells with the potential to form virtually any somatic cell in the human body (1). If research with HESC continues, scientists could soon be able to differentiate those universal cells into specific cell types, thereby growing new neurons for neurodegenerative disorders such as Parkinson’s disease and Alzheimer’s disease, new pancreatic cells for diabetic patients, and new cardiac muscle for rebuilding the heart (2). Research with

HESC is also expected to result in banks of cell types for transplantation medicine, because HESC “could be grown as universal graft tissue for blood, bone marrow, lung, liver, kidney, tendons, ligaments, muscle, skin, hair, teeth, the retina and the lens of the eye. The possibilities are endless” (2).

In view of the “enormous” (3) clinical potential of HESC research, *The Lancet* has recently pointed out that this research “may lead to a revolution in medical science” (4). Indeed, several studies (5–12) suggest that “Each potential use of stem cells promises revolutionary advances”

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(13). However, despite the fact that “the potential of this research to alleviate human suffering” (14) has led more than 80 Nobel Laureates (4), the American Medical Association (15), and most researchers to approve HESC research (16), many governments hamper it with strict regulations or even ban it completely (17). This ban is enforced, for example, in Ireland and Austria (18). Germany and Italy have “highly restrictive” legislation on HESC research (19). In the United States, there is a broad ban on federal funding for HESC research, unless federally approved stem cell lines are used (20). These policies, which have been widely criticized (19–24), represent an expression of “legislative myopia” (24), because they “threaten to starve the field at a critical stage” (21). Indeed, HESC research “is an example of the type of work that merits public funding and might require it to succeed” (19). As emphasized in *The Lancet*, “banning this work will deny thousands of individuals the chance to live a comfortable life” (22). In view of the predictably revolutionary applications of HESC research, the father of a paralyzed son asked: “Shall we deny our loved ones what may well be the greatest advance in medical history?” (23).

“MORAL REASONS”

Somewhat paradoxically, even though the potential of HESC research to alleviate human suffering represents an excellent moral reason to encourage such a promising research, all the bans and restrictive legislations that impede it have been enacted for “moral reasons.” These grounds are invoked especially by the Roman Catholic Church (25,26) and the anti-abortion movements, which, driven by their religious “aggressive zealotry” (27), insist loudly on an international ban on HESC research, on the grounds that it requires the destruction of embryos (1). In the United States, by wielding their political influence, those movements “have been able to block all research in the field” (27). They claim that this research is immoral, because human embryos, in view of their potential to develop into complete human beings, have “all the moral rights and protections of persons from the moment of conception” (1). This thesis reflects exactly the Vatican’s official views on human reproduction, which were expressed by Pope Paul VI in his encyclical letter *Humanae Vitae* (28). These views have also been aired more recently by Pope John Paul II in his book *Crossing the Threshold of Hope* (29). In the editorial entitled tellingly “Crossing the threshold of credibility,” however, *The Lancet* implied that the Pope has a “faulty understanding of biological matters” (30). Similarly, in *Nature*, it has been stressed that the Pope “ignores most of modern genetics and embryology” (31).

The advocates of HESC research argue that the “microscopic ball of around 100–200 cells” (32) that form

the preimplantation embryo (blastocyst) (32) not exceeding 14 days, which constitute the deadline for this research (32–34), must not be accorded the same legal status of persons, because the precursors of the brain, spinal cord, and sense organs do not appear until between 6 and 8 weeks after conception (30). Those advocates also focus on the scientific evidence that the human fetus cannot feel pain before 26 weeks (35). Moreover, they point out that Thomas Aquinas, whose philosophical views guided the Catholic Church for many centuries, believed that ensoulment occurred in three stages that were completed around 40 days after conception (31). The supporters of HESC research also stress that Christian tradition, until the late nineteenth century, followed Aquinas’s thoughts and, for this reason, the Catholic Church graded the protection to human fetus according to the stages of its development (31), which is in sharp contrast with the current position of the Vatican (29).

All the arguments outlined above, however, despite being based on reason and common sense, are probably inadequate to convince governments to ease bans and restrictions on HESC research, because its opponents not only lobby politicians to prohibit it (26), but also have the great advantage of presenting themselves as champions of such valued things as religious traditions, ethical principles, and morality. Therefore, rather than contesting the religious ideas about the legal status of human embryos, which unavoidably “results in hedgehog positions and endless debates” (36), scientists should challenge the religious claim that morality imposes to save microscopic and insensitive blastocysts, even at the expense of the lives of many suffering individuals. An example of this moral challenge can be found in an article of Lanza and colleagues (37), who compellingly wrote: “Where is the morality in letting millions of people continue to suffer from chronic and life-threatening disease? . . . does a blastocyst warrant the same rights and reverence as that accorded a living soul—a parent, a child or a partner—who might die because we failed to move the moral line?” (37). The moral challenge expressed in these questions, however, can hardly be successful without a scientifically objective definition of morality.

WHAT IS MORALITY?

The term “morality” and its derivatives are used profusely in the debate on HESC research. For example, in a short paper on this topic (38), the words “moral,” “morally,” and “immoral,” jointly, were used 11 times. Considering that several articles on HESC research discuss extensively its moral implications, it is rather surprising that not a single published article on HESC research has attempted to answer scientifically this fundamental question: What is morality? A scientific an-

swer to this central question, of course, is absolutely necessary to determine whether morality can be invoked justifiably as a reason to ban HESC research.

Most of those who believe in transcendental explanations will probably offer an answer in line with the religious dogma that morality has been benevolently infused by a divinity only in human beings, to privilege them over animals, which have no morality. This view has lately been epitomized as follows: “God is the foundation on which civilisation stands, without which there is no basis for discussing right and wrong, charity, compassion, ethics, law, and the greater good” (39). All of these uplifting things, however, can be discussed in purely evolutionary and biological terms, free of any religious connotation (40–42). Indeed, morality is not a prerogative of human beings, because “the social behavior of even the lowest animals may teach us about fostering cooperation and moral behavior among humans” (43). The idea of studying morality from an evolutionary viewpoint is scientifically well founded, because, “Increasingly, evolutionary theory is providing knowledge about the instructive basis that underlies many human behaviours” (44). Indeed, several scientists have recently discovered “the untapped potential of darwinian thinking to provide a conceptual framework for better understanding many aspects of human behavior” (45).

Considering that 93% of leading scientists do not believe in God (46), that “Evolution is the unifying concept of biology and the basis for all modern biological research” (47), and that humankind is a biological product of evolution, it is likely that most of those who prefer scientific explanations will agree with the evolutionary view that morality originated as a selectively advantageous product of evolution and preceded all religions and philosophies by millions of years (40–42). As de Waal rightly stated, “No doubt some philosophers regard morality as entirely theirs” (42) (p. 10). However, he also properly underlined that “We seem to be reaching a point at which science can wrest morality from the hands of philosophers” (42) (p. 218). It can reasonably be predicted, therefore, that “The choice between a transcendental and an empirical foundation for ethics will vanish, leaving only the latter” (48).

ORIGINS OF MORALITY

Animal aggregation is “an evolutionarily advantageous state, in which members derive the benefits of protection, mate choice, and centralized information” (49). The selective advantages of animal aggregation (45,50–52) explain why many species, including humans and other primates, live in social groups. In ancestral times, early communities of apes, to enhance their chances of survival in their harshly savage environment, had to evolve se-

lectively advantageous social behaviors, which constitute precisely the essence of morality (53).

The selective advantages of morality explain why chimpanzees display such moral acts as sharing of resources with non-kin (42,54–58), caring and consolation toward non-kin (42,59,60), and attempts to reconcile non-kin (42,58,59). These and other moral behaviors reported in de Waal’s book *Good Natured* (42), namely, altruism, collaboration, succor, empathy, special treatment of the handicapped, protection of injured individuals, tolerance, and community concern, “which is perfectly capable of being favoured by ordinary processes of natural selection” (61), can all make sense only in the context of an evolutionary strategy for promoting the survival of the social groups of chimpanzees.

Chimpanzees’ morality, which was not instilled by priests or philosophers, demonstrates that Theodosius Dobzhansky was farsighted when he wrote that “Nothing in biology makes sense except in the light of evolution” (62). In view of both the 99.4% genetic identity between humans and chimpanzees (63) and the influences of genes in determining behavior (64–73), it is logical to assume that also humankind’s morality, far from being a divine gift conferred uniquely to our species, is essentially a biological phenomenon favored in the course of human evolution (40–42).

ORIGINS OF ALTRUISM

Human beings’ morality, just as the one of chimpanzees, is mainly based on altruism (74,75) and cooperative behavior (76,77), “without which any society would, sooner or later, crumble” (78). Altruism is a genetic trait (79,80) that seems incompatible with the simplistically popularized Darwinian concept that the “survival of the fittest” is a result of “selfish” genes that have been selected at the expense of others. In truth, as shown by mathematical models of population genetics, if the reduction in survival and reproduction of individuals with genes for altruism is more than offset by the increased probability of survival of the groups formed of individuals with those genes, then genes for altruism will rise in frequency (41). In other words, “Altruists may be less fit than nonaltruists within a single group, but groups of altruists are more fit than groups of nonaltruists” (81). As has rightly been remarked, “human social groups are so well designed at the group level that they must have evolved by group selection” (82). The important role of group selection in evolution has recently been confirmed by theoretical studies (83,84).

Until a few decades ago, the idea of group selection was discredited, whereas currently “an increasing number of biologists chafe against the idea that individual competition explains every aspect of evolution” (85).

Their chafe is understandable, because natural selection operates at many levels (86), including group selection, which has certainly played a pivotal role in humankind's evolution. Indeed, if we bear in mind that humans, in their hostile ancestral surroundings, were more likely to survive in groups than alone (49) and that groups, for the 99% of humankind's evolution, consisted of a few tens of members (87), just as still occurs in hunter-gatherer tribes (88,89), it is obvious that groups strengthened by the moral altruism of their members were more likely to survive than were groups weakened by the immoral selfishness of their members (87). Even today, the socially beneficial effects of altruism and the detrimental ones of selfishness may contribute to explain, respectively, the prosperity of some nations and the socioeconomic problems of others (90).

That altruism is a genetic trait produced by group selection has clearly been demonstrated by several recent experiments that "confirm a general tendency in humans both to be generous to distantly related individuals and to punish cheaters, sometimes at great personal cost. . . . Such findings have stimulated evolutionary theorists to return to models of the evolution of group-beneficial . . . genetic traits . . . , all in populations structured in small groups at high risk of extinction. Such conditions could have prevailed in human societies in the not-too-distant evolutionary past" (91). Only these ancestral conditions can plausibly account for the otherwise puzzling altruistic behavior—even at great personal cost—that those experiments have consistently found in modern humans (91). Indeed, as Charlton (92) correctly argued, "Contemporary behaviour is . . . a consequence of modern inputs being processed by mechanisms and driven by instincts designed for ancestral conditions" (92), because "we are, after all, animals, only recently emerged from a stone age culture . . . [and] much of our behavior can be described as animal instinct, genetically determined" (93).

As de Waal appropriately recalled, "Darwin himself leaned toward group selection when tackling the issue of morality. He literally saw one tribe gain advantage over another" (42) (p. 23). Indeed, Darwin, quoted by de Waal (42) (p. 23), wrote as follows: "At all times throughout the world tribes have supplanted other tribes; and as morality is one element in their success, the standard of morality and the number of well-endowed men will thus everywhere tend to rise and increase."

REDUCED ABILITY TO RECOGNIZE IMMORALITY

For millions of years, evolution rewarded the morality—i.e., socially beneficial behaviors—of some human groups by favoring their survival and punished the immorality—i.e., socially harmful behaviors—of other

groups by hastening their extinction (87). By means of these selective pressures, therefore, evolution has taught human beings that morality consists in behaviors that favor the survival of the community and that immorality is represented by behaviors that can jeopardize its survival. Even "animals may take account not merely of how their companions do behave but also of how they ought to behave" (61). Intuitively, for most of humankind's existence, our ancestors regarded morality and immorality as essentially represented by actions that, respectively, reduced or increased the physical and psychological sufferings of the members of the community, because pains and distresses, as the more visible expressions of diseases and impairments, constituted a threat to the fitness and survival of the small ancestral groups (94–96).

Considering that "Humans have been 'designed' for a historical situation, not for contemporary society" (97), it is not surprising that morality, molded as it was to ensure the survival of "the small-scale societies in which humans lived for most of our prehistory" (98), began to fade when the dimensions of human societies increased enormously (87), as a result of the demographic explosion that ensued from the invention of agriculture about 12,000 years ago (97). It is worth noting that 12,000 years represent less than 0.5% of the 2.5 million years during which our remote ancestors lived in small tribes (97), whose survival largely depended on the socially beneficial effects of their morality (87). The socially detrimental consequences of a disproportionate increase in the size of human communities were unavoidable, because "Statistics from several sources point to an optimal human group size of around 150 individuals (three times that of any other primate)" (99).

The excessive increase in the dimensions of human groups, by "diluting" the socially harmful consequences of immoral actions among millions of untouched and distant individuals, allowed immorality to become less easily recognizable socially than it was in small primitive groups (87), in which all the members knew each other and recognized promptly the immoral actions that could menace the survival of their little communities. Nowadays, therefore, to test the alleged morality of individual actions and government policies, we should determine their predictable effects on the well-being and survival of small theoretical communities (87). Indeed, unless we make the prodigious statement that the remote risk of extinction of our immense societies entitles us to overturn the meaning of morality, all actions and policies that would cause the extinction of small communities must be regarded as patently immoral (87).

The reduced ability of the members of enormous societies to recognize and condemn immorality explains why they permit religious parents to refuse vaccinations (100) and medical treatments for their children (101,102), which results in multiplied infections (100) and several

fatalities (101,103). Given that the undesirable consequences of religious and philosophical exemptions affect severely not only exempted individuals but also non-exempted children (100), it has rightly been written that “The critical issue is whether some parents should be allowed to place other people’s children at increased risk for disease by refusing immunizations for their own children” (104). At the economic level, since we have the “moral duty to use our finite resources efficiently” (105), one may well complain about the waste of considerable resources to save patients who refuse blood transfusions for religious reasons (105). It has been depressingly estimated that “Costs incurred by one severely ill Jehovah’s Witness could run one unit in Africa for one year. . . . Will the time come when a religious group will be charged the costs of keeping its members alive?” (106).

The impaired ability to recognize immorality also explains why the nonsensical immorality of some religious movements can elude social reprobation. For example, the male members of a Christian group, “to attain their ideal of sanctity, subjected themselves to castration . . . (removal of the penis, the scrotum, and the testes)” (107) and, despite this madness, were allowed to become “ardent proselytizers” (107). This proselytism resulted in thousands of castrations (107), which are numerous enough to lead tens of small communities to extinction (87).

Not only the “ideal of sanctity” (107) of a little religious group, however, but also the ideal of “morality” of great religious movements can produce tragic consequences. Indeed, the Vatican’s precepts about human reproduction, which include the prohibition of using condoms “regardless of whether their intended use is contraception or disease prevention” (108), have been officially reaffirmed even in the light of the millions of children orphaned by the devastating epidemic of AIDS (109). At the United Nations session on AIDS in June, 2001, the Vatican’s delegate proclaimed: “The Holy See wishes to emphasize that, with regard to the use of condoms as a means of preventing HIV infection, it has in no way changed its moral position” (108). This “moral” position, which may well justify the question “Does God want orphans?” (110), demonstrates that Pascal, quoted by Good (111), was surely right when he said that “Men never do evil so completely and cheerfully as when they do it from religious conviction.” Indeed, as Savulescu correctly underscored, religion and ethics represent two distinct worlds (112). Likewise, others observed that “religious ethics is not well suited to solve moral problems in secular society” (113).

IMMORALITY OF BANS AND RESTRICTIONS ON HESC RESEARCH

Unless we overturn the meaning of morality or we advance the untenable thesis that what is indisputably im-

moral in small communities can be moral in great societies, we cannot but realize that unmistakable immorality, not morality, underpins all bans and restrictions on HESC research, because they constitute an immoral evolutionary nonsense, which would be selectively disadvantageous and potentially fatal for small communities (94). Had HESC research and its therapeutic applications been available to early humans, our remote ancestors would have deemed it unquestionably immoral to save those amorphous and microscopic agglomerates of insensitive cells representing neither parental nor social investment (95), at the expense of the sick and suffering members of the social group, because their disabling diseases and premature deaths weakened the little community, thereby potentially hastening its extinction (94). Even though the risk of extinction of today’s enormous societies is remote, there is no rational reason to overturn the meaning of morality, which still dictates that our first moral duty is to reduce the physical and psychological sufferings of our fellow beings. Notably, this primary moral duty also guides chimpanzees, as shown by their “*succorant behavior*, defined as helping, caregiving, or providing relief to distressed or endangered individuals other than progeny” (42) (p. 41).

As de Waal cogently reasoned, “If attachment and bonding are at the root of succorant behavior, parental care must be its ultimate evolutionary source. As explained by Irenäus Eibl-Eibesfeldt, with the evolution of parental care in birds and mammals came feeding, warming, cleaning, alleviation of distress, and grooming of the young, which in turn led to the development of infantile appeals to trigger these activities. Once tender exchanges between parent and offspring had evolved—with the one asking for and the other providing care—they could be extended to all sorts of other relationships, including those among unrelated adults” (42) (p. 43).

Considering that parental care is the most ancestral form of morality (114–116) and that maternal care constitutes its maximal expression and is probably one of the most perfected products of evolution, because the existence of all mammalian species depends primarily on maternal care, human mothers are the best judges of the morality of HESC research. Opinion polls performed worldwide will undoubtedly show that mothers would overwhelmingly decide to produce an insensitive and microscopic blastocyst, to be destroyed within 14 days, if its therapeutic use can save their suffering children. The opposite decision, besides being evidently absurd in view of the mother–child relationships (117–122), which are the strongest ones existing in nature, would emerge as an immoral evolutionary nonsense, because blastocysts, unlike children, represent no parental investment, which is a crucial evolutionary factor (123–125).

Hypothetical aliens studying humankind since its origins might wonder why a sound maternal decision, which

reflects moral behaviors evolved and perfected under selective pressures over millions of years, should be prohibited by laic governments under the pressures of religious movements espousing “moral” principles that have been invented extemporaneously in the last 0.1% of humankind’s evolution (96). Those aliens, by looking at the enlarged photo of a microscopic embryo on the point of a pin (126), could also argue that only a blind faith and an irrational adherence to dogmatic principles can explain why some humans claim that such a tiny and unformed clot of cells must always be saved, even at the expense of the lives of many suffering children.

CONCLUSIONS

Evolution imposingly warns humankind against being deceived by the “empty rhetoric of invoking resonant principles with no conceivable or coherent application” (127), because these vacuous principles unequivocally violate the moral imperatives that enabled our species to survive for millions of years (87,94–96). As has timely been emphasized, “From the jailing of Galileo to the Scopes trial on the teaching of evolution, there are countless cautionary tales that highlight the perils of allowing any single ideological view to dominate science policy” (128). Indeed, considering that “Dozens of new infectious diseases are likely to emerge over the next 25 years” (129), as AIDS and SARS (severe acute respiratory syndrome) did previously, reason suggests that it could be a tragically shortsighted error to keep bans and strict regulations on HESC research. Its predicted clinical applications, for example in the treatment of neurodegenerative disorders (2), could enable our species to avoid a dramatic increase in human suffering, by remedying the destructive effects of unknown diseases causing neuronal degeneration. No one can exclude that among the dozens of new infectious diseases that are expected to affect humankind in the next years (129) there will be some neurodegenerative disorders caused by mutated, highly contagious strains of the infectious agents that are responsible for transmissible spongiform encephalopathies (130).

The moral imperative of easing bans and restrictions on HESC research, besides being corroborated by evolutionary considerations, is also strengthened by historical lessons, which caution humankind against forgetting “the fallibility, even lethality, of religious dogma and precept” (131). Indeed, despite the long-proclaimed infallibility of the popes (132), the Holy See is well known for its tardy apologies for papal errors. The Vatican rehabilitated Galileo 359 years after his sentence, passed by the Holy Office (133). In 1950, Pope Pius XII condemned the “fictitious tenets of evolution” (134), but in 1996, nearly 120 years after Darwin’s burial, Pope John Paul

II acknowledged that Darwin was right about evolution (135). Later, he asked forgiveness for errors of the Church over 2,000 years (136). After 2010, when the number of African children orphaned by AIDS will come to 20 million (137), he or another pope will probably apologize for the religious misinformation and interferences that hamper the use of condoms as a means of preventing HIV/AIDS (138).

In the near or distant future, if humankind will be ravaged by a devastating disease potentially curable only by the therapeutic applications of HESC research, the papal apologies for the current religious pressures to ban worldwide this promising research will hardly console the bereaved survivors.

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Received January 1, 2005; accepted January 15, 2005.