Humanity should colonize space in order to survive but not with embryo space colonization

Konrad Szocik

Department of Social Sciences, University of Information Technology and Management, Sucharskiego 2 Street, Rzeszów, 35-311, Poland

Abstract

The embryo space colonization (ESC) concept is an interesting, very rational and quite effective way to guarantee the survival of the human species, as long as the technology is achieved and no unforeseen complications arise during even many millions of years journey to an exoplanet. Despite these formal advantages of the concept, this paper points to a number of arguments against its validity. These arguments revolve around two issues. One is to point out that while the concept of saving the *Homo sapiens* species is noble and should be supported, the way of saving humanity envisioned by the ESC departs from what should be understood by the concept of saving humanity through space colonization. The second issue is to draw attention to the ethical controversies that make this concept perhaps unsuitable for implementation at all. At least some of these objections do not address the concept of saving humanity by sending adult living persons on space missions.

Introduction

In this paper, I refer only to the embryo space colonization (ESC) concept under the assumption that humanity will send cryopreserved embryos on a mission to an exoplanet lasting perhaps millions of years before extinction on Earth (Edwards, 2021). So, I am referring to a scenario in which there will not be a single living human for many millions of years, and the only form will be frozen embryos. I am not discussing the concept of embryo earth recolonization presented by the author, nor am I referring to a hypothetical scenario in which at least a small group of currently living adult human survivors would be living on Earth in parallel with cryopreserved embryos in a spaceship. My arguments apply only to a scenario in which there is not a single currently living adult human being on Earth or anywhere else, and the only forms belonging to the *Homo sapiens* species are frozen embryos on a spaceship travelling to an exoplanet. My objections relate to two aspects. One is related to demonstrating the non-sensicality of the concept of self-preservation of the human species with ESC. The second aspect relates to the ethical controversy surrounding ESC. While the author emphasizes that many legal and bioethical issues will need to be discussed in relation to the concept of ectogenesis, in this paper I point out that some of the ethical controversies may be so serious that they may already be questioning the ethical legitimacy of the ESC concept itself.

The survival of the human species should have as its starting point the protection of currently existing humans and the preservation of the continuity of existence

The idea of colonizing space is to save the currently living rather than simply to guarantee the presence of the human species. Even if it is guided by the idea of preserving the human species, the starting point is always the people currently living. We agree that the guiding idea behind the concept of space colonization is the survival value of humans as a species. But this is a value concerned with keeping alive the people currently living at the time of the catastrophe, even if only a small fraction of them would survive. It is difficult to imagine any motivation or justification for the idea of keeping embryos alive in a situation where there will be total annihilation of all humans. I do not see any point to the idea of preserving the existence of the species in this way. Integral to the concept of maintaining the existence of our species is the continuity of living humans. We can only care, empathize, and feel with currently living humans. We have no such relationship with frozen embryos travelling perhaps millions of years in a spaceship. No one currently alive will benefit in any way from the fact that millions of years later human embryos will develop into humans on some exoplanet. It is about both feeling a connection and relationship with people currently alive and knowing that at least a small number of people currently alive have been preserved in the face of impending doom. If our species perishes and its only surviving form are frozen embryos travelling somewhere in
space, none of the currently living people benefit from the fact of such a specifically understood extension of our existence. As much as I am in favour of the concept of preserving the existence of our species, I recognize the non-sense of the solution assumed by the ESC. It is not clear what the purpose of preserving the existence of the human species in this form is when there will be an interruption of its existence even for many millions of years. What is needed are ‘witnesses’ who link the generations and can tell the story. Will embryos when thawed and born on an exoplanet even know the history of humans on Earth? Will they be able to emotionally feel any connection, unity and identity with a human species extinct millions of years ago? I believe that the lack of such continuity is a serious problem, and while genetically the embryos that will be born millions of years after our extinction will be just like us, ethically, psychologically, and most importantly in terms of a sense of identity and unity they will operationally function as a new species. This lack of continuity is also, in my opinion, an argument against the rationality of such a form of extending the human species.

Survival of the human species as a value, but only using standard, not extraordinary means

This argument known in bioethics can be successfully applied by analogy to the concept of colonization of space motivated by the desire to guarantee the survival of the human species. In the case of health care, a number of criteria are taken into account when deciding whether to continue treatment or resuscitation. One of these is what is known as exceptionality of the measures taken, which are exceptional if they are disproportionately expensive or if they restrict access to medical care for other patients in need. The survival of the entire Homo sapiens species can be treated analogously to the survival of the individual human being. What measures will we consider standard and what measures will we consider extraordinary? Standard measures include concern for the environment and all activities related to the fight against global warming. Perhaps such an action is the slow, gradually implemented concept of human space missions to the Moon and Mars, initially treated as exploratory, mainly scientific missions. It is possible that such missions will, in time, evolve into colonization missions, but even if that were to happen, it would happen slowly and would be spread out over at least decades, if not hundreds of years. In this sense, it is treated as a standard measure. An extraordinary measure would be the concept of rapid and direct colonization of some astronomical object, bypassing other stages considered natural and easier, such as the concept of a scientific mission or commercial exploitation of space.

The ESC concept should be treated as an extraordinary measure. First, it should be considered only as a last resort when other means of saving the species are certain to fail. This includes both subterranean refuges and space refuges with currently living humans. Second, the ESC concept essentially assumes an inevitable interruption in humanity’s existence, which, as outlined above, is, under certain conditions, unacceptable from the point of view of the meaningfulness and desirability of the existence of the human species in an uninterrupted manner that guarantees intergenerational identity. Third, the ESC concept raises a number of ethical controversies discussed below. The assumption is that any solution that causes serious ethical controversy should be treated as an emergency solution with a strong rationale, which, however, the ESC concept lacks.

Argument from postponing ECS to wait for better technology

This is one of the more commonly discussed arguments against both the concept of space colonization itself and the concept of space colonization involving human enhancement. The main idea behind this argument is the belief that in order to avoid the difficulties associated with sending humans into the harsh environment of space and/or using ethically controversial human enhancement, it is better to wait for technology to develop in such a way as to either protect humanity on Earth or preclude the need for human enhancement for space exploration. With respect to the ESC concept, a possible scenario is that a spaceship with embryos can be overtaken by a spaceship with living people sent later but realized with better propulsion technology. Should this happen, we can consider several scenarios:

(a) Adults arrive before cryopreserved embryos and oversee the birth process.
(b) The adults go to another place in space.
(c) The ethical evaluation of such a duplication of the mission is positive. We increase the chances for survival of the species by realizing as soon as possible that option which is technologically available earlier.
(d) The ethical evaluation of such a duplication of the mission is negative. Since in the end, we were able to send adults on such a colonization mission anyway, we unnecessarily endangered/are continuing to endanger embryos. So we should already be working more intensively, not on the ESC concept, but on our ability to forecast the future, anticipate global threats and even on technologies to reduce or even prevent at least some of them. So, on a negative moral assessment (more likely from the standpoint of moral conservatism), we should already be planning our goals differently when making science policy in the context of humanity’s future.

This argument leads to the idea that, in essence, the ESC concept abolishes itself. This relies on the fact that the goal of space colonization is species preservation assuming at the starting point the survival of at least a small group of currently living humans. The ESC concept, however, assumes something different, as it does not take into account currently living humans. Thus, we still have to wait for such a development of technology that will enable us to send at least a small fraction of the currently living people to colonize in space.

Argument against ESC from quality of life ethics

The concept of quality of life should play an important role in discussions of human space habitat design and planning. The starting point here is the assumption that regardless of the difficulty of the space environment, as well as the motivation for space colonization, a space habitat should offer a minimum quality of life. This means not only guaranteeing a certain level of comfort and health, but also protecting basic rights. The quality of life ethic is concerned with the fact that a person, even though he or she will preserve life by fleeing the Earth, should not deprive himself or herself of the valuable life he or she led on Earth before the catastrophe or before being forced to leave it, in favour of a harmful life in an unknown environment. This is the idea that it is not so much about biological survival as it is about quality
of life and this quality of life includes the right to emigrate or simply to leave an unfavourable place (Schwartz, 2021). These allegations apply to missions that, in terms of ethical controversy, degree of unpredictability, or technical challenges, are incomparably simpler and more accessible than the ESC concept, such as missions to the Moon and Mars. Since these arguments are raised with respect to currently living humans – future astronauts, these arguments seem all the more valid with respect to unknown exoplanets. An additional factor that raises the ethical controversy of the ESC concept is that it is not known whether the target exoplanets will be inspected by space robots beforehand. Such missions are currently being carried out on the Moon and Mars, and such robotic reconnaissance is seen as a necessary prelude to human missions.

The relationship of currently living people to future generations

This is another concept familiar from philosophy and particularly useful in the bioethical debate over abortion. Do we have duties to future human beings? In the abortion debate, this takes the form of, among other things, considering the concept of the rights of future human beings. The concept of rights for future people relates to humans who do not yet exist (Gosselies, 2008). As such, future people are potential persons (embryos) or possible persons (unidentified future people who will be born at some point in the future). With respect to the ESC concept, we are only talking about potential persons. The concept of intergenerational justice can be applied here. If we agree that every child has a right to adequate life prospects, ‘the duty is to ensure that children will enjoy equally good life prospects as the adults who rear them’ (Gheaus, 2016). This refers to a minimal level of quality of life that should not be lower than the quality of life of every other average child living. Anca Gheaus notes that we should not give life to future children if we are not able to secure their interests and offer them lives that are lives worth living. While she discusses a context of environmental pollution and climate change, she has in mind care of current generations in terms of a good environment and availability of resources. This is applicable to the concept of ESC, as well. When we decide to bring into existence embryos in an unknown environment, without parents, but also without any living adult, surrounded by androids, we are hurting them. In all these cases, the future child is deprived of ordinary chances (Mill, 1859).

Here we encounter a paradox. On the one hand, we can say that it may follow from our duty to future humans that we must take all possible measures (perhaps not just ordinary measures, as was discussed above) to ensure their survival. But on the other hand, the same conception of duty to future human beings may prohibit us from exporting frozen embryos to an exoplanet precisely because in doing so we deprive them of what today is the minimum standard expected to guarantee any child – care, security, a sense of being at home. The scenario described by Matthew R. Edwards does not guarantee this. This also overlaps with the concept of quality of life discussed above, which also applies to the carefree childhood and the right to have parents. While some of the arguments from quality of life ethics against space colonization retain validity against living adult astronauts as well, sending living adults on space missions is free of at least that part of the objection that concerns a safe and carefree childhood.

Can we implement ESC without first germline gene editing (GGE)?

Will such a cryopreserved embryo be viable in a new environment without prior genetic modification? There are good arguments for subjecting such embryos to GGE or genetic human enhancement. But before doing so, one would need to know the physical conditions of the target site and at least roughly define the required adaptations. Thus, sending embryos to very distant destinations without prior human enhancement may still prevent their development and force them to remain perhaps forever in a frozen state, which in turn goes against the idea of ESC. The problem disappears if the target location is an exoplanet with the same parameters as the Earth (primarily exposure to space radiation and gravitational force).

We should also take into account the possibility of negative effects of these factors, namely the lack of gravity and exposure to space radiation during the interplanetary travel on the frozen embryos. Although Edwards cites research on mouse spermatozoa stored for 9 months on the International Space Station (ISS) and the lack of negative effects on fertility and risk of complications at birth, he erroneously states that radiation on the ISS is 100 times higher than radiation on Earth – radiation on the ISS is only 10 times higher and we do not know how embryos will withstand exposure to an additional 10 times higher radiation than on the ISS during interplanetary travel. We can assume, however, that the technology available in the distant future will make it possible to adequately protect against these factors during the flight, if only through the use of artificial gravity. In any case, the need for perhaps radical GGE of embryos planned for shipment under ESC is not a trivial issue. But if it turns out that GGE in this situation would be necessary, we run into an important ethical controversy regarding the application of GGE. While we might accept that the purpose of the ESC is noble – after all, it is about preserving the existence of our species – the manner in which this rescue mission is carried out may be questionable to many for the reasons described above (namely, that we are not saving currently living humans, but sending cryopreserved embryos).

The risk of objections from moral conservatism

Regardless of our ethical preferences and where we place ourselves on the axis between moral conservatism and moral liberalism, we should consider the conservative ethical view of the status of embryos. From the conservative point of view, an embryo is not only a human being, but primarily a person, and its moral status is equal to that of a person. Conservatives would probably oppose sending living adult persons on a mission such as the ESC concept described in the article. But since they make no distinction between adults and embryos, the same prohibition should apply to embryos. Moral conservatives would surely also be interested in the justification for ESC. Maybe if it were still about sending already existing people to save the species, they would be willing to accept cryopreserved adult humans sooner. On the other hand, the justification for sending cryopreserved embryos on such a mission in a situation when life on our planet is still going on, and what is more, must be in pretty good shape if we are able to accomplish such a mission (i.e. humanity even despite the coming problems still has free human, technical and financial resources to organize an ESC) is very weak. The problem is as follows. If moral conservatives oppose abortion of embryos because of their moral status in the face of currently happening, tangible
problems (many moral conservatives prohibit abortion even in the situation of rape or despite lethal defects of the embryo/foetus), then we can assume by analogy that they will all the more oppose such a risky and uncertain mission as the ESC when the expected problem that this mission is supposed to anticipate, i.e. the annihilation of the human species, has not yet happened. Nor can we forget that there will be plenty of sceptics who will not believe in the coming end of the human species.

I am not saying that moral conservatives are right about the status of the human embryo. On the other hand, I believe that their position should not be ignored. We also do not know what the dominant ideological and worldview currents will be in the future Edwards discusses, where ESC will become technically possible. If we assume that the global situation will worsen rather than improve – which it must, after all, because that is what the ESC concept assumes (otherwise the ESC is not necessary) – then we can expect religiosity to increase globally in accordance with the concept of existential security, which indicates a correlation of religiosity with a lower sense of security (Norris and Inglehart, 2004). And since religion as such is usually correlated with conservative morality concerning, among other things, the status of the embryo, we can expect a situation in which the aforementioned moral conservatism will be dominant in today's morally liberal Western countries (assuming that it is any of the Western spacefaring countries that will implement ESC).

We may be dealing here with a moral paradox. On the one hand, according to moral conservatism, embryos are treated as persons and therefore deserve respect equal to an adult. On the other hand, these same embryos in a state of cryopreservation are de facto treated as future full human beings by the implementers of ESC. Thus, regardless of one's moral views – although one might guess that the proponents of ESC would be moral liberals rather than conservatives – they grant de facto high moral status to embryos in the sense that they must be kept alive and cannot, for example, be subjected to research or removed. But it seems that here the status of embryos is rather instrumental, subordinated to the survival of the species, which is an intrinsic value. In this respect, however, the difference between liberals and conservatives would be preserved, although the consequences – keeping all embryos alive – would probably be the same for both sides.

**Mind uploading as a better alternative to ESC**

The ESC concept seems to suggest that it is not so much about the survival of life as such as it is about the survival of the human species. If it were about the survival of life itself, it would be easier to send microbes or tardigrades, for example, instead of human embryos. If, on the other hand, it is about the survival of the human species specifically, then what sets us apart is the reason. So, this is a decidedly anthropocentric and ratiocentric conception. And if this is indeed the case, then the mind uploading project (whole brain emulation) seems to be a better solution. So, since we have established that this is about the life of the human species, not life itself, and we still agree on even a multi-million years discontinuity between currently living humans and those who will someday be born from frozen embryos, a better solution is to upload our minds applied to appropriate material inanimate media. In the end, it is only our minds implanted in material vehicles that will suffer, not our bodies. This should satisfy moral conservatives, who in turn care for the embryo from the moment of conception and thus have in mind not a concern for the mind but for the body, even if it does not yet feel and is an aggregate of cells. The risk of inflicting physical suffering is also dismissed here. The advantage of not having to provide a life support system and consumables is obvious when sending emulated brains.

**Conclusions**

The moral conflict over the idea of extending the human species through space colonization can be reduced to a conflict between consequence-maximizing principles and duty-based principles. The first position holds that since our goal is the survival of the species, we should pursue that goal at all costs. That price, in the case of ESC, is exposing children born in the future on an exoplanet to a lower quality of life, or the need for medical procedures that remain controversial to many, such as ectogenesis or GGE. Duty-based principles, on the other hand, will oppose saving the species at any price, if that price were to be a violation of, for example, autonomy or a reduction in quality of life. It seems that we should be able to make some sacrifices to save the species in the long term, and the concept of ESC perhaps does not seem particularly ethically controversial to many after all. However, the one sticking point that may tilt the balance of argument against ESC proponents is the specific form of ESC’s ‘evacuation’ of humanity from Earth, which basically ignores the interests of currently living humans and assumes perhaps even a multi-million-year interruption in humanity’s existence.

**References**


