Ethics in Stem Cell Applications

Michael Fuchs

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What You Will Learn in This Chapter

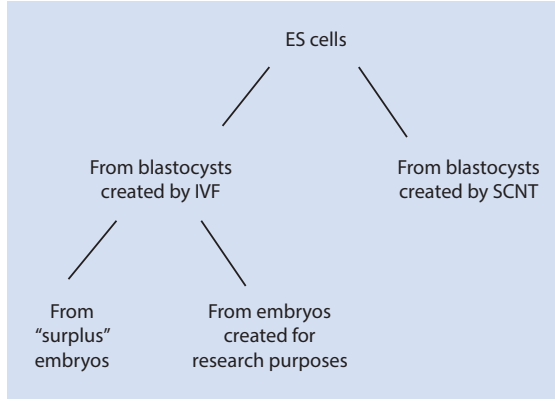
In this chapter you will learn about the different sources to get embryonic cells for research or for therapeutic applications. Since getting ES cells from embryos in the blastocyst stage normally implies the destruction of the embryo the chapter deals with the moral status of the human embryo. You are informed about different positions and their background assumptions. In addition to the international ethical discussion the genesis of the legal regulation in Germany and Europe is described and explained. Finally the question of moral disagreement is addressed.

The ethics of medical research constitutes a part within the field of medical ethics and bioethics where a far-reaching consensus could be found, at least as far as the principles and necessary procedures are concerned. This consensus has been built upon the concept of informed consent, which is deemed a central aspect in the ethics of research on human beings and on human biological material (Faden and Beauchamp 1986). The idea behind this concept is to avoid any kind of instrumentalization of human persons and to respect human dignity.

If we look at stem cell research we have to be aware that several kinds of cells have to be distinguished. This distinction is based on differences in the biological potentials, the ontological status (what kind of thing is x?) and the moral status (what is the moral value of x?). Some cells do have the potential to differentiate and to create various tissues and even various types of tissue. This is the reason why they are of high interest for research and for future therapeutic applications. Some cells even have the potential to develop into an entire organism for instance an adult human being. In this regard the term "totipotency" stands for the potential to develop into an entire organism, "pluripotency" for the potential to develop into (theoretically) all cell types apart from extraembryonic tissues (Denker 2002).

Since cells differentiate and lose their potential during their live time, embryonic cells are of special interest. We have different sources to get embryonic cells for research or for therapeutic applications: EC cells (embryonic carcinoma cells) are taken from embryonic tumour cells, EG cells (embryonic germ cells) from fetal precursor cells of gametes and ES cells (embryonic stem cells) from early embryonic stages of development (blastocysts). ES cells (embryonic stem cells) may be subdivided into the following groups: ES cells generated from blastocysts created by in vitro fertilisation (IVF), ES cells generated from blastocysts created by somatic cell nuclear transfer (SCNT) (Tachibana et al. 2013; Meissner and Jaenisch 2005).

ES cells generated from blastocysts created by in vitro fertilisation (IVF) can be derived either from socalled surplus or supernumerary embryos or from embryos created for research purposes.



For many decades the discussion on stem cell research was focused on human embryonic stem cell (Hug and Hermerén 2011). And the central issue in the discussion on human embryonic stem cells was the moral status of the human embryo (Føllesdal 2006). Taking ES cells from embryos in the blastocyst stage normally implied and still implies the destruction of the embryo. Killing of an embryo or fetus is one of the most contentious moral issues (De Gracia 2012, 16–59).

14.1 Disagreements on the Question of the Status of Embryos

The spectrum of positions in the philosophical debate ranged from the positing of a moral imperative to pursue embryo research and therapeutic cloning (Merkel 2001), to the belief in a duty to ensure ungraduated protection of human dignity for all early stages of development, which biologically have be considered part of the "human family" (Spaemann 2001). A radical position was held by Peter Singer and Helga Kuhse: "We must recall however," they argued, "that when we kill a new-born infant there is no person whose life has begun. When I think of myself as the person I now am, I realize that I did not come into existence until sometime after my birth. At birth I had no sense of the future, and no experiences which I can now remember as ‚mine'. It is the beginning of the person, rather than of the physical organism, that is crucial so far as the right to life is concerned" (Singer and Kuhse 1985, 133). Singer and Kuhse agree with most of us, that adult human beings deserve respect and protection of their lives and even of their corporal integrity. But since this respect presupposes a specific degree of mental capacity Singer and Kuhse deny that already the newborn has to be kept alive in any case. Another position was marked by Michael Tooley who was looking for an analogy between brain death and the beginning of the brain: "Just as I shall live only as long as the relevant part of my brain remains essentially intact, so I came into existence only when the appropriate part or parts of my brain came into existence, or more precisely, reached the appropriate stage of development to sustain my identity as a human being, with the capacity for consciousness. When I came into existence is a matter of how far back the relevant neurophysiological continuity can be traced. Presumably, then, my life began somewhere between conception and birth" (Lockwood 1985, 23).

For the debate in the United Kingdom individuation was seen as a morally significant break physiologically indicated by the appearance of the primitive streak: "The primitive streak stage is a vitally important landmark in development because it marks the onset of individuality. [...] Once the primitive streak has formed, we can for the first time recognise and delineate the boundaries of a discrete coherent entity, an individual, that can become transformed through growth and differentiation into an adult human being. If I had to point to a stage and say ‚This was when I began being me', I think it would have to be here" (McLaren 1984). Before the appearance of the primitive streak identical twinning is still possible, chimeara can be created and there is little evidence of an intrinsic unity. For the proponents of this position the early embryo is either more an aggregation than a unity or an individual or it is not the same individual entity as after the point in development when twinning is not any more possible.

Others argued in favour of fertilisation as the onset of a human being. "A change in organism was seen", John Noonan explained in 1970, "to occur at the moment of fertilization which distinguished the resultant from the components. It was easier to mark this new organism off from the living elements which had preceded it than it was to mark it off

from some later stage of its organic growth in the uterus. If a moment had to be chosen for ensoulment, no convincing argument now appeared to support Aristotle or to put ensoulment at a later stage of fetal life" (Noonan 1970, 38).

Those who argued in favour of an early onset of human identity or even personhood made use of arguments that the stages of development are linked. "We can say", Norman Ford stated in 1991, "the human person is a living individual with a human nature, i.e. a living ontological individual that has within itself the active capacity to maintain, or at least to begin, the process of the human life-cycle without loss of identity" (Ford 1991, 84–85). In analyzing this sentence and other positions philosophers distinguished a species argument, an identity argument, a continuity argument and a potentiality argument which all were carefully discussed (Damschen and Schönecker 2003; Deutsches Referenzzentrum für Ethik in den Biowissenschaften: In focus: Research with human embryonic stem cells).

In Germany the basic attitudes towards the worthiness of protection to be granted to the human embryo in vitro are similarly heterogeneous like those found in other European countries and in the Anglo-Saxon countries in particular. In the attempts to qualify the necessity to protect life only for some of the first phases of development involved – alongside consistency arguments, such as reference to the legality of nidation inhibitors – the search for caesura in the development of the human organism from fertilisation to birth played an equally important role as in other countries (Rager 2009). Whereas the argument that individuation has not ceased as long as there are residual possibilities of polyembryony played a major role in the Anglo-Saxon discourse of the 80s, the German discussion was more concerned with the criterion of nidation, since – as was said – it is only with nidation that essential nutritional and morphogenetic factors on the mother's side enter into the genetic programme of the fertilised egg cell (Nüsslein-Volhard 2001, see also Heinemann and Honnefelder 2002). Moreover the Constitutional Court made use of the difference between the nasciturus in utero and the embryo in vitro. Since the German Basic Law does not give a definition of a human being and no answer to the question of the status of the early embryo the court declared in two decisions that the right to life extends to the unborn (1975) and affirms that the unborn human life is already entitled of human dignity (1993). Nevertheless in both decisions the court left the question explicitly open if this right to live and to be protected applies already for the embryo before nidation or individuation (1975) although it is argued that insights from medical anthropology might suggest that human life arises prior the pregnancy "with the fusion of egg and sperm cell" (1993).

The individual opinions within the spectrum of positions in Germany break down into two basic patterns of argument, in much the same way as we have seen in other countries (House of Lords 2002; Føllesdal 2006; De Gracia 2012; German Bundestag. Study Commission on Law and Ethics in Modern Medicine, 2001). What both patterns of argument have in common is that they start with a clear assumption that the born human being must be ensured protection, whether on grounds of its status as a moral subject or on the basis of its facility for reason, whether as the holder of preferences of a special kind or as the image of God, or whether simply on grounds of divine command. Both patterns of argument proceed from this fundamental understanding by drawing conclusions as to the status of human beings in the phases prior to birth. The two patterns occur because the development process can be seen, on the one hand, as a process of emerging and, on the other, as a process of growing. One side emphasises that the relevant characteristics and prerequisites of being a person are successively added, while the other side stresses identify and continuity between the embryo and the born human being. This difference comes

sharply into focus in the respective understandings of "potentiality". While potentiality is seen on one side as a purely logical or material possibility, the other side regards the entity that has in itself the potential a power of action "leading to the fulfilment of the potential" (Holm 1998, 43). If we would give up the conception of potentiality, the second group argues, we would risk not being able to insist on the protection of persons that are sleeping or in coma (Føllesdal 2006, 70).

Looking at the debate in Germany as a whole, we should note, however, that there have been very few participants in this discourse who favour the option of permitting embryo harvesting for research or therapeutic purposes (Fuchs 2011, 124–129). Additional concerns have been voiced about the possibility that this might occur by means of therapeutic cloning, i.e. via procedures to transplant the nucleus (Fuchs 2003).

This stance reflects a tendency, already visible in the deliberations leading up to the framing of the Embryo Protection Act, that if embryo-consuming research is, even for a therapeutic objective, to be permitted at all, then only when carried out on orphaned supernumerary embryos. Such embryos have become available – although only in small numbers – even under scope of the Embryo Protection Act. This is not due to infringements of the law. For, although the Embryo Protection Act seeks to create a framework for the use of in vitro fertilisation in which such embryos do not occur, it cannot and does not wish to give guarantees that an artificially produced embryo is implanted. Rather, we have to consider the possibility that the mother may fall ill or die, or that the mother – and the Embryo Protection Act also accepts this possibility – may refuse implantation. In general the discussions did make clear that the Embryo Protection Act, although appearing rigid by international comparison, does not only pursue the aim of preventing the unregulated practice of artificial insemination and research on embryos for uses other than the well-being of the embryo, but is also designed to offer protection for, in addition to the embryo, the family with its traditional parents-child structures (Kirchhof 2002, 22–24). Only keeping in mind this dual purpose we can understand why no legal framework was created for embryo adoptions and why, in order to enhance the efficiency of artificial insemination, the production and implantation of more than one embryo is permitted (to a maximum of three). In other words, the debate in the 1980s concerns, as it does today, the question of whether those embryos that, as far as anyone can tell, have no chance of being carried to full term and becoming a child, i.e. can be said to be doomed, could not be put to good use rather than simply allowed to die. Not only utilitarian arguments but also general altruistic intuitions might be used to justify such a use of surplus embryos. The arguments *against* their use are not based on any residual uncertainty about the fate of the embryo. Rather, they seem to be based on a distinction, which can be made from a particular perspective, between a requirement to protect life, which is agreed to be no longer possible, and a requirement to protect dignity, which in a certain sense remains valid in these cases. The idea here is that by allowing the embryo to die we show greater respect than by using it for extraneous purposes, i.e. other than its own well-being.

Those who accept that the production of embryos is a violation of human dignity but have no objection to the use of orphaned embryos argue that the question of instrumentalization, which entails their use, differs between the first case and the second. If one assumes that the early human being has the potential within itself to become a person, i.e. to develop *itself* into a person, then the deliberate production of embryos for extraneous uses will always amount to improper instrumentalization violating human dignity; however, the use of doomed embryos does not automatically have to be seen as such an act of instrumentalization.

And, irrespective of the legal arrangements favoured by the experts in each case, the overwhelming majority in Germany would seem to adopt such an ethical approach that makes a moral distinction between producing embryos for research purposes and using surplus embryos.

14.2 Moral Assessment of Stem Cell Research

For a moral assessment of stem cell research several issues have to be examined, namely questions about the status of the cells and about the status of their source but also questions about available alternatives and the moral evaluation of the goals of research. Producing human embryos in a culture medium for research or therapeutic purposes was an option that – at least through the 1990s – appeared in Germany to be ruled out on ethical grounds. So the debate in Germany essentially revolved around the question of how Germany should respond to developments in other European countries with a more permissive stance, such as in Great Britain or Belgium. Was an erosion of our own ethical standards to be feared if Germany agreed to a middle position under international agreements or sign up to minimal requirements far less restrictive than ones own rules? Such considerations lay in part behind Germany's refusal to sign the Convention on Human Rights and Biomedicine of the Council of Europe, (de Wachter 1997) which Germany has still not yet signed.

14.3 Legal Regulation in Germany: From the Embryo Protection Act to the Amendment of the Stem Cell Act

Indeed, the course chosen in Germany – after an intensive interdisciplinary discussion between legal experts, scientists, medical professionals, philosophers and theologians (Bundesministerium für Forschung und Technologie 1985) and a subsequent parliamentary debate which accentuated their proposals – was to regulate all conceivable options opened up by in-vitro fertilisation under a criminal law with the adoption of the Embryo Protection Act. Passed in 1990, the act only allows the production of human embryos for the purpose of bringing about pregnancy. Other, abusive, applications of reproductive techniques are threatened with serious punishment, as is artificial modification of the human germ-line, reproduction by means of cloning techniques or the creation of chimeras and hybrid beings. Selection according to sex or fertilisation using sperm from someone who has died are also treated as criminal offences. As for research that is not intended to benefit the embryo affected, the law does not provide for any legitimising exemptions.[1]

1 Günther et al. (2014). The legal regulation of preimplantation genetic diagnosis in § 3a does not change the prohibition of research with embryos: "With the law of regulation of the preimplantation genetic diagnosis, which got approved by the German parliament on November 21st 2011, and the change of embryo protection law related to it, and despite its fundamental prohibition, the genetic examination of the pluripotent cells of the embryo in vitro, before its intrauterine transfer, within exceptions and tight limits, is declared not illegal. Hence there is an explicitly legal regulation of PGD for the first time. Applying PGD on the basis of the new law is however only permitted once the regulation on the legitimate implementation of preimplantation genetic diagnosis is legally valid." (Deutsches Referenzzentrum für Ethik in den Biowissenschaften 2016, In focus (▶ http://www.drze.de/in-focus/preimplantation-genetic-diagnosis/legal-aspects?set_language=en)

The debate took on a new urgency when, in November 1998, an American-Israeli research group headed by the American embryologist James A. Thomson reported the first ever successful cultivation of human embryonic stem cells (Thomson et al. 1998). It was generally assumed that the possibility of keeping embryonic stem cell lines in a culture medium was a key prerequisite for developing a wider understanding of the differentiation process of human cells. There was also a very widespread view that this would at least open up good prospects for successful transplantation of tissues and perhaps even whole organs. The debate in Germany was driven forward above all by opinions presented by the Deutsche Forschungsgemeinschaft (DFG), which is the self-governing body of the sciences and humanities in Germany, funded by the German federal government and the governments of the 16 Länder. As the conviction increasingly emerged in the scientific community that primordial germ cells (EG cells) do not show the same potential as embryonic stem cells (ES cells), the Deutsche Forschungsgemeinschaft adviced in 2001 (Deutsche Forschungsgemeinschaft 2001), also for ethical reasons, a gradual acceptance of ES cell research with the importing of human embryonic stem cells as a first legally and morally legitimate step to be followed in the medium-term by further ethical clarification and, if necessary, policy changes.

In fact the DFG managed to trigger a national debate along these lines. The issues were considered by two national ethics committees instituted by constitutional bodies (Nationaler Ethikrat 2002; and Enquete Kommission "Recht und Ethik der modernen Medizin" 2002), a debate in parliament (Deutscher Bundestag 2002), a widely-heeded sceptical speech by the federal President, and a very intensive and controversial ethical discussion, especially in the national newspapers. At the end of the debate it was decided not to amend the Embryo Protection Act for the time being, but to pass a law to regulate the importing of human embryonic stem cells. In taking this course, Parliament, as the legislature, was actually following the minority opinion among the experts and parliamentarians sitting on the German Bundestag's Study Commission on Law and Ethics in Modern Medicine (2001).

German law as it stands (Gesetz zur Sicherstellung des Embryonenschutzes im Zusammenhang mit Einfuhr und Verwendung menschlicher embryonaler Stammzellen (Stammzellgesetz – StZG)) does not, however, permit the production of stem cells from supernumerary embryos. The import of embryonic stem cells is only legal under certain conditions. In particular, the cells in question must have been derived before the date set by the act, and the intended research must be without alternative and of high priority. The stem cells to be imported must have been taken from orphaned embryos. Each individual research proposal must be subject to expert appraisal, above all with regard to lack of alternatives and priority status, by a central ethics commission convened for this purpose and a decision must be reached by a special committee at the Robert Koch Institute. None believes that this legal arrangement marks the end of the discussion. Nevertheless, it does represent a compromise by providing a middle way between the opposing positions. It also follows the proposal put forward by a group within the Study Commission of the German Bundestag as its own minority position: "Even for the position that regards the harvesting of stem cells from 'supernumerary' embryos as ethically unjustifiable, some differentiation is necessary between the method of derivation and the act of using the stem cell lines, with regard to the weight of the ethical problem. Also of importance is the question of whether such use relates to existing stem cell lines or whether it gives rise to the derivation of additional stem cell lines and therefore to the

destruction of further 'supernumerary' embryos" (German Bundestag. Study Commission on Law and Ethics in Modern Medicine 2001, 6).

Alongside these ethical considerations, we also find that an understanding in the perspective of German constitutional law has played a considerable role in the decision to provide for exemptions from the ban on imports and to prevent a 'slippery slope': "Following the deliberations of the Study Commission it seems doubtful whether a complete ban on the importation of human embryonic stem cells derived from embryos abroad can be established on the basis of constitutional and European law. The importation of human embryonic stem cells is therefore to be tolerated under strict conditions. Adherence to these conditions is to be monitored by a state-authorised control body whose operations are open to scrutiny" (German Bundestag. Study Commission on Law and Ethics in Modern Medicine 2001, 14)

Actually the Stem Cell Act (Stammzellgesetz) was amended in 2008[2] and the cut off date postponed from the first January 2002 to the first May 2007. From the point of view of some leading scientists this amendment seemed to be required, since the quality of the stem cell lines produced after 2002 was significantly higher compared to the older stem cell lines. Nevertheless it was discussed if new key date would become object for further amendments in the future. In the meantime, more than 140 projects applications to the Robert Koch Institute for research involving imported human embryonic stem cells have been approved, having been ethically evaluated by the central Ethics Commission for Stem Cell Research, a body established under the Federal Stem Cell Act.

14.4 IPS-Cells and the Question of Totipotency

This half way position to resolve the question of importing embryonic stem cells (ES cells) links an understanding of the moral status of the human embryo with an evaluation of research purposes. For a moral assessment of stem cell research several issues had been taken into consideration: the status of the cells and the status of their source, the moral evaluation of the goals of research and the question about available alternatives. At the beginning of the millennium it was difficult to predict what direction the discussion of the high-priority and no-alternative criteria in the Stem Cell Act would take and what kind of research practice would ensue. Both the public debate and the ethical discourse changed in 2007, when two groups of researchers published data explaining techniques to reprogram human somatic cells so that they showed characteristics of embryonic stem cells. With these induced pluripotent stem cells (iPS-cells) an alternative seemed to be available both in research as for therapeutic applications. Researchers argued that embryonic stem cells would still be necessary as a gold standard for pluripotency. In the first years there were some doubts that iPS technology could be applicable for therapies in humans. A philosophical and ethical question came up if there could be a guarantee that iPS cells cannot become totipotent.

2 The first amendment of the Stem Cell Act in 2008 shows that joint European research programmes have brought up the question of harmonisation of the legal situation across Europe and that opponents of restrictive legislation could succeed to reverse the cut-off date. This is because scientists broadly agree that stem cell lines produced before this cut-off date are unsuitable for such purposes.

Stem cells are generally characterised by their high potential for differentiation. In other words, they are not, or not yet, specialised in the same way as other cells. We know that embryonic cells at the stage of the very first cell divisions have the capacity to develop into a complete organism. On the other hand, the adult stem cells have the ability to continue differentiating within a particular tissue. Whereas cells of the former type are referred to as totipotent, the latter are called multipotent. Research into adult stem cells is aimed at showing what the possibilities are for transdifferentiation and reprogramming. If the cell shows the potential to act as the type of cell associated with other sorts of tissue, they must be called pluripotent. Some cells even have the ability to develop into any type of cell found in the body, and it is proposed that these be designated as omnipotent. But there is some disagreement over definitions and the classifications. In particular, the expression "totipotent" is used by some scientists for those properties designated above as "omnipotent". It is also unclear whether a single totipotent cell is necessarily able to form a whole and whether the said whole will necessarily comprise the embryoblast and the trophoblast or whether the embryoblast should be regarded as a sufficient archetype of the living being.

It is hardly surprising that a clarification of definitions has been demanded from German scientists in particular. The reason, however, does not lie in their penchant for conceptual clarity but in the significance assumed by the term totipotency in the Embryo Protection Act. In its own legal definitions, the act considers not only the embryo from the zygote stage onwards, but also each totipotent cell taken from the embryo to be an embryo, i.e. an early human being. Thus, if an embryonic stem cell which had been extracted from the blastocyst turned out to be totipotent, it would require the protection afforded under the Embryo Protection Act.

Hans-Werner Denker, who drew attention at an early stage in the debate in Germany (Denker 2002) to the uncertainty in the definition of the potential of embryonic stem cells, refers in his contributions to findings by the research team around Thomson (presented before their aforementioned publication on the human embryonic stem cells) from experiments on marmosets (Callithrix jacchus). Denker cites the reports of Thomson et al. (1996) on the astounding differentiation achieved by ES cell lines they had harvested from embryos of this South American monkey species. They found that it was sufficient to let the cultures of these cells grow in very close proximity for the spontaneous formation of "embryoid bodies", which as they reported, were amazingly similar to embryos in postimplantation stages and might even be equated with them. To the extent that it was examined, their structure was found to be virtually indistinguishable from that of normal embryos occurring in vivo and implanted in the uterus at the stage of the blastocyst with the primitive streak. Thomson et al. (1996) and Thomson and Marshall (1998) emphasise that these spontaneous developments are not an isolated phenomenon, but occur regularly. Denker takes the view that such ordered developments cannot be excluded for other primates like humans.

It is indeed surprising that while the ethical significance of the totipotency criterion is firmly asserted, the scientific community and the research institutions make no effort to investigate clarification of the relevant uncertainties in development biology. On the other hand, it must also be conceded that even if the worthiness of protection due to ES cells is clarified, no plausible practical conclusions concerning existing ES cell cultures are available.

What would be the ethical conclusion if researchers would find out that iPS cells are totipotent or could become totipotent under certain conditions? Would we than come up with a distinction between naturally totipotent cells and reprogrammed totipotent cell? Would this distinction be relevant for the ontological status? Would it be relevant for the moral status? On the one hand we are well advised not to give up the concept of totipotency in discussions on the status of organisms and parts of organisms. On the other hand it seems to be absurd to take even a somatic cell taken from an adult as if it would have the same status as an entire organism.

14.5 Translational Stem Cell Research. The Question of Patenting

Since the beginning of the stem cell debate in Germany Patent Courts in Germany are confronted with the request if methods for generating specific cells out of human embryonic cells should be regarded as contrary to public order and should be excluded from patentability. In 2009 the German Federal Court of Justice referred to the European Court of Justice with this question of patentability. It was expected that the European View would be more permissible that the national view. But the European Court came to the conclusion that Article 6 (2) of the European Directive 98/44 would exclude the use of human embryos for industrial or commercial purposes from patentability. It argues that any invention has to be excluded from patentability "where the technical teaching which is the subject-matter of the patent application requires the prior destruction of human embryos".

Although this legal argumentation only concerns patent law and has no direct impact on other parts of the legal system the question of patentability has some consequences for the translation of fundamental research into specific applications. Exclusions from patentability might even be an argument in political and parliamentary discussions on public funding of basic research.

14.6 Outlook

Is there a chance to overcome the dissent on the moral value of the embryo? Most participants in the discussion think that there is no such chance? But why? Does the disagreement show that moral questions are purely subjective? In dead we can learn from the long-lasting discussion that a variety of rational arguments is presented. It is not just a question of feelings or subjective opinions. As far as moral principles are concerned we even have considerable consensus. The disagreement is more about the ontological and anthropological framing of terms like unity, identity or individuality than about moral concepts like respect, dignity, utility and so on. There is no categorical reason why these disagreements could not be overcome. Nevertheless practical reasoning has to do with decisions that have to be taken even when there is no complete consensus what the best option might be.

After 20 years of debate many participants are convinced that we are in a situation of moral uncertainty. Some philosophers call this situation a rational disagreement. Different legal solutions show a way to cope with this situation. They try to find ways to protect the embryo without closing the door for advancing new therapeutic options.

Take Home Message

For a moral assessment of stem cell research several issues have to be examined, namely questions about the status of the cells and about the status of their source but also questions about available alternatives and the moral evaluation of the goals of research.

Since taking ES cells from embryos in the blastocyst stage implies the destruction of the embryo the disagreement about the status of the early embryo is central for the debate. In Germany after an intensive public and interdisciplinary discussion parliament decided to regulate all conceivable options opened up by in-vitro fertilisation under criminal law. Under certain conditions, importing embryonic stem cells is allowed according to the Stem Cell Act.

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